CHAPTER 1

Introduction to Microeconomics

- "Economics is everywhere, and understanding economics can help you make better decisions and lead a happier life" –Tyler Cowen
- Economics is about making choices in the presence of scarcity.
- The notions, "scarcity" and "choice", are very important in economics.
- *Problems of choice arise because of scarcity.*
- Various economic problems facing an economy can be categorised into three types. These are the so-called "what", "how" and "for whom" problems.
- They arise due to scarcity.
  - **What to be**: What goods and services are produced and in what quantities?
  - **How to be**: How (i.e. by which methods) would the goods and services be produced?
  - **For whom to be**: Given that various goods and services are available to an economy, who gets how much to consume?
- It refers to distribution of income and wealth in the society.
- *In a market-oriented or capitalist economy, these fundamental problems are solved by the "market".*
- *There is a price, which is influenced by the forces of demand and supply.*
- As more resources go into one sector and produce more, less is available for other sectors and they will produce less than before.
- PPC *shows the maximum amount that can be produced of one good, given the amount produced of the other good.*

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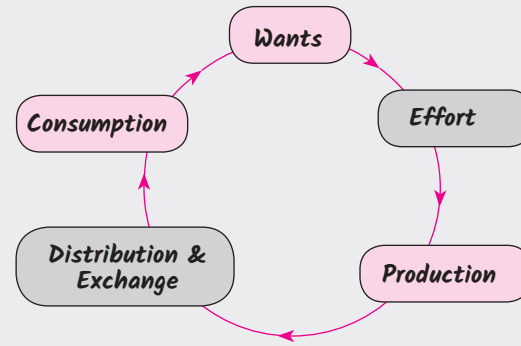
Economics: Its Subject-Matter

Economics focuses on the behaviour and interactions among economic agents, individuals and groups belonging to an economic system. It deals with the activities such as the consumption and production of goods and services and the distribution of income among the factors of production. The activities of the rational human beings in the ordinary business of life under the existing social, legal and institutional arrangement are included in the Science of Economics; the abnormal persons and the socially unacceptable and unethical activities are excluded.



Economics studies the ways in which people use the available resources to satisfy their multiplicity of wants. Scarcity is a problem indicating the gap between what people want and what they are able to get. This scarcity can be eliminated either by limiting the human wants or by increasing the supply of the goods that satisfy the human wants. The method of getting more is resorted to, rather than the method of wanting less.

Economics is concerned with activities of human being only. Human beings are related to one another and the actions of one member affect those of the other members in the society. Hence, Economics is called a Human Science or Social Science.

The activities of rational or normal human beings are the subject-matter of Economics. All human activities related to wealth constitute the subject-matter ofEconomics. Thus, human activities not related to wealth (non-economic activities) are not treated in Economics. For example, playing cricket for pleasure, mother's child care.

Goods and Services

Both goods and services satisfy human wants. In Economics, the term 'goods' implies the term 'services' also, unless specified otherwise.

Goods (also called 'products', 'commodities', 'things' etc)

a. *as material things, they are tangible;*
b. *have physical dimensions, i.e., their physical attributes can be preserved over time;*
c. *exist independently of their owner;*
d. *are owned by some persons;*
e. *are transferable;*
f. *have value-in exchange;*

Kinds of Goods

a. *Free and Economic goods Free goods are available in nature and in abundance. Man does not need to incur any expenditure to own or use them. For example air, and sun shine. Water was also an example in the past, but at present it has exchange value. So it is not a free good.*
b. *Consumer goods and Capital goods: Consumer goods directly satisfy human wants, TV, Furniture, Automobile etc. Capital-goods (also called producer's goods) don't directly satisfy the consumer wants. They help to produce consumer goods. For example, machines do not directly satisfy the consumers, but in factories, the manufacturers need them.*

Services

Along with goods, services are produced and consumed. They are generally, possess the following:

Intangible: *Intangible things are not physical objects but exist in connection to other things, for example, brand image, goodwill etc. But today, the intangible things are converted and stored into tangible items such as recording a music piece into a pen-drive. They are marketed as a good.*

Heterogeneous: *Services vary across regions or cultural backgrounds. They can be grouped on the basis of quality standards. A single type service yields multiple experiences. For example, music, consulting physicians etc.*

Inseparable From Their Makers

Services are inextricably connected to their makers. For example, labour and labourer are inseparable;

Perishable: Services cannot be stored as inventories like assets. For example, it is useless to possess a ticket for a cricket-match once the match is over. It cannot be stored and it has no valuein- exchange.

Opportunity Cost – A More General Concept

- The concept of opportunity cost is very important and universal – not specific to PPC. Most generally, *the opportunity cost of a given activity is defined as the value of the next best activity*.
- In the context of PPC, there are only two goods, and therefore, the opportunity cost of (additionally) producing one has to be defined in terms of the only remaining good.
- If the production of one good goes up, the (maximum) production of the other must fall, you should not however think that an economy can never produce more of all goods.
- There are two core branches, called **microeconomics** and **macroeconomics**.

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A Simple Economy

1. Society consists of people and people in the society need many goods and services in their everyday life including food, clothing, shelter, transport facilities like, roads, railways and various other services like that of teachers and doctors.
2. In fact, the list of goods and services that any individual needs is so large that no individual in society, to begin with, has all the things he needs.
3. For example, the teacher in the school has the skills required to impart education to the students and he can earn some money by teaching students in the school and use the money for obtaining the goods and services that he wants.
4. Economy is a system which provides people with the means to work and earn a living.
5. Economics is about studying economic problems arising due to limited means (having alternative uses) in relation to unlimited wants.
6. **Economic problem is a problem of choice involving satisfaction of unlimited wants out of limited resources having alternative uses.**

- Take an example of a piece of land. It can be used for constructing a house, a factory, a school, a park etc. It

can also be used for growing wheat, rice, vegetables etc. The economic problem here is that for which purpose this piece of land should be used.

- Similar problems may arise in making a choice in the use of other resources like labour, capital and enterprise.

7. **Economic problem arises because of scarcity of resources in relation to demand for them.**

Wants are unlimited

- This is a basic fact of human life.
- Human wants are unlimited.
- They are not only unlimited but also grow and multiply very fast.

Resources are limited

- The resources to produce goods and services to satisfy human wants are available in limited quantities. Land, labour, capital and enterprise are the basic scarce resources.
- These resources are available in limited quantities in every economy, big or small, developed or underdeveloped, rich or poor. Some economies may have more of one or two resources but not all the resources.
- For example, Indian economy has relatively more labour but less capital and land. The U.S. economy has relatively more land but less labour. No economy in the world is rich in all the resources.
- Resources have alternative uses:
- Generally a resource has many alternative uses.
- A worker can be employed in a factory, in a school, in a government office, self employed and so on.

8. **"Scarcity" in economics is the short supply of resources in relation to the demand. Resources of the economy are scarce with the result that the economy can't produce all that the society needs.**
   - Greater Scarcity Higher Prices Examples: Petrol, Diamonds
   - Lesser Scarcity Lesser Prices Example: Water
   - No Scarcity No Price Example: Air we breathe

9. **Economising of resources means that resources are to be used in such a manner that the maximum output is realised per unit of input. It also means optimum utilization of resources.**

Central Problems of an Economy

1. The problem of making a choice among alternative uses of resources is known as basic or central problem of an economy.
2. There are many central problems of an economy, but according to syllabus we have to do one, that is; Problem of Allocation of Resources: Every economy has limited resources which can alternatively be used to produce different goods and services. Hence, it has to allocate its available resources in the production of different goods and services in such a manner that it ideally meets the needs of the society.

While allocating resources optimally, the decisions regarding the following three central problems of an economy are required to be taken:

- What to produce?
- How to produce?
- For whom to produce?

(a) What to produce?

- What to produce refers to a problem in which decision regarding which goods and services should be produced is to be taken.
- Since its resources are limited, every economy has to decide what commodities are to be produced and in what quantities.
- In view of limited resources when we produce more of a commodity, it means we will be able to produce less of another. Because more production of one commodity would force us to withdraw resources from the production of the other commodity.
- So, the economy has to choose between capital goods (like machines, tools, etc.), civil goods (like cloth, watch, radio etc.), consumer goods (like wheat, cloth, shoes, sugar, etc.), military goods (like guns, bombs, tanks, etc.) necessities of life (such as food, clothing, housing, etc.) and luxury goods (such as car, colour TV, etc).
- The guiding principle for an economy here is to allocate resources in such a way that gives maximum aggregate utility to the society.

(b) How to produce?

- How to produce refers to a problem in which decision regarding which technique of production should be used is taken.
- Goods and services can be produced in two ways: by using labour intensive techniques, and by using capital-intensive techniques.
- Under labour intensive techniques, more of labour and less of capital per unit of output is used in producing goods and services, while in capital-intensive techniques more of capital and less of labour per unit of output is used.
- Thus, the economy has to decide whether the chosen goods and services should be produced with the help of automatic machines or handicrafts. Every method of production has its own advantages and disadvantages.
- For example, on one side use of more capital; i.e., automatic machines, increases the quantity and improves the quality of production but it results

in unemployment as it requires lesser number of labourers. On the other side, handicrafts generate more employment but produce smaller amount of production.

- The guiding principle for an economy in such a case is to decide about the techniques of production on the basis of cost of production. Those techniques of production should be used which lead to the least possible cost per unit of commodity or service.

(c) For whom to produce?

- For whom to produce refers to a problem in which decision regarding which category of people are going to consume a good, i.e., economically poor or rich.
- As we know, goods and services are produced for those who can purchase them or have the capacity to buy them.
- Capacity to buy depends upon how income is distributed among the factors of production. The higher the income, the higher will be the capacity to buy and vice Versa. So, this is a problem of distribution.
- We know that the whole output is distributed among factors of production which have contributed to it.
- Since production is the combined efforts of all the four factors of production, viz, land, labour, capital and enterprise, it is distributed among them in the form of money income (i.e. rent, wages, interest and profits). Who should get how much is, thus, the problem.
- The guiding principle is that the economy must see here that important and urgent wants of its citizens are being satisfied to the maximum possible extent or not.

Production Possibility Frontier

1. Production possibility frontier is a curve which depicts all possible combinations of two goods which can be produced with given resources and technology in an economy.
2. Production possibility frontier is also known as production possibility curve or transformation curve.
3. The concept of PP curve is based on the following assumptions:
   - First, the amount of resources in the economy is fixed.
   - Second, the technology is given and unchanged.
   - Third, the resources are efficient and fully employed.
   - Fourth, all the resources are not equally efficient in production of all goods.
4. Production Possibility Frontier Schedule and Curve

(a) It helps us to understand and solve the problem of what to produce and in what quantity. Let us for the sake of simplicity assume that with given resources and technology, an economy can produce only two goods, namely Rice and Tanks as shown in the production possibility schedule.

(b) **Full Employment and Underemployment Under PP Curve**

i. Full Employment of Resources: It is represented along the PP-curve. The economy has to decide that which combination of good X and good Y should be produced. It means that the economy has to decide that how should resources be allocated in the production of good X and good Y. The desired allocation of the two goods must lie somewhere on the PP curve. For example, point A on the PP represents one such allocation.

ii. Under Utilization of Resources: If resources are not fully and efficiently employed, may there be a problem of underutilization of resources. Underutilization of resources arises because of unemployment and inefficiency.

iii. The Problem of Unemployment: If the actual combination of two produced goods lies below the PP curve, it means that the resources are not fully employed. If the resources are fully employed, the combination must lie somewhere on the PP curve. For example, the combination 'U' below the PP curve represents unemployment, i.e., the resources are not fully utilized.

iv. The Problem of Inefficiency: Assuming that the resources are fully efficient, and if the actual combinations, say I, produced still lies below the PP curve, it means that resources are inefficiently employed. So, any combination that lies below the PP curve also indicates the problem of inefficient utilization of resources.

(c) **Rightward and Leftward Shift of PP Curve**

(i) **Rightward Shift (When both intercept Change)**

- When Resources Increase: Production possibility curve shows the combination of two pieces of goods which can be produced-by utilizing the resources efficiently.
- But, every economy tries to increase its resources so that more and more goods can be produced. PP curve is based on the assumption that the amount of resources in the economy is fixed.
- When resources are fixed, one or more goods can be produced only by sacrificing some quantity of the other good. We cannot produce more of both the goods. However, when resources increase, we can produce more pieces of both the goods.
- For example, Discovery of oil reserves in the GULF countries has caused a substantial shift to rightward in the PPC of these countries.

- When Technology Changes: Generally, the change in technology is for the better. Better technology means that more quantities of both goods can be produced. In this situation also PP frontier shifts upwards.

(ii) Rightward Shift (When one intercept changes)

(iii) Leftward Shift: When Resources Decrease: Resources with the society may decrease due to unusual happenings like earthquakes, war, natural calamities like floods etc. In such situations the production capacity of the country decreases, and the PP frontier shifts downwards.

(d) **The concept of opportunity cost** has occupied a very important place in economics. Modern economists have used the concept of opportunity cost in allocation of resources besides other fields. Simply, opportunity cost means opportunity lost. What is given up for getting something is called the opportunity cost of that thing. For instance, theoretically if a consumer has to forego 2 cups of tea for getting one glass of orange juice, opportunity cost of one glass of orange juice will be 2 cups of tea. Thus opportunity cost of any commodity is the amount of other goods which has been given up in order to produce that commodity. Alternatively opportunity cost of a given activity is the value of the next best activity.

(e) **Marginal opportunity cost** is an addition to a cost in terms of a number of units of a commodity sacrificed to produce one additional unit of another commodity.

(f) **Marginal rate of transformation** is the ratio of number of units of a good sacrificed to produce one additional unit of another commodity.

(g) **PPC is concave to the point of origin** because of increasing marginal opportunity cost (MOC). This behaviour of the MOC is based on the assumption that all resources are not equally efficient in production of all goods. Rise in opportunity cost occurs when factors (resources) which are specialized or more adopted for production of a particular good (say, guns), is transferred to the production of another good (say, rice) for which they are less productive or less specialized. Thus, transfer of resources from more productive to less productive uses indirectly means fall in their productivity, with the result more of such resources are needed to produce an additional unit of the other commodity. Thus marginal opportunity cost goes on increasing making the PP curve concave in shape.

5. Properties or Characteristics of Production Possibilty Curve

- PPC is downward sloping: The downward slope of PPC means that if the country wants to produce more of one good, it has to produce less quantity of the other goods.
- PPC is concave to the point of origin: Concave shape of PPC implies that slope of PPC increases. Slope of PPC is defined as the quantity of good Y given up in exchange for additional unit of good X.

6. Other shapes of PPC: MOC Decreasing: PPC would be Convex to the point of origin, as shown below.

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Difference between Microeconomics and Macroeconomics

Microeconomics	Macroeconomics
1. It is that branch of economics which deals with the economic decision making of individual economic agents such as the producer, the consumer etc.	It is that branch of economics which deals with aggregates and averages of the entire economy. E.g., aggregate output, national income, aggregate savings and investment, etc.
2. It takes into account small components of the whole economy.	It takes into consideration the economy of the country as a whole.
3. It deals with the process of price determination in case of individual products and factors of production.	It deals with general price-level in any economy.
4. It is known as price theory.	It is also known as the income theory.
5. It is concerned with the optimization goals of individual consumers and producers.	It is concerned with the optimization of the growth process of the entire economy.

Words that Matter

- **Economy:** Economy is a system which provides people with the means to work and earn a living.
- **Economics:** Economics is about studying economic problems arising due to limited means (having alternative uses) in relation to unlimited wants.
- **Economic problem:** Economic problem is a problem of choice involving satisfaction of unlimited wants out of limited resources having alternative uses.
- **Scarcity:** Scarcity in economics is short supply in relation to the demand. Resources of the economy are scarce with the result that the economy can't produce all that the society needs.
- **Economising of resources:** It means that resources are to be used in such a manner that the maximum output is realised per unit of input. It also means optimum utilization of resources.
- **Central problem of an economy:** The problem of making a choice among alternative uses of resources is known as basic or central problem of an economy.
- **What to produce:** What to produce refers to a problem in which decision regarding which goods and services should be produced is to be taken.
- **How to produce:** How to produce refers to a problem in which decision regarding which technique of production should be used.
- **For whom to produce:** It refers to a problem in which decision regarding which category of people are going to consume a good, i.e., economically poor or rich.
- **Production:** It is the process of transforming inputs (Raw material) into output (finished goods). So, production means creation of goods and services.
- **Consumption:** It is a process of using up of goods and services to satisfy human wants.
- **Production possibility curve:** It is a curve which depicts all possible combinations of two goods which can be produced with given resources and technology in an economy.
- **Production possibilities:** It refers to different combinations of goods and services which an economy can produce from a given amount of resources and a given stock of technology.
- **Opportunity cost:** Opportunity Cost of any commodity is the amount of other good which has been given up in order to produce that commodity. Alternatively opportunity cost of a given activity is the value of the next best activity.
- **Marginal opportunity:** It is an addition to a cost in terms of a number of units of a commodity sacrificed to produce one additional unit of another commodity.
- **Marginal rate of transformation:** It is the ratio of number of units of a good sacrificed to produce one additional unit of another commodity.
- **Microeconomics:** The term 'micro' has been derived from Greek word 'MIKROS' means 'small'. Microeconomics, therefore, studies the behaviour of individual economic units of an economy, like households, firms, individual consumers and producers etc.
- **Macroeconomics:** It is that part of economic theory which studies the economy as a whole, such as national income, aggregate employment, general price level, aggregate consumption, aggregate investment, etc.

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CHAPTER 2

Consumer Choice and Behaviour

Consumer's Equilibrium: The Basis of the Law of Demand

Utility Concepts

- A consumer derives some satisfaction from consuming a product; otherwise, she would not demand it at all. This is captured by a term called **total utility**.
- Defined as *the total psychological satisfaction a consumer obtains from consuming a given amount of a particular good*.
- **Marginal utility**, is defined as *the utility from the last unit consumed*. This pattern of marginal utility is called the **law of diminishing marginal utility**.
- The comparison between how much of marginal utility in terms of money you get and the price you pay implies that, at either of these two levels of consumption, the difference between the total utility in terms of money and your total expenditure on products (defined as price × quantity purchased) is maximised.
- The **marginal utility in** terms of money (Rs. 2) is equal to price (Rs. 2). This is indeed the principle and we can state this in two **alternative ways**.
- The consumer's equilibrium is attained when

(A) $$\frac{\text{Marginal Utility of a Product}}{\text{Marginal Utility of a Rupee}} = \text{Its Price}$$

Or

(B) $$\frac{\text{Marginal Utility of a Product}}{\text{Its Price}} = \text{Marginal Utility of a Rupee}$$

Loosely stated as "*marginal utility is equal to price*".

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Characteristics of Demand

Price : *Demand is always related to price.*
Time : *Demand always means demand per unit of time, per day, per week, per month or per year.*
Market : *Demand is always related to the market, buyer and sellers.*
Amount: *Demand is always a specific quantity which a consumer is willing to purchase.*

Meaning and Determinants of Demand

- The price of a product is not the only factor that influences how much a consumer should buy of that product.
- Three factors mentioned below are called the **determinants of demand**.

(a) prices of related goods,
(b) income and
(c) tastes

- **Law of Demand** states that *other things remaining unchanged, as the own price of a commodity increases, the quantity demanded of it by a consumer falls*.
- The law of demand in tabular form is called a **demand schedule**. If we graph a demand schedule, we obtain a **demand curve**.

Why is the Demand Curve Downward Sloping?

The demand curve is essentially the marginal utility curve.

Determinants of Demand

- Complementary good is said to be that good whose price is improved because of a good that can be substituted in place of that previous good.

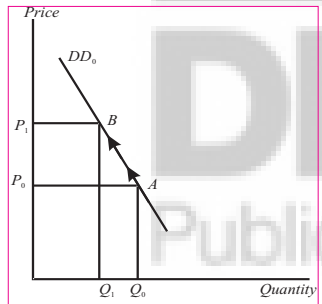
A Change in Income

- *Normal goods are those for which demand increases as income increases. Inferior goods are those for which demand falls as income rises.*
- The inferior goods characteristic applies to bajra, jowar, maize and related cereals.

A Change in Tastes

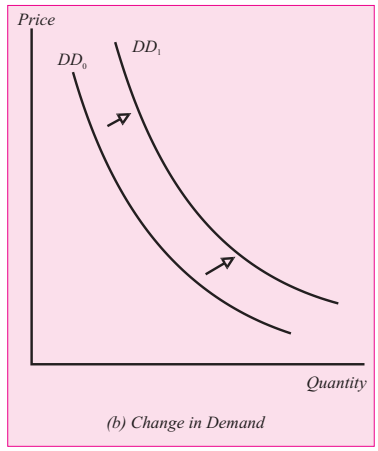
- A change in the own price causes a movement along a given demand curve: higher (lower) the price, less (more) is the quantity demanded. Such a movement is called a **change in the quantity demanded**.
- In contrast, when a change in any other factor causes a (leftward or rightward) shift of a demand curve, we call this a **change in demand**.

Market Demand Curve



(a) Change in Quantity Demanded

The economy wide demand curve for a particular product is called the **market demand curve**.



(b) Change in Demand

Change in Quantity Demanded Versus Change in Demand

What are the determinants of the market demand curve?

(a) prices of related goods;
(b) income levels across individuals, or what we can call, the distribution of income;
(c) consumer's tastes; and
(d) the number of consumers who buy the product or what we can call, the market size.

Price Elasticity of Demand

The concept of elasticity captures the magnitude of change or the *degree or responsiveness*.

Definition and Formulas

Elasticity of demand is defined as

(C) Price elasticity of demand = e_D.

$$= \frac{\text{\% change in the quantity demanded}}{\text{\% change in the own price}}$$

Properties

1. A very desirable property of the elasticity formula in measuring the degree of responsiveness is that *it is independent of the choice of units*. It is because any percentage change of a variable is independent of units.
2. If two demand curves intersect, at their point of intersection, the elasticity associated with the flatter demand curve is higher. The demand curves DD and DD' intersect at the point C. At this point, P_0 is the price of the product. The claim is that, at price P_0, the elasticity is greater along the flatter demand curve DD'.
3. Higher the value of the price elasticity, greater is the degree of responsiveness of quantity demanded to price.
4. In particular, if $e_0 > 1$, then the % change in quantity demanded must exceed the % change in price. We can say that the product demand is **elastic**.
5. If $e_0 < 1$, the % change in quantity demanded is less than that of the price, and, we say that the product demand is **inelastic**.

   The demand for luxury goods is elastic and that for necessary goods (e.g., basic food items) is inelastic.

   Finally, if $e_0 = 1$, it is said that the demand is **unitarily elastic**.

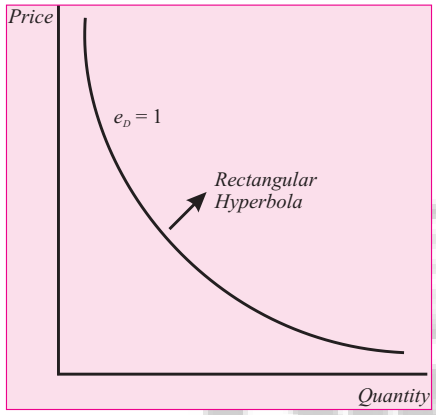
   In this special case, the demand curve takes a

particular shape, called *rectangular hyperbola* in geometry.

4. If the product is absolutely essential, like demand for a rare medicine or some very bad case of addiction to undesirable products like opium, the demand curve is vertical.

In this case, the price elasticity is zero, i.e., the product demand is totally or perfectly inelastic.

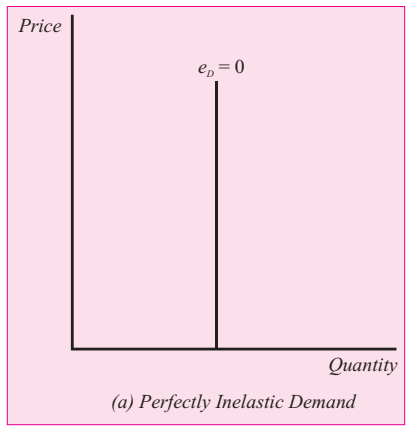
The last special case is the one, where demand curve is horizontal and thus the demand is *perfectly elastic*, i.e., the price elasticity is equal to infinity.



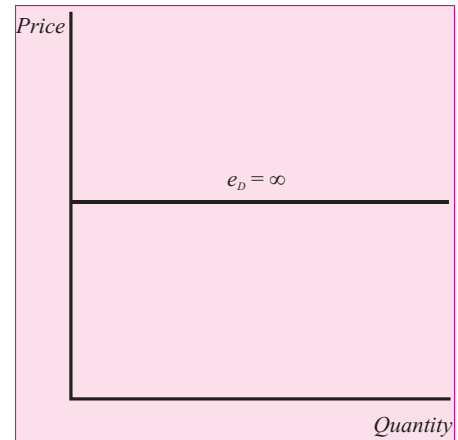
Unitarily Elastic Demand

Factors Affecting the Magnetic of Price Elasticity

- **Availability of Close Substitutes:** If close substitutes of a product are readily available, its price elasticity of demand is likely to be high, because even a very small increase in price will make consumers switch to other products in a big way.



(a) Perfectly Inelastic Demand



(b) Perfectly Elastic Demand

Elasticity = 0, ∞

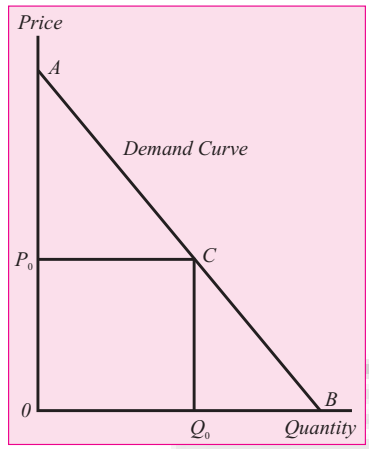
- **Proportion of Total Expenditure spent on the Product:** If the amount spent on a product constitutes a very small fraction of the total expenditure on all goods and services you consume, then the price elasticity is likely to be small.
- **Habits**: Some products which are not essential for some individuals are essential for others. A form of consumption such as eating out in five-star restaurants is a luxury for many people; therefore, their demand for it is very elastic.
- **Time Period**: All other things remaining the same, the longer the time period, more elastic is the demand for any product.

Measurement of Elasticity

- Price elasticity of demand using its definition as such is called the **percentage method** of measuring elasticity.
- In particular, when the price change is very small, a graphical formula or a **geometric method** can also be used to measure elasticity.
- *Point elasticity, at a certain point along a straight line demand curve, is equal to the lower segment divided by the upper segment of the demand curve at that point*.
- The point elasticity formula implies that, as price increases, the ratio of the lower segment to the upper segment increases (as we are looking at points higher up on the demand curve) and therefore, the product becomes more elastic.

Total Expenditure and Price Elasticity

The concept of price elasticity quantifies the relationship between price and quantity demanded; it also indicates the direction in which the total expenditure on a product changes, as there is a change in price.



Point Elasticity along a Straight Line Demand Curve

- If the product demand is inelastic, the total expenditure always increases as price increases.
- *If the product demand is elastic, unitarily elastic or inelastic, an increase in price leads respectively to a decrease, no change or an increase in the total expenditure on the product.*
- The total expenditure must change in the same direction as the price change, i.e., a price increase leads to an increase in total expenditure.
- If we know the direction of change in price and the direction of change in total expenditure, we can infer whether the product demand is elastic or inelastic.
- If because of a price increase, the total expenditure increases, then the product demand must be inelastic.
- From a seller's perspective, the total value of sales is usually called total revenue.
- Total revenue is equal to the total expenditure by the consumers.
- Hence, the relationships between elasticity, price change and total expenditure are important from the viewpoint of decision making by a producer or a firm.

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- **Consumer:** is an economic agent who consumes final goods or services for a consideration.
- **Utility:** is want satisfying power of a commodity.
- **Total Utility:** It is the total satisfaction derived from consumption of given quantity of a commodity at a given time. In other words, it is the sum total of marginal utility.
- **Marginal utility:** It is the change in total utility resulting from the consumption of an additional unit of the commodity. In other words, it is the utility derived from each additional unit.

$$MU_n = TU_n - TU_{n-1}$$

Relation between Total Utility and Marginal Utility

UNITS	MU	TU
1	10	10
2	8	18
3	6	24
4	4	28
5	2	30
6	0	30
7	–2	28

- When MU diminishes, positive TU increases at a diminishing rate.
- When MU is zero, TU is maximum.
- When MU is negative, TU diminishes.
- **Law of Diminishing Marginal Utility:** As consumer consumes more and more units of commodity, the marginal utility derived from each successive units go on declining. This is the basis of law of demand.
- **Consumer's Bundle:** It is a quantitative combination of two goods which can be purchased by a consumer from his given income.
- **Law of Equimarginal Utility:** It states that when a consumer spends his income on different commodities, he will attain equilibrium or maximize his satisfaction at that point where ratio between marginal utility and price of different commodities are equal and which in turn is equal to marginal utility of money.
- **Budget Set:** It is quantitative combination of those bundles which a consumer can purchase from his given income at prevailing market prices.

- **Consumer Budget:** It states the real purchasing power of the consumer from which he can purchase the certain quantitative bundles of two goods at given price.
- **Budget Line:** A graphical representation of all those bundles which cost the amount just equal to the consumer's money income gives us the budget line.
- **Monotonic Preferences:** Consumer's preferences are called monotonic when between any two bundles; one bundle has more of one good and no less of other good as it offers him a higher level of satisfaction.
- **Change in Budget Line:** There can be parallel shift (leftwards or rightwards) due to change in income of the consumer and change in price of goods. A rise in income of the consumer shifts the budget line rightwards and vice versa. In case of change in price of one good, there will be rotation in the budget line. Fall in price causes outward rotation due to rise in purchasing power and vice versa.
- **Marginal Rate of Substitution (MRS):** It is the rate at which a consumer is willing to substitute one good (good Y/ good X) to obtain one more unit of the other good. Generally, it is the slope of indifference curve.
- **Indifference Curve:** It is a curve showing different combinations of two goods, each combination offering the same level of satisfaction to the consumer.

Characteristics of Indifference Curve

- Indifference curves are negatively sloped (i.e., slopes downwards from left to right).
- Indifference curves are convex to the point of origin. It is due to diminishing marginal rate of substitution.
- Indifference curves never touch or intersect each other. Two points on different ICs cannot give equal level of satisfaction.
- Higher indifference curve represents higher level of satisfaction.
- **Consumer's Equilibrium:** A consumer is said to be in equilibrium when he maximizes his satisfaction, given his money income and prices of two commodities. He attains equilibrium at that point where the slope of IC is equal to the slope of budget line.

Condition of Consumer's Equilibrium

(a) **Cardinal approach (Utility Analysis):** According to this approach, utility can be measured. "Utils" is the unit of utility.

Condition

- In case of one community
- Where, MUm = Marginal utility of money
- MUx = Marginal utility of 'x', Px = Price of 'x'
- In case of two commodities.
- xy and MU must be decreasing

Units	MUx	MUy	MUx/Px	MUy/Py
1	36	40	12	10
2	33	36	11	9
3	30	32	10	8
4	27	28	9	7
5	24	24	8	6
6	21	20	7	5

Assumption, Px = Rs. 3, Py = Rs. 4

Y = Rs. 20

Here, MUm = 9

(b) Ordinal approach (Indifference Curve Analysis)

- According to this approach, utility cannot be measured but can be expressed in order or ranking.
- Condition of Equilibrium or budget line must be tangent to indifference curve.
- MRS must be diminishing or, indifference curve must be convex to the origin.
- *Quantity Demanded:* It is that quantity which a consumer is able and is willing to buy at particular price and in a given period of time.

Determinants of Demand

- Price of goods
- Income of consumers
- Taste & preference of consumers
- Change in price of related goods
- Future expectations to changes in price

Change of Demand

- Change in quantity demanded or movement along demand curve, vhange in Demand or shift in demand
- **Market Demand:** It is the total quantity of the commodity demanded in the market by all consumers at different prices at a point of time.
- **Demand Function:** It is the functional relationship between the demand for a commodity and factors affecting demand.
- **Law of Demand:** The law states that when all other things remain constant then there is inverse relationship between price of the commodity and quantity demanded of it. That is, higher the price, lower the demand and lower the price, higher the demand.

- **Change in Demand:** When demand changes due to change in any one of its determinants other than the price.
- **Change in Quantity Demanded:** When demand changes due to change in its own price keeping all other factors constant.
- **Demand Curve and Demand Schedule:** The tabular presentation of price and quantity demanded is called demand schedule and a demand curve is the graphical representation of the demand schedule.

Demand Curve and its Slope

- **Price Elasticity of Demand:** Price elasticity of demand is a measurement of change in quantity demanded in response to a change in price of the commodity.
- **Percentage Method or Total Expenditure Method:** It measures price elasticity of demand on the basis of change in total expenditure incurred on the commodity by a household due to change in its price.

There are three conditions

- Ed=1 When due to rise or fall in price of a good, total expenditure remains unchanged.
- Ed >1 When due to fall in price, total expenditure goes up and due to rise in price, total expenditure goes down.
- Ed <1 When due to fall in price, total expenditure goes down and due to rise in price, total expenditure goes up.

Geometric Method: Elasticity of demand at any point is measured by dividing the length of lower segment of the demand curve with the length of upper segment of demand curve at that point.

The value of ED is unity at midpoint of any linear demand curve. Diagram to show geometric or point method:

- Elasticity of demand at given point.
- D is midpoint of the demand curve.

Factors influencing Price Elasticity of Demand

- Nature of the commodity.
- Availability of substitute goods.
- Income level of the consumer.
- Price level of the commodity.
- Time period.
- Different uses of the commodity.
- Behavior of the consumer.
- Postponement of consumption.

Utility

1. **Utility** is the power or capacity of a commodity to satisfy human wants. Alternatively, utility of a commodity means the amount of satisfaction that a person gets from consumption of a good or service.
2. **There are two types of Utilities:**

(a) Cardinal Utility Approach (Marginal Utility Analysis or Marshall Utility Analysis)

- It states that the satisfaction the consumer derives by consuming goods and services can be measured with a number.
- Cardinal utility is measured in terms of utils (the units on a scale of utility or satisfaction).
- According to cardinal utility the goods and services that are able to derive a higher level of satisfaction to a consumer will be assigned higher utils and goods that result in a lower level of satisfaction will be assigned lower utils.
- Cardinal utility is a quantitative method that is used to measure consumption satisfaction.

(b) Ordinal Utility Approach (Indifference Curve Analysis or J.R. Hicks Analysis):

- It states that the satisfaction the consumer derives from the consumption of goods and services cannot be measured in numbers.
- Rather, ordinal utility uses a ranking system in which a rank is provided to the satisfaction that is derived from consumption.
- According to ordinal utility, the goods and services that offer a customer a higher level of satisfaction will be assigned higher ranks and the goods and services that offer a lower level of satisfaction will be assigned lower ranks.
- Ordinal utility is a qualitative method that is used to measure consumption satisfaction.

Cardinal Utility

- **Total utility** is the total psychological satisfaction a consumer obtains from consuming a given amount of a particular good. Alternatively, total utility is the sum of marginal utilities obtained from consumption of successive units of a commodity. It is measured in utils.
- TU = MUj + MU2 + MU3 + MUN = IMU
- Marginal utility is the additional utility derived from consumption of an additional unit of a commodity.

Relationship between marginal utility and total utility:

1. When MU decreases, TU increases at a diminishing rate.
2. When MU is zero, TU is constant and maximum at P.
3. When MU is negative, TU starts diminishing.

Consumer Equilibrium under Marginal Utility Analysis (Cardinal Approach)

1. **Consumer's equilibrium** refers to a situation where a consumer gets maximum satisfaction out of his given money income and given market price.
2. **Consumer's equilibrium** through utility analysis can be ascertained with reference to:
   1. A single commodity
   2. Two or several commodities

(a) Single Commodity Consumer Equilibrium:

(i) When purchasing a unit of a commodity, a consumer compares its price with the expected utility from it. Utility obtained is the benefit, and the price payable is the cost. The consumer compares benefit and the cost. He will buy the unit of a commodity only if the benefit is greater than or at least equal to the cost.

Necessary Condition

Where, MU of one rupee refers to the utility obtained from the purchase of commodities with one rupee. In particular, the condition (a) says that the marginal utility of a product in terms of money should be equal to its price.

Sometimes, this is loosely stated as marginal utility is equal to price, i.e.,

MU = Price.

$\Rightarrow$ If MU > Price

$\Rightarrow$ As a rational consumer, he keeps on going to purchase an additional unit of a commodity as long as MU = Price.

$\Rightarrow$ MU > Price implies when benefit is greater than cost and whenever benefit is greater than cost, a consumer keeps on consuming additional unit of a commodity till MU = Price.

$\Rightarrow$ It is so because according to the law of diminishing marginal utility, MU falls as more is purchased. As MU falls, it is bound to become equal to the price at some point of purchase.

$\Rightarrow$ If MU< Price

$\Rightarrow$ As a rational consumer he would have to reduce the consumption of a commodity as long as MU=Price.

$\Rightarrow$ MU < Price implies when benefit is less than cost and whenever benefit is less than cost, consumer keeps on decreasing the additional unit of a commodity till MU = Price.

$\Rightarrow$ It is so because according to the law of diminishing marginal utility, MU rises as less units are consumed. As MU rises, it is bound to become equal to the price at some point of purchase.

- **Sufficient Condition:** Total gain falls as more is purchased after equilibrium. It means that consumer continues to purchase so long as total gain is increasing or at least constant.

Preferences of the Consumer (Ordinal Utility Analysis)

1. **Ordinal utility** states that the satisfaction the consumer derived from the consumption of goods and services cannot be measured in numbers.
2. Rather, ordinal utility uses a ranking system in which a rank is provided to the satisfaction that is derived from consumption.

Demand

1. **Demand is a quantity of a commodity** which a consumer wishes to purchase at a given level of price and during a specified period of time. In other words, demand for a commodity refers to the desire to buy a commodity backed with sufficient purchasing power and the willingness to spend.
2. **Desire is just a wish for a commodity** and a person can desire a commodity even if he does not have the capacity to buy it from the market whereas demand is desire backed by purchasing power, that is to say, whatever an individual is willing to buy from the market in a given period of time at a given price. A poor person can desire to own a car but that will not become a demand because he does not have the purchasing power to buy a car from the market.
3. **Factors affecting personal (individual) demand:**

(a) Price of the commodity: Inverse relationship exists between price of the commodity and demand of that commodity. It means with the rise in price of the commodity, the demand of that commodity falls and vice versa.

(b) Price of related goods: It may be of two types:

- **Substitute goods**
- **Complementary goods**

- **Substitute Goods:** Substitute goods are those goods which can be used in place of another good and give the same satisfaction to a consumer.
  - There would always exist a direct relationship between the price of substitute goods and demand for a given commodity.
  - It means with an increase in price of substitute goods, the demand for given commodity also rises and vice versa. For example, Pepsi and Coke.
- **Complementary Goods:** Complementary goods are those which are useless in the absence of another good and which are demanded jointly.
  - There would always exist an inverse relationship between price of complementary goods and demand for given commodity. It means, with a rise in price of complementary goods, the demand for given commodity falls and vice versa. For example, pen and refill.

(c) Income of a Consumer: There are three types of goods:

- For Normal Commodities: With a rise in income, the demand of the commodity also rises and vice versa. Shortly, direct relationship exists between income of a consumer and demand of normal commodity.
- For Inferior Goods: With a rise in income, the demand of the commodity falls and vice versa. Shortly, inverse relationship exists between income of a consumer and demand of inferior goods.
- For Necessity Goods: Whether income increases or decreases, quantity demanded remains constant.

(d) Tastes and Preferences of the Consumers

- Tastes, preferences and habits of a consumer also influence its demand for a commodity.
- For example, if Black and White TV set goes out of fashion, its demand will fall. Similarly, a student may demand more of books and pens than utensils of his preferences and taste.

- **Miscellaneous:** Some of the other factors affecting the demand of a consumer are: Change in weather, change in number of family members, expected change in future price, etc.

4. **Market demand refers to the quantity of a commodity that all the consumers are willing and able to buy, at a particular price during a given period of time.**
5. **Factors affecting market demand:**
   - Price of the commodity
   - Price of related commodity
   - Income of a consumer
   - Taste and preference of a consumer
   - Miscellaneous

Population Size: Demand increases with the increase in population and decreases with the decrease in population. This is because with the increase (or decrease) in population size, the number of buyers of the product tends to increase (or decrease). Composition of population also affects demand. If composition of population changes, namely, female population increases, demand for goods meant for women will go up.

Distribution of Income: Market demand is also influenced by change in distribution of income in the society. If income is not equally distributed, there will be less demand. If income is equally distributed, there will be more demand.

6. Demand function shows the relationship between quantity demanded for a particular commodity and the factors that are influencing it.
7. Individual demand function refers to the functional relationship between individual demand and the factors affecting the individual demand.
8. Market demand function refers to the functional relationship between market demand and the factors affecting the market demand.
9. Demand schedule is a table showing different quantities being demanded of a given commodity at various levels of price. It shows the inverse relationship between price of the commodity and its quantity demanded. It is of two types:
   - Individual Demand Schedule
   - Market Demand Schedule
10. Individual demand schedule refers to a table that shows various quantities of a commodity that a consumer is willing to purchase at different prices during a given period of time.
11. Market demand schedule is a tabular statement showing various quantities of a commodity that all the consumers are willing to buy at various levels of price. It is the sum of all individual demand schedules at each and every price.

Market demand schedule can be expressed as, Movement along. The demand curve or change in quantity demanded.

1. It is based on Law of Demand which states that quantity demanded of the commodity changes due to the changes in price of the commodity.

2. The change in quantity demanded due to the change in price of the commodity is known as movement along the demand curve. It may be of two types; namely,
   a. Expansion in Demand (Increase in quantity demanded)
   b. Contraction in Demand (Decrease in quantity demanded)

a. Expansion in Demand (Increase in quantity demanded or downward movement along the demand curve):

(a) It is based on Law of Demand which states that quantity demanded of the commodity rises due to the fall in price of the commodity.

(b) The rise in quantity demanded due to the fall in price of the commodity, is known as expansion in demand.

b. Contraction in Demand (Decrease in quantity demanded or upward movement along the demand curve)

(a) It is based on Law of Demand which states that quantity demanded for the commodity falls due to the rise in price of the commodity.

(b) The fall in quantity demanded due to the rise in price of the commodity is known as contraction in demand.

Shift in Demand Curve or Change in Demand

1. It is based on factors other than price. If demand changes due to the change in factors other than price, it is known as shift in demand curve.
2. It may be of two types:
   (a) Increase in Demand
   (b) Decrease in Demand

(a) Increase in Demand:

i. An increase in demand means that consumers now demand more at a given price of a commodity.

ii. It's conditions are:

- Price of substitute goods rises.
- Price of complementary goods falls.
- Income of a consumer rises in case of normal goods.
- Income of a consumer falls in case of inferior goods.

(b) Decrease in Demand:

i. A decrease in demand means that consumers now demand less at a given price of a commodity.

ii. Its conditions are:

- Price of substitute goods falls.
- Price of complementary goods rises.
- Income of a consumer falls in case of normal goods.
- Income of a consumer rises in case of inferior goods.

Causes of Law of Demand and Exceptions to Law of Demand

1. **There is a inverse relationship between price of the commodity and quantity demanded for that commodity which causes demand curve to slope downward from left to right.**
2. It is because of the following reasons:

(a) Income Effect:

i. Quantity demanded of a commodity changes due to change in purchasing power (real income), caused by change in price of a commodity called Income Effect.

ii. Any change in the price of a commodity affects the purchasing power or real income of consumers although his money income remains the same.

iii. When price of a commodity rises, more has to be spent on purchase of the same quantity of that commodity. Thus, rise in price of commodity leads to fall in real income, which will thereby reduce quantity demanded that is known as Income Effect.

(b) Substitution Effect

- It refers to substitution of one commodity in place of another commodity when it becomes relatively cheaper.
- A rise in price of the commodity eg. coke, also means that price of its substitute, eg. pepsi, has fallen in relation to that of coke, even though the price of pepsi remains unchanged. So, people will buy more of pepsi and less of coke when price of coke rises.
- In other words, consumers will substitute pepsi for coke. This is called Substitution Effect.

(c) Law of Diminishing Marginal Utility

i. This law states that when a consumer consumes more and more units of a commodity, every additional unit of a commodity gives lesser and lesser satisfaction and marginal utility decreases.

ii. The consumer consumes a commodity till marginal utility (benefit) he gets equals to the price (cost) they pay, i.e., where benefit = cost.

(d) Additional consumer

i. When price of a commodity falls, two effects are quite possible:

- New consumers, that is, consumers that were not able to afford a commodity previously, start demanding it at a lower price.
- Old consumers of the commodity start demanding more of the same commodity by spending the same amount of money.

ii. As the result of old and new buyers push up the demand for a commodity when price falls.

3. Exceptions to the Law of Demand

(a) Inferior Goods or Giffen Goods:

i. Giffen goods are a special category of inferior goods in which demand for a commodity falls with a fall in its price.

ii. In case of certain inferior goods when their prices fall, their demand may not rise because extra purchasing power (caused by fall in prices) is diverted on purchase of superior goods.

(b) Goods expected to become scarce or costly in future:

i. These goods are purchased by the household in increased quantities even when their prices are rising upwards.

ii. This is due to the fear of further rise in prices.

(c) Goods of Ostentation:

i. Status symbol goods are purchased not because of their intrinsic value but because of status or prestige value.

ii. The same jewellery when sold at a lower price sells poorly but offered at two times the price, sells quite well.

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Importance of Elasticity of Demand

The concept of elasticity of demand is of much practical importance.

1. ***Price fixation:*** *Each seller under monopoly and imperfect competition has to take into account elasticity of demand while fixing the price for his product. If the demand for the product is inelastic, he can fix a higher price.*
2. ***Production:*** *Producers generally decide their production level on the basis of demand for the product.*
3. ***Distribution:*** *Elasticity of demand also helps in the determination of rewards for factors of production.*
4. ***International trade:*** *Elasticity of demand helps in finding out the terms of trade between two countries. Terms of trade depend upon the elasticity of demand for the goods of the two countries.*
5. ***Public finance:*** *Elasticity of demand helps the government in formulating tax policies. For example, for imposing tax on a commodity.*
6. ***Nationalization:*** *The concept of elasticity of demand enables the government to decide over nationalization of industries.*

Words that Matter

- **Demand:** Demand is a quantity of a commodity which a consumer wishes to purchase at a given level of price and during a specified period of time.
- **Substitute goods:** Substitute goods are those goods which can be used in place of another good and give the same satisfaction to a consumer.
- **Complementary goods:** Complementary goods are those which are useless in the absence of other goods and which are demanded jointly.
- **Normal goods:** For normal commodity, with a rise in income, the demand of the commodity also rises and vice versa.
- **Inferior goods:** For inferior goods, with a rise in income, the demand of the commodity falls and vice versa.
- **Law of demand:** It states that price of the commodity and quantity demanded are inversely related to each other when other factors remain constant (*ceteris paribus*).
- **Movement along the demand curve:** The change in quantity demanded due to the change in price of the commodity is known as movement along the demand curve.
- **Income effect:** Quantity demanded of a commodity changes due to change in purchasing power (real income), caused by change in price of a commodity which is called Income Effect.

- **Substitution effect:** It refers to substitution of one commodity in place of another commodity when it becomes relatively cheaper.
- **Law of diminishing marginal utility:** This law states that when a consumer consumes more and more units of a commodity, every additional unit of a commodity gives lesser and lesser satisfaction and marginal utility decreases.
- **Giffen goods:** A special category of inferior goods in which demand for a commodity falls with a fall in its price. In case of certain inferior goods when their prices fall, their demand may not rise because extra purchasing power (caused by fall in prices) is diverted on purchase of superior goods.
- **Utility:** Utility is the power or capacity of a commodity to satisfy human wants.
- **Cardinal utility:** Cardinal utility states that the satisfaction the consumer derives by consuming goods and services can be measured with number.
- **Ordinal utility:** Ordinal utility uses a ranking system in which a rank is provided to the satisfaction that is derived from consumption.
- **Total utility:** Total utility is the total psychological satisfaction a consumer obtains from consuming a given amount of a particular good.
- **Marginal utility:** Marginal utility is the additional utility derived from consumption of an additional unit of a commodity.
- **Consumer's equilibrium:** It refers to a situation where a consumer gets maximum satisfaction out of his given money income and given market price.
- **MU of one rupee:** It refers to the utility obtained from purchase of commodities with one rupee.
- **Monotonic Preferences:** Consumer's preferences are assumed to be such that between any two bundles (x_1, x_2) and (y_1, y_2), if (x_1, x_2) has more of at least one of the goods and no less of the other good as compared to (y_1, y_2), the consumer prefers (x_1, x_2) to (y_1, y_2). Preferences of this kind are called monotonic preferences.
- **Marginal rate of substitution:** It is the rate at which a consumer is willing to sacrifice one commodity for an extra unit of another commodity without affecting his total satisfaction.
- **Indifference curve:** It refers to the graphical representation of various combinations of the goods that provide the same level of satisfaction to the consumer.

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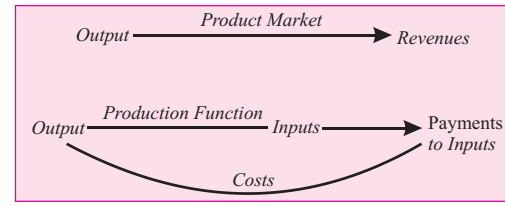
CHAPTER 3

Production Cost, Behaviour and Supply

- By definition, **profit** earned by a firm is equal to its total revenues minus the total costs.
- The above example is illustrative of some important linkages. On one hand, the amount produced, or, what is called **output**, is linked to total revenues in the product market.
- Output is linked to inputs via technology, which is called **production function** (defined later), and, the employment of inputs leads to their payments.



Linkages

Production

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Features of the Factors of Production

Factors of production means resources used in the process of production of commodities. There are four types viz., land, labour, capital and organization or enterprise. Here, land represents natural resources (such as soil, mineral deposits, seas, rivers, natural forests, fisheries, etc). Labour represents human resources. Together, these two factors are called the 'primary factors of production'.

These two factors produce some units of goods for the purpose of consumption. And as consumption of these goods takes place, there is a possibility of some of these goods getting left out. Thus, saving is production minus consumption. This saved amount is called capital, which serves as investment in the production process. Also, organisation or enterprise is a special form of labour. The third and the fourth factors are called 'secondary factors of production'.

These four factors depend on each other. They have a coordinated impact on production of goods and services.

(i) Land (ii) Labour (iii) Capital (iv) Organization

Production Function

- The most basic concept here is what is called the production function, defined as *a technological relationship that tells the maximum output producible from various combinations of inputs*.

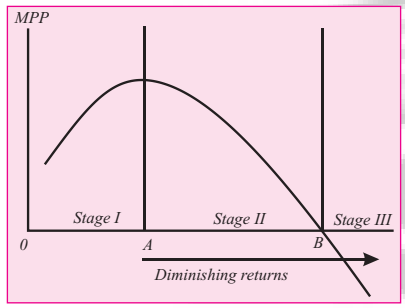
Returns to an Input

- We define **Average Product** or **Average Physical Product** (*APP*) as the *TPP* per unit employment of the variable input, i.e., $APP = TPP/L$, where L is the level of employment of the variable input.
- These are also respectively called **total, marginal** and **average returns** to an input.
- The marginal physical product, *MPP*, is derived from the total physical product. *TPP*, just as marginal utility is obtained from total utility.

Law of Variable Proportions and Law of Diminishing Returns

- The *MPP* initially increases with an increase in the employment of the input in question, then it diminishes and finally it becomes negative. This pattern of *MPP* is called the **Law of Variable Proportions**.

- Closely associated with this law is another important law, called the **law of diminishing marginal product** or the **law of diminishing marginal returns** (which is similar to the law of diminishing marginal utility). More briefly, it goes by the name of the **law of diminishing returns**.
- *That, the employment of other inputs remaining the same, as more of a particular input is used in production, after a certain level, its marginal physical product decreases with further employment of it.*
- The reason behind the law of variable proportions or the law of diminishing returns is fundamentally the same.
- The significance of these stages of production is that a profit-maximising firm will never operate in stage III. It is because, by entering stage III, a firm will have to incur higher costs on one hand (as it is hiring more of the input), and, at the same time, since output is falling, in the output market, it will get less revenues.



Three Stages of Production and Diminishing Returns

The law of diminishing returns implies that the *MPP* curve is inversely U-shaped.

In turn, this implies that the *APP* curve is inversely U-shaped also.

Returns to Scale

Three Phases of Returns to Scale

(1) **Increasing Returns to Scale:** In this case if all inputs are increased by one percent, output increase by more than one percent.

(2) **Constant Returns to Scale:** In this case if all inputs are increased by one percent, output increases exactly by one percent.

(3) **Diminishing Returns to Scale:** In this case if all inputs are increased by one percent, output increases by less than one percent.

- Suppose all inputs are increased by a given proportion. **Increasing** (respectively **decreasing**) **returns to scale** hold when output increases more (respectively less) than proportionately. **Constant returns to scale** hold when output increases exactly by the proportion in which inputs are increased.

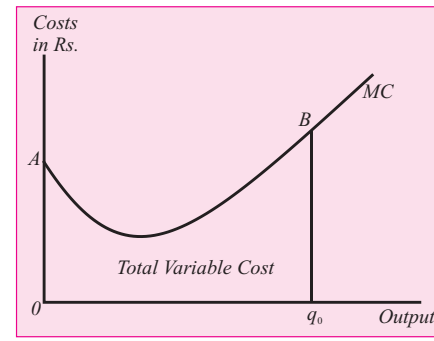
Short Run

Fixed and Variable Costs

- A firm faces two types of costs: **fixed costs** and **variable costs**. Fixed costs are those that do not vary with the level of output. (These are also called **overhead costs**.)
- Instead of being termed simply fixed and variable cost, these are formally called **Total Fixed Costs (*TFC*)** and **Total Variable Costs (*TVC*)**. Total cost (*TC*) is then, by definition, total fixed costs + total variable costs.
- The *TFC* curve is horizontal because fixed costs do not change with the output. However, since *TVC* and *TC* increase with the output, these curves are upward sloping.
- The total cost curve is the vertical summation of the total fixed and total variable cost curves. Notice that, at the zero level of output, *TC* = *TFC*, because *TVC* is zero when output is zero.
- If we divide total fixed cost and total variable cost by output, we respectively get the **Average Fixed Cost** (*AFC*) and the **Average Variable Cost** (*AVC*). That is, *AFC* = *TFC*/Output and *AVC* = *TVC*/Output.
- By dividing total cost by output, we obtain the **Average Total Cost** (*ATC*), i.e., *ATC* = *TC*/Output. Note that, by definition, *ATC* = *AFC* + *AVC*.
- Average total cost is sometimes loosely called average cost only.

Marginal Costs

- There is another important cost concept, the marginal cost (*MC*). Similar to marginal utility or marginal product, this is defined as the increase in total cost when one extra unit is produced.



A Smooth Marginal Cost Curve

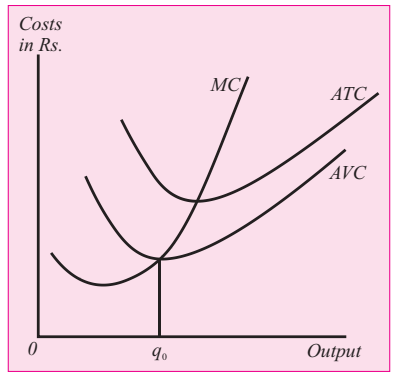
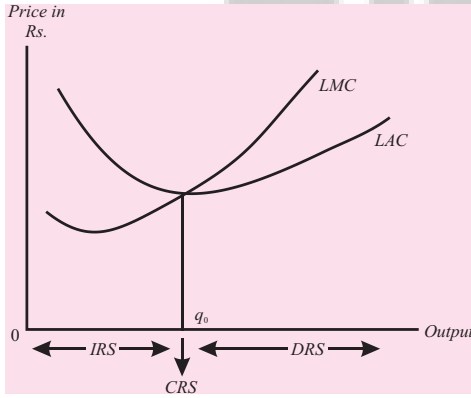


Fig. *AVC, ATC and MC Curves*

Long Run

- Increasing returns to scale mean that if output is increased at a given rate (say 10%), inputs need to be increased only by less than proportionately (say by 7%).
- In the figure, it shows a U-shaped *LAC* curve. This means that, as output is gradually increased starting from a small level, there are increasing returns to scale (in the output range *0* to q_0) such that *LAC* falls, then there are constant returns to scale (at q_0), and finally decreasing returns to scale prevail at output levels higher than q_0, such that *LAC* increases with output.



The Long-Run Average and Marginal Cost Curves

- A firm would be able to reap the advantages of (a) division of labour and (b) volume discounts.
- In case of volume discounts, for instance, a garment factory buys 100 tonnes of yarn at a certain price.
- The U-shape of the *LAC* curve implies the U-shape of the *LMC* curve.

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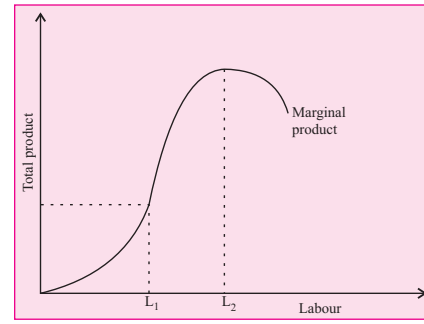
Producer Behaviour and Supply

- **Production Function:** It shows the functional relation between physical inputs and physical output of a good. It can be expressed as $Q = (f_1, f_2, f_3 \ldots\ldots f_n)$.
  Where Q = Physical output of a good; f_1, f_2, f_3, $\ldots\ldots f_n$ = Physical inputs.
- **Production is creation of utility.**
- **Types of Production Function:**
  - **Short-run Production Function:** In this production function, one factor of production is variable and all others are fixed. So, law of return to a factor is applied. It is also called variable proportion type of production function.

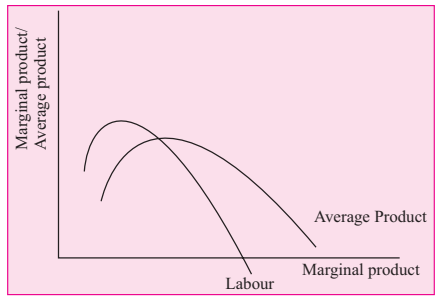
  It is a time period which is not enough to make change in all inputs. In this, level of production can be changed by changing the variable factors.
  - **Long-run Production Function:** In this production function, all the factors of production are variable. So, law of returns to scale is applied. It is also called constant proportion type of production function.

  It is a time period which is enough to make change in all inputs, all inputs are variable in the long run. In this, level of production can be changed by changing all inputs.
- **Total product or Total physical product** refers to total quantity of goods and services produced by a firm in a given period of time.
  TP = ∑∑MP



- **Average production** is the per unit production of variable factor.

$$AP = \frac{TP}{\text{Variable input}}$$



- Marginal product refers to the change in total product resulting from the employment of an additional unit of variable factor. In other words, it is the contribution of each additional unit of variable factor to output.

$$MP = \frac{\Delta TP}{\Delta L} \text{ or } MP_n = TP_n - TP_{n-1}$$

- **Relation among Total, Average and Marginal Product**

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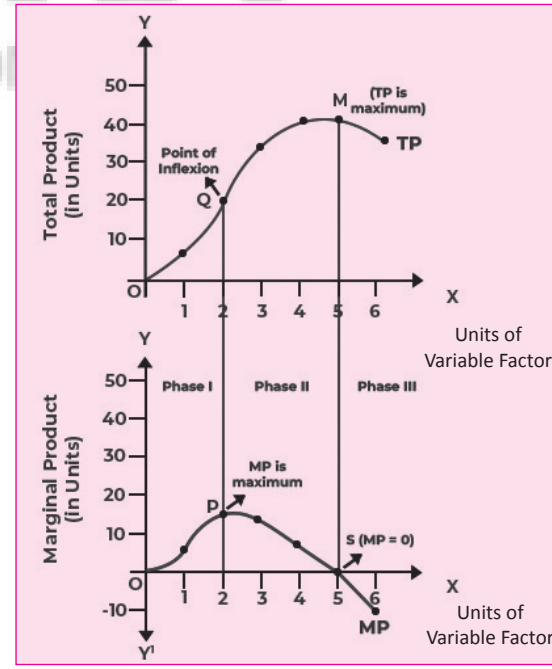
Stage	Total Product	Marginal Product	Average Product
Stage I	Initially it increases at an increasing rate and then increases at a decreasing rate.	At the beginning it increases, then reaches a maximum and starts to decrease.	At the first instant it increases, then attains maximum.
Stage II	It continues to increase at a diminishing rate and reaches maximum.	It continues to diminish and becomes equal to zero.	It is equal to MP and then begins to diminish.
Stage III	It diminishes.	It becomes negative.	It continues to diminish but always greater than zero (positive).

1. When TP increases at an increasing rate, MP also increases.
2. When TP increases at a diminishing rate, MP declines.
3. When TP is maximum, MP = 0.
4. When TP begins to decline, MP becomes negative.

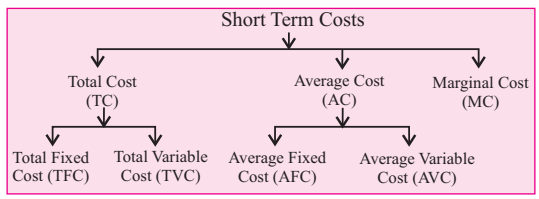
Labour	MP	TP	AP
1	2	2	2
2	3	5	2.5
3	4	9	3
4	3	12	3
5	1	13	2.6
6	0	13	2.16
7	–2	11	1.6

1. When MP > AP, AP rises.
2. When MP = AP, AP is maximum and constant.
3. When MP < AP, AP falls.
4. MP may be zero or negative, but AP continues to be positive.
5. AP increases, even when MP falls but MP should lie above AP.

- **Returns to a factor:** It refers to the behaviour of output when only one variable factor of production in increased in short run and fixed factors remain constant.
- **Law of variable proportion:** The law states that when more and more units of variable factors are employed to increase the output, initially output increases at an increasing rate and finally falls.



- **Stage I (Stage of Increasing Return to factor):** TP increases at increasing rate : In the initial phase as more and more units of variable factors are employed with fixed factor total physical production increases at increasing rate, MP increases.
- **Causes for increasing return:** (a) Under utilisation of fixed factor, (b) Indivisibility of factor and (c) Increased efficiency of variable factor.
- **Stage II (Stage of Diminishing Return to factor):** TP increases at decreasing rate: As more and more units of variable factors are employed with fixed factors then total product increases at diminishing rate, MP decreases but is positive. At the end of this phase, TP is maximum and MP becomes zero.
- **Causes of diminishing return:** (a) Optimal use of fixed factor and (b) imperfect factor substitutability.
- **Stage III (Stage of Negative Return to Factor):** TP falls: As more and more units of variable factors are employed with fixed factors, total production starts decreasing and marginal product becomes negative.
- **Causes of negative return:** (a) Poor co-ordination between fixed factor and variable factor and (b) over utilisation of fixed factor.
- **Economic Cost:** It is the sum total of explicit and implicit costs.
- **Explicit Cost:** Actual money expenditure incurred by a firm on the purchase and hiring the factor inputs for the production is called explicit cost. These are entered into books of accounts. For example, payment of wages, rent, interest, purchases of raw materials, etc.
- **Implicit cost** is the cost of self-owned resources of the production used in production process. Or estimated value of inputs supplied by owner itself. These are not entered into books of accounts.
- **Normal profit** : It is the minimum amount required to keep the producers into business. In other words, it is the minimum supply price of the entrepreneur. It is also called the wage of an entrepreneur.



- **Total cost** refers to total amount of money which is incurred by a firm on production of a given amount of a commodity.

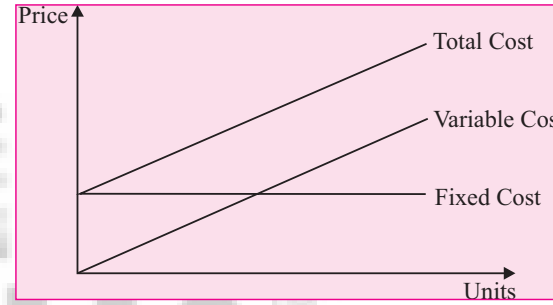
Total cost is the sum of total fixed cost and total variable cost.

TC = TFC + TVC or TC = AC × Q

Total fixed cost is also called supplementary cost. It is the total expenditure incurred by the producer for employing fixed inputs. Eg., rent of land and building, interest on capital, license fee, etc.

TFC = TC – TVC or TFC = AFC × Q

- **Features of Total Fixed Cost:** (a) It remains constant at all levels of output. ***It is not zero even at zero output level.*** Therefore, **TFC curve is parallel to X-axis**. (b) **Total cost at zero level of output is equal to total fixed cost.**



- Total variable cost is the cost which varies with the quantity of output produced. It is zero at zero level of output. TVC curve is parallel to TC curve. Eg., cost of raw material, expenses on power, etc.

TVC = TC – TFC or TVC = AVC × Q

Features of Total Variable Cost: (a) It is zero when output is zero. (b) It increases with increase in output. (c) Initially TVC increases at diminishing rate due to increasing returns and later it increases at an increasing rate due to diminishing return.

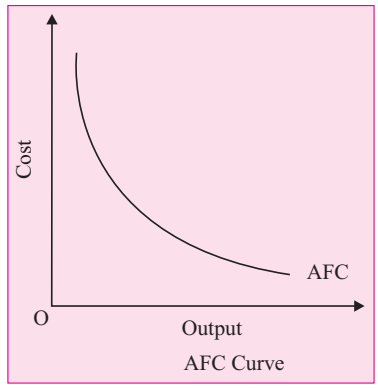
- **Average cost** is per unit cost of production of a commodity. It is the sum of average fixed cost and average variable cost.

$$AC = \frac{TC}{Q} \text{ or } AC = AFC + AVC$$

- **Average fixed cost** is per unit fixed cost of production of a commodity.

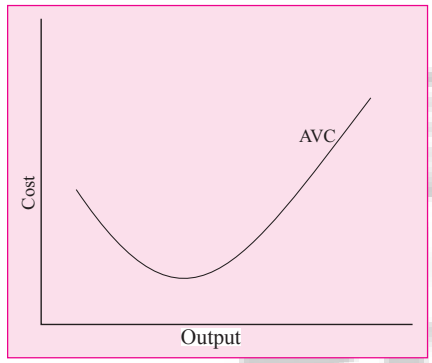
$$AFC = \frac{TFC}{Q} \text{ or } AFC = AC - AVC$$

- **Features of AFC:** (a) AFC diminishes with increase in output. (b) AFC curve is a rectangular hyperbola. (c) It cannot intersect X-axis or Y-axis.



AFC Curve

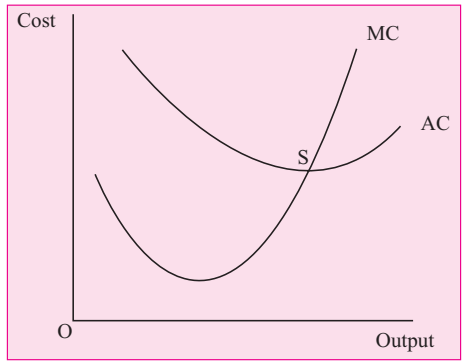
- **Average variable cost** is per unit variable cost of production of a commodity. AVC is U-shaped due to law of variable proportion.



$$AVC = \frac{TVC}{Q} \text{ or } AVC = AC - AFC$$

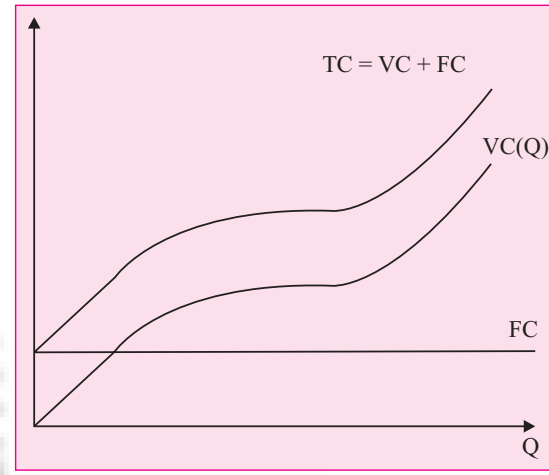
- **Marginal cost** refers to change in TC, due to an additional unit of a commodity being produced.
- $MC = \Delta TC/\Delta Q$ or $MC_n = TC_n - TC_{n-1}$. But under short run, it is calculated from TVC.

$$MC_n = TVC_n - TC_{n-1} \text{ or } MC = \frac{\Delta TVC}{\Delta Q}$$



Relation Between Short-term Cost & Output

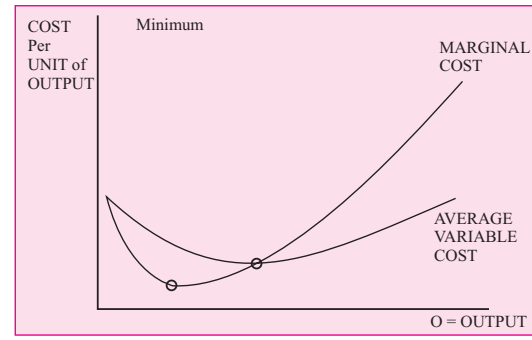
- **Total cost curve and total variable cost curve** remain parallel to each other. The vertical distance between these two curves is equal to total fixed cost. TFC curve remains parallel to X-axis and TVC curve remains parallel to TC curve.



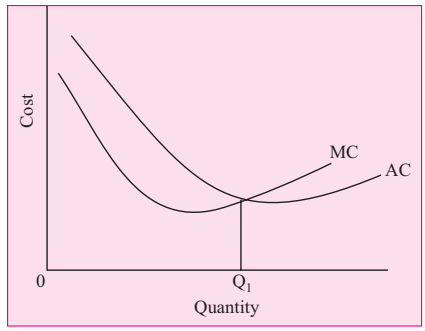
With increase in level of output, the vertical distance between AFC curve and AC curve goes on increasing. On contrary, the vertical distance between AC curve and AVC curve goes on decreasing but these two curves never intersect because average fixed cost is never zero.

- **Relation between MC and AVC**

When MC < AVC, AVC falls.
When MC = AVC, AVC is minimum and constant.
When MC > AVC, AVC rises. MC curve cuts AVC curve at its lowest point. Both curves are U-shaped and start from the same point.



- **Relation between MC and AC:** (i) when AC falls, MC < AC; (ii) when AC rises, MC > AC; (iii) when AC is constant and minimum, MC = AC.



- **Money received from the sale of product is called revenue.**
- **Total revenue** is the total amount of money received by a firm from the sale of given units of a commodity.
  TR = AR × Q or TR = ∑ MR
  TR = Price × Quantity Sold.
  Price = AR
- Per unit revenue received from the sale of given units of a commodity is called **average revenue**. Average revenue is equal to price. Per unit price of a commodity it also called AR.

$$AR = \frac{TR}{Q} \text{ or } \frac{P \times Q}{Q} = P = \text{Price}$$

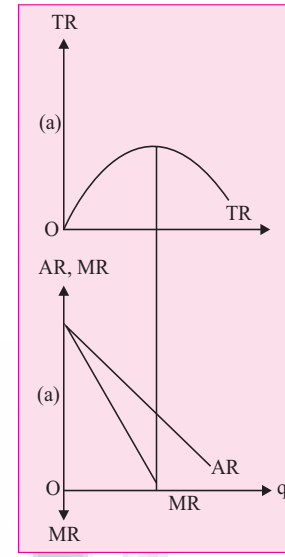
- Marginal revenue is net addition to total revenue when one additional unit of output is sold.

$$MR = \frac{\Delta TR}{\Delta Q} \text{ or } MR_n = TR_n - TR_{n-1}$$

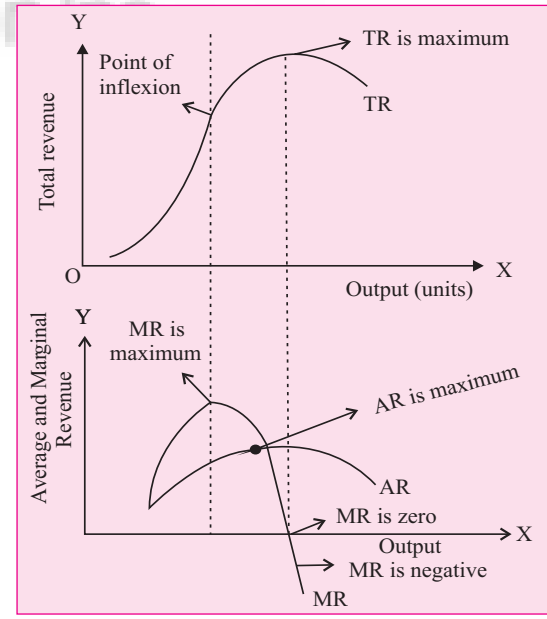
- **Relation between TR, AR, and MR when more quantity is sold at the same price under perfect competition.**
  (a) Average revenue and marginal revenue remains constant at all levels of output and AR and MR curves are parallel to OX-axis.
  AR= MR.
  (b) Total revenue increases at constant rate, MR is constant and TR curve is positively sloped straight line passing through the origin.
- **Relation between TR, AR and MR** when more quantity is sold at the lower price or there is monopoly or monopolistic competition in the market.
  (a) Average revenue and marginal revenue curves have negative slope. MR curve lies below AR curve. AR > MR
  (b) Marginal revenue falls, twice the rate of average revenue.

$$MR = \frac{1}{2} AR$$

(c) So long as marginal revenue decreases and is positive, total revenue increases at diminishing rate. When marginal revenue is zero, total revenue is maximum and when marginal revenue becomes negative, TR starts falling.



- Relation between AR and MR (General relationship)
  When MR = AR, AR is maximum and constant. MR can be negative, but not AR.
  When MR < AR, AR falls. When TR increases at an increasing rate, MR and AR also increase.



- **Concept of Producer's Equilibrium:** If refers to the stage where producer is getting maximum profit with given cost and he has no incentive to increase or decrease the level of output.

(a) MR and MC Approach: Conditions of producers equilibrium according to this approach are :

(a) MC = MR and also AR = MR, hence AR = MR = MC. MC should be rising.

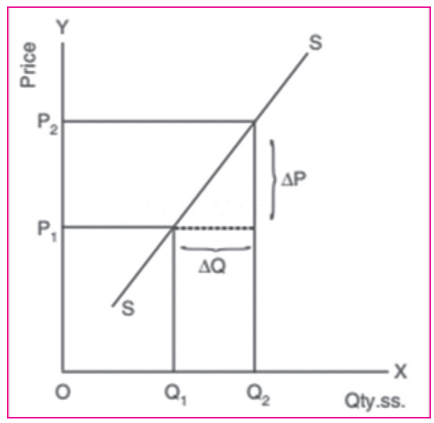
(b) MC curve should cut the MR curve from below at the point of equilibrium.

Or

MC should be more than MR after the equilibrium point, with increase in output.

- **Normal Profit:** It is a no profit no loss situation, it is achieved when P = AC. It is the minimum return that a producer expects from his capital invested in the business.
- **Break-even Point:-** It occurs when AR = AC or (TR = TC). At this point, firm is earning zero economic profit or normal profit. Or we can say it is just covering all its costs.
- **Shut-down Point:** It occurs when a firm is covering its variable costs only, here, the firm is incurring loss of fixed cost. (TR < TVC or AR < AVC)
- **Supply:** Refers to the amount of the commodity that a firm or seller is willing to sell at different prices during a given period of time.
- **Factors affecting supply of a commodity:**

Price of the commodity.
Prices of other related goods.
Level of technology.
Prices of inputs.
Number of firms.
Government policy regarding taxation and subsidies.
Goals of the firm.



- **Individual Supply:** Refers to quantity of a commodity that an individual firm is willing and able to offer for sale at different prices during a given period of time.
- **Market Supply:** It is the sum total of quantity supplied of a commodity by all sellers or all firms in the market at different prices and in a given period of time.
- **Stock:** Refers to the total quantity of a particular commodity available with the firm at a particular point of time.
- **Supply Schedule:** Refers to a tabular presentation which shows various quantities of a commodity that a producer is willing to supply at different prices, during a given period of time.
- **Supply Curve:** Refers to the graphical representation of supply schedule which represents various quantities of a commodity that a producer is willing to supply at different prices during a given period of time.
- **Slope of Supply Curve** = $\Delta P/\Delta Q$. A supply curve has a positive slope.
- **Law of Supply:** States the direct relationship between price and supply of a commodity, keeping other factors constant, i.e., higher the price, higher the supply and lower the price, lower the supply.
- **Price Elasticity of Supply**: Refers to the degree of responsiveness of supply of a commodity with reference to a change in price of the commodity. It is always positive due to direct relationship between price and quantity supplied.

$$\text{Price Elasticity of Supply (Es)} = \frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$$

- **Methods for measuring price elasticity of supply**

1. Percentage Method

$$Es = \frac{\%\text{ change in a quantity supplied}}{\%\text{ change in price}}$$

$$\text{Or } Es = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

2. Geometric Method

$$Es = \frac{\text{Supply curve intercepted on X-axis}}{\text{Quantity supplied}}$$

- There are three possibilities of Elasticity of Supply:

(a) If a straight line supply curve passes through the point of origin doesn't matter what angles it makes, Es at any point is equal to unity.

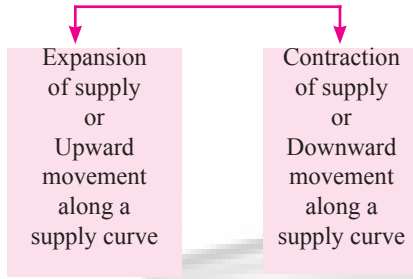
(b) If a straight line supply curve passes through left side of point of origin and intersect Y-axis, Es > 1.

(c) If a straight line supply curve passes through right side of point of origin and intersect X-axis, Es < 1.

- **Change in quantity Supplied Vs Change in Supply:**

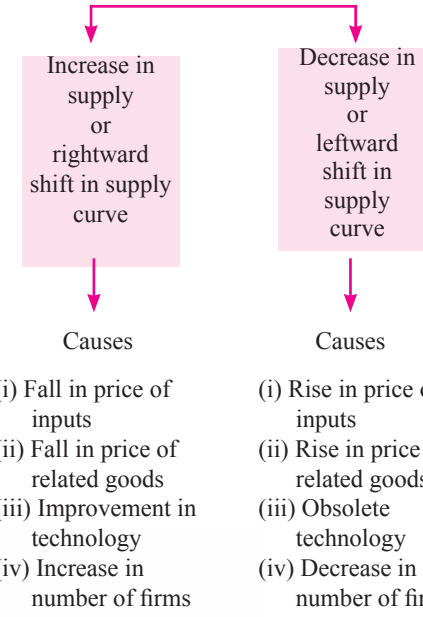
(a) Change in quantity Supplied or movement along supply curve

(i) Due to change in price of commodity other factors remain constant.



(b) Change in Supply or Shift in supply curve

(i) Due to change in factors other than price of the commodity



- In simple words, number increase in supply is more supply at the same price or same supply at lower price.

Decrease in supply is less supply at same price or same supply at a higher price.

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CHAPTER 4

Producer Equilibrium

- We develop the revenue concepts, and, together with the cost concepts, we study profit maximisation. This, in turn, forms the basis of what is called the **supply curve**.
- Total revenues, defined as price × output, change with output. This sets the stage for analysing profit maximisation or what is called **producer's equilibrium**.

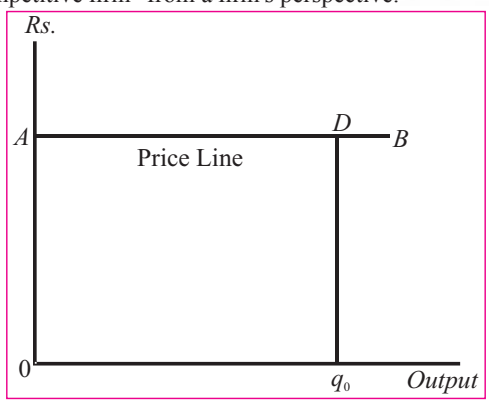
Total Revenues

The following six characteristics define **perfect competition** or a perfectly **competitive market**.

(A) There are a large number of buyers and sellers (producers).
(B) Firms sell a very homogenous (i.e., identical) product and service.
(C) There is free entry and exit.
(D) Perfect knowledge
(E) Uniform price
(F) No transport and selling cost

Total Revenue Curve and Price Line

Price line is also called the "demand curve facing a competitive firm" from a firm's perspective.



Price Line and Total Revenue

Marginal revenue is defined as the increase in total revenue when one extra unit is sold, i.e., it is the revenue obtained from one extra or last unit sold.

Producer's Equilibrium: The Basis of the Supply Curve

1. The total variable cost is equal to the area under the marginal cost curve.
2. The total revenue is equal to the area under the price line.

The Profit-maximising Condition

- In a parallel way, the key reason behind the producer's equilibrium condition, $P = MC$, is that *marginal cost be increasing with output*.
- Extra revenues will be less than the extra costs, implying that the profits will be less.
- *MR = MC. That is marginal revenue is equal to marginal cost*.
- The law of supply states that, *other things remaining unchanged, an increase in the price of a product leads to an increase in the quantity supplied of it*. It is because, higher the price, the more a producer wants to supply.
- The graph of a **supply schedule** gives the **supply curve**.

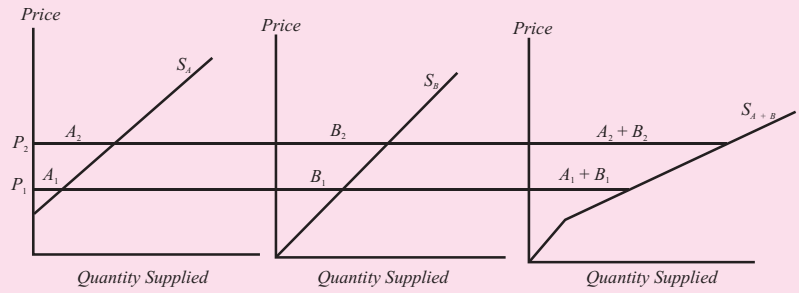
Change in Quantity Supplied Versus Change in Supply

Determinants of the Supply Curve

- There is still another factor that our simple profit-maximising analysis does not capture, namely, changes in the prices of related goods.
- Changes are nearly cost less to include. Using printers to print is also an easy and fairly inexpensive job.
- Since the *MC* curve is essentially the supply curve, we have the result that a *technological progress shifts the supply curve to the right*.
- *Thus, an increase (or decrease) in the price of a substitute good in production shifts the supply curve of a good to the left (or right).*

Market Supply Curve

An increase (or decrease) in the number of firms shifts the market supply curve to the right (or left).



Individual Supply Curve and the Market Supply Curve

Time Horizon

- In a longer run, i.e., in the short run or long run, the supply curve will be upward sloping, as drawn earlier, because inputs can be changed.

Price Elasticity of Supply

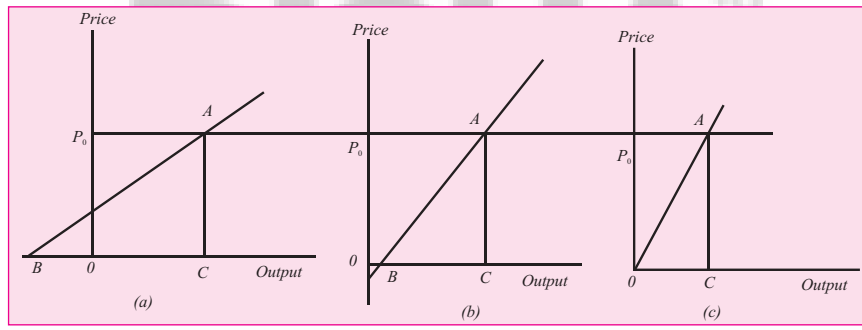
- Parallel to price elasticity of demand, the price elasticity of supply is the responsiveness of quantity supplied after changes in price. It is defined as

(B) Price elasticity of supply = e_s.

$$= \frac{\%\ change\ in\ the\ quantity\ supplied}{\%\ change\ in\ the\ price}$$

In case of price elasticity of demand, (a) the price elasticity of supply is independent of units, and (b), if two supply curves intersect, the flatter one has higher price elasticity at the point of intersection. The reasons are exactly parallel what they were in case of price elasticity of demand.

The price elasticity of supply can be measured by a convenient geometric formula.



Price Elasticity associated with Straight Line Supply Curves

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Determination of Market Equilibrium under Perfectly Competitive Market

1. **Market equilibrium** refers to that point which has come to be established under a given condition of demand and supply and has a tendency to stick to that level, i.e., where Demand = Supply.
2. If due to some disturbance we divert from our position the economic forces will work in such a manner that it could be driven back to its original position, i.e., where Demand = Supply. In short, it is the position of rest.
3. **It can be explained with the help of the schedule and diagram:**

(a) In the given schedule, market equilibrium is determined at price Rs. 3 where market demand is equal to market supply.

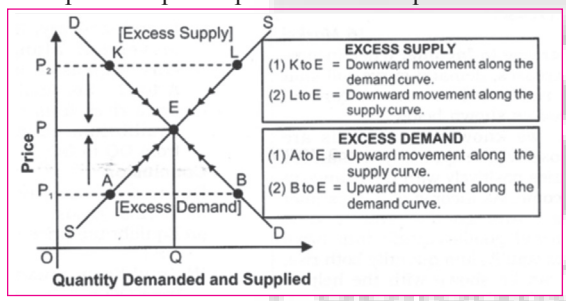
(i) At price 1 and 2, there is excess demand, which leads to rise in price, resulting tendency is expansion in supply.

(ii) Similarly, at price 4 and 5, there is excess supply, which leads to fall in price, resulting tendency is contraction in supply.

Price (₹)	Demand (Units)	Supply (Units)	Surplus (+) or Shortage (–)	Resulting Tendency
1	5	1	(–) 4	Expansion
2	4	2	(–) 2	Expansion
3	**3**	**3**	**0**	**Market Equilibrium**
4	2	4	(+) 2	Contraction
5	1	5	(+) 4	Contraction

(b) (i) In the given diagram, price is measured on vertical axis, whereas quantity demanded and supplied is measured on horizontal axis.

(ii) Suppose that initially the price in the market is P_1. At this price, the consumer demands P_1B and the producer supplies P_1A, i.e., consumers want more than what the producers are willing to supply. There is excess demand equal to AB. So, price cannot stay on P_1 as excess demand will create competition among the buyers and push the price up till we reach equilibrium.



Due to rise in price from P_1 to P_2 there is upward movement along the supply curve (expansion in supply) from A to E and upward movement along the demand curve (contraction in demand) from B to E.

(iii) Similarly, at price supplied P_2L, there is excess supply, equal to KL, which will create competition among the sellers and lower the price. The price will keep falling as long as there is an excess supply.

Due to fall in price from P_2 to P, there is downward movement along the supply curve (contraction in supply) from L to E and downward movement along the demand curve (expansion in demand) from K to E.

(iv) The situation of zero excess demand and zero excess supply defines market equilibrium (E). Alternatively, it is defined by the equality between quantity demanded and quantity supplied. The price P is called equilibrium price and quantity Q is called equilibrium quantity.

Effect of Change in Equilibrium due to Increase and Decrease in Demand and Supply.

Case I: Increase in Demand

1. An increase in demand leads to rightward shift of demand curve.

You Must Know

When demand increases, then shifting should be such that initial price remains constant. It is so because increase in demand is the part of the shift in demand in which other factor changes and price remains constant.

Changes in Demand

(1) A to B because of increase in demand (shift in demand)

(2) B to C as price rises because of excess demand which leads to upward movement along the demand curve.

A to C as price rises because of excess demand which leads to upward movement along the supply curve.

2. We assume that initial price is OP and equilibrium quantity is OQ as shown above:

(a) In the above figure price is on vertical axis and quantity demanded and supplied is on horizontal axis. But due to increase in demand due to the following reasons, the demand curve shifts rightward from DD to D_1D_1.

(i) Price of substitute goods rises.

(ii) Price of complementary goods falls.

(iii) Income of a consumer rises in case of normal goods.

(iv) Income of a consumer falls in case of inferior goods.

(v) When preferences are favourable.

(b) With new demand curve D_1D_1, there is excess demand at initial price OP because at price OP_1 demand is PB and supply is PA, so there is excess demand of AB at price OP.

(c) Due to this excess demand, competition among the consumer will rise the price. With the rise in price, there is upward movement along the demand curve (contraction in demand) from B to C and similarly, there is upward movement along the supply curve (expansion in supply) from A to C. So, finally equilibrium price rises from OP to OP_1, and equilibrium quantity also rises from OQ to OQ_1

Conclusion

Due to increase in demand,

(i) Equilibrium price rises from OP to OP_1

(ii) Equilibrium quantity also rises from OQ to OQ_1

Case II: Decrease in Demand

1. A decrease in demand leads to leftward shift of demand curve as shown in the below figure.

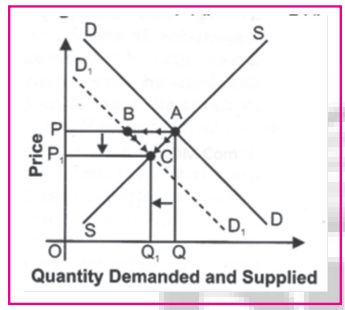
You Must Know

When demand decreases, then shifting should be such that initial price remains constant. It is so because decrease in demand is the part of the shift in demand in which other factor changes and price remains constant.

Changes in Demand

(1) A to B because of decrease in demand (shift in demand).

(2) B to C as price falls because of excess supply which leads to downward movement along the demand curve.



2. (a) A to C as price falls because of excess supply which leads to downward movement along the supply curve.

(i) Price of substitute goods falls.

(ii) Price of complementary goods rises.

(iii) Income of a consumer falls in case of normal goods.

(iv) Income of a consumer rises in case of inferior goods.

(v) When a preference becomes unfavourable.

(b) With new demand curve D_1D_1, there is excess supply of AB at price OP.

(c) Due to this excess supply, competition among the producer will make the price fall. Due to fall in price, there is downward movement along the demand curve.

(Expansion in demand) from B to C and similarly there is downward movement along the supply curve (contraction in supply) from A to C. So, finally, the equilibrium price falls from OP to OP_1 and equilibrium quantity also falls from OQ to OQ_1.

Conclusion

Due to decrease in demand,

(i) Equilibrium price falls from OP to OP_1.

(ii) Equilibrium quantity also falls from OQ to OQ_1.

Case III: Increase In Supply

1. An increase in supply leads to rightward shift of supply curve as shown in the below figure:

You Must Know

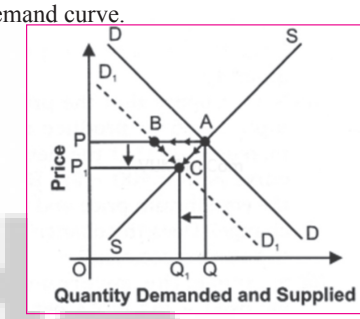
When supply increases, then shifting should be such that initial price remains constant. It is so because increase in supply is the part of the shift in supply in which other factor changes and price remains constant.

Changes in Supply

(1) A to B because of increase in supply (shift in supply).

(2) B to C as price falls because of excess supply which leads to downward movement along the supply curve.

(3) A to C as price falls because of excess supply which leads to downward movement along the demand curve.



2. We assume that initial price is OP and equilibrium quantity is OQ as shown above:

(a) In the above figure, price is on vertical axis and quantity demanded and supplied is on horizontal axis. But increase in supply is due to the following reasons:

(i) Fall in the prices of remuneration of factors of production.

(ii) Fall in the prices of other commodities.

(iii) Improvement in technology.

(iv) Change in objective of producer (inducing them to increase supply at the same price.)

(v) Taxation policy of government falls.

(b) The supply curve shifts rightward from SS to S_1S_1. With new supply curve S, S,, there is excess supply at initial price OP because at price OP_1 supply is PB and demand is PA, so there is excess supply of AB at price OP.

(c) Due to this excess supply, competition among the producer will make the price fall. Due to this fall in price, there is downward movement along the supply curve (contraction in supply) from B to C

and similarly, there is downward movement along the demand curve (expansion in demand) from A to C. So, finally, equilibrium price falls from OP to OP_1 and equilibrium quantity rises from OQ to OQ_1

Conclusion

Due to increase in supply,

(i) Equilibrium price falls from OP to OP_1.
(ii) Equilibrium quantity rises from OQ to OQ_1.

Case IV: Decrease in Supply

A decrease in supply leads to leftward shift of supply curve as shown in the below figure.

You Must Know

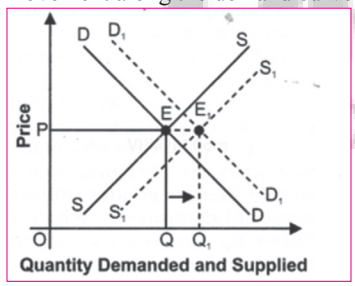
When supply decreases, then shifting should be such that initial price remains constant. It is so because decrease in supply is the part of the shift in supply in which other factor changes and price remains constant.

Changes in Supply

(1) A to B because of decrease in supply (shift in supply).
(2) B to C as price rises because of excess demand which leads to upward movement along the supply curve.

Changes in Demand

A to C as price rises because of excess demand which leads to upward movement along the demand curve.



2. We assume that initial price is OP and equilibrium quantity is OQ as shown above.
   (a) In the above figure, price is on vertical axis and quantity demanded and supplied is on horizontal axis. But decrease in supply is due to the following reasons; the supply curve shifts leftwards from SS to S_1S_1.
      (i) Rise in the prices of remuneration of factors of production.
      (ii) Rise in the prices of other goods.
      (iii) When the technology becomes outdated.
      (iv) Change in objective of producer (inducing them to decrease supply at the same price).
      (v) Taxation policy of government rises.
   (b) With new supply curve S_1S_1, there is excess demand at initial price OP because at price OP, supply is PB and demand is PA, so there is excess demand of AB at price OP.
   (c) Due to this excess demand, competition among the consumers will rise the price. Due to this rise in price, there is upward movement along the supply curve (expansion in supply) from B to C and similarly, there is upward movement along the demand curve (contraction in demand) from A to C. So, finally, equilibrium price rises from OP to OP_1 and equilibrium quantity falls from OQ to OQ_1.

Conclusion

Due to decrease in supply,

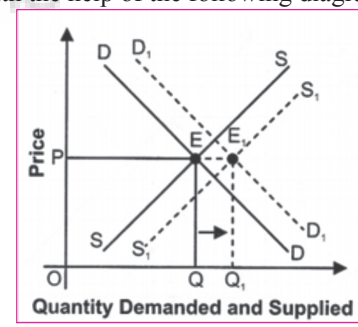
(i) Equilibrium price rises from OP to OP_1
(ii) Equilibrium quantity falls from OQ to OQ_1

Simultaneously Increase and Decrease in Demand and Supply

Case I: Both Demand and Supply Increases: When both demand and supply increases, then there are three possibilities:

Case A: When Demand and Supply both Increase at the Same Rate

1. When demand and supply both increase at the same rate, equilibrium price remains constant and equilibrium quantity rises. It can be shown with the help of the following diagram.



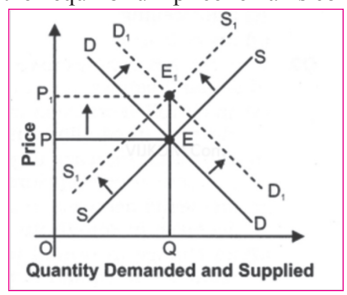
You Must Know

When demand and supply both increase at the same rate, then equilibrium price remains constant.

Logic

Suppose demand and supply both increase by 5%, then there is neither excess demand nor excess supply, that is why price remains constant.

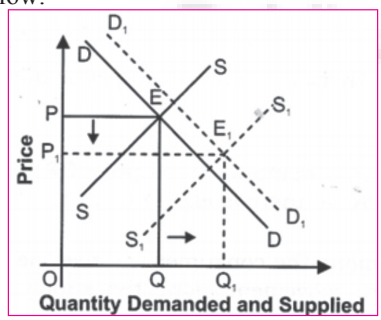
Case B: When demand and supply both increase at the same rate, then equilibrium price remains constant.



1. We assume that initial price is OP and equilibrium quantity is OQ as shown above.
   (a) In the above diagram, price is measured on vertical axis and quantity demanded and supplied is measured on horizontal axis.
   (b) But when, "demand and supply both increase at the same rate", then,
      (i) Equilibrium price remains constant at OP and
      (ii) Equilibrium quantity rises from OQ to OQ_1.

Case B: When demand increases, supply also increases but at a much faster rate.

2. When demand increases, supply also increases but at a much faster rate, then equilibrium price falls and equilibrium quantity rises as shown below:



You Must Know

When demand increases and supply also increases but at a much faster rate, equilibrium price falls.

Logic

(Demand 5% ↑) → (Supply 7% ↑). So there is excess supply of 2% which will create competition among the sellers and equilibrium price falls.

2. We assume that initial price is OP and equilibrium quantity is OQ as shown above.
   (a) In the above diagram, price is measured on vertical axis and quantity demanded and supplied is measured on horizontal axis.
   (b) But when "demand increases and supply also increases but at a much faster rate", then,
      (i) Equilibrium price falls from OP to OP_1 and
      (ii) Equilibrium quantity rises from OQ to OQ_1.

Case C: When supply increases, demand also increases but at a much faster rate.

1. When supply increases, demand also increases but at a much faster rate, then equilibrium price rises and equilibrium quantity rises as shown below.
2. We assume that initial price is OP and equilibrium quantity is OQ as shown above:
   (a) In the above diagram, price is measured on vertical axis and quantity demanded and supplied is measured on horizontal axis.
   (b) But when "supply increases and demand also increases but at a much faster rate" then,
      (i) Equilibrium price rises from OP to OP_1 and
      (ii) Equilibrium quantity also rises from OQ to OQ_1.

Case II: Both Demand and Supply Decrease: When both demand and supply decreases, then there are three possibilities:

Case A: When demand and supply both decrease at the same rate

1. When demand and supply both decrease at the same rate, equilibrium price remains constant and equilibrium quantity falls as shown below.

You Must Know

When demand and supply both decrease at the same rate, equilibrium price remains constant.

Logic

Suppose demand and supply both decrease by 5%, then there is neither excess demand nor excess supply, i.e., why price remains constant.

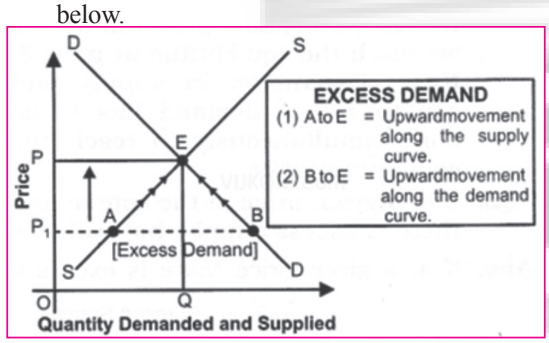
2. We assume that initial price is OP and equilibrium quantity is OQ as shown above:
   (a) In the above diagram, price is measured on vertical axis and quantity demanded and supplied is measured on horizontal axis.
   (b) But when "demand and supply both decrease at the same rate" then,
      (i) Equilibrium price remains constant at OP_1 and
      (ii) Equilibrium quantity falls from OQ to OQ_1.

Case B: When demand decreases, supply also decreases but at a much faster rate

1. When demand decreases, supply also decreases but at a much faster rate, then equilibrium price rises and equilibrium quantity falls as shown below.
2. We assume that initial price is OP and equilibrium quantity is OQ as shown above.
   (a) In the above diagram, price is measured on vertical axis and quantity demanded and supplied is measured on horizontal axis.
   (b) But when "demand decreases, supply also decreases but at a much faster rate" then,
      (i) Equilibrium price rises from OP to OP_1 and
      (ii) Equilibrium quantity falls from OQ to OQ_1.

Case III: When supply decreases, demand also decreases but at a must faster rate

1. When supply decreases, demand also decreases but at a much faster rate, then equilibrium price and equilibrium quantity both fall as shown below.



2. We assume that initial price is OP and equilibrium quantity is OQ as shown above.
   (a) In the above diagram, price is measured on vertical axis and quantity demanded and supplied is measured on horizontal axis.
   (b) But when "supply decreases, demand also decreases but at a much faster rate" then,
      (i) Equilibrium price falls from OP to OP_1 and
      (ii) Equilibrium quantity falls from OQ to OQ_1

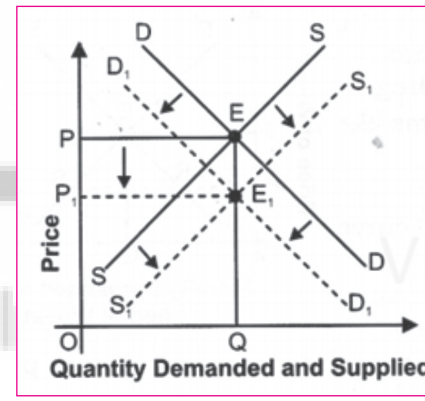
Shift in Demand and Supply in Opposite Direction

Case I: When demand increases and supply decreases at the same rate

1. When demand increases and supply decreases but at the same rate, then equilibrium price rises and equilibrium quantity remains constant as shown below.
2. We assume that initial price is OP and equilibrium quantity is OQ as shown above.
   (a) In the above diagram, price is measured on vertical axis and quantity demanded and supplied is measured on horizontal axis.
   (b) But when, "demand increases and supply decreases but at the same rate", then,
      (i) Equilibrium price rises from OP to OP_1 and
      (ii) Equilibrium quantity remains constant at OQ.

Case II: When demand decreases and supply increases at the same rate

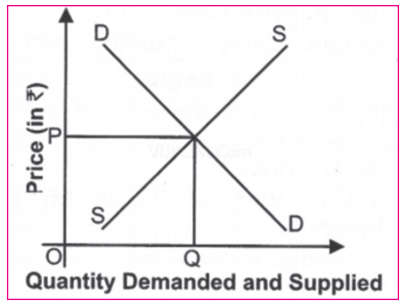
1. When demand decreases and supply increases but at the same rate, then equilibrium price falls and equilibrium quantity remains constant as shown below.



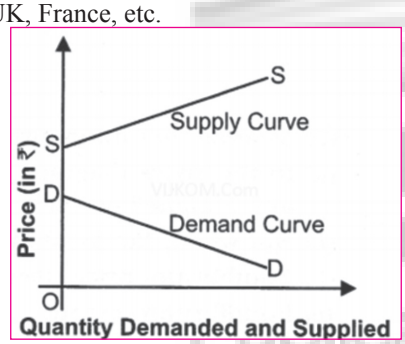
2. We assume that initial price is OP and equilibrium quantity is OQ as shown above.
   (a) In the above diagram, price is measured on vertical axis and quantity demanded and supplied are measured on horizontal axis.
   (b) But when, "demand decreases and supply increases but at the same rate", then, (i) Equilibrium price falls from OP to OP_1 and (ii) Equilibrium quantity remains constant at OQ.

Viable Industry and Non-viable Industry

1. **Viable industry** refers to an industry for which supply curve and demand curve intersect each other in positive axes.



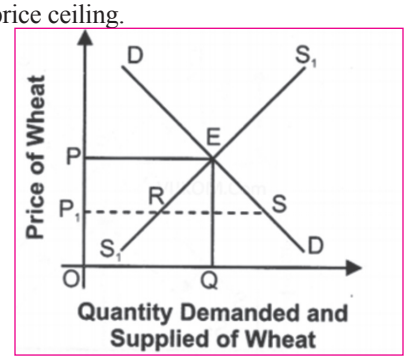
2. **Non-viable industry** refers to an industry for which supply curve and demand curve never intersect each other in the positive axes. In India, commercial aircraft is an example of a non-viable industry. It means, aircraft cannot be produced at all. Note that an industry which is non-viable in one country may be viable for another country. For instance, commercial aircraft are produced in countries like USA, UK, France, etc.



Simple Applications of Tools of Demand and Supply

Price Ceiling (Maximum Price Ceiling)

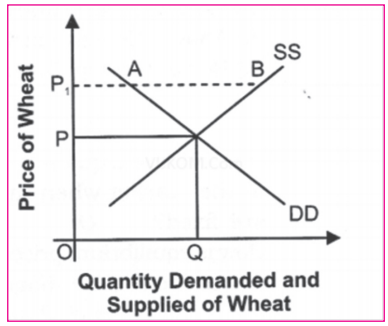
1. When the government imposes upper limit on the price (maximum price) of a good or service which is lower than equilibrium price, it is called price ceiling.



2. **Price ceiling** is generally imposed on necessary items like wheat, rice, kerosene, etc.
3. **It can be explained with the help of the given diagram:**
   (a) In the given diagram, DD is the market demand curve and SS is the market supply curve of wheat.
   (b) Suppose, equilibrium price OP is very high for many individuals and they are unable to afford at this price.
   (c) As wheat is a necessary product, government has to intervene and impose price ceiling, which is below the equilibrium level.
   (d) When the government fixes the price of a commodity at a level lower than the equilibrium price (say it fixes the price at OP_1, there would be a shortage of the commodity in the market. Because at this price, demand exceeds supply. Quantity demanded is P_1S, while quantity supplied is only P_1R. There is, thus, a shortage of RS quantity at this price (i.e., OP_1). In free market, this excess demand of RS would have raised the price to the equilibrium level of OP. But, under government price-control consumers' demand would remain unsatisfied.
   (e) Though the intention of the government was to help the consumers, it would end up creating shortage of wheat.
   (f) To meet this excess demand, government may use rationing system.
   (g) Under rationing system, a certain part of demand of the consumers is met at a price lower than the equilibrium price. Under this system, consumers are given ration coupons/Cards to buy essential commodities at a price lower than the equilibrium price from Fair Price/Ration Shops.
   (h) Rationing system can create the problem of black market, under which the commodity is bought and sold at a price higher than the maximum price fixed by the government.

Price Floor (Minimum Price Ceiling)

1. When the government imposes lower limit on the price (minimum price) that may be charged for a good or service which is higher than equilibrium price, it is called price floor.
2. Price Floor is generally imposed on agricultural price support programmes and the minimum wage legislation.
   (a) Agricultural price support programmes: Through an agricultural price support programme, the government imposes a lower limit on the purchase price for some of the agricultural goods and the floor is normally set at a level higher than the market—determined price for these goods.
   (b) Minimum wage legislation: Through the minimum wage legislation, the government ensures that the wage rate of the labourers does not fall below a particular level and here again the minimum wage rate is set above the equilibrium wage rate.
3. **It can be explained with the help of given diagram.**
   (a) In the given diagram, DD is the market demand curve and SS is the market supply curve of wheat.
   (b) Suppose, equilibrium price OP is not so profitable for farmers, who have suppose, just faced drought.



   (c) To help farmers, government must intervene and impose price floor of P_1; which is above than the equilibrium price.
   (d) Since, the price P_1 is above the equilibrium price P_1 the quantity supplied P_1B exceeds the quantity demanded is P_1A. There is excess supply of wheat.
   (e) In case of excess supply, farmers of these commodities need not sell at prices lower than the minimum price fixed by the government.
   (f) The surplus quantity will be purchased by the government. If the government does not procure the excess supply, competition among its sellers would bring down the price to the level of equilibrium price.

Words that Matter

- **Market equilibrium:** It refers to the situation when market demand is equal to the market supply.
- **Equilibrium price:** The price at which equilibrium is reached.
- **Equilibrium quantity:** The quantity bought and sold at the equilibrium price.
- **Equilibrium point:** Equilibrium point is the point of intersection of the demand curve and supply of commodity.
- **Viable industry:** It refers to an industry for which supply curve and demand curve intersect each other at positive axes.
- **Non-viable industry:** It refers to an industry for which supply curve and demand curve never intersect each other in the positive axis.
- **Price ceiling:** When the government imposed upper limit on the price (maximum price) of a good or service which is lower than equilibrium price.
- **Price floor:** When the government imposed lower limit on the price (minimum price) that may be charged for a good or service which is higher than equilibrium price.
- **Rationing:** Under rationing system, a certain part of demand of the consumers is met at a price lower than the equilibrium price. Under this system, consumers are given ration coupons/Cards to buy essential commodities at a Price lower than the equilibrium price from Fair Price/Ration Shops.
- **Black market:** It is a market under which the commodity is bought and sold at a price higher than the maximum price fixed by the government.

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CHAPTER 1

Geography as a Discipline

- Human beings depend on the resources to sustain themselves in the surrounding areas.
- Primitive societies subsisted on 'natural means of subsistence', i.e., edible plants and animals.
- With the passage of time, we developed technologies and started producing our food using natural resources such as land, soil and water.
- Human beings adjusted food habits and clothing according to the prevailing weather conditions.
- There are variations in the natural resource base, technological development, adaptation with and modification of physical environment, social organisations and cultural development.
- Earth is our home. It is also the home of many other creatures, big and small, which live on the earth and sustain.
- The earth's surface is not uniform. It has variations in its physical features. There are mountains, hills, valleys, plains, plateaus, oceans, lakes, deserts and wilderness.
- There are variations in its social and cultural features too.
- There are villages, cities, roads, railways, ports, markets and many other elements created by human beings across the entire period of their cultural development.
- This variation provides a clue to the understanding of the relationship between the physical environment and social/cultural features.
- The physical environment has provided the stage, on which human societies enacted the drama of their creative skills with the tools and techniques which they invented and evolved in the process of their cultural development.

Tamil Nadu Textbook

Geography

The study of Geography is about more than just memorising places on a map. It is about understanding the complexity of our world, appreciating the diversity of cultures that exists across continents. And in the end, it is about using all that knowledge to help bridge divides and bring people together"

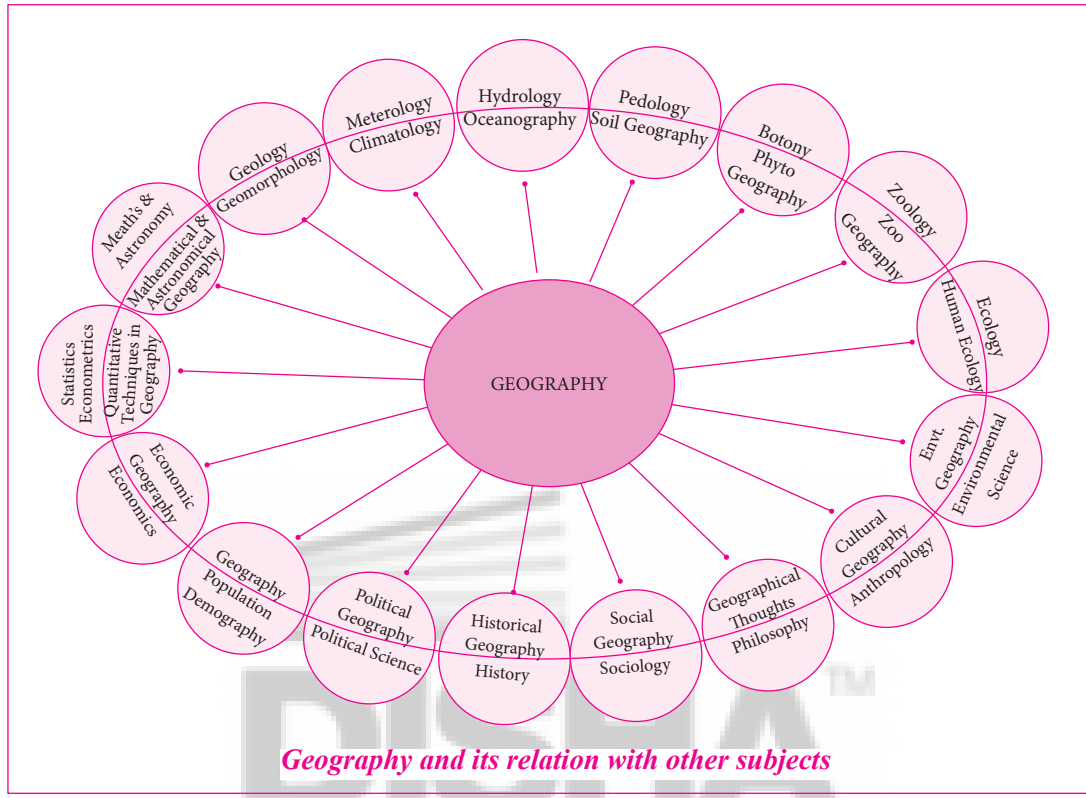
– Barak Obama, Former President of USA

- It can be said that geography is the description of the earth.
- The term geography was first coined by Eratosthenese, a Greek scholar (276-194 BC).
- The word has been derived from two roots of Greek language geo (earth) and graphien (description). Put together, they mean description of the earth.
- The earth has always been seen as the abode of human beings and thus, scholars defined geography as, "the description of the earth as the abode of human beings".
- The 'earth' is also multi-dimensional, that is why many disciplines from natural sciences such as geology, pedology, oceanography, botany, zoology and meteorology and a number of sister disciplines in social sciences such as economics, history, sociology, political science, anthropology, etc., study different aspects of the earth's surface.

- Geography is different from other sciences in its subject matter and methodology but at the same time, it is closely related to other disciplines.
- Geography derives its data base from all the natural and social sciences and attempts their **synthesis.**
- A number of phenomena are similar and many are dissimilar. It was, therefore, logical to perceive geography as the **study of areal differentiation.**
- The geography was perceived to study all those phenomena which vary **over space.**
- Geographers do not study only the variations in the phenomena over the earth's surface (space) but also study the associations with the other factors which cause these variations.
- The concern of geography is to find out the **causal relationship** between any two phenomena or between more than one phenomenon.
- A geographer explains the phenomena in a frame of cause and effect relationship, as it does not only help in interpretation but also foresees the phenomena in future.
- The geographical phenomena, both the physical and human, are not static but highly dynamic.
- They change over time as a result of the interactive processes between ever-changing earth and untiring and ever-active human beings.
- Primitive human societies were directly dependent on their immediate environment.
- Geography is concerned with the study of Nature and Human interactions as an integrated whole.
- 'Human' is an integral part of 'nature' and 'nature' has the imprints of 'human'.
- 'Nature' has influenced different aspects of human life.
- Its imprints can be noticed on food, clothing, shelter and occupation.
- Human beings have come to terms with nature through adaptation and modification.
- The present society has passed the stage of primitive societies, which were directly dependent on their immediate physical environment for sustenance.
- Present societies have modified their natural environment by inventing and using technology and thus, have expanded the horizon of their operation by appropriating and utilising the resources provided by nature.
- With the gradual development of technology, human beings were able to loosen the shackles of their physical environment.
- Technology helped in reducing the harshness of labour, increased labour efficiency and provided leisure to human beings to attend to the higher needs of life.
- It also increased the scale of production and the mobility of labour.
- The links (routes) and nodes (settlements of all types and hierarchies) integrated the space and gradually, it got organised.
- As a social science discipline, geography studies the 'spatial organisation' and 'spatial integration'.
- Geography as a discipline is concerned with three sets of questions:
  - (i) Some questions are related to the **identification of the patterns of natural** and **cultural features** as found over the surface of the earth.
  - (ii) Some questions are related to the **distribution of the natural and human/ cultural features** over the surface of the earth.
- Taken together, both these questions take care of distributional and locational aspects of the natural and cultural features. These questions provided inventorised information of features and location.
- It was a very popular approach during the colonial period. These two questions did not make geography a scientific discipline till the third question was added.
  - (iii) The third question is related to the explanation or the **causal relationships** between features and the processes and phenomena.
- Geography as a discipline is related to space and takes note of spatial characteristics and attributes.
- It studies the patterns of distribution, location and concentration of phenomena over space and interprets them providing explanations for these patterns.
- It takes note of the associations and inter -relationships between the phenomena over space and interprets them providing explanations for these patterns.

It also takes note of the **associations and inter-relationships** between the phenomena resulting from the dynamic interaction between human beings and their physical environment.

Geography as an Integrated Discipline



Geography and its relation with other subjects

- Geography is a discipline of synthesis.
- It attempts spatial synthesis, and history attempts temporal synthesis.
- Its approach is holistic in nature.
- It recognises the fact that the world is a system of interdependencies.
- The present world is being perceived as a global village.
- The distances have been reduced by better means of transportation increasing accessibility.
- The audio-visual media and information technology have enriched the database.
- Technology has provided better chances of monitoring natural phenomena as well as the economic and social parameters.
- Geography as an integrating discipline has interface with numerous natural and social sciences.
- All the sciences, whether natural or social, have one basic objective, of understanding the reality.
- Geography attempts to comprehend the associations of phenomena as related in sections of reality.
- Every discipline, concerned with scientific knowledge is linked with geography as many of their elements vary over space.
- Geography helps in understanding the **reality in totality in its spatial perspective**.
- Geography, thus, not only takes note of the differences in the phenomena from place to place but integrates them holistically which may be different at other places.
- A geographer is required to have a broad understanding of all the related fields, to be able to logically integrate them.
- This integration can be understood with some examples.
- Geography influences historical events.
- Spatial distance itself has been a very potent factor to alter the course of history of the world. Spatial depth provided defence to many countries, particularly in the last century.

- In traditional warfare, countries with large size in area, **gain time at the cost of space**. The defence provided by oceanic expanse around the countries of the new world has protected them from wars being imposed on their soil.
- In India, the **Himalayas** have acted as great barriers and provided **protection** but the passes provided **routes to the migrants** and **invaders** from Central Asia.
- The sea coast has encouraged contact with people from East and Southeast Asia, Europe and Africa.
- **Navigation technology** helped European countries to colonise a number of countries of Asia and Africa, including India as they got accessibility through oceans.
- The geographical factors have modified the course of history in different parts of the world.
- Every geographical phenomenon undergoes change through time and can be explained temporally.
- The changes in landforms, climate, vegetation, economic activities, occupations and cultural developments have followed a definite historical course.
- Many geographical features result from the decision making process by different institutions at a particular point of time.
- It is possible to convert time in terms of space and space in terms of time.

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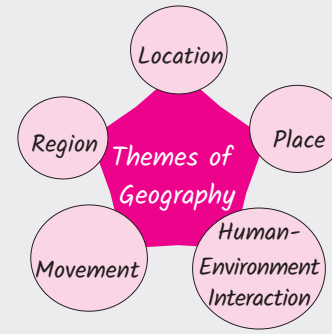
Themes in Geography

- *These themes are the educational tools for understanding geography as a subject in detail.*
- *It was adopted in the year 1984 by the Association of American Geographers and these five themes were published in the National Council for Geographic Education/Association of American Geographers' publication, Guidelines for Geographic Education.*



Location

The location can be described in two different ways:

1. ***Absolute location:*** *A location as described by its latitude and longitude on the earth. For example, the coordinates of* ***Chennai Central Railway station*** *are 13°04'56" N latitude and 80°16'32" E longitude.*
2. ***Relative location:*** *A position of a place in relation to another well-known landmark. For example,* ***Kallanai Dam or Grand Anicut*** *is located roughly 350 km southwest of Chennai City.*

Place

- *A place is an area that is defined by everything in it. All places have features that give them personality to distinguish them from other places.*
- *A number of place names in Tamil Nadu, like* ***St. Thomas Mount, Fort St. George, Mint,*** *and* ***George Town*** *are examples to this theme.*

1. ***Toponym:*** *A place name, especially one derived from any topographical feature.*

2. ***Site:*** *An area of ground on which a town, building, or monument is constructed.*
3. ***Situation:*** *The location and surroundings of a place.*

Human-Environment Interaction

- *The theme describes how people interact with the environment and how the environment responds.*
- *This is studied with reference to the following three key concepts:*
  1. ***Dependency:*** *How humans depend on the environment (Example: For water, fresh air, sunlight, etc.)*
  2. ***Adaptation:*** *How humans adapt to the environment (Example: Life in polar and desert regions)*
  3. ***Modification:*** *How humans modify the environment (Example: Construction of Underground Metro rail, Agriculture in Israel).*

Movement

- *Movement is the network of travel of people, goods and ideas from one location to another.*
- *Examples,* ***rural-urban migration*** *and* ***metro train*** *commuting in Chennai.* ***Air transport*** *which carries people and goods and the* ***internet*** *that allows access to ideas and knowledge across the world are also examples of this kind.*

Region

- *Regions are areas with* ***distinct homogenous characteristics*** *such as* ***climate*** *(Monsoon regions),* ***natural vegetation*** *(Tropical rainforests), crops (Corn Belt of USA),* ***major land forms*** *(Himalayan region),* ***industries*** *(Bangalore and Hosur), etc.*

Physical Geography and Natural Sciences

- All the branches of physical geography have interface with natural sciences.
- Geography is linked with geology, meteorology, hydrology and pedology, and thus, geomorphology, climatology, oceanography and soil geography, respectively have very close link with the natural sciences as these derive their data from these sciences.
- Bio-geography is closely related to botany, zoology as well as ecology as human beings are located in different locational niches.
- A geographer should have some proficiency in mathematics and art, particularly in drawing maps.
- Geography is also linked with the study of astronomical locations and deals with latitudes and longitudes.
- The shape of the earth is **Geoid** but the basic tool of a geographer is a map which is two-dimensional representation of the earth.
- The problem of converting geoids into two dimensions can be tackled by projections constructed graphically or mathematically.
- The cartographic and quantitative techniques require sufficient proficiency in mathematics, statistics and econometrics.
- Maps are prepared through artistic imagination.
- Making sketches, mental maps and cartographic work requires proficiency in arts.

Geography and Social Sciences

- Every discipline has a philosophy which is the raison d'etre for that discipline.
- Philosophy provides roots to a discipline and in the process of its evolution, it also experiences distinct historical processes.
- Thus, the history of geographical thought as mother branch of geography is included universally in its curricula.
- All the social science disciplines, viz. sociology, political science, economics and demography study different aspects of social reality.

- The branches of geography, viz. social, political, economic, population and settlements are closely linked with these disciplines as each one of them has spatial attributes.
- The core concern of political science is territory, people and sovereignty while political geography is also interested in the study of the state as a spatial unit as well as people and their political behaviour.
- Economics deals with basic attributes of the economy such as production, distribution, exchange and consumption.
- Each of these attributes also has spatial aspects and here comes the role of **Economic Geography** which studies the **spatial aspects** of **production**, **distribution**, **exchange** and **consumption.**
- Population geography is closely linked with the discipline of demography.
- Geography has strong interface with natural and social sciences.
- It follows its own methodology of study which makes it distinct from others.
- It has osmotic relationship with other disciplines.
- While all the disciplines have their own individual scope, this individuality does not obstruct the flow of information as in case of all cells in the body that have individual identity separated by membranes but the flow of blood is not obstructed.
- Geographers use data obtained from sister disciplines and attempt synthesis over space. Maps are very effective tools of geographers in which the tabular data is converted into visual form to bring out the spatial pattern.

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Approaches to Study Geography

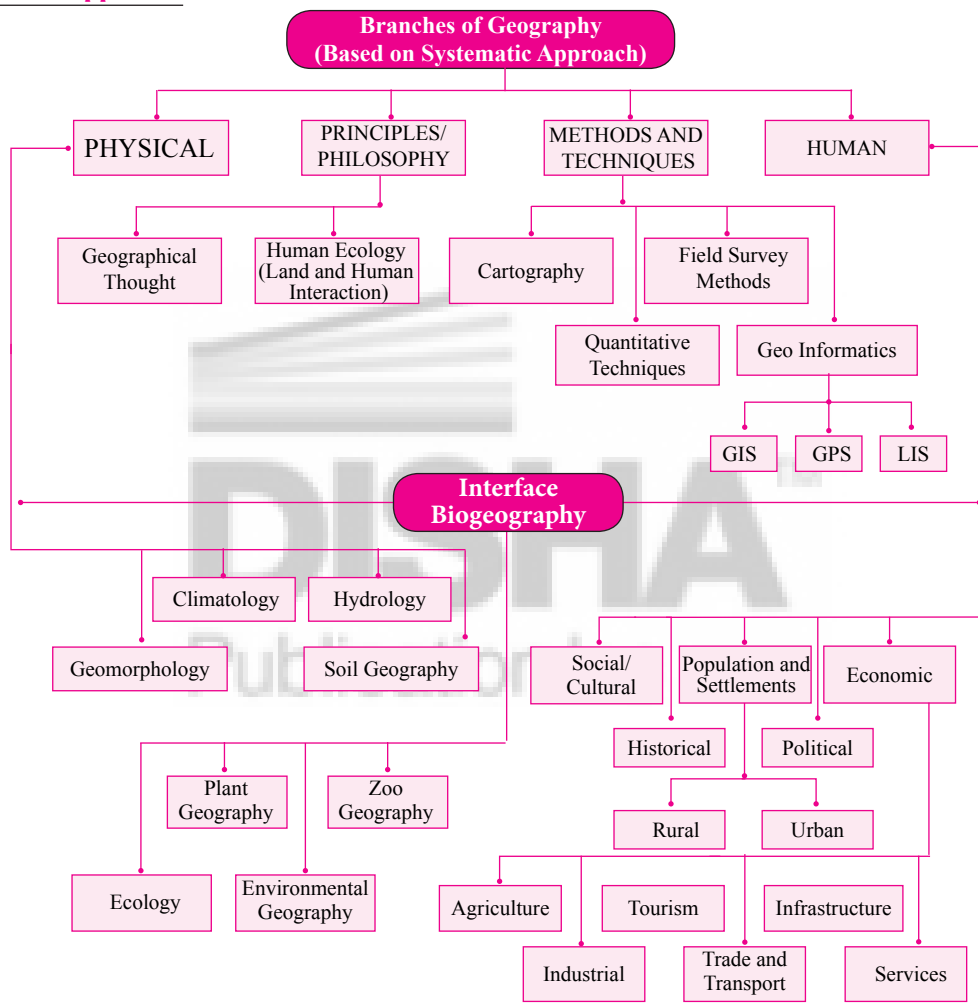
Generally, systematic geography is divided into four main branches.

1. ***Physical geography:*** *Study of various elements of earth systems like atmosphere (air), hydrosphere (water), lithosphere (rock) and biosphere (life) and their distributions.*
2. ***Biogeography & environmental geography:*** *It focuses on various kinds of forests, grasslands, distribution of flora and fauna, human-nature relationships, quality of the living environment and its implications for human welfare.*
3. ***Human Geography:*** *It describes human culture, population, dynamic socio-economic and political aspects.*
4. ***Geographical methods and techniques:*** *It is concerned with methods and techniques for field studies, qualitative, quantitative and cartographic analysis.*

- The study of every subject is done according to some approach.
- The major approaches to study geography have been (i) Systematic and (ii) Regional.
- The **systematic geography** approach is the same as that of general geography.
- This approach was introduced by **Alexander Von Humboldt**, a German geographer (1769-1859) while **regional geography** approach was developed by another German geographer and a contemporary of Humboldt, **Karl Ritter** (1779-1859).
- In systematic approach, **a phenomenon** is **studied world over as a whole**, and then the **identification of typologies** or spatial patterns is done. For example, if one is interested in studying natural vegetation, the study will be done at the world level as a first step.
- In the regional approach, the world **is divided into regions** at different **hierarchical levels** and then all the geographical phenomena in a particular region are studied.
- These regions may be natural, political or designated. The phenomena in a region is studied in a holistic manner searching for unity in diversity.

- **Dualism** is one of the main characteristics of geography which got introduced from the very beginning.
- This dualism depended on the aspect emphasised in the study. Earlier scholars laid emphasis on physical geography.
- But human beings are an integral part of the earth's surface. They are a part and parcel of nature.
- They have also contributed through their cultural development. Thus developed human geography with emphasis on human activities.

Systematic Approach



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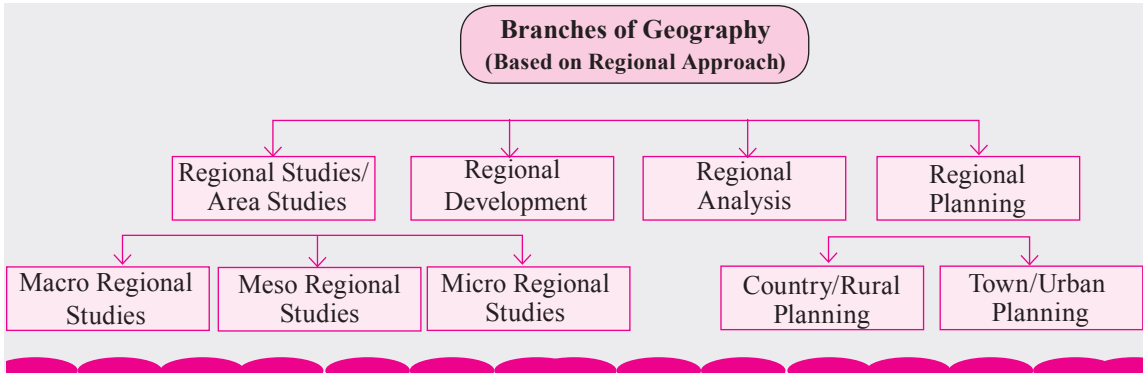
The main sub-branches of regional geography are:

1. Regional studies
2. Regional analysis
3. Regional development
4. Regional planning



Branches of Geography

1. Physical Geography

(i) **Geomorphology** is devoted to the study of landforms, their evolution and related processes.

(ii) **Climatology** encompasses the study of structure of atmosphere and elements of weather and climates and climatic types and regions.

(iii) **Hydrology** studies the realm of water over the surface of the earth including oceans, lakes, rivers and other water bodies and its effect on different life forms including human life and their activities.

(iv) **Soil Geography** is devoted to study the processes of soil formation, soil types, their fertility status, distribution and use.

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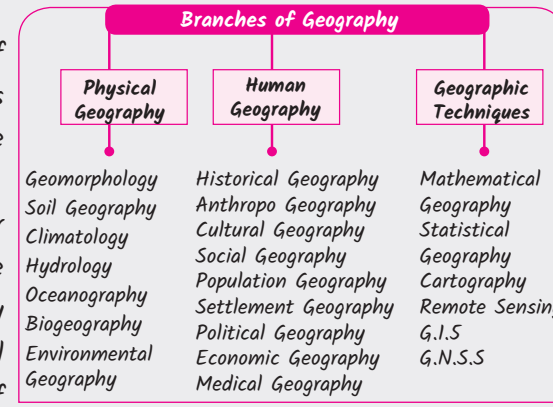
(v) ***Oceanography*** *is the study of seas and oceans. The shape, size, depth and bottom relief of ocean, distribution of oceans, ocean currents and various life forms existing in oceans are also studied under oceanography.*

(vi) ***Biogeography*** *is a study of ecosystems over geographical space. It also analyses the changes in the ecosystems. Phytogeography or plant geography, zoo geography or animal geography and ecology are the branches of biogeography.*



(vii) ***Environmental Geography*** *is the study of environmental issues arising out of misuse of various spheres of the earth and their implications. The ozone layer depletion, global warming, melting of polar ice caps, rising sea level and other related aspects are also given due importance. It also tries to give sustainable solutions to these problems.*

2. Human Geography

(i) **Social/Cultural Geography** encompasses the study of society and its spatial dynamics as well as the cultural elements contributed by the society.

(ii) **Population and Settlement Geography** (Rural and Urban). Population geography studies population growth, distribution, density, sex ratio, migration and occupational structure, etc. Settlement geography studies the characteristics of rural and urban settlements.

(iii) **Economic Geography** studies economic activities of the people including agriculture, industry, tourism, trade, and transport, infrastructure and services, etc.

(iv) **Historical Geography** studies the historical processes through which the space gets organised. Every region has undergone some historical experiences before attaining the present day status. The geographical features also experience temporal changes and these form the concerns of historical geography.

(v) **Political Geography** looks at the space from the angle of political events and studies boundaries, space relations between neighbouring political units, delimitations of constituencies, election scenario and develops theoretical framework to understand the political behaviour of the population.

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(vi) ***Medical Geography*** *mainly deals with study of geographical aspects of origin, diffusion and distribution of various communicable diseases and health care planning.*

Geographic Techniques

Geography has developed a number of methods and tools to investigate and identify the spatial structures and patterns. Besides, it also lends or borrows some methods and tools to measure and investigate precise understanding of the spatial locations and patterns.

1. ***Mathematical Geography*** *deals with the study of earth's size and shape, motions of the earth, concept of time and the time zones.*
2. ***Statistical Geography*** *is concerned with the practice of collecting, analysing and presenting data that has a geographic or areal dimension, such as census data.*
3. ***Cartography*** *is the study of making maps of various scales using authentic information.*
4. ***Remote Sensing*** *is the art, science and technique of capturing the earth's surface features using sensors or cameras in airplanes or satellites, processing and presenting the spatial information to users.*
5. ***Geographic Information System (GIS)*** *is a computer-based tool of the recent decades for geographical studies. It is used for storing, retrieving, transforming, analysing, and displaying data to prepare useful thematic maps.*
6. ***Global Navigation Satellite System (GNSS)*** *is used to pinpoint the geographic location of a user anywhere in the world. Airlines, shipping, travel agencies and automobile drivers use the system to track the vehicles and follow the best routes to reach the destination in the shortest possible time.*

Note: Global Navigation Satellites System

GNSS is the standard generic term for satellite navigation systems that provide geo-spatial positioning with global or regional coverage. This term includes the GPS (USA), GLONASS (Russia), Galileo (Europe), Beidou (China), IRNSS (India) and other systems.

The GPS was the first GNSS system of the United States and originally used for military applications. Today it is commonly used in mobiles, vehicles, agriculture and other areas that allow us to use it in all fields of mapping.

Physical Geography and its Importance

- Physical geography includes the study of lithosphere (landforms, drainage, relief and physiography), atmosphere (its composition, structure, elements and controls of weather and climate; temperature, pressure, winds, precipitation, climatic types, etc.), hydrosphere (oceans, seas, lakes and associated features with water realm) and biosphere (life forms including human beings and macro-organism and their sustaining mechanism, viz. food chain, ecological parameters and ecological balance).
- Soils are formed through the process of pedogenesis and depend upon the parent rocks, climate, biological activity and time.
- Time provides maturity to soils and helps in the development of soil profiles.
- Each element is important for human beings.
- Landforms provide the base on which human activities are located.
- The plains are utilised for agriculture.
- Plateaus provide forests and minerals.
- Mountains provide pastures, forests, tourist spots and are sources of rivers providing water to lowlands.
- Climate influences our house types, clothing and food habits.
- The climate has a profound effect on vegetation, cropping pattern, livestock farming and some industries, etc.
- Human beings have developed technologies which modify climatic elements in a restricted space such as air conditioners and coolers.
- Temperature and precipitation ensure the density of forests and quality of grasslands.
- In India, monsoonal rainfall sets the agriculture rhythm in motion.
- Precipitation recharges the groundwater aquifers which later provides water for agriculture and domestic use.
- Oceans are the storehouse of resources. Besides fish and other sea-food, oceans are rich in mineral resources.
- India has developed the technology for collecting manganese nodules from oceanic bed.
- Soils are renewable resources, which influence a number of economic activities such as agriculture.
- The fertility of the soil is both naturally determined and culturally induced.
- Soils also provide the basis for the biosphere accommodating plants, animals and micro-organisms.
- The study of physical geography is emerging as a discipline of evaluating and managing natural resources.
- In order to achieve this objective, it is essential to understand the intricate relationship between physical environment and human beings.
- Physical environment provides resources, and human beings utilise these resources and ensure their economic and cultural development.
- Accelerated pace of resource utilisation with the help of modern technology has created ecological imbalance in the world.
- Hence, a better understanding of physical environment is absolutely essential for sustainable development.

CHAPTER 2

The Earth in the Solar System

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Theories of Earth's origin

- One of the earlier arguments of the earth's origin was by a German professor **Immanuel Kant. Mathematician Laplace** revised it in 1796. It was known as **Nebular Hypothesis**.
- It considered that planets were formed out of a **cloud of material** associated with a **youthful sun,** which was slowly rotating.
- **Lyttleton** propounded the **accretion theory** of the earth's formation. According to this theory, approximately 4.6 billion years ago, the solar system was a **cloud of dust** and **gas** known as a **solar nebula.**
- As the solar nebula began to spin, the gravity collapsed the materials on itself and it formed the sun in the centre of the solar system.
- When the sun formed, the remaining materials began to clump up. Small particles drew together, bound by the force of gravity, into larger particles.
- The solar wind swept away lighter elements, such as hydrogen and helium, from the closer regions. It left only heavy rocky materials to create planets like the Earth.
- But farther away, the solar winds had less impact on lighter elements, allowing them to coalesce into gas giants.
- In this way, planets, moons, asteroids, comets, etc. were created. Earth's rocky core first formed when heavy elements collided and bound together.
- Dense materials sank to the center, while the lighter material created the crust. The planet's magnetic field probably formed around this time.
- Gravity captured some of the gases that made up the planet's early atmosphere.

Big Bang Theory (Expanding the universe Hypothesis)

- In 1927, **Abbe Georges Lemaitre,** a Belgian astronomer was the first to propose, a theory on the origin of the universe.
- It was **Edwin Hubble** who provided the evidence that the universe is expanding. It was called the 'Big Bang Theory'.
- According to it, the universe was formed during a period of inflation that began about 13.75 billion years ago.
- Like a rapidly expanding balloon, its welled from a size smaller than an electron to nearly its current size within a fraction of a second.

- *Matter from the universe was thrown out with great force in all directions and started expanding outwards. From this matter, many groups of stars were formed which we call 'galaxies'.*
- *A galaxy is a system of billions of stars, stellar remnants, interstellar gas, dust, and dark matter.*
- *The word galaxy is derived from the Greek word Galaxies, literally meaning "milky", a reference to the Milky Way. The* ***Milky Way*** *is the galaxy that contains our Solar System.*

Major forms of Galaxies

1. ***Spiral Galaxies:*** *It consists of a flat and rotating disk of stars, gases and dust. It has a central concentration of stars known as the 'bulge'. The Milky Way and the Andromeda are spiral galaxies.*
2. ***Elliptical Galaxies:*** *It contains older stars with fewer gases. Messier 89 is an elliptical galaxy.*
3. ***Irregular Galaxies:*** *They are youthful galaxies with more dust and gases. This can make them very bright. Large Magellanic Cloud is an example of irregular galaxy.*

Phases of the Moon

Full Moon/ Poornima

- It occurs only once in about a month's time when its whole disc can be seen as being illuminated.

New Moon/ Amavasya

- It's a phase of the moon when it cannot be seen at all. The Night sky is best seen on this day.

Interesting Trivia

Both Full moon and New moon can be observed after a gap of a fortnight from each other.

Celestial Bodies

- These are the objects shining in the night sky. Eg, the Sun, Moon, stars, planets, etc.

Stars

- Some celestial bodies are hot and made up of gases.
- They have their own heat and light, which they emit in large amounts. These celestial bodies are called stars.
- The sun is a star.

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- *Stars are self-luminous celestial bodies, with the Sun being the closest to Earth.*
- *Sirius shines brighter than the Sun, while* ***Proxima Centauri*** *is the nearest star to it.*
- *Stars form from dust and gas accumulation due to gravity, evolving through stages like red giants, white dwarfs, neutron stars, and black holes.*

Constellations

- Various patterns formed by different groups of stars.
- Examples:
  (i) Ursa Major or Big Bear
  (ii) Saptrishi Mandal: As a group of 7 stars, it is one of the most recognisable constellations, and forms a part of the Ursa Major constellation.

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- *In 1929, the **International Astronomical Union (IAU)** adopted official constellation boundaries that defined 88 official constellations that exist today.*
- *Earlier **Ptolemy,** in his book **Almagest**, listed 48 constellations.*
- ***Ursa Major** is a constellation that can be seen in the northern hemisphere and part of the southern hemisphere. Ursa Major means **Great Bear** in Latin.*

Pole Star

- Also called the North Star, it helped in determining directions during the night in ancient times as it indicates the north direction.
- It always remains in the same position in the sky.
- We can locate the position of the Pole Star with the help of the Saptarishi.
- If an imaginary line is drawn joining the pointer stars and extended further, it will point to the Pole Star.

Planets

- These are the celestial bodies which do not have their own heat and light and are lit by the light of the stars.
- The word 'planet' comes from the Greek word Planetai which means 'wanderers'.

Interesting Trivia

- Jupiter, Saturn and Uranus have rings around them called as debris, and can be seen from the earth through telescopes.

Key facts about Earth

- The Earth on which we live is a planet, and it gets all its heat and light from the sun, which is our nearest star.
- The earth appears as bright as the moon from a great distance.

Key facts about Moon

- The Moon is a satellite which moves around the Earth.
- Seven other planets get heat and light from the sun, just like our earth, and some of these have their own moons too.

Key facts about Light from the Sun

- Light travels at the speed of about 300,000 km per second. Yet, even with this speed, the light of the sun takes about eight minutes to reach the earth.

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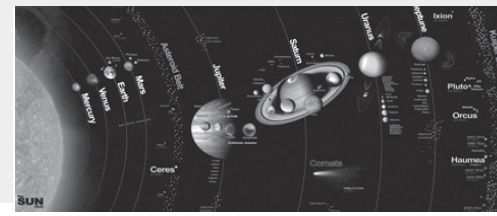
Solar System

- *The sun, eight planets, satellites and some other celestial bodies, known as asteroids and meteoroids, form the solar system.*
- *It is often called as the solar family, with sun as its head.*



- The sun, being extremely huge is in the centre of the solar system, and is made up of extremely hot gases.
- Being the ultimate source of heat and light for the solar system, it provides the pulling force that binds the solar system.
- But that tremendous heat is not felt so much by us because despite being our nearest star (approx. 150 million km away from earth), it is far away from us.

The Sun

- The Sun, a yellow dwarf star at the center of the solar system, emits glowing gases due to intense heat.
- Its gravity maintains orbits of celestial bodies, and its magnetic field, powered by electric currents, extends through the solar system via solar wind.

Structure of the Sun

- The Sun consists mainly of hydrogen (70.6%) and helium (27.4%), with the remaining 2% comprising other gases.
- Gravitational forces maintain its immense mass, generating high pressure and temperature at the core, where nuclear fusion occurs, powering the Sun.
- Its interior comprises three layers: core, radiative zone, and convective zone.
- The Sun's interior consists of three main layers, the **radiative zone** where energy is transported by photons as thermal radiation; the **convective zone,** where energy is carried by convection; and the **photosphere,** the visible 'surface' of the Sun marking the boundary between its interior and atmosphere.
- The solar atmosphere comprises the chromospheres, situated below the corona, named for its reddish hue during eclipses.
- A transition layer separates the chromospheres from the corona, where temperatures sharply increase.
- The corona, hotter than the Sun's surface, transitions into the solar wind, a plasma flow extending into interstellar space, constituting the uppermost part of the Sun's atmosphere.
- The Sun consists of six main regions: the core, radioactive zone, convective zone, photosphere, chromospheres, and corona.
- Surface temperature ranges from 5,500°C to 6,000°C, while the core reaches 15 million °C, enabling thermonuclear fusion where hydrogen atoms combine to form helium, releasing immense energy.

Size and Distance

The sun has a radius of 695,508 kilometres. It is far more massive than earth and 3,32,946 Earths equal to the mass of the Sun. The Sun's volume would need 1.3 Million Earths to fill it.

Orbit and Rotation

- The Milky Way consists of four primary spiral arms, i.e., Norma and Cygnus, Sagittarius, Scutum-Crux, and Perseus.
- Our solar system resides in the Sagittarius arm, orbiting the galactic center at 828,000 km/h.
- A complete orbit around the Milky Way takes approximately 230 million years, encompassing planets, asteroids, and comets.

- *The Sun exhibits a 7.25 degree axial tilt relative to the planets' orbital plane, leading to differential rotation rates across its surface.*
- *While the equator rotates every 25 days, the poles take 36 Earth days. This non-solid body's gravitational pull centralizes materials, shaping the solar structure.*
- *The Sun constitutes 99.8% of the solar system's mass and will eventually exhaust its energy, expanding to engulf Mercury, Venus, and possibly Earth.*
- *Scientists estimate it's halfway through its lifespan, with approximately 6.5 billion years remaining before it becomes a white dwarf.*

Planets in Our Solar System

- There are eight planets in our solar system.
- In order of their distance from the sun, they are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

Mnemonics

An easy way to memorise the name of the planets in order of their distance from the sun is:
My Very Efficient Mother Just Served Us Nuts.

Some other facts about Planets

Mercury

- One orbit around the sun - 88 days. One spin on the axis - 59 days

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- *Mercury is the nearest planet to the sun and it is the smallest planet in the solar system. It does not have any satellite.*
- *The sunlight takes 3.2 minutes to travel from the Sun to Mercury. Mercury is the second hottest planet though it is nearest to the sun.*

Venus

- One orbit around the sun - 255 days. One spin on the axis - 243 days

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- *Venus, known as Earth's Sister, shares similar size and mass.*
- *It's the solar system's hottest planet with a surface temperature of 462°C.*
- *Dubbed "Morning star and Evening star," it is one of the two planets rotating east to west.*

Earth

- One orbit around the sun - 365 days. One spin on the axis - 1 day, Number of moons - 1

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- *It is the only known planet to support life.*
- *It is also known as the 'Blue Planet' because of the presence of water.*
- *Earth has only one natural satellite called the Moon.*
- *The sunlight takes about 8.2 minutes to reach the earth.*

Mars

- One orbit around the sun - 687 days. One spin on the axis - 1 day, Number of moons – 2

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- *Mars, often called the "Red planet," exhibits a reddish hue due to iron oxide.*
- *Similar in landmass to Earth, it experiences temperatures ranging from -153°C to 20°C.*
- *Despite harsh conditions, Mars resembles Earth in many ways, with seasons, polar ice caps, volcanoes, canyons, and two moons: Phobos and Deimos.*

Jupiter

- One orbit around the sun - 11 years, 11months (approx. 12 years). One spin on the axis - 9 hours, 56 minutes, Number of moons - about 53

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- *Jupiter, the largest gas giant in the solar system, boasts of a short day and a faint ring system composed mainly of dust particles.*
- *With 67 confirmed satellites, Ganymede stands out as the largest natural satellite in the solar system, surpassing even Mercury in size.*

Saturn

- One orbit around the sun - 29 years, 5 months. One spin on the axis - 10 hours 40 minutes, Number of moons - about 53.

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- *Saturn, known as the Ringed Planet, boasts of extensive ring systems primarily composed of ice and carbonaceous dust.*
- *With an average density lower than water, it's unique in our solar system.*
- *Saturn has 30 rings and 53 confirmed natural satellites.*
- *Its largest moon, Titan, second only to Jupiter's Ganymede, features clouds and a dense, Earth-like atmosphere, making it a remarkable celestial body in our system.*

Uranus

- One orbit around the sun - 84 years. One spin around the axis - 17 hours 14 minutes, Number of Moons - about 27

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- *Uranus, the seventh planet from the sun, is invisible to the naked eye.*
- *Its atmosphere, dominated by hydrogen, helium, and methane, gives it a frigid climate due to its vast distance from the sun.*
- *Named after the Greek god of the sky, Uranus rotates east to west, resembling Venus.*
- *It showcases a bluish-green hue, hosts rings, and boasts of twenty-seven moons.*

Neptune

- One orbit around the sun - 164 years. One spin on the axis - 16 hours 7 minutes, Number of Moons - 13. It has 13 natural satellites and 5 rings.
- It is the **coldest planet** in the Solar System because it is the farthest planet from the Sun.

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- *Neptune was the first planet located through mathematical calculations. Neptune is our solar system's windiest planet.*

- All the eight planets of the solar system move around the sun in fixed and elongated paths called as orbits.
- Mercury is nearest to the sun and takes only about 88 days to complete one round along its orbit.
- Venus is considered as 'Earth's-twin' because its size and shape are very similar to that of the earth.

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Dwarf Planets

- *Dwarf planets are small celestial bodies in the solar system that orbit the sun, possess enough mass for self-gravity, and are nearly spherical.*
- *They include Ceres, Pluto, Haumea, Makemake and Eris. Pluto was demoted from planet status in 2006 due to its failure to clear its orbit of other debris.*

Interesting facts about Pluto

- Until August 2006, Pluto was also considered a planet.
- However, in a meeting of the International Astronomical Union, a decision was taken that Pluto like other celestial objects (Ceres, 2003 UB313) discovered in recent past may be called dwarf planets.

The Earth

- Being the fifth largest planet in size, the earth is the third nearest planet to the sun.
- Being slightly flattened at the poles, its shape is described as a Geoid, meaning an earth-like shape.
- Conditions favourable to support life are probably found only on the earth as it is neither too hot nor too cold.

- Being a unique planet of the solar system, it has water and air and other life-supporting gases like oxygen, essential for our survival.
- It is also called as the blue planet as from the outer space, it appears blue with two-thirds of its surface being covered by water.

The Moon

- The Moon, being the only satellite of the earth has a diameter of only about one-quarter of the earth.
- Being 3,84,400 km away from us, it appears big because it is nearer to our planet than other celestial bodies.
- It moves around the earth in about 27 days and takes exactly the same time to complete one spin, that makes only one of its sides visible to us on the earth.
- The moon does not have conditions favourable for life.
- It has mountains, plains and depressions on its surface that cast shadows on its surface.

Some Key Facts

Satellite

- It is a celestial body that moves around the planets in the same way as the planets move around the sun.

Human-made Satellite

- It is an artificial body designed by scientists to gather information about the universe or for communication.
- It is carried by a rocket and placed in the orbit around the earth.
- Some of the Indian satellites in space are INSAT, IRS, EDUSAT, etc.

Asteroids

- Asteroids are the tiny bodies that move around the sun and are found between the orbits of Mars and Jupiter.
- Leading view suggests that they are parts of a planet which exploded many years ago.

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- *They are also called 'Minor Planets'.*
- *There are lots of asteroids in the solar system.*
- *Larger asteroids are called Planetoids.*
- *These are found in between the planets Mars and Jupiter.*
- *This belt is known as the 'Asteroid belt'.*
- *The diameter of the asteroids varies from 100 km to the size of a pebble.*

Comets

- *Comets, derived from the Greek word for 'Long Haired Star', are celestial objects composed of ice particles and meteoric fragments.*
- *They orbit the Sun, with irregular paths varying from close (Perihelion) to far (Aphelion).*
- *Halley's Comet, renowned for its 76-year cycle, last appeared in 1986 and will next be visible on 28th July 2061.*
- *Comets intrigue humanity with their unpredictable trajectories, inspiring both curiosity and occasional apprehension.*

Meteoroids

- Meteoroids are small pieces of rocks which move around the sun.
- Sometimes these meteoroids come near the earth and tend to drop upon it.
- During this process due to friction with the air, they get heated up and burn which causes a flash of light.
- Sometimes, a meteor without being completely burnt falls on the earth and creates a hollow.

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- *They are known as 'shooting stars'.*
- *They are the removed pieces of rocks mainly from the Asteroid belt.*
- *Examples for Meteorite Fall: Meteor crater in Northern Arizona and Lake Lonar in Buldhana District of Maharashtra in India were created by meteor impacts.*

Galaxy

- Galaxy is a huge system of billions of stars, and clouds of dust and gases.
- Our Galaxy, the Milky Way can be seen as a whitish broad band on a clear starry night, and forms a part of our solar system.
- Millions of such galaxies form the universe.

Other interesting information related to Geography and the Solar System

- In ancient India, the Milky Way was imagined to be a river of light flowing in the sky. Thus, it was named Akash Ganga.
- 'Sol' in Roman mythology is the 'Sun god' hence 'solar' means 'related to the sun'. The family of the sun is, therefore, called the solar system.
- The word 'Geography' has its origin in Greek, where 'ge' stands for earth, while 'graphia' means writing.
- Those who study the celestial bodies and their movements are called astronomers. Aryabhatta was a famous astronomer of ancient India who stated that the moon and the planets shine due to reflected sunlight.
- Neil Armstrong was the first man to step on the surface of the moon on 20 July 1969.

CHAPTER 3

Latitudes and Longitudes

Key Facts about Earth as a Globe

Axis of the Earth

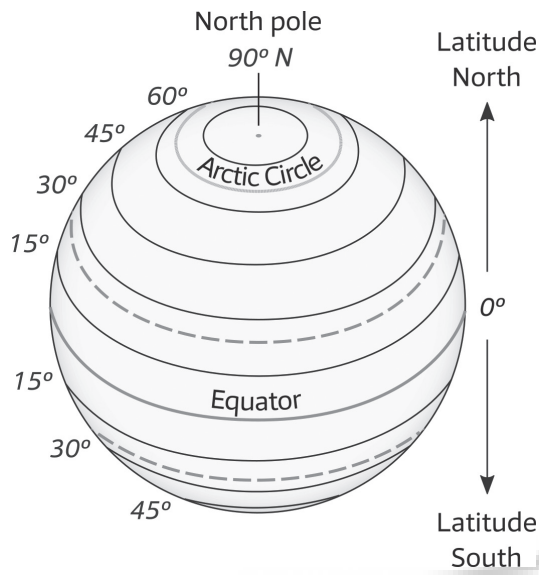
- Earth's rotational needle-like axis is an imaginary straight line that runs through the North and South Poles.
- The globe can be moved around this needle-like axis from west to east just as the earth moves.

Equator

- Another imaginary line running on the globe divides the Earth into two equal parts which is called as the equator.
- The northern half of the earth is known as the Northern Hemisphere and the southern half is known as the Southern Hemisphere.
- The equator is an imaginary circular line and is a very important reference point to locate places on the earth.
- All parallel circles from the equator up to the poles are called parallels of latitudes, which are measured in degrees.
- The equator represents the zero degree latitude.
- Since the distance from the equator to either of the poles is one-fourth of a circle round the earth, it will measure 1/4th of 360 degrees, i.e., 90°. Thus, 90 degrees north latitude marks the North Pole and 90 degrees south latitude marks the South Pole.
- As such, all parallels north of the equator are called 'north latitudes.'
- Similarly, all parallels south of the equator are called 'south latitudes'. The value of each latitude is, therefore, followed by either the word 'north' or 'south'. Generally, this is indicated by the letter 'N' or 'S'. For example, both Chandrapur in Maharashtra (India) and Belo Horizonte in Brazil (South America) are located on parallels of about 20° latitude. But the former is 20° north of the equator and the latter is 20° south of it. We, therefore, say that Chandrapur is situated at 20° N latitude and Belo Horizonte is situated at 20° S latitude.
- The size of the parallels of latitude decreases as we move away from the equator.

Parallels of Latitudes

- The latitude of a place on the earth's surface is its distance north or south of the equator, measured along the meridian of that place as an angle from the centre of the earth.
- Lines joining places with the same latitudes are called parallels.
- The value of equator is 0° and the latitude of the poles are 90°N and 90°S.
- If parallels of latitude are drawn at an interval of one degree, there will be 89 parallels each in the northern and the southern hemispheres.
- The total number of parallels thus drawn, including the equator, will be 179.
- Depending upon the location of a feature or a place north or south of the equator, the letter N or S is written along with the value of the latitude.
- If the earth were a perfect sphere, the length of 10 of latitude (a one degree arc of a meridian) would be a constant value, i.e., 111 km everywhere on the earth.
- This length is almost the same as that of a degree of longitude at the equator.
- But to be precise, a degree of latitude changes slightly in length from the equator to the poles.
- While at the equator, it is 110.6 km and at the poles, it is 111.7 km. Latitude of a place may be determined with the help of the altitude of the sun or the Pole Star.



Important Parallels of Latitudes

- Besides the equator (0°), the North Pole (90° N) and the South Pole (90° S), there are four important parallels of latitudes–

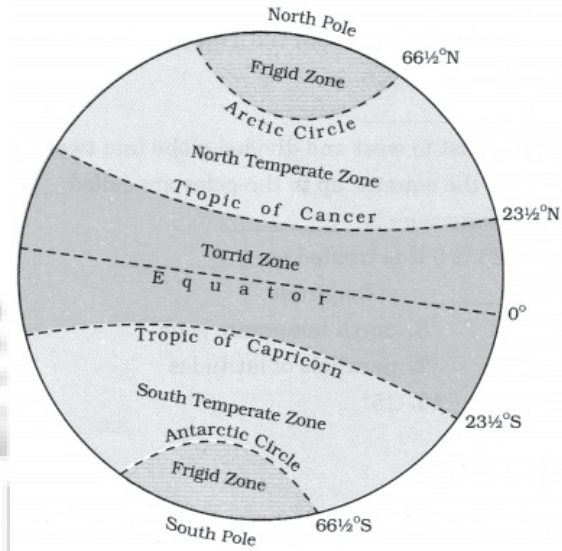
(i) *Tropic of Cancer* (23½° N) in the Northern Hemisphere.
(ii) *Tropic of Capricorn* (23½° S) in the Southern Hemisphere.
(iii) *Arctic Circle* at 66½° north of the equator.
(iv) *Antarctic Circle* at 66½° south of the equator.

Interesting Trivia

By measuring the angle of the Pole Star from your place, you can know the latitude of your place.

Heat Zones of the Earth

- The mid-day sun is exactly overhead at least once a year on all latitudes in between the Tropic of Cancer and the Tropic of Capricorn. This area, receives the maximum heat and is called the Torrid Zone.
- The mid-day sun never shines overhead on any latitude beyond the Tropic of Cancer and the Tropic of Capricorn. The angle of the sun's rays goes on decreasing towards the poles. As such, the areas bounded by the Tropic of Cancer and the Arctic Circle in the Northern Hemisphere, and the Tropic of Capricorn and the Antarctic Circle in the Southern Hemisphere, have moderate temperatures. These are called Temperate Zones.
- Areas lying between the Arctic Circle and the North Pole in the Northern Hemisphere and the Antarctic Circle and the South Pole in the Southern Hemisphere, are very cold as here the sun does not rise much above the horizon. Therefore, its rays are always slanting and provide less heat. These are, therefore, called Frigid Zones (very cold).



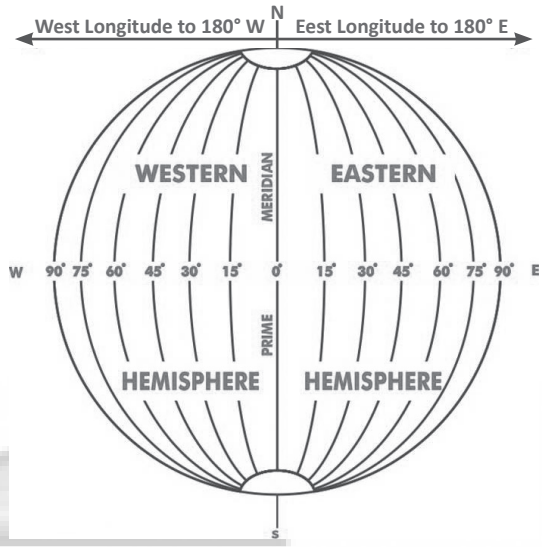
Longitudes of a Place

- In order to know the precise location of a place, the distance towards east or west of that place from a given reference line running from the north pole to the south pole is to be known.
- These lines of references are called the meridians of longitude with each degree being further divided into minutes, and minutes into seconds.
- They are semicircles and the distance between them decreases steadily polewards until it becomes zero at the poles, where all the meridians meet.
- Unlike parallels of latitude, all meridians are of equal length making it difficult to number them.
- Hence, all countries decided that the count should begin from the meridian which passed through Greenwich, where the British Royal Observatory is located. This meridian is called the Prime Meridian.

Prime Meridian

- Its value is 0° longitude and from it we count 180° eastward as well as 180° westward.

- The Prime Meridian and 180° meridian divide the earth into two equal halves, the Eastern Hemisphere and the Western Hemisphere.
- Therefore, the longitude of a place is followed by the letter E for the east and W for the west.
- It is, however, interesting to note that 180° East and 180° West meridians are on the same line.



Interesting Observation

- Parallels of latitude and meridians of longitude intersect each other at right angles to each other, thus forming a grid-like pattern.
- Their point of intersection gives the location of a place on the globe.

Comparison Table of Latitude and Longitude

	Latitude	Longitude
Direction	East-west, parallel to the equator	North-south, converging at the poles and widest at the equator
Parallel lines	Yes	No
Range	0 to 90° North and South	0 to 180° East and West
Denoted by	Greek letter phi (Φ)	Greek letter lambda (λ)
Hemisphere	All locations along a common latitude fall in the same hemisphere of the earth (northern or southern)	Locations along a common longitude may be in different hemispheres.
Denotes distance from	equator (north or south)	Prime Meridian (east or west)
Time zone	Locations that share the same latitude do not necessarily fall into the same time zone	All locations on the same longitude fall in the same time zone
Number of lines	180	360
Notable lines	Equator, Tropic of Cancer, Tropic of Capricorn	Greenwich Meridian
Applications	Classifying temperature zones	Classifying time zones

Longitude and Time

- Time can be measured by the movement of the earth, the moon and the planets.
- The sun regularly rises and sets every day, and naturally, it is the best time-keeper throughout the world.
- Local time can be reckoned by the shadow cast by the sun, which is the shortest at noon and longest at sunrise and sunset.
- When the Prime Meridian of Greenwich has the sun at the highest point in the sky, all the places along this meridian will have mid-day or noon.
- As the earth rotates from west to east, those places east of Greenwich will be ahead of Greenwich time and those to the west will be behind it.
- The rate of difference can be calculated as follows.
  - The earth rotates 360° in about 24 hours, which means 15° an hour or 1° in four minutes. Thus, when it is 12 noon at Greenwich, the time at 15° east of Greenwich will be 15 × 4 = 60 minutes, i.e., one hour ahead of Greenwich time, which means 1 P.M.
  - But at 15° west of Greenwich, the time will be behind Greenwich time by one hour, i.e., it will be 11.00 a.m.
  - Similarly, at 180°, it will be midnight when it is 12 noon at Greenwich.
- At any place, a watch can be adjusted to read 12 o'clock when the sun is at the highest point in the sky, i.e., when it is mid-day.
- The time shown by such a watch will give the local time for that place.

Standard Time

- The local time of places which are on different meridians are bound to differ.
- For example, it will be difficult to prepare a time-table for trains which cross several longitudes.
- In India, for instance, there will be a difference of about 1 hour and 45 minutes in the local times of Dwarka in Gujarat and Dibrugarh in Assam.
- It is, therefore, necessary to adopt the local time of some central meridian of a country as the standard time for the country.
- In India, the longitude of 82½° E (82° 30'E) is treated as the standard meridian.
- The local time at this meridian is taken as the standard time for the whole country, known as the Indian Standard Time (IST).
- India located east of Greenwich at 82°30'E is 5 hours and 30 minutes ahead of GMT. So it will be 7:30 p.m. in India when it is 2:00 p.m. noon in London.

Some interesting information about standard time

- Some countries have a great longitudinal extent and so they have adopted more than one standard time.
- For example, in Russia, there are as many as eleven standard times.
- The earth has been divided into twenty-four time zones of one hour each.
- Each zone thus covers 15° of longitude.

6/New/I/2

International Date Line

- While the world is divided into 24 time zones, there has to be a place where there is a difference in days, somewhere the day truly "starts" on the planet.
- The 180° line of longitude is approximately where the International Date Line passes.
- The time at this longitude is exactly 12 hours from the 0° longitude, irrespective of one travelling westwards or eastwards from the Prime Meridian.
- We know that time increases east of the Prime Meridian and decreases to its west. Hence, for a person moving east of the Prime Meridian, the time would be 12 hours less than the time at 0° longitude.
- For another person moving westwards, the time would be 12 hours more than the Prime Meridian.
- For example, a person moving eastwards on Tuesday will count the day as Wednesday once the International Date Line is crossed. Similarly, another person starting his journey on the same day, but moving westwards will count the day as Monday after crossing the line.

CHAPTER 4

Motions of the Earth

Rotation

- It is the movement of the earth on its axis.

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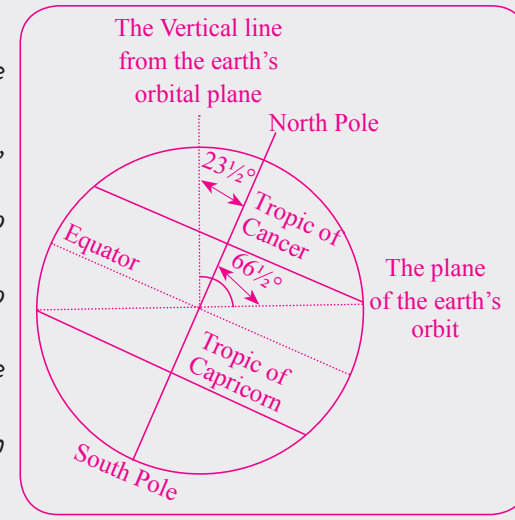
- The spinning of the earth around its axis is called the rotation of the earth.
- The axis is the imaginary line passing through the centre of the earth.
- The earth completes one rotation in 23 hours, 56 minutes and 4.09 seconds.
- It rotates in an eastward direction opposite to the apparent movement of the sun.
- The earth's axis is inclined at an angle of 66° to the orbital plane as it moves around the sun.
- It can be said that the earth's axis is tilted at an angle of 23.° from a perpendicular to the elliptic plane.
- The velocity of earth's rotation varies depending on the distance of a given place from the equator.
- The rotational velocity at the poles is nearly zero.



- The greatest velocity of the rotation is found at the equator.
- The velocity of rotation at the equator is 1,670 km per hour and in the poles it is about zero.

Effects of Earth's Rotation

- The apparent rising and setting of the sun is actually caused by the earth's rotation which results in the alternate occurrence of day and night everywhere on the earth's surface.
- Rotation of the earth is also responsible for the difference in time between different places on the earth. A 24 hour period divided by 360 degrees gives a difference of 4 minutes for every degree of longitude that passes the sun. The hour (60 minutes) is thus 1/24 of a day.
- When you observe through a moving train, trees, houses and fields on the other side of the track appear to move in the direction opposite to that of the speeding train. The apparent movement of the sun and the other heavenly bodies in relation to the rotating earth is similar. As the earth rotates from west to east, the sun, moon, planets and stars appear to rise in the east and set in the west.

- *Rotation causes the working of the Coriolis force which results in the deflection of the winds and the ocean currents from their normal path.*
- *Tide is caused by the rotation of the earth apart from the gravitational pull of the sun and the moon.*
- *Rotation causes a flattening of Earth at the two poles and bulging at the Equator. Hence, there is a difference in diameter at the poles and equator.*

Revolution

- The movement of the earth around the sun in an anti-clockwise & a fixed path or orbit is called Revolution.

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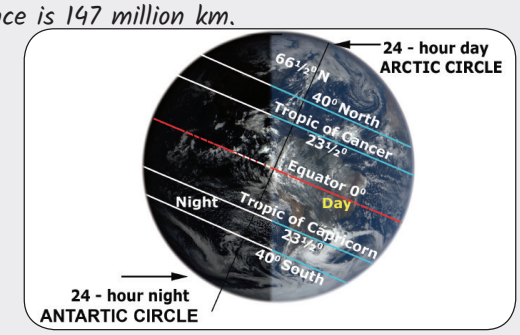
- *The earth revolves in an orbit at an average distance of 150 million km.*
- *The distance of the earth from sun varies time to time due to the elliptical shape of the orbit.*
- *About January 3rd the earth is closest to the sun and it is said to be at Perihelion ('peri' means close to and Helios means sun).*
- *At Perihelion, the distance is 147 million km.*



- *Around July 4th the earth is farthest from the sun and it is said to be at Aphelion (Ap means away and Helios means sun).*
- *At Aphelion, the distance of the earth is 152 million km away from the sun.*
- *The period taken by the earth to complete one revolution around the sun is 365 days and 6 hours (5 hours, 48 minutes and 45 seconds) or 365 days.*
- *The speed of the revolution is 1,07,000 km per hour.*
- *The speed is 30 km per second. The bullet from a gun travels with a speed of 9 km per second.*

Effects of Revolution of the Earth

- *Cycle of seasons,*
- *Variation in length of days and nights,*
- *Variation in distribution of solar energy over the earth and the temperature zones.*

Orbital Plane

- The axis of the earth, which is an imaginary line, makes an angle of 66½° with its orbital plane called as the orbital plane.
- The earth goes around the sun in an elliptical orbit.

Circle of Illumination

- The earth receives light from the sun.
- Due to the spherical shape of the earth, only half of it gets light from the sun at a time.
- The portion facing the sun experiences day while the other half away from the sun experiences night.
- The circle that divides the day from night on the globe is called the circle of illumination.
- This circle does not coincide with the axis.

Earth Day

- The earth takes about 24 hours to complete one rotation around its axis, a period called as the earth day.
- This is the daily motion of the earth.

What would happen if the earth did not rotate?

- The portion of the earth facing the sun would always experience day, thus bringing continuous warmth to the region, while the other half would remain in darkness and be freezing cold all the time.
- Life would not have been possible in such extreme conditions.

Important aspects about revolution of the Earth

- It takes 365¼ days (one year) to revolve around the sun.
- We consider a year as consisting of 365 days only and ignore six hours for the sake of convenience.
- Six hours saved every year are added to make one day (24 hours) over a span of four years.
- This surplus day is added to the month of February.
- Thus every fourth year, February is of 29 days instead of 28 days.
- Such a year with 366 days is called a Leap Year.
- A year is usually divided into summer, winter, spring and autumn seasons.
- Seasons change due to the change in the position of the earth around the sun.

Seasons

- **Summer Solstice**
  - On 21st June, the Northern Hemisphere is tilted towards the sun and the rays of the sun fall directly on the Tropic of Cancer.
  - As a result, these areas receive more heat with the areas near the poles receiving less heat as the rays of the sun are slanting.
  - The North Pole is inclined towards the sun and the places beyond the Arctic Circle experience continuous daylight for about six months.
  - Since a large portion of the Northern Hemisphere gets light from the sun, it is summer in the regions north of the equator.
  - The longest day and the shortest night at these places occur on 21st June.
  - At this time in the Southern Hemisphere all these conditions are reversed. It is winter season there, with nights being longer than the days.
  - This position of the earth is called the *Summer Solstice*.
- **Winter Solstice**
  - On 22nd December, the Tropic of Capricorn receives direct rays of the sun as the South Pole tilts towards it.
  - As the sun's rays fall vertically at the Tropic of Capricorn (23½° S), a larger portion of the Southern Hemisphere gets light.
  - Therefore, it is summer in the Southern Hemisphere with longer days and shorter nights.
  - The reverse happens in the Northern Hemisphere.
  - This position of the earth is called the *Winter Solstice*.

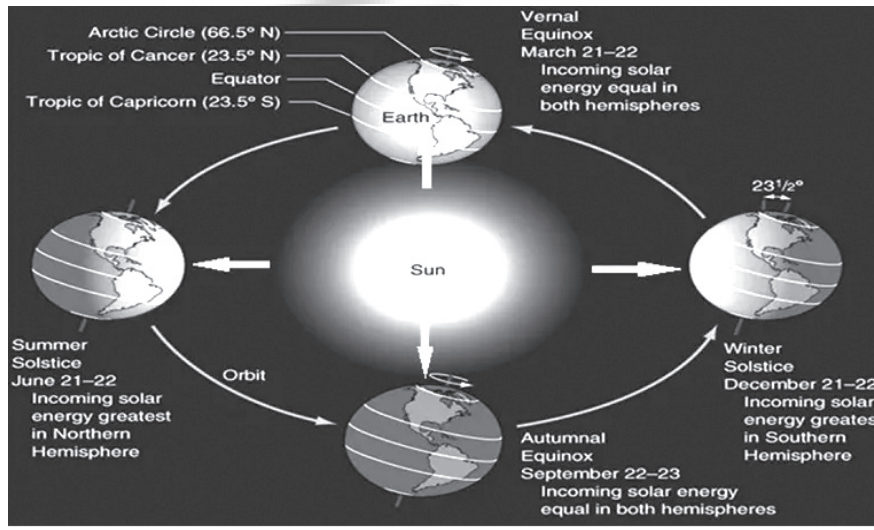
- Interestingly, Christmas is celebrated in Australia in the summer season.

- **Equinox**
  - On 21st March and September 23rd, direct rays of the sun fall on the equator.
  - At this position, neither of the poles is tilted towards the sun; so, the whole earth experiences equal days and equal nights.
  - This is called an *equinox*.
  - On 23rd September, it is autumn season in the Northern Hemisphere and spring season in the Southern Hemisphere.
  - The opposite is the case on 21st March, when it is spring in the Northern Hemisphere and autumn in the Southern Hemisphere.

Other Interesting Facts

- There are days and nights and changes in the seasons because of the rotation and revolution of the earth respectively.
- The ancient Indian astronomer Aryabhata had stated that 'the earth is round and rotates on its own axis'.

6/New/I/3



CHAPTER 1

Sources for History Writing

Knowing about the Past

- The most important thing about the past know about what people used to eat, the type of clothes they used to wear, the houses in which they lived.
- Knowing about the lives of hunters, herders, farmers, rulers, merchants, priests, crafts persons, artists, musicians, and scientists.
- The games children used to play, the stories they have heard, the songs they sang.

6/New/I/1

The Importance of Ancient Indian History

- Ancient Indian history is interesting because India proved to be a crucible of ethnic groups. The pre-Aryans, the Indo-aryans, the Greeks, the Scythians,' the Hunas,the Turks, etc., made India their home.
- Each ethnic group contributed its might to the evolution of Indian social system, art and architecture, and literature.
- All these peoples and their cultural traits mixed up so inextricably with one another that at present none of them can be clearly identified in their original form.
- A remarkable feature of ancient Indian culture has been the commingling of cultural elements from the north and thesouth, and from the east and the west.

Relevance of the Past to the Present

- The study of India's past assumes special significance inthe context of the problems we face in modern times.
- Some people clamour for the restoration of ancient culture and civilization, and a good many are sentimentally swayed by what they consider to be the past glories of India. This is different from the concern for the preservation of ancient heritage in art and architecture. What they really want to bring back is the old pattern of society and culture.
- Sucha situation demands a far better understanding of the past.
- There is no doubt that ancient Indians made remarkable progress in different fields of life, but these advances cannot enable us to compete with the achievements of modern science and technology.
- We cannot ignore the fact that the ancient Indian society was marked by gross social injustice.

Nationalist Approach and Contribution

- All this naturally came as a great challenge to Indian scholars, particularly to those who had received western education.
- They were irked by the colonialist distortions of their past history and at the same time distressed by the contrast between the decaying feudal society of India and the progressive capitalist society of England.
- A band of scholars took, upon themselves not only the mission to reform Indian society but also to reconstruct ancient Indian history in such a manner as to make case for social reforms and, more importantly, for self-government.
- In doing so most historians were guided by the nationalist ideas of Hindurevivalism, but there was no dearth of scholars who adopteda rationalist and objective approach.
- To the second category belongs Rajendra Lal Mitra (1822- 1891), who published some Vedic texts and wrote a book entitled Indo-Aryans.
  - A great lover of ancient heritage, he took a rational view of ancient society and produced a forceful tract to show that in ancient times people took beef.
  - Others tried to prove that in spite of its peculiarities the caste system was not basically

different from the class system based on division of labour found in pre-industrial and ancient societies of Europe.

- In Maharashtra, Ramakrishna Gopal Bhandarkar (1837-1925) and Vishwanath Kashinath Rajwade (1869-1926) emerged as two great dedicated scholars who pieced together varied sources to reconstruct the social and political history of the country.
- R.G. Bhandarkar reconstructed the political history of the Deccan of the Satavahanas and the history of Vaishnavism and other sects.
  - A great social reformer, through his researches he advocated widow marriages and castigated the evils of the caste system and child marriage.
- With his unadulterated passion for research, V.K. Rajwade went from village to village in Maharashtra' in search of Sanskrit manuscripts and sources of Maratha history: the sources came to be published in twenty-two volumes.
  - He did not write much, but the history of the institution of marriage that he wrote in Marathi in 1926 will continue to be a classic because of its solid base in Vedic and other texts, and also because of the author's insight into the stages in the evolution of marriage in India.
- Pandurang Vaman Kane (1880- 1972), a great Sanskritist wedded to social reform, continued the earlier tradition of scholarship.

His monumental work entitled the History of the Dharmasastra published in five volumes in the twentieth century is an encyclopaedia of ancient social laws and customs. It enables us to make a study of social processes in ancient India.

11/Old/I/1

Historians and their Sources

- Historians are scholars who study the past.
- Historians use coins, inscriptions, architecture and textual records to learn about the past. The number and variety of textual records increased dramatically during this period, slowly displacing other types of available information.
- Once sources are found, learning about the past becomes an adventure, as we reconstruct it bit by bit.
- Paper gradually became cheaper and more widely available. It is used to write holy texts, chronicles of rulers, letters and teachings of saints, petitions and judicial records, and for registers of accounts and taxes.
- Manuscripts collected by wealthy people, rulers, monasteries and temples and placed in libraries and archives provide a lot of detailed information to historians but are also difficult to use.
- Scribes had to copy the manuscripts by hand and they made slight changes while doing so. These changes over the centuries grew thus making manuscripts of the same text different from each other. It became very difficult to find the original author of manuscripts.
- 14th-century chronicler Ziyauddin Barani wrote his chronicle first in 1356 and another version two years later. But historians did not know about the existence of the first version until the 1960s as it remained lost in large library collections.
- Historians and archaeologists are like detectives, who use all these sources like clues to find out about our pasts.

7/New/I/1

Historical Sense

- Ancient Indians are charged with the lack of historical sense. It is obvious that they did not write history in the manner it is done now, nor did they write it in the way the Greeks did.
- We have a sort of history in the Puranas which are eighteen in number (Eighteen was a conventional term).
- Though encyclopedic in contents, the Puranas provide dynastic history up to the beginning of 'the Gupta rule.
- The Vikrama Samvat began in 57 B.C., the Shaka Samvatin A.D. 78, and the Gupta era in A.D. 319. Inscriptions record events in the context of time and place.
- During the third century B.C. Ashokan inscriptions show considerable historical sense.
- Ashoka ruled for 37 years. His inscriptionsrecord events that happened from the eighth to the twenty- seventh regnal year. So far events relating to only nine regnalyears appear in the inscriptions that have been discovered.
- B.C. Kharavela of Kalinga records a good many events of his life year-wise in the Hathigumpha inscription.
- Indians display considerable historical sense in biographical writings.

- A good example is the composition of the Harshacharita by Banabhatta in the seventh century A.D.
- It is a semi-biographical work written in ornate style, whichbecame the despair of later imitators. It describes the early career of Harshavardhana. Although full of exaggerations itgives an excellent idea of the court life under Harsha and thesocial and religious life in his age.
- Bilhana's Vikramanakadevacharita recounts the achievements of his patron, Vikramaditya VI (1076-1127). the Chalukya king of Kalyan.
- Even the biographies (charita)of some merchants of Gujarat were written in the twelfth- thirteenth centuries A.D. Similar historical works may have been written in south India.
- But so far only one such account has been discovered. This is called the Mushika Vamsha, which was written byAtula in the eleventh century.
- It gives an account of the dynasty of the Mushikas, which ruled in northern Kerala.
- But the best example of the earliest historical writing is provided by the Rajatarangint or The Stream of Kings' written by Kalhana in the twelfth century. It is a string of biographies of the kings of Kashmir, and can be considered to be the first work which possesses several traits of history as it is understood in our times.

11/Old/I/1

Archaeologists

- An archaeologist is a person who studies the remains of buildings made of stone and brick, paintings and sculpture.
- They also explore and excavate to find tools, weapons, pots, pans, ornaments and coins.
- They also look for bones of animals, birds, and fish to find out what people ate in the past.

6/New/I/1

Types of sources and Historical Construction

Material Remains

- The Ancient Indians left innumerable material remains.
- The stone temples in south India and the brick monasteries in eastern India still stand to remind us of the great building activities of the past.
- But the major part of these remains lies buried in the mounds scattered all over thecountry (The mound is an elevated portion of land covering remains of old habitations).
- It may be of different types single culture, major-culture and multi-culture. Single- culture mounds represent only one culture throughout.
- Some mounds represent only Painted Grey Ware (PGW) culture, others Satavahana culture, and still others Kushan culture.
- In major culture mounds, one culture is dominant and the others are not so important.
- Multi-culture mounds represent several important cultures in succession which occasionally overlap with one another, Like the Ramayana and the Mahabharata, an excavated mound can be used for the understanding of successive layers in material and otheraspects of culture.
- A mound can be excavated vertically or horizontally.
- Vertical excavation means lengthwise digging to uncover the period wise sequence of cultures; it is generally confinedto a part of the site.
- Horizontal excavation means digging the mound as a whole or a major part of it. The method may enable the excavator to obtain a complete idea of the site culture in a particular period.

11/Old/I/1

Manuscripts

- One is to search for and read books that were written long ago. These are called manuscripts, because they were written by hand (this comes from the Latin word 'manu', meaning hand).
- Manuscripts were usually written on palm leaf, or on the specially prepared bark of a tree known as the birch, which grows in the Himalayas.
- The palm leaves were cut into pages and tied together to make books.
- Over the years, many manuscripts were eaten away by insects, some were destroyed, but many have survived, often preserved in temples and monasteries.
- Manuscripts dealt with all kinds of subjects: religious beliefs and practices, the lives of kings, medicine and science.
- There were epics, poems, plays. Many of these were written in Sanskrit, others were in Prakrit (languages used by ordinary people) and Tamil.

Place of Habitation

- People have lived along the banks of the Narmada river for several hundred thousand years. These people stayed on the bank of Narmada river as they knew about the vast wealth of plants in the surrounding forests.
- They used to collect roots, fruits and other forest produce for their food. Sometimes they also hunted animals.
- The areas where women and men first began to grow crops such as wheat and barley was about 8000 years ago.
- People also began to look after animals like sheep, goat, and cattle and used to live in villages.
- The places where rice was first grown are to the north of the Vindhyas.
- About 2500 years ago, cities developed on the banks of the Ganga and its tributaries, and along the sea coasts.
- In ancient times, the area along the Ganga and its tributary rivers, to the south of the Ganga was known as Magadha which is now lying in the state of Bihar. Its rulers were very powerful, and set up a large kingdom. Kingdoms were set up in other parts of the country as well.

Inscriptions

- Inscriptions are writings on relatively hard surfaces such as stone or metal.
- In the past, when kings wanted their orders inscribed so that people could see, read and obey them, they used inscriptions for this purpose.
- There are other kinds of inscriptions as well, where men and women (including kings and queens) recorded what they did. For example, records of victories in battle.
- All inscriptions contain both scripts and languages. Languages which were used, as well as scripts, have changed over time.
- Scholars understand what is inscribed on inscription through a process known as decipherment.

Inscriptions

- Far more important than coins are inscriptions. Their study is called epigraphy, and the study of the old writing used in inscriptions and other old records is called palaeography.
- Inscriptions were carved on seals, stone pillars, rocks, copper plates, temple walls and bricks or images.
- In the country as a whole the earliest inscriptions were recorded on stone. But in the early centuries of the Christianera, copper plates began to be used for this purpose.
- Even then the practice of engraving inscriptions on stone continued in south India on a large scale.
- Most inscriptions bearing on the history of Maurya, post-Maurya and Gupta times have been published in a series of collections called Corpus Inscriptionum Indicarum.

Famous story of Decipherment

Rosetta is a town on the north coast of Egypt, and here an inscribed stone was found, which contained inscriptions in three different languages and scripts (Greek, and two forms of Egyptian).

Scholars who could read Greek figured out that the names of kings and queens were enclosed in a little frame, called a cartouche. They then placed the Greek and the Egyptian signs side by side, and identified the sounds for which the Egyptian letters stood. As you can see, a lion stood for L, and a bird for A. Once they knew what the letters stood for, they could read other inscriptions as well.

6/New/I/1

Coins

- Although a good number of coins and inscriptions has been found on the surface, many of them have been unearthed by digging.
- The study of coins is called numismatics. Ancient Indian currency was not issued in the form of paper, as is being used these days, but as metal coins.
- Ancient coins were made of metal-copper, silver, gold, or lead. Coin moulds made of burnt clay have been discovered in large numbers.
- Most of them belong to the Kushan period, i.e. the first three Christian centuries. The use of such moulds in the post-Gupta periods almost disappeared.

Literary Sources

- Although the ancient Indian knew writing as early as 2500 B.C., our most ancient manuscripts are not older than the fourth century A.D., and have been found in Central Asia.
- The Sangam literature comprises about 30,000 lines of poetry, which are arranged in eight anthologies called Ettuttokal.

- The poems are collected in groups of hundreds such as Purananuru (The Four Hundred of the Exterior) andothers.
- There are two main groups Patinienkil Kannakku (The Eighteen Lower Collections) and Pattuppattu (The TenSongs).
- The former is generally assumed to be older than the latter, and hence considered to be of much historical importance.
- The Sangam texts have several layers, but at present they cannot be established on the basis of style and content. As shown later, these layers can be detected on the basis of stages in social, evolution.

Foreign Accounts

- The Greek writers mention Sandrokottas, a contemporary of Alexander the Great who invaded India in 326 B.C. Prince Sandrokottas is identified with Chandragupta Maurya, whose date of accession is fixed at 322 B.C.
- This identification has served as the sheet-anchor in ancient Indian chronology.
- The Indika of Megasthenes, who came tothe court of Chandragupta Maurya, has been preserved only in-fragments quoted by subsequent classical writers.

Migration of People

- Men and women moved in search of livelihood and also to escape from natural disasters like floods or droughts.
- Sometimes men marched in armies, conquering others' lands. Besides, merchants travelled with caravans or ships, carrying valuable goods from place to place.
- Religious teachers walked from village to village, town to town, stopping to offer instruction and advice on the way. Finally, some people perhaps travelled driven by a spirit of adventure, wanting to discover new and exciting places. All these led to the sharing of ideas between people.
- Movements of people enriched our cultural traditions. People have shared new ways of carving stone, composing music, and even cooking food over several hundreds of years.

Origin of India's Name

- Our country is known by both words i.e India and Bharat.
- The word India comes from the Indus, called Sindhu in Sanskrit. The Iranians and the Greeks who came through the northwest about 2500 years ago called it the Hindos or the Indos, and the land to the east of the river was called India.
- The name Bharata was used for a group of people who lived in the northwest, and who are mentioned in the Rigveda, the earliest composition in Sanskrit (dated to about 3500 years ago). Later it was used for the country.

New and Old Terminologies

- The terms and meaning of words change over time. For example, "Hindustan", today means "India".
- The term was first used in the 13th century by Minhaj-i-Siraj, a chronicler who wrote in Persian and contains the areas of Punjab, Haryana and the lands between the Ganga and Yamuna.
- In early 16th century, Babur used Hindustan to describe the geography, the fauna and the culture of the inhabitants of the subcontinent, same as how 14th-century poet Amir Khusrau used the word "Hind".
- A simple term like "foreigner" is used today to mean someone who is not an Indian. In the medieval period, a "foreigner" (Pardesi) was any stranger who appeared in a given village, someone who was not a part of that society or culture.
- A city-dweller might regard a forest-dweller as a "foreigner", but two peasants living in the same village are not foreigners to each other, even if they have different religious or caste backgrounds.

7/New/I/1

Different Aspects of Past

- The word 'pasts' has been used in plural form to draw attention to the fact that the past was different for different groups of people.
- People followed different practices and customs in different parts of the country.
- Archaeology did not help us to know more about the ordinary people in the past because they did not keep records of what they did. Whereas, kings used to keep the records of their victories and the battles they fought.

Meaning of Dates

- Years are counted from the date generally assigned to the birth of Jesus Christ, the founder of Christianity.
- All dates before the birth of Christ are counted backwards and usually have the letters BC (Before Christ) added on.
- AD stands for two Latin words, 'Anno Domini', meaning 'in the year of the Lord' (i.e. Christ). So 2012 can also be written as AD 2012.
- CE is used instead of AD and BCE instead of BC. The letters CE stand for 'Common Era' and BCE for 'Before Common Era'. We use these terms because the Christian Era is now used in most countries of the world.
- The letters BP means 'Before Present'.

6/New/I/1

CHAPTER 2

Pre-historic Age

Source of Information about Earliest People

- Archaeologists have found some of the things hunter-gatherers made and used.
- People made and used tools of stone, wood and bone, of which stone tools have survived best.
- Some of these stone tools were used to cut meat and bone, scrape bark (from trees) and hides (animal skins), chop fruit and roots.
- Some may have been attached to handles of bone or wood, to make spears and arrows for hunting.

Other tools were used to chop wood, which was used as firewood. Wood was also used to make huts and tools.

Place of Settlement (Site)

- Sites are places where the remains of things (tools, pots, buildings etc.) were found. These were made, used and left behind by people.
- These may be found on the surface of the earth, buried under the earth, or sometimes even under water.

Rock Painting

Many of the caves in which these early people lived have paintings on the walls. Some of the best examples are from Madhya Pradesh and southern Uttar Pradesh. These paintings show wild animals, drawn with great accuracy and skill.

- Earliest People selected sites which were located near sources of water, such as rivers and lakes.
- As stone tools were important, people tried to find places where good quality stone was easily available.

The Palaeolithic Period: Hunters and Food Gatherers

- The Earth is over 4000 million years old.
- The evolution of its crust shows four stages. The fourth stage is called the Quaternary, which is divided into Pleistocene (most recent) and Holocene (present); the former lasted between 2,000,000 and 10,000 years before the present and the latter began about 10,000 years ago.
- Man is said to have appeared on the earth in the early pleistocene, when true ox, true elephant and true horse also originated. But now this event seems to have occurred in Africa about three million years back.
- They call the earliest period the Palaeolithic. This comes from two Greek words, 'palaeo', meaning old, and 'lithos', meaning stone.

6/New/I/2

- Palaeolithic tools, which could be as old as 100,000 B.C., have been found in the Chotanagpur plateau. Such tools belonging to 20,000 B.C.-10,000 B.C. have been found in Kurnool district in Andhra Pradesh about 55 km from kurnool.

11/Old/I/5

Hunter-gatherers and Their Movement

- People lived in the subcontinent as early as two million years ago. The earliest people were known as hunter-gatherers.
- The name comes from the way in which they got their food. Generally, they hunted wild animals, caught fish and birds, gathered fruits, roots, nuts, seeds, leaves, stalks and eggs.
- Hunter-gatherers moved from place to place due to different reasons.
- They had stayed at one place for a long time, they would have eaten up all the available plant and animal resources. Therefore, they would have had to go elsewhere in search of food.

- Animals move from place to place–either in search of smaller prey, or, in the case of deer and wild cattle, in search of grass and leaves. That is why those who hunted them had to follow their movements.
- People may have moved from season to season in search of different kinds of plants.

6/New/I/2

Phases in the Palaeolithic Age

- The Palaeolithic Age in India is divided into three phases according to the nature of the stone tools used by the peopleand also according to the nature of change in the climate.
- The first phase is called Early or Lower Palaeolithic, the second Middle. Palaeolithic and the third Upper Palaeolithic. Unless adequate information is available about Bori artefacts the first phase may be placed broadly, between 500,000 B.C: and 50,000 B.C; the second between 50,000 B.C. and 40,000 B.C and the third between 40,000 B.C. and 10,000 B.C. But between 40,000 B.C. and 1500 B.C. tools belonging to both Middle and Upper Palaeolithic Ages are found in the Deccan Plateau.

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*The first Palaeolithic tools were identified at the site of **Pallavaram** near Chennai by Robert Bruce Foote in 1863. He found many prehistoric sites when he extensively surveyed different parts of South India. Since then, numerous Palaeolithic sites have been identified and excavated all over India.*

- The first Palaeolithic tools were identified at the site of Pallavaram near Chennai by Robert Bruce Foote in 1863. He found many prehistoric sites when he extensively surveyed different parts of South India. Since then, numerous Palaeolithic sites have been identified and excavated all over India.
- The Lower Palaeolithic or the Early Old Stone Age covers the greater part of the Ice Age. Its characteristic feature is the use of hand axes, cleavers and choppers.
- The axes found in India are more or less similar to thoseof western Asia, Europe and Africa. Stone tools were used mainly for chopping, digging and skinning.
- The Early Old Stone Age sites are found in the valley of river Soan or Sohan in Punjab, now in Pakistan. Several sites have been found in Kashmir and the Thar Desert.
- The Lower Palaeolithic tools have also been found in the Belan valley in Mirzapur District in Uttar Pradesh. Those found in the desert area of Didwana in Rajasthan in the valleys of the Belan and the Narmada, and in the caves and rock' shelters of Bhimbetka near Bhopal in Madhya Pradesh roughly belong to 100,000 B.C.
- The rockshelters may have served as seasonal camps for human beings. Hand-axes have been found in a deposit of the time of the second Himalayan inter-glaciation. In thisperiod climate became less humid.

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*Lower Palaeolithic tools are found in most parts of India, except in a few regions of the Ganges valley, southern Tamil Nadu and in the hilly areas of the Western Ghats. **Athirampakkam, Pallavaram** and **Gudiyam near Chennai**, Hunsgi valley and Isampur in Karnataka, and Bhimbetka in Madhya Pradesh are some important Palaeolithic sites where the Acheulian tools are found.*

*Animal fossils are useful to understand the palaeo-environmental context in which people lived. In the Narmada valley, animal fossils of Elephas namadicus (giant tusked pre-historic elephant), Stegodon ganesa (a giant pre-historic elephant), Bos namadicus (wild cattle) and Equus namadicus (extinct great horse like animal) have been recovered. **Teeth of Equus, evidence of water buffalo and nilgai as well as 17 animal hoof prints have been uncovered at Attirampakkam.***

- The Middle Palaeolithic industries are mainly based upon flakes. These flakes are found in different parts of India & show regional variations.
- The principal tools are varieties of blades points, borers and scrapers made of flakes. We also find a large number of borers and blade-like tools.
- The geographical horizon of the Middle Palaeolithic sites coincides roughly with that of the Lower Palaeolithic sites.
- Here we notice a crude pebble industry in strata contemporarywith the third Himalayan glaciation.
- The artefacts of this ageare also found at several places on the river Narmada, and also at several places, south of the Tungabhadra river.
- The Upper Palaeolithic phase was less humid.
- It coincided with the last phase of the Ice Age when climate became comparatively warm.
- In the world context it marks the appearance of new flint, industries and of men of the modern type (Homo sapiens).
- In India, we notice the use of blades and burins, which have been found in Andhra Pradesh, Karnataka. Maharashtra, central Madhya Pradesh, southern Uttar Pradesh, south Bihar plateau and the adjoining areas.
- Caves and rockshelters for use by human beings in the Upper Palaeolithic phase have been discovered at Bhimbetka, 45 km south of Bhopal.
- An Upper Palaeolithic assemblage, characterised by comparatively large flakes, blades, burins and scrapers has also been found in the upper levels of the Gujarat dunes.

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Ostrich Egg Shells

Evidence of ostrich has been found in some pre-historic sites of India. The egg shell of this bird had been used as beads and those from Patne have been dated to 25,000 BP. They are found in ***Bhimbetka*** *and* ***Patne.***

The Mesolithic Age: Hunters and Herders

- The Upper Palaeolithic Age came to an end with the endof the Ice Age around 9000 B.C., and the climate became warm and dry.

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In Levant (Eastern Mediterranean), they are dated between 20,000 and 9500 BCE. In India, Mesolithic cultures appeared around 10,000 BCE. In certain parts of India including Kerala and Tamil Nadu, it continued up to 1000 BCE, till the beginning of the Iron Age. In ***Sri Lanka****, the microliths appeared about 28,500 years BP.*

- Climatic changes brought about changesin fauna and flora and made it possible for human beings to move to new areas. Since then there have not been any major changes in climatic conditions.
- An intermediate stage in stone age culture, which is called the Mesollithic Age, it intervened as a transitional phase between the Palaeolithic Age and the Neolithic or New Stone Age.
- The mesolithic people lived on hunting, fishing and food gathering: at a later stage they also domesticated animals.

- The characteristic tools of the Mesolithic Age are microliths. The mesolithic sites are found in good numbers in Rajasthan, southern Uttar Pradesh, central and eastern India and also south of the river Krishna.
- The cultivation of plants around 7000-6000 B.C. is suggested in Rajasthan from a study of the deposits of the former salt Lake, Sambhar.

Prehistoric Art

- The people of palaeolithic and mesolithic ages practised painting.
- Prehistoric art appears at several places, but Bhimbetka in Madhya Pradesh is a striking site.
- Situated in the Vindhyan range, 45 km south of Bhopal, it has more than 500 painted rock shelters, distributed in an area of 10 sq km.

The Neolithic Age Food Producers

- In the world context the New Stone Age began in 9000 B.C. The only neolithic settlement in the Indian subcontinent attributed to 7000 B.C. lies in Mehrgarh, which is situated in Baluchistan, a province of Pakistan. In the initial stage, before 5000 B.C. the people of this place did not use any pottery.
- Some neolithic sites found on the northern spurs of the Vindhyas are considered as old as 5000 B.C. but generally neolithic settlements found in south India are not older than 2500 B.C., in some parts of southern and eastern India they are as late as 1000 B.C.
- The people of Burzahom used coarse grey pottery. It is interesting that the Burzahom domestic dogs were buried with their masters in their graves.
- The placing of domestic dogs in the graves of the masters do not seem to be the practice with neolithie people in any other part of India
- Theearliest date for Burzahom is about 2700 B.C., but the bonesrecovered from Chirand cannot be dated earlier than 2000 B.C. and they possibly belong to the late neolithic phase.
- The second group of neolithic people lived in south India, south of the Godavari river. They usually settled on the tops of granite hills or on plateaus near the river banks. They used stone axes and also some kind of stone blades.
- The third area from which neolithic tools have been recovered is in the hills of Assam. Neolithic tools are also found in the Garo hills in Meghalaya on the north-eastern frontier of India.
- Some of the important neolithic sites or those with neolithic layers that have been excavated include Maski, Brahmagiri, Hallur Kodekal, Sanganakallu, T. Narsipur, Piklihal and Takkalakota in Karnataka, and Palyampalli in Tamil Nadu.
- Utnur is an important neolithic site in AndhraPradesh. The neolithic phase in south India seems to have covered the period from about 2000 B.C. to about 1000 B.C.The neolithic settlers in Piklihal were cattle-herders.
- Neolithic celts, axes, adzes, chisels, etc., have also been found in the Orissa and Chotanagpur, hill areas. But traces of neolithic settlements are generally few in parts of MadhyaPradesh and the tracts of the upper Deccan, because of the lack of the types of stone which lend themselves easily to grinding and polishing.
- The period between 9000 B.C. and 3000 B.C. saw a remarkable progress of technology in western Asia, because the people developed the arts of cultivation, weaving, pot- making, house building, domestication of animals writing, etc. But the whole process started a little late in India.
- However, the Neolithic Age in the Indian sub-continent began around the sixth millennium B.C. Some of the important crops, including rice, wheat and barley, came to be cultivated in the subcontinent in this period and a few villages appeared in this part of the world.

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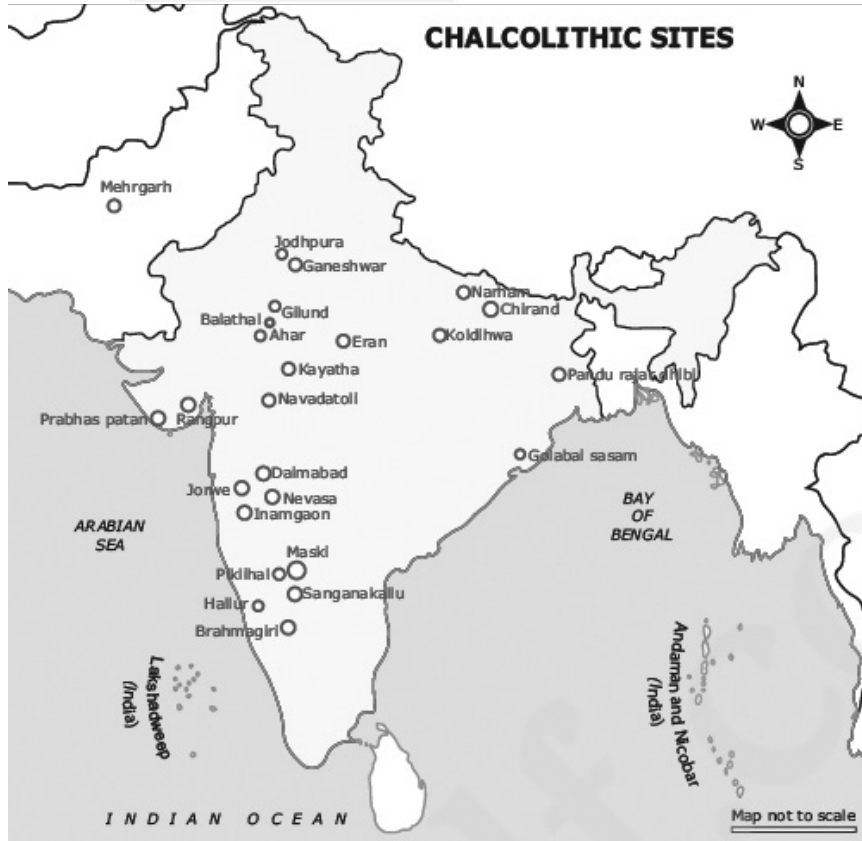
Early Dentistry in the Neolithic Mehrgarh

The human ancestors had knowledge of medicinal herbs and were capable of taking care of health for survival from the pre-historic times. As their ways of life changed, new diseases appeared and they had to find remedies. The earliest evidence for drilling human tooth (of a living person) has been found at Mehrgarh. It is seen as a prelude to dentistry.

11/Old/I/5

Chalcolithic Settlements

- The End of the neolithic period saw the use of metals.
- The metal to be used first was copper, and several cultures were based on the use of stone and copper implements. Such a culture is called chalcolithic which means the stone copper phase. Technologically chalcolithic stage appliedto the pre-Harappans.
- But in various parts of the countrythe chalcolithic cultures appear after the end of the bronze Harappa culture.
- In India, settlements belonging to the chalcolithic phase are found in south-eastern Rajasthan, western part of Madhya Pradesh, western Maharashtra and in southern and eastern India.



- In south-eastern Rajasthan, two sites, one at Ahar and the other at Gilund, have been excavated. They lie in the dry zones of the Banas valley. In western Madhya Pradesh, Malwa, Kayatha and Eran have been exposed.
- TheMalwa Ware typical of the Malwa chalcolithic culture of central and western India is considered the richest among the chalcolithic ceramics.
- Some of its pottery and othercultural elements are also found in Maharashtra. But the most extensive excavations have taken place in Maharashtra.
- Several chalcolithic sites, such as Jorwe, Nevasa Daimabad in Ahmadanagar District; Chandoli, Songaon and Inamgaon in Pune district, Prakash and Nasik have been excavated. They all belong to the Jorwe culture named after Jorwe, the type-site situated on the left bank of the Pravara river, a tributary of the Godavari, in Ahmadnagar district, The Jorweculture owed much to the Malwa culture but it also containedelements of the south neolithic culture.
- The Jorwe culture, c. 1400 to 700 B.C. covered modern Maharashtra except parts of Vidarbha and the coastal region of Konkan. Although the Jorwe culture was rural, some of its settlements such as Daimabad and Inamgaon had almost reached the urban stage. All these Maharashtra sites were located in semi-arid areas mostly on brown-black soil which had ber and babul vegetation but fell in the riverine tracts. In addition to these, we have Navdatoli situated on the Narmada. Most chalcolithic ingredients intruded into the neolithic sites in south India.
- Several chalcolithic sites have been found in the Vindhyan region of Allahabad district. In eastern India, besides Chirand on the Ganga, mention may be made of Pandu Rajar Dhibi in Burdwan district and Mahishdal in Birbhum district in West Bengal.
- Chalcolithic cultures in central and western India disappeared by 1200 B.C. or so only the Jorwe culture continued until 700 B.C. However, in several parts of the, country the chalcolithic black-and-red ware continued into historical times till the second century B.C. But by and largea gap of about four to six centuries appears between the chalcolithic cultures and the early historic cultures in centraland western India.

Importance of the Chalcolithic Phase

- Except for the alluvial plains and the thickly forested areas, traces of chalcolithic cultures have been discovered almost all over the country.
- In the alluvial plains of the mid- Ganga region, several chalcolithic sites occur, particularly near a lake or a river confluence.
- In this phase people mostly founded rural settlements on river banks not far removed from the hills.

11/Old/I/6

Limitations of Chalcolithic Cultures

- The chalcolithic people domesticated cattle - sheep/goats which were tethered in the courtyard. Probably the domesticated animals were slaughtered for food and not milked for drink and dairy products.
- The tribal people such as the Gonds of Bastar think that milk is meant only to feed the young animals and, therefore, they do not milk their cattle. Because of this the chalcolithic people could notmake full use of the animals.
- The general weakness of chalcolithic cultures is evident from the burial of a large number of children in western Maharashtra.
- In spite of a food-producing economy, the rate of infant mortality was very high. It might be attributed to lack of nutrition, absence of medical knowledge or outbreakof epidemics.
- At any rate the chalcolithic social and economic pattern did not promote longe. The Copper Hoards and the Ochre-coloured Pottery Phase
- More than forty copper hoards consisting of rings, celts, hatchets, swords, harpbons, spearheads and human-like figures have been found in a wide area ranging from West Bengal and Orissa in the east to Gujarat and Haryana in the west, and from Andhra Pradesh in the south to Uttar Pradeshin the north.
- The largest hoard comes from Gungeria in Madhya Pradesh: it contains 424 copper tools and weapons and 102 thin sheets of silver objects.
- But nearly half of the copper hoards are concentrated in the Ganga-Yamuna doab in other areas we encounter stray finds of copper harpoon's,antennae swords, and anthropomorphic figures.

The Copper Hoards and the Ochre-coloured Pottery Phase

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Chalcolithic Cultures of South India

The southern part of India has not produced cultural evidence of a fullfledged chalcolithic culture. Perforated and spouted vessels have been found in some sites. Copper bronze tools like chisels and flat axes occur at these sites. Stone tools continued to be used in this area. Black on red ware pottery is found.These people survived through animal rearing and agriculture. Millets, pulses and horse gram were cultivated, and fruits, leaves and tubers were collected.

Iron Age in North India

The Iron Age in North India coincides with the painted Grey Ware culture. The painted grey ware is dated to from 1100 to 800 BCE. More than 1000 sites have been identified with painted grey ware pottery in northern India, with a major concentration in the Ganga-Yamuna valley. These ceramics succeeded the Black and Red Ware Culture in the eastern Ganga valley and Central India.

The Painted Grey Ware cultural phase is followed by Northern Black Polished Ware culture (NBPW), which is associated with the Mahajanapada and Mauryan periods.

The Iron Age in North India was coeval with Painted Greyware Culture, and in South India it was associated with Megalithic burial mounds.

Megalithic/ Iron Age in Tamilnadu

The burial system followed by the people of Neolithic period continued into the Megalithic period. A circular tomb using big stone slabs built upon the place of burial is known as a megalith. Such megaliths have been found in many parts of Tamilnadu.

The end of Megalithic burial practice is assigned to third-second centuries CE. During this period Brahmi writing akin to Ashokan Brahmi has been discovered in Kodumanal (Erode District).

Adichanallur: *Adichanallur, 22 km from Tirunelveli, is located in Thoothukudi district. In 1876, a German ethnologist and naturalist, Andrew Jagor conducted an excavation at Adichanallur.*

Paiyampalli: *Paiyampalli is a village in Tirupathur taluk, Vellore district. The Archaeological Survey of India carried out an excavation in the 1960s and unearthed black and red ware pottery in this megalithic site. A large number of urn burials were also found in this region. The date of this culture, based on radio carbon dating, is 1000 BCE.*

Kodumanal: *Kodumanal, 40 km from Erode, is located on the northern bank of Noyyal river, a tributary of the Cauvery. A series of excavations were carried out during the 1980s and 1990s. The most recent was in 2012.*

CHAPTER 3

Indus Valley Civilization

- The Indus valley civilisation is also called the Harappan culture.
- Archaeologists use the term "culture" for a group of objects, distinctive in style, that are usually found together within a specific geographical area and period of time.
- In the case of the Harappan culture, these distinctive objects include seals, beads, weights, stone blades and even baked bricks.
- These objects were found from areas as far apart as Afghanistan, Jammu, Baluchistan (Pakistan) and Gujarat.
- Named after Harappa, the first site where this unique culture was discovered, the civilisation is dated between c. 2600 and 1900 BCE.
- There were earlier and later cultures, often called Early Harappan and Late Harappan, in the same area.
- The Harappan civilisation is sometimes called the Mature Harappan culture to distinguish it from these cultures.
- There were several archaeological cultures in the region prior to the Mature Harappan.
- These cultures were associated with distinctive pottery, evidence of agriculture and pastoralism, and some crafts.
- Settlements were generally small, and there were virtually no large buildings.
- It appears that there was a break between the Early Harappan and the Harappan civilisation, evident from large-scale burning at some sites, as well as the abandonment of certain settlements.
- In 1924, John Marshall, Director-General of the ASI, announced the discovery of a new civilisation in the Indus valley to the world.
- Geographically, this civilization covered Punjab, Sindh, Baluchistan, Rajasthan, Gujarat and Western Uttar Pradesh. It extended from Sutkagengor (in Baluchistan) in the West to Alamgirpur (Western UP) in the East; and from Mandu (Jammu) in the North to Daimabad (Ahmednagar, Maharashtra) in the South. Some Indus Valley sites have also been found as far away as Afghanistan and Turkmenistan.

12/New/I/1

Harappa

- Excavated by Daya Ram Sahini in 1921.

11/Old/I/5

- Situated on the bank of river Ravi in Montgomery district of Punjab (Pakistan).

The Plight of Harappa

- Although Harappa was the first site to be discovered, it was badly destroyed by brick robbers.
- As early as 1875, Alexander Cunningham, the first Director-General of the Archaeological Survey of India (ASI), often called the father of Indian archaeology, noted that the amount of brick taken from the ancient site was enough to lay bricks for "about 100 miles" of the railway line between Lahore and Multan. Thus, many of the ancient structures at the site were damaged.

12/New/I/1

- Harappa was one of the oldest cities in the subcontinent, which archaeologists found 80 years ago.
- It was the first city to be discovered.
- All other cities where buildings similar to Harappa were found were described as Harappan.
- These cities developed about 4700 years ago.

6/New/I/3

- **Findings**
  - Piece of Pottery with Indus Script

- Cubical Limestone Weight
- Faience Slag
- Sandstone statues of Human anatomy
- Copper Bullock cart
- Granaries
- **Coffin burials (Only founded in Harrapa)**
- Terracotta Figurines

11/Old/I/5

Mohenjodaro

- Location- on Larkana District of Sind on the bank of Indus
- Discovered by R. D Banerjee in 1922.
- The settlement is divided into two sections, one smaller but higher and the other much larger but lower.
- Archaeologists designate these as the Citadel and the Lower Town respectively.
- The Citadel owes its height to the fact that buildings were constructed on mud brick platforms.
- It was walled, which meant that it was physically separated from the Lower Town.
- The Lower Town was also walled.
- Several buildings were built on platforms, which served as foundations.
- It has been calculated that if one labourer moved roughly a cubic metre of earth daily, just to put the foundations in place it would have required four million person-days, in other words, mobilising labour on a very large scale.
- **Findings**
- **Great bath**
  - The Great Bath was lined with bricks, coated with plaster, and made water-tight with a layer of natural tar.
  - There were steps leading down to Great Bath from two sides, while there were rooms on all sides.
  - Water was probably brought in from a well, and drained out after use. Perhaps important people took a dip in this tank on special occasions.
  - Scholars have estimated that the total number of wells in Mohenjodaro was about 700.

12/New/I/1

- **Granary**
  - Unicorn Seals (Most numbers of it in here)
  - Bronze dancing girl statue
  - Seal of a man with deers, elephants, tiger and rhinos around- Considered to be Pashupati Seal)
  - Steatite statue of beard man
  - Bronze buffalo

Sutkagendor

- Location- on Baluchistan on Dast river
- Discovered by Stein in 1929.
- **Findings-**
  - Trade point between Harappa and Babylon
  - Flint Blades
  - Stone Vessels
  - Stone Arrowheads
  - Shell Beads
  - Pottery
  - Bactria-Margiana Archaeological Complex (BMAC) associated Copper-Bronze Disc

11/Old/I/5

Chanhudaro

- Loacation-Mullan Sandha, Sind on the Indus river
- Discovered by N G Majumdar in 1931
- **Findings-**
  - Bangle Factory
  - Almost exclusively devoted to craft production, including bead-making, shell-cutting, metal-working, seal- making and weight-making.
  - The variety of materials used to make beads is remarkable: stones like carnelian (of a beautiful red colour), jasper, crystal, quartz and steatite; metals like copper, bronze and gold; and shell, faience and terracotta or burnt clay.
  - Some beads were made of two or more stones, cemented together, some of stone with gold caps.
  - The shapes were numerous-disc shaped, cylindrical, spherical, barrel-shaped, segmented. Some were decorated by incising or painting and some had designs etched onto them.

12/New/I/1

  - Ink Pot
  - The footprint of a dog chasing a cat
  - Cart with a seated driver

Note: It is the only city without a citadel

Amri

- Location- Close to Balochistan, on the bank of Indus river.

- Discovered by N G Majumdar in 1935.
- **Findings-**
  - Antelope evidence
  - Rhinoceros' evidence

Kalibangan

- Location-Hanumangarh District, Rajasthan on the bank of Ghaggar river.
- Discovered by Amlanand Ghose in 1953.
- **Findings-**
  - Lower fortified town
  - Wooden drainage
  - Copper Ox
  - Evidence of earthquake
  - Wooden plough
  - Camel's bone
  - Fire alters
  - Camel's bones
  - Furrowed land

11/Old/I/5

Lothal

- Location- Gujarat on Bhogva river near the Gulf of Cambay.
- Discovered by R. Rao 1953.
- **Findings-**
  - Port Town
  - Houses were built of mud bricks, drains were made of burnt bricks.

12/New/I/1

  - Graveyard
  - Ivory weight balance
  - Copper dog
  - First manmade port
  - Dockyard
  - Rice husk
  - Fire alters
  - Chess-playing

Surkotada

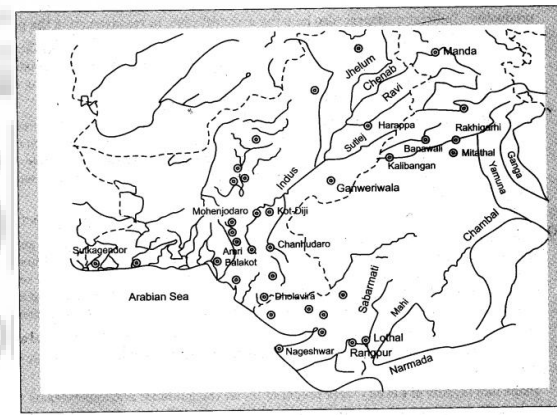
- Situated in Gujarat
- Discovered by J P Joshi 1964
- **Findings-**
  - Bones of horses
  - Beads
  - Stone Covered Beads

Banawali

- Situated at Fatehabad district of Haryana.
- Discovered by R S Bisht in 1974.
- **Findings**
  - Beads
  - Barley
  - Oval shaped settlement
  - The only city with radial streets
  - Toy plough
  - The largest number of barley grains

Dholavira

- Location- Gujarat in Rann of Katchchh.
- Discovered by R S Bisht 1985.
- **Findings**
  - Exclusive water management
  - Only site to be divided into three parts
  - Giant water reservoir
  - Unique water harnessing system
  - Dams
  - Embankments
  - Stadium
  - Rock – Cut architecture



11/Old/I/5

Subsistence Strategies

- The Harappans ate a wide range of plant and animal products, including fish.
- Archaeologists have been able to reconstruct dietary practices from finds of charred grains and seeds.
- Grains found at Harappan sites include wheat, barley, lentil, chickpea and sesame. Millets are found from sites in Gujarat.
- Finds of rice are relatively rare.
- Animal bones found at Harappan sites include those of cattle, sheep, goat, buffalo and pig.

- Bones of wild species such as boar, deer and *gharial* are also found.
- It is not clear the, whether the Harappans hunted these animals themselves or obtained meat from other hunting communities.
- Bones of fish and fowl are also found.

Agricultural Technologies

- Representations on seals and terracotta sculpture indicate that the bull was known, and archaeologists extrapolate from this that oxen were used for ploughing.
- Moreover, terracotta models of the plough have been found at sites in Cholistan and at Banawali (Haryana).
- Archaeologists have also found evidence of a ploughed field at Kalibangan (Rajasthan), associated with Early Harappan levels.
- The field had two sets of furrows at right angles to each other, suggesting that two different crops were grown together.
- Archaeologists have also tried to identify the tools used for harvesting.
- Most Harappan sites are located in semi-arid lands, where irrigation was probably required for agriculture.
- Traces of canals have been found at the Harappan site of Shortughai in Afghanistan, but not in Punjab or Sind.
- It is possible that ancient canals silted up long ago. It is also likely that water drawn from wells was used for irrigation.
- Besides, water reservoirs found in Dholavira (Gujarat) may have been used to store water for agriculture.

Special Features of the Harappan Cities

- Cities were divided into two or more parts.
- The part to the west was smaller but higher. Archaeologists describe this as the citadel.
- The part to the east was larger but lower. This is called the lower town.
- Walls of baked brick were built around each part. The bricks were so well baked that they have lasted for thousands of years.
- The bricks were laid in an interlocking pattern and that made the walls strong.
- In some cities, special buildings were constructed on the citadel. For example, in Mohenjodaro, a very special tank, which archaeologists call the Great Bath, was built in this area.

6/New/I/3

Laying Out Drains

- One of the most distinctive features of Harappan cities was the carefully planned drainage system.
- If we look at the plan of the Lower Town we will notice that roads and streets were laid out along an approximate **"grid"** pattern, intersecting at right angles.
- It seems that streets with drains were laid out first and then houses built along them.
- If domestic waste water had to flow into the street drains, every house needed to have at least one wall along a street.

Citadels

- *While most Harappan settlements have a small high western part and a larger lower eastern section, there are variations.*
- *At sites such as Dholavira & Lothal (Gujarat), the entire settlement was fortified, and sections within the town were also separated by walls.*
- *The Citadel within Lothal was not walled off, but was built at a height.*

12/New/I/1

Life in the City

- Harappan city was a very busy place.
- Rulers were the people who planned the construction of special buildings in the city. Rulers sent people to distant lands to get metal, precious stones, and other things that they wanted.
- Scribes were the people who knew how to write and help in preparing the seals and perhaps write on other materials that have not survived.
- There were men and women, crafts persons who used to make all kinds of things.
- Many terracotta toys have been found in Harappan cities, which shows that children must have played with these.

6/New/I/3

Domestic Architecture

- The Lower Town at Mohenjodaro provides examples of residential buildings.
- Many were centred on a courtyard, with rooms on all sides.
- The courtyard was probably the centre of activities such as cooking and weaving, particularly during hot and dry weather.
- There are no windows in the walls along the ground level.
- Besides, the main entrance does not give a direct view of the interior or the courtyard.
- Every house had its own bathroom paved with bricks, with drains connected through the wall to the street drains.
- Some houses have remains of staircases to reach a second storey or the roof.
- Many houses had wells, often in a room that could be reached from the outside and perhaps used by passers-by.

Major Periods in Early Indian Archaeology

2 Million Bp (Before Present)	Lower Palaeolithic
80,000	Middle Palaeolithic
35,000	Upper Palaeolithic
12,000	Mesolithic
10,000	Neolithic (early agriculturists and pastoralists)
6,000	Chalcolithic (first use of copper)
2600 BCE	Harappan civilisation
1000 BCE	Early iron, megalithic burials
600 BCE-400 CE	Early Historic

(**Note:** All dates are approximate. Besides, there are wide variations in developments in different parts of the subcontinent. Dates indicated are for the earliest evidence of each phase.)

Tracking Social differences

Burials

- At burials in Harappan sites the dead were generally laid in pits.
- Sometimes, there were differences in the way the burial pit was made – in some instances, the hollowed-out spaces were lined with bricks.
- Some graves contain pottery and ornaments, perhaps indicating a belief that these could be used in the afterlife.
- Jewellery has been found in burials of both men and women.
- In fact, in the excavations at the cemetery in Harappa in the mid-1980s, an ornament consisting of three shell rings, a jasper (a kind of semi-precious stone) bead and hundreds of micro beads was found near the skull of a male.
- In some instances the dead were buried with copper mirrors.
- But on the whole, it appears that the Harappans did not believe in burying precious things with the dead.

Looking for "luxuries"

- Another strategy to identify social differences is to study artefacts, which archaeologists broadly classify as utilitarian and luxuries.
- The first category includes objects of daily use made fairly easily out of ordinary materials such as stone or clay. These include querns, pottery, needles, flesh- rubbers (body scrubbers), etc., and are usually found distributed throughout settlements.
- Archaeologists assume objects were luxuries if they are rare or made from costly, non-local materials or with complicated technologies. Thus, little pots of faience (a material made of ground sand or silica mixed with colour and a gum and then fired) were probably considered precious because they were difficult to make.
- Miniature pots of faience, perhaps used as perfume bottles, are found mostly in Mohenjodaro and Harappa, and there are none from small settlements like Kalibangan.
- Gold too was rare, and as at present, probably precious – all the gold jewellery found at Harappan sites was recovered from hoards.

Materials from the subcontinent and beyond

- The Harappans procured materials for craft production in various ways. For instance,
  - They established settlements such as Nageshwar and Balakot in areas where shell was available.
  - Other such sites were Shortughai, in far-off
  - Afghanistan, near the best source of lapis lazuli, a blue stone that was apparently very highly valued, and Lothal which was near sources of carnelian (from Bharuch in Gujarat), steatite (from south Rajasthan and north Gujarat) and metal (from Rajasthan).

- Another strategy for procuring raw materials may have been to send expeditions to areas such as the Khetri region of Rajasthan (for copper) and south India (for gold).
- These expeditions established communication with local communities.
- Occasional finds of Harappan artefacts such as steatite micro beads in these areas are indications of such contact.
- There is evidence in the Khetri area for what archaeologists call the Ganeshwar-Jodhpura culture, with its distinctive non-Harappan pottery and an unusual wealth of copper objects.
- It is possible that the inhabitants of this region supplied copper to the Harappans.

Tamil Nadu Textbook

Trade and Exchange

One of the sources of Harappan economy was trade and exchange activities. Harappans had close trade contacts with the ***Mesopotamians*** *and also with various cultures of India. The Harappan seals and materials have been found in the Sumerianites in* ***Oman, Bahrain,*** *and* ***Iraq*** *and* ***Iran.*** *The cuneiform inscriptions mention the trade contacts between Mesopotamia and Harappans.*

*The mention of "****Meluhha****" in the cuneiform inscriptions refers to the Indus region. A Harappan jar has been found in Oman. Harappan seals, weights, dice and beads are found in Mesopotamia. Carnelian, lapis lazuli, copper, gold and varieties of wood were exported to Mesopotamia. Harappans also interacted with various regions of India and acquired raw materials and processed them.*

Rohri chert

The chert, a fine grained sedimentary rock, was found in the region of Rohri in Pakistan. It was used by the Harappans for making stone blades and tools.

Weights and Measures

Harappans had developed proper weights and measures. Since they were involved in commercial transactions, they needed standard measures. Cubical chert weights have been unearthed from Harappan sites. The weights exhibit a binary system. The ratio of ***weight is doubled as 1:2:4:8:16:32.*** *The small weight measure of* ***16th ratio weighs 13.63 grams****. They also used a measuring scale in which one inch was around* ***1.75 cm.*** *Weights made of chert were cubical. They used binary numbering system* ***(1, 2, 4, 8, 16, 32, etc.).*** *They might have been used for weighing jewellery and metal.*

Contact with Distant Lands

- Recent archaeological finds suggest that copper was also probably brought from Oman, on the southeastern tip of the Arabian peninsula.
- Chemical analyses have shown that both the Omani copper and Harappan artefacts have traces of nickel, suggesting a common origin.
- There are other traces of contact as well.
- A distinctive type of vessel, a large Harappan jar coated with a thick layer of black clay has been found at Omani sites.
- Such thick coatings prevent the percolation of liquids.
- Mesopotamian texts datable to the third millennium BCE refer to copper coming from a region called Magan, perhaps a name for Oman, and interestingly enough copper found at Mesopotamian sites also contains traces of nickel.

- Other archaeological finds suggestive of long distance contacts include Harappan seals, weights, dice and beads.
- In this context, it is worth noting that Mesopotamian texts mention contact with regions named Dilmun (probably the island of Bahrain), Magan and Meluhha, possibly the Harappan region. They mention the products from Meluhha: carnelian, lapis lazuli, copper, gold, and varieties of wood.
- Mesopotamian texts refer to Meluhha as a land of seafarers. Besides, we find depictions of ships and boats on seals.

12/New/I/1

Ancient Authority

There are indications of complex decisions being taken and implemented in Harappan society.

Palaces and kings

- If we look for a centre of power or for depictions of people in power, archaeological records provide no immediate answers.
- A large building found at Mohenjodaro was labeled as a palace by archaeologists but no spectacular finds were associated with it.
- A stone statue was labelled and continues to be known as the "priest-king".
- This is because archaeologists were familiar with Mesopotamian history and its "priest-kings" and have found parallels in the Indus region.
- Some archaeologists are of the opinion that Harappan society had no rulers, and that everybody enjoyed equal status.
- Others feel there was no single ruler but several, that Mohenjodaro had a separate ruler, Harappa another, and so forth.
- Yet others argue that there was a single state, given the similarity in artefacts, the evidence for planned settlements, the standardised ratio of brick size, and the establishment of settlements near sources of raw material.
- As of now, the last theory seems the most plausible, as it is unlikely that entire communities could have collectively made and implemented such complex decisions.

Discovering the Harappan Civilisation

When Harappan cities fell into ruin, people gradually forgot all about them. When men and women began living in the area millennia later, they did not know what to make of the strange artefacts that occasionally surfaced, washed by floods or exposed by soil erosion, or turned up while ploughing a field, or digging for treasure.

Cunningham's confusion

- When Cunningham, the first Director-General of the ASI, began archaeological excavations in the midnineteenth century, archaeologists preferred to use the written word (texts and inscriptions) as a guide to investigations.
- In fact, Cunningham's main interest was in the archaeology of the Early Historic (*c*. sixth century BCE-fourth century CE) and later periods.
- He used the accounts left by Chinese Buddhist pilgrims who had visited the subcontinent between the fourth and seventh centuries CE to locate early settlements. Cunningham also collected, documented and translated inscriptions found during his surveys.
- When he excavated sites he tended to recover artefacts that he thought had cultural value.
- A site like Harappa, which was not part of the itinerary of the Chinese pilgrims and was not known as an Early Historic city, did not fit very neatly within his framework of investigation.
- So, although Harappan artefacts were found fairly often during the nineteenth century and some of these reached Cunningham, he did not realise how old these were.
- A Harappan seal was given to Cunningham by an Englishman. He noted the object, but unsuccessfully tried to place it within the time-frame with which he was familiar. This was because he, like many others, thought that Indian history began with the first cities in the Ganga valley .
- Given his specific focus, it is not surprising that he missed the significance of Harappa.

Sites, Mounds, Layers

- Archaeological sites are formed through the production, use and discarding of materials and structures.
- When people continue to live in the same place, their constant use and reuse of the landscape results in the build up of occupational debris, called a mound.
- Brief or permanent abandonment results in alteration of the landscape by wind or water activity and erosion.

- Occupations are detected by traces of ancient materials found in layers, which differ from one another in colour, texture and the artefacts that are found in them. Abandonment or desertions, what are called "sterile layers", can be identified by the absence of such traces.
- Generally, the lowest layers are the oldest and the highest are the most recent. The study of these layers is called stratigraphy. Artefacts found in layers can be assigned to specific cultural periods and can thus provide the cultural sequence for a site.

A new old Civilisation

- Subsequently, seals were discovered at Harappa by archaeologists such as **Daya Ram Sahni** in the early decades of the twentieth century, in layers that were definitely much older than Early Historic levels. It was then that their significance began to be realised.
- Another archaeologist, **Rakhal Das Banerji** found similar seals at Mohenjodaro, leading to the conjecture that these sites were part of a single archaeological culture.
- Based on these finds, in 1924, **John Marshall**, Director-General of the ASI, announced the discovery of a new civilisation in the Indus valley to the world.
- As **S.N. Roy** noted in *The Story of Indian Archaeology,* "Marshall left India three thousand years older than he had found her." This was because similar, till- then-unidentified seals were found at excavations at Mesopotamian sites. It was then that the world knew not only of a new civilisation, but also of one contemporaneous with Mesopotamia.
- In fact, **John Marshall's** stint as Director-General of the ASI marked a major change in Indian archaeology. **He was the first professional archaeologist to work in India,** and brought his experience of working in Greece and Crete to the field.
- More importantly, though like Cunningham he too was interested in spectacular finds, he was equally keen to look for patterns of everyday life.

New Techniques and Questions

- It was R.E.M. Wheeler, after he took over as Director- General of the ASI in 1944, who rectified this problem.
- Wheeler recognised that it was necessary to follow the stratigraphy of the mound rather than dig mechanically along uniform horizontal lines.
- The frontiers of the Harappan civilisation have little or no connection with present-day national boundaries.
- However, with the partition of the subcontinent and the creation of Pakistan, the major sites are now in Pakistani territory.
- An extensive survey in Kutch has revealed a number of Harappan settlements and explorations in Punjab and Haryana have added to the list of Harappan sites.
- While Kalibangan, Lothal, Rakhi Garhi and most recently Dholavira have been discovered, explored and excavated as part of these efforts, fresh explorations continue.

Problems of Interpretation

- Early archaeologists thought that certain objects which seemed unusual or unfamiliar may have had a religious significance.
- These included terracotta figurines of women, heavily jewelled, some with elaborate head-dresses. These were regarded as mother goddesses.
- Rare stone statuary of men in an almost standardised posture, seated with one hand on the knee – such as the "priest-king" – was also similarly classified. In other instances, structures have been assigned ritual significance.
- These include the Great Bath and fire altars found at Kalibangan and Lothal.
- Attempts have also been made to reconstruct religious beliefs and practices by examining seals, some of which seem to depict ritual scenes. Others, with plant motifs, are thought to indicate nature worship.
- Some animals – such as the one-horned animal, often called the "unicorn" – depicted on seals seem to be mythical, composite creatures.
- In some seals, a figure shown seated cross-legged in a "yogic" posture, sometimes surrounded by animals, has been regarded as a depiction of "proto- Shiva", that is, an early form of one of the major deities of Hinduism.
- Besides, conical stone objects have been classified as lingas.
- A linga is a polished stone that is worshipped as a symbol of Shiva.

- Many reconstructions of Harappan religion are made on the assumption that later traditions provide parallels with earlier ones. This is because archaeologists often move from the known to the unknown, that is, from the present to the past.
- While this is plausible in the case of stone querns and pots, it becomes more speculative when we extend it to "religious" symbols.

Major Developments in Harappan Archaeology	
1875	Report of Alexander Cunningham on Harappan seal
1921	M.S. Vats begins excavations at Harappan
1925	Excavations begin at Mohenjodaro
1946	R.E.M. Wheeler excavates at Harappa
1955	S.R. Rao begins excavations at Lothal
1960	B.B. Lal and B.K. Thapar begin excavations at Kalibangan
1974	M.R. Mughal begins explorations in Bahawalpur
1980	A team of German and Italian archaeologists begins surface explorations at Mohenjodaro
1986	American team begins excavations at Harappa
1990	R.S. Bisht begins excavations at Dholavira

12/New/I/1

Reason behind Decline

- Some scholars suggest that the rivers dried up. Others suggest that there was deforestation.
- Decline could have happened because fuel was required for baking bricks, and for smelting copper ores. Besides, grazing by large herds of cattle, sheep and goat may have destroyed the green cover.
- In some areas there were floods.
- But none of these reasons can explain the end of all the cities. Flooding, or a river drying up would have had an effect in only some areas.

6/New/I/3

- It appears as if the rulers lost control. Sites in Sind and west Punjab (present-day Pakistan) were abandoned, while many people moved into newer, smaller settlements to the east and the south.
- There is evidence that by *c.* 1800 BCE most of the Mature Harappan sites in regions such as Cholistan had been abandoned.
- Simultaneously, there was an expansion of population into new settlements in Gujarat, Haryana and western Uttar Pradesh.
- In the few Harappan sites that continued to be occupied after 1900 BCE there appears to have been a transformation of material culture, marked by the disappearance of the distinctive artefacts of the civilisation – weights, seals, special beads.
- Writing, long-distance trade, and craft specialisation also disappeared.

12/New/I/1

Tamil Nadu Textbook

Indus Civilisation and Tamil Civilisation

The Indus Civilisation represents the first urbanisation of Indian history. The origin and authorship of the Indus Civilisation are keenly debated historical questions. The Indus script has not yet been conclusively deciphered and hence the authorship is not certain.

The graffiti found on the megalithic burial pots of South India and the place names presented are cited to establish the relationship between Indus and Tamil cultures.

The archaeological evidence points to several groups of people living in Tamil Nadu and South India continuously from the Mesolithic period.

The towns of ancient Tamizhagam such as ***Arikamedu, Keezhadi*** *and* ***Uraiyur*** *that flourished are part of the second urbanisation of India and these towns are quite different from the Indus cities.*

CHAPTER 1

Political Science: Its Meaning and Scope

Meaning and Significance

- Political Science deals with processes of conflict and integration in society and with the interplay and organisation of power.
- It is all pervasive and omnipresent in the activities of individuals, groups and society at large and affects all the individuals in society.
- Political Science is a recognised social science discipline. The subject is associated with great masters and philosophers in the intellectual history Plato, Aristotle, Socrates, Kautilya, Machiavelli, Rousseau, Marx and Mahatma Gandhi.
- It has developed over the centuries adding new concepts, theories, and methods. The study of Political Science is training for students in the academic discipline.
- Political Science also tells us about the institutions and process of government. It deals with the constitution and with the powers and functions of different governmental agencies. In a more specific sense, it deals with institutions of a state government which have direct control over and impact on society.
- The governmental organisation is different from the other social organisations in the sense that no individual in modern society is outside its purview.
- A political system has to function under different kinds of pressures and compulsions, with the result that there are certain decisions that are not possible. An understanding of the process of politics helps in better understanding of the process of government. It results in a balanced understanding of the political system.

Political System

- A political system is a network of institutions and activities and net inter relationship.
- Whereas the traditional political concept of state focuses on the legal formal and institutional aspect of politics, the concept of political system perceives politics in a broader setting, i.e., the environment and explains political phenomenon in terms of actual operationalisation of political institutions.
- David Easton was themost important proponent in this approach in political science.Easton directed the basic components of political system as follow:
  I. 'Inputs' consist of 'demand' and 'support'. Demand means the expectations of the people from the political system, while 'support' to political system is provided by the political community.
  II. 'Outputs' are decisions taken by the government having an authoritative character in the form of legislation and policy formulation.
  III. Feedback is a channel to 'transmit reactions or policy decisions'.
- Thus, political system is a dynamic process through which information about the performance of the system is communicated back to it in such a way as to affect the subsequent behaviour of the system.
- Different elements of a political system are inter-related, and no element works in isolation. Changes occurring in any part of the system has its effect on other parts and finally on the system as a whole.
- Though inter-related different elements constitute 'system' by themselves, so there are system and sub-systems. The sub-systems that constitute it are in turn systems by themselves.

Politics and Political Science

- 'Politics and Political Science' are often used as synonymous terms. But their meanings differ both in terms of scope and emphasis.
- Politics refers to the processes of cooperation, conflict and competition.
- Political Science refers to a systematic study of the processes of politics.
- The two terms point towards its two aspects. While 'political' covers the subject matter or its study, 'science' refers to a systematic way of studying it. The first part seeks to answer the question. "What is studied?" and the second part "How is studied?" The first part refers to the scope of such a study and the second refers to the method of study. These two aspects, scope and method cannot be separated.
- While studying the process of politics, Political Science identifies the factors that determine cooperation and conflict among individuals and groups.
- The nature of such conflicts differs from individual to individual and from group to group. Political scientists study these variations and analyse the reasons for those variations.
- The variations that one finds in 'politics' in different situations and at different times are the bases of various theories in Political Science.

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Politics was a matter of discussion in the churches during the medieval period as political power remained with the church under the Holy Roman Empire. The works of philosophers such as St. Augustine ('The City of God') amalgamated the principles of political philosophy with those of religion. It must be noted here that for the Greek and medieval philosophers, politics was a knowledge centring on the city-state, which by and large had spiritual bond. It was more of a community than a state.

- To sum up, politics arises from the fact that we have different visions of what is just and desirable for us and our society.
- It involves the multiple negotiations that go on in society through which collective decisions are made.
- At one level, it involves what governments do and how they relate to the aspirations of the people.
- It involves how people struggle and influence decision making.
- People may be said to engage in political activity whenever they negotiate with each other and take part in collective activities which are designed to promote social development and help to resolve common problems.
- Political Science is an organised body of knowledge dealing with concepts and theories concerning the process of politics.

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Nature of Political Science

- Political Science is concerned with a systematic study of politics in human societies.
- To understand the nature and scope of the subject matter of 'politics', it will be useful to see the linkages with human societies.
- What is important about human societies is the fact that they always progress towards a higher level of development and are influenced by the culture of the people.
- Human beings are never satisfied with having just enough of life; they have always sought to produce more and have some 'surplus' at hand

for future use. They have found in the process of their historical evolution that the secret lies in cooperative organisation of activities.

- Such organisation of people is voluntary most of the time. As the individuals realise that economic and other activities can be performed better with the cooperation of others and in groups, they join together.
- In such cases some individuals or agencies may use some amount of compulsion to bring the people together for undertaking the work.
- For organising work on a cooperative basis, there are a number of factors that keep the people together: self- interest, allurement, commitment and even force. While force (for compulsion) may be necessary at times, yet people cannot be held together for long by force alone.
- There are some who manipulate to get a larger share and thus acquire personal property. Questions of equality and justice are raised in this context and there are differences on working out the system of distribution of surplus power, prestige and privileges.
- Conflicts of interests and opinions come to the surface on such occasions and affect the organisation itself. Individuals having similar interests organise themselves into groups.
- There are differences in terms of non-tangible factors that are culturally determined. Questions concerning what is good and what is bad and what is desirable and what is undesirable are not answered in the same way by different sets of people.
- Cooperation and conflict are thus, the two sides of politics that are inevitable in human societies.
- There are conflicts between individuals within co-operative- groups, as well as conflicts between different groups.
- These conflicts have to be sorted out and regulated to maintain the groups. Rules regulations and procedures are formulated to regulate the conflicts.

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Conflict and Integrations

- Cooperation and conflict are the two apparently opposite forces that constitute the process of politics and in fact are the two sides of the same coin.
- Conflicts in society are concerned with power which confers privileges, honour prestige benefits and pleasures. Power in this sense is concerned with controlling the behaviour of others.
- One aspect that is universally true about distribution of power is that it is always unequal, while some have more power others have less.
- This phenomenon has been explained in many ways. Various reasons and forms of conflicts have been pointed out. Among them economic cultural and psychological reasons are important.
- Some conflicts refer to socio-economic factors. In all societies, more so in human societies, there is a chronic shortage of resources of all kinds. Competition and conflicts are for acquiring scarce resources.
- Education plays a major role in the process of integration. The last and the most important technique of achieving the objective of integration is the use of force against those who still do not become a part of the common process and the common goal.
- The state has at its disposal the instruments of coercion. But they should be used only as a last resort. Frequent use of force and coercion may prove to be costly, as also keep the state in a constant threat of being challenged. If a state has to use coercion against too many people and too often, it is regarded as not being in good health.
- A state which is able to muster obedience of the people without actually using much of coercion is a state in best of its health.
- The social and economic spheres and the consequent demarcation of the functions of the state moulded the definition of Political Science.

Scope

- Political Science, is defined as "the science of the state" and was advocated by R.G. Gettel. The detailed study of the different stages of the evolution of state, the functions that it should perform and the norms that it should follow constituted the subject matter for the study in Political Science.

- Since the state performs its functions through the agency of the government. Stephan Leacock said that "Political Science deals with government".
- State and the government constitute the subject matter of the study in Political Science. The emphasis is on the institutions and their powers and functions.
- Political institutions function differently in different contexts. Definition of Political Science that stops at analysing the 'institution' and structures do not tell us the whole story.
- It is also important to analyse the actual working of the institutions. The 'process' of working of institutions, instead of the 'structure' should be the proper focus of analysis.
- The word 'political' is specifically defined in terms of activities rather than institutions.
- According to this approach the disagreements, conflicts, and competition along with cooperation integration and settlement of conflicts are the key processes in the game of politics.
- Power represents the kernel of political processes. There are some individuals or groups who command and others who obey. The capacity of the former to make others accept order and behave or act according to the command is defined as power. How and why do some individuals or groups acquire more power.
- Politics is thus concerned with the process by which some individual or groups acquire power and exercise it on others.
- The concepts of justice, equality and freedom have always been subjects of discussion in Political Science. Scholars have given definitions and suggested different ways through which these objectives can be achieved. There is no disagreement on the fact that they represent objectives that human societies do and should, aspire to achieve.
- As per R.N. Gilchrist, Political Science as dealing "general problems of the state and government." The organs of government are more concrete and visible. The state is often identified with the government though scholars have made a distinction between the two.
- Forms of government and their institutions have been the main concerns of Political Science. The act of governance involves framing of rules, regulations and laws and enforcing them in society.
- The three well-known organs of government, the Legislature, the Executive and the Judiciary are responsible for different functions and have powers that are regarded as necessary for the performance of those functions. Institutions are not the only ones framing rules and regulations for the people to obey. Customs and traditions are well-known sources of law. Voluntary groups like clubs also make their own rules and regulations. Such rules and regulations are not binding in the same way as are those framed by the government.
- State is undoubtedly an important concept in Political Science. The most distinctive feature of state is sovereignty, i.e. supreme power and there is much merit in treating this characteristic as the key to the analysis of political process.
- There is an influential group of scholars who treat power as the most important concept in Political Science.
- Politics is found wherever power relationships and conflict situations exist. The emphasis once again is on the type of activity and behaviour rather than on institutions.
- Harold D. Lasswell's definition of "Politics: Who gets What, When and How" is the best illustration of this approach. Power is defined as capacity to control the behaviour of others, with the use, or threat of use of force. But then coercion or threat of force alone cannot hold a political system together.
- According to T.H. Green "Will not force, is the basis of the State". The new term that is introduced by these scholars is that of legitimacy, which refers to voluntary obedience.
- Legitimacy: States do have power or coercive force, which can be used so that people obey the state. Even when actual coercion is not being used, the threat of its use exists.
- Max Weber gave the first systematic theory of the processes through which such legitimacy is gained.

Political Science and Its Relationship with Other Social Sciences

- A wider understanding of the subject does not accept that politics can be restricted only to certain institutions.
- In fact, a sector of all social activities involves conflict and struggle for power. Thus, we hear terms like 'politics of religion', 'politics of clubs', 'politics in sports', and even 'politics in families'.

Relationship with History

- The scope of History is wider than that of Political Science in the sense that it is concerned with different events like social, economic, religious, cultural, and political. History is mainly associated with the study of the past.
- Contemporary problems faced by a society are also studied by historians, though the emphasis is on finding explanations in the past.
- A Political Scientist depends upon historical analysis to have a fuller view of socio-economic conditions under which certain institutions emerge. Institutions take shape in response to certain contemporary problems.
- A study of our Freedom Movement for example is useful in analysing many of the processes and institutions of contemporary India.

Relationship with Economics

- Economics is concerned with the study of production and distribution of wealth in society.
- Material resources are important to the individuals as well as for the society. It is but stating the obvious that such economic relationships and institutions affect the political processes. Looking after the economic aspects is a basic function of the state and the government because economic development is important for the well being of the society. Any agency that is concerned with managing the society cannot but make it one of its central activities.
- Contemporary governments of different types give importance to their respective economic policies. Planning and monitoring of economic development is one of the important concerns of governments.
- A Political Scientist has to take into account the interplay of economic forces in society. Political activities certainly are influenced by the economic factors.
- The nature of politics and of the political system is similarly important for an economist. Many of the decisions regarding economy are, in fact 'political'. In such matters, political considerations play an important role.

Relationship with Ethics

- Ethics is concerned mainly with questions regarding the principles of good life for individuals. Good life is justified on grounds of morality and prescribes what 'ends' ought to be sought and through what 'means'.
- Political Science is concerned with the study of the realisation of common good of the society as a whole.
- It was in this context that Jeremy Bentham and other utilitarians talked about "the greatest good of the greatest number" as an important aspect of politics. What institutions should be devised and how should they be organised and operated so that a good society comes into being.
- The reciprocal relationship between ethics and politics is important in this context. Political organisation is ultimately judged in terms of the extent to which it ensures good life for individuals.
- Political system works in this direction by providing general conditions for good life. The preconditions of 'good' life and 'good' society are concerned with different institutions, organisations and relationships in society.

- In other words, aspects of 'good' life has to be looked at from the point of view of organised society.
- Protection against war, slavery, poverty, unhealthy conditions, and provision of safety, educational opportunities, liberty and providing leisure, are some of the examples of facilities for which the individuals must depend upon organised society.
  - The theory of natural rights emphasises the fact that there are some rights that are 'natural' to human beings.
  - All individuals must have them. This has received so much of importance because such rights represent the conditions for achieving good life.
  - People have natural rights because they have natural needs.
  - The political system is expected to guarantee such rights to individuals. In fact, how many really enjoy the rights, is often the real test of a polity.
  - As a repository of organised power in society, polity achieves this objective both by negative and by positive means.
  - For example every state guarantees certain rights to its citizens. The state prevents an individual and a group from violating rights of others and also promotes general welfare in those activities that the individuals cannot provide for themselves.
  - Both the individuals and the state face limitations in following the ethical and moral standards in their actions.
  - There are always certain forces outside the power of the individuals and the state that act as limitations.
  - Shortage of resources is one such factor that acts as a serious limitation. One must make distinction between the practicable and the utopian ideals.
  - Political decisions are often a result of compromises. Politics is also referred to as the art of the possible. Under these circumstances ethics acts as a guide to politics.

Relationship with Sociology

- Sociology studies society in terms of many levels of its working. It studies how institutions are related with one another and how such relationships are different in different types of societies.
- A sociologist studies the internal organisation of society and the way in which it is different from other societies.
- Institutions are studied in terms of functions that they perform and those that they should perform.
  - There are many specific aspects of human societies that are studied in sociology, e.g. culture, race, caste and religion.
  - These aspects of human society are analysed by sociologists both in terms of their importance for human behaviour and their place in society.
  - At the different levels of these studies, patterns of dominance of groups, institutions and of individuals, come as natural points of enquiry.
  - Dominance is concerned with power, which is studied at the different levels of the sociological enquiry that we have discussed above. i.e. the institutions social relationships, and individuals.
  - Institutions of state and government are found in almost all societies and any study of society has to take these institutions into account.
  - On the other hand, political institutions exist within society and they have to function in the social context.

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Political Science and Public Administration

Political Science is closely related to Public Administration and in fact, the term 'public' denotes 'government' though Public Administration also includes the study of non-governmental organizations. Public Administration is the implementation of governmental policies and Political Science deals with the process of policy formulation. There is a similarity in the objective of Political Science and Public Administration as they both aim at optimum use of resources and social welfare.

Thus, we understand that Political Science is the systematic study of governance by the application of empirical and scientific methods of analysis. Though it involves empirical investigations, it does not generally produce precise predictions. Political Science examines the state and its organs and institutions. It also encompasses the study of societal, cultural, economic and psychological factors that influence the government. It borrows heavily from the other social sciences but its focus on power differentiates it from the other disciplines. Apart from power, Political Science also focuses on comparative politics, international relations, political theory, public law and public policy. Most importantly, the study of Political Science gives us the basic understanding of the political process, the system of government and the way in which it affects the life of every citizen.

The Social Science Perspective

- Different subjects, like history, economics, sociology, ethics and political science after all deal with human societies and are related with one another.
- At the ultimate level of social phenomena and social problems, these distinctions intermingle with one another.
- In actual analysis the distinctions between subjects often sound artificial.
- Expanding areas of studies in different subjects has led to inter sectionality. Thus, we find specialists in social and economic history, political economy and political sociology.
- These subjects that cut across different disciplines use their approaches to study a real human problem that cannot be studied in a comprehensive manner if it is studied only from one perspective.
- A comprehensive study of a problem will require perspectives from different subjects.
- Modern scientific methods have helped this process of establishing a dialogue among different disciplines.

CHAPTER 2

Concept of State and its Elements

Introduction

- State represents a stage of social organisation with some amount of order and stability in society.
- When an activity is taken up jointly by a group of people, there is a need for some collective understanding. Though this understanding is shared by the groups, the extent of this understanding is not uniform.
- This sometimes, affects participation in activities that are not equally shared. Some participate and contribute in the activity more than the others.
- For any organised activity, it is important that individuals accept it and also that their obedience is insured. It is for this reason that organised activities have an authority structure. This is necessary also for maintaining order in society.
- The need for a state was felt when more and more collective activities were being taken up by human societies.
- The need was also to have an authority that was superior to the individuals and groups and had the power to ensure obedience. State with superior authority is thus rooted in the evolution of human societies.

State

- State for long has been the central point of enquiry in Political Science. In ancient India, the *Saptanga Theory of State* elaborated in Kautilya's *Arthshastra*, mentions seven elements

  – ***Swami Amatya, Janpad, Durga, Kosa, Danda and Mitra***.

  – ***Janapada***: **population and territory**,

  – ***Amatya***: **system of state officialdom**, and

  – ***Danda***: **coercive power**.

- In the west, writers like Harold J. Laski and J.W. Garner have referred to four elements of state: population, territory, government and sovereignty. Among the four elements, sovereignty is the central attribute of state.
- Sovereignty is defined as undisputed legal authority. Sovereignty needs to be defined in terms of the territory and the people over whom the sovereign power is exercised. Power is to be used with reference to some region and people.
- State exercises sovereign power over a certain territory.

- Government is that element of state through which the sovereign power is exercised.
- Population was a definite asset for a state in earlier days when physical power was the main source of the production process as well as for the defence of the country.
- But a population disproportionately larger than the resources of a state is certainly a liability.
- Population pressure is one of the most vexing problems faced by many states.
- Besides the size of the population, the functioning of the state is conditioned by the qualities of character and patriotism on the part of its citizens.
- Variations in size, either in terms of territory or of population, do not affect the legal status of a state. Big or small they are recognized as states by citizens within its own territory as well as by other states. So far as legal status is concerned Vatican City and China, both are sovereign states.
- A state has a definite territory and has effective control over it. Protecting the boundary of the state is as important as its demarcation. Claims over disputed territories are often occasions for military conflicts among the states.
- There are states of varying territory size and population. India covers an area of 32,87,263

square kilometers and a population of over 1 billion.

- According to international law states of varying sizes are equal. Smaller states have the same status as the bigger ones. But that is only in law. Smaller states do find themselves dependent on bigger states.
- The number of states has increased in the twentieth century. This process was started after the First World War with emphasis on the right of self determination and was accentuated by the forces of democratisation and decolonisation.
- The number of members in the United Nations was 51 when it was founded in 1945 which has now increased to more than 193.
- A state should have the territory under its jurisdiction that it can keep under effective control. In their effort to have such control, modern states are helped to an extent by the improved means of transport and communication.
- Many states are not self reliant in essential supplies like food and industrial material. They have to depend on imports from other countries which makes them more dependent.
- This is more true of smaller states. It is important for the states to use modern technology of production in agriculture as well as industry for optimum use of a territorial area. Besides the size, other important features of the territory are geographical features, location, resources and climate.
- It is also important to see what kind of neighbours a state has and what kind of relations prevails among neighbours.
- State is distinguished from other forms of social organisation in terms of the sovereign power that it is vested with.
- The state has at its command the supreme legal authority, no legal power exists beyond and outside the state. State is the source of laws that are to be obeyed by the citizens. State in turn is itself governed by laws that circumscribe and regulate its working. In India, for example, a written constitution defines what the state and its institutions can and can not do. The judiciary has the power to see whether the institutions are functioning according to the laws.
- International organisations like the United Nations grant membership to sovereign states. The U.N. membership is one such mechanism of recognising state's sovereignty. Whenever a new state comes into existence, its recognition by other states and by the international agencies is extremely important.

Government

- The state has to exercise sovereign power over the territory and the people within its jurisdiction. For doing this it needs an organisation with persons exercising power on its behalf.
- States may organise governments in different ways and there may be different forms of governments, e.g. democratic or non democratic unitary or federal, parliamentary or presidential etc.

Origins of State

There are different theories about the origin of state.

- The Social Contract Theory suggests that the people decided on their own to have the organisation of state. The mutual agreement is known as 'social contract'.
- This theory was authored by the Buddhist text ***Digha Nikkaya,*** Kautilya's ***Arthashashtra***, ***Shanti Parv*** of ***Mahabharata*** and more popularly by Thomas Hobbes, John Locke and J.J. Rousseau.
- These writers agreed that it was a conscious decision on the part of the people to have a state. Even if contract is not taken as a true event in history, it is more of a symbolic representation of the nature of state. It was thus a repository of power to exercise control on behalf of the society.
- The Evolutionary Theory of the Anthropologists says that state evolved from the family and kinship when they were expanded into tribes.
- Families combined to form larger groups of tribes (or castes) for meeting the collective needs of the people e.g. safety and the system of production. The tribes in turn combined to form bigger groups under a leader and this provided them the form of an organised state.

- Some other writers suggest that state developed when societies took up a large scale activity that required collective effort of large number of people. Karl A. Wittfogel gives the example of 'hydrolic' societies that depended on irrigation on a large scale.
- The efficient management of such activities required proper control and management. State assumed that role.
- *The Fore Theory* proposes that in the evolution of societies from the pastoral to the agricultural state, the former often established their superiority over the later.
- Conquest, thus resulted into a state structure where the defeated group became the 'subject' and had to pay tribute to the masters. State came into existence to enforce this subordination.

Concepts of State

While there is a basic agreement that state is essential for stable societies, some theorists are suspicious towards the power of the state.

The three concepts of state that are significant are the Indian the Liberal and the Marxian.

The Indian Concept

- The tradition of the concept of state in Indian political thought is as old as the Vedas, which was elaborated and refined in later texts like the *Ramayana*, *Shanti Parva* of *Mahabharat*. *Manusmriti*, *Arthashastra* and *Sukraniti*.
- Buddhism and Jainism also included discussions on the nature of political organisation. The Indian concept has been rooted deeply in the broad philosophical traditions where the concept of Dharma was the basic principle that guided politics and political organisations propounded by different theories. Though translated popularly as religion, Dharma has much broader and deeper meanings – law, duty, social order, justice and righteousness.
- *Manusmriti* the earliest text to elaborate the principles of social life propounds decentralisation and welfare activities as the basis of the state organisation.
- The organisation of the state is recommended in terms of ascending cycles of villages, districts and provinces. In fact, the size and the diversity of the country persuaded many writers, to believe that the state should be organised on the principles of decentralised units.
- Public opinion is given a place of importance and the rulers were to be judged according to the principles of Dharma.
  - The contract theory of state was elaborated by Valmiki's *Ramayana* and Vyas's *Mahabharat*, especially in the 'Shanti Parva'. The state is conceived as constituted of different elements-king, people, ministers, army, treasury and system of justice.
  - The Arthashastra tradition of the pragmatic review of the state found its basis in Kautilya. Putting much emphasis on the authority of the King the *Saptanga Theory* mentions seven elements of the state: *Swami, Amatya, Janapada, Durga, Kosa, Danda and Mitra*.
  - ***Swami*** is understood as the ***head of the state organisation*** in monarchies or in republics.
  - ***Amatyas*** refers to the cadre of officers in charge of the various functions of the state.
  - ***Janapada*** included both territory and population.
  - ***Kosa*** refers to the treasury
  - ***Danda*** refers to army
  - These are necessary parts of the state and the state also must have important and reliable allies, i.e. ***Mitra.***
- According to Kautilya, in its functioning, the state should keep in view the maintenance of order in society.
- More importantly the activities regarding comfortable and good life of people must be pursued. Promotion of trade, commerce and industry and providing infrastructure like roads were regarded as necessary.
- Mahatma Gandhi's concept of state was rooted in the Indian tradition of morality and ethical basis of state emphasiging on decentralisation.
- He was suspicious of concentration of power mainly because it would harm individual freedom. The village constitutes the basic unit and a system of decentralised governance has to start from there.

- Most of the functions are to be performed by the local self-governing units and the state has to perform minimum regulatory functions.
- Thus, he advocated a self-regulated system of government with cooperation as the basis of community activities. A strong believer in non-violence, Gandhi was not in favour of any form of state coercion.

The Liberal Concept

- The Liberal concept of state regards the state as a necessary and useful institution, which needs to be put under control all the time.
- Its deep suspicions of political power being misused led them to insist on the mechanism of putting conditions and limits to the powers of the state in the form of constitutional checks.
- A state with minimum functions is the ideal of classical liberalism.
- Adam Smith suggested that the state as a minimalist night-watchman was best suited to economic development.
- The liberal idea of state was incorporated in the development of constitutionalism since the writings of John Locke.
- Constitutionalism suggested arrangements of the institutions of the state and government. A constitution was to control and regulate the working of state and government.
- Institutions are to be organised in a manner so that none of them becomes supreme.
- The concepts of separation of powers, constitutional monarchy and majority rule were parts of this school of thought.
- The nature of liberalism changed as a result of the writings of T.H. Green, T. Hobhouse, John Dewey and John Rawls.
- Later liberals have a more positive view of individual liberty. They suggest the state is in a position to make laws and promote individual liberty.
- John Locke propounded the Doctrine of Consent. For Rousseau popular sovereignty and general will are important John Stuart Mill gave much importance to representative and responsible government.
- Basic objections to state are expressed by Anarchists. Pluralists, Marxist's and the Gandhian traditions of political thought.
- The Anarchists do not believe in any form of state power. They are advocates of complete freedom to individuals without any restrictions.
- Instead of imposing an institution like the state, the anarchists advocate voluntary cooperation among people for achieving collective objectives.

The Marxian Concept

- The Marxian analysis of the character of the state is consistent with its basic proposition that institutions in society are but reflections of the prevailing method and mode of production.
- Such economic considerations divide the society into 'classes' of people engaged in different kinds of economic activities.
- The nature of this class division is such that it is in conflict with one another. The conflict is basically economic but it is also for dominance of one class over the other.
- Marxist understanding relates state with such 'class antagonism'. Thus the mode of production and the nature of class contradictions that result from it, determine the character of state.
- Historically, the state takes many forms, but all of them remain 'class states', meaning thereby that the class that is economically - dominant also controls the state. State represents the dominant class. Every state functions within the framework set forth by the mode of production.
- Thus the Marxist theory of state emphasises two sets of factors in the analysis i.e. general and specific.
- The general point is that state is an institution determined by the 'classes' in society and that it is an instrument of class domination.
- The specific point is that every state evolves through a historical process which gives it a specific character.

Domain of State Activity

- Relationship between state and society varies from time to time and there are different view points on this issue.
- One view is that only if individuals are left free to pursue their own will they would together naturally move towards the common good.

- Thus, the state should have limited authority in economic matters.
- The theory that advocated for greater autonomy for the socio-economic processes and for limited functions of the state was known as Laissez Faire.
- Later theorists and ideologists questioned the efficiency of free market i.e. complete freedom to the individuals and groups to pursue their economic activities, with least interference from the state.
- It was pointed out that such freedom may not 'benefit' all. Instead it may create chaos and be unfair to certain sections of the society.
- For example, it may go against the interests of the poor and disadvantaged sections.
- The 'Marxist socialist' view is that the state has wider functions and covers many activities that are required for society.
- Both the welfare state concept and the Marxist-Socialist concept of the state marked the beginning of an '*interventionist'* state, i.e. positive intervention of the state in the economic activities of the society.
- More recent scholars like C.B. Macpherson have suggested incorporation of certain aspects of the 'interventionist' state into the domain of state activity. Convinced about the '*dehumanising*' aspects of capitalism, the new liberal writers advocate great reach of state in certain sectors of society.
- Advancements in science and technology and the socio- economic processes, made societies more complex and led to the enhancement of the power of state. A distinction between state and society has gained importance.
- The increasing trend of globalisation in economic and trade matters has affected all the countries.
- Thus, the state attempts to solve socio-cultural problems, contain them, encourage some of the tendencies and suppress some.
- While taking all these policy decisions, state gives a direction to society. The relationship between state and society therefore is complex. Very often state has to maintain a difficult balance.
- The state is expected also to keep in view the development of the society. Law-making therefore represents an exercise in balancing the existing practices in the society and giving a proper direction by initiating new practices and institutions.
- The relationship between state and society is reciprocal i.e. both determine and are, in turn, determined by each other.

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CHAPTER 3

Society, State and Citizenship

Introduction

Society

- The term society is used for a large number of individuals, institution norms and relationships in an all encompassing manner. It includes all the individuals and all the relationships.
- At another level, the term 'society' is used to refer to a group of individuals who organise themselves for a specific purpose. We have heard terms like Milk Cooperative Society, Society for the Prevention of Blindness, Music Society, and so on.
- The term society has a partial meaning here, because they refer only to part of the whole society, its activities, and relationships. Societies can be all inclusive as well as partial.
- As human societies develop, institutions come into being for the attainment of different objectives. Thus, there are economic, religious, cultural and political institutions as well.
- The collection of human beings does not make a society. Only when it has a common will and common objective(s) it is called society. As human societies evolve and attain different levels of development, different kinds of institutions take shape.

State

- Anthropological literature provides examples of societies that do not have organised states e.g., the Nuer in southern Sudan the Tallensi in northern territory of Gold Coast, the Anuak in Anglo-Egyptian Sudan, the Kikuyu, the Bedouin and Swat Pathans on the borders of Pakistan and Afghanistan.
- The evidence shows that these communities do have an organised authority system, but a formal organised state is absent.
- Conversely, state without a society is inconceivable. It is in this sense that thinkers claim that society is prior to state.
- There are two important attributes of state, i.e., **sovereignty and territory** that are not necessarily applicable to society.
- A society binds people together for various reasons. It is not always necessary that all the people will be living in a single territory.
- Society is also not limited to a particular territory in the strict sense of the term. The common bond and common objectives of institutions that we have mentioned above, may be broader or narrower than the ones covered by the state.
- As we have noted earlier society includes many processes, relationships and institutions while state is meant to look after 'political' aspects.
- A state which exerts such control over the totality of social institutions and activities of individuals is called a totalitarian state. The term totalitarian state is often used in a derogatory sense.

State and Government

- State represents a comprehensive set of relationships and institutions, of which the government is an important aspect. State includes characteristics like territory and population over which it exercises sovereignty.
- The government represents such visible, tangible concrete aspects of the state. It is through its government that the state becomes effective. Government is an apparatus for the functioning of state. It is organised into public offices with constitutional and legal powers and its working is bound by certain procedures.

- A set of institutions and individuals occupying positions in the institutions and procedures for exercise of power, is referred to as the government.
- A government is constituted of institutions where individuals occupy positions of power.
- The rules and procedures that define the government also prescribe the method by which persons occupy positions in government. Thus we have general elections every five years in India and a new government is formed after every such election. Different governments may come into power within the same form of state.
- Also change in government is easier and frequent than change in the form of state, The state is more enduring than the government.
- The powers of the organs of government are legally defined. Organs of government e.g., the executive, the legislature and the judiciary, have their respective powers and functions as defined by the constitution.
- In actual working as we have seen above, the state and the government become inseparable at times. Yet a distinction between the two is both necessary and useful.

State and Nation

- The idea of nation and the process of nationalism emphasises the sense of solidarity, and resemblances on various grounds: **language, religion, race, customs, myths, value systems and culture.**
- Emergence of a nation is helped also by sharing of an ideology. There may be a consciousness or an urge in a group to strengthen the common ties and the common identity.
- The will to live together is reinforced by a common ideal and by sharing a common destiny. The idea of freedom from the British Rule brought together the diverse sets of people into the mainstream of Freedom Movement in India.
- Nations, like individuals, are products of history. For example, the British formally established their control over India in 1858 the Indian National Congress was founded in 1885. There was famine in Bengal in 1870; India became independent in 1947 and partition took place at the same time. Things big and small, of various kinds–social, political commercial–have their impact on society.
- 'Nation is rooted in the Latin work 'natus' which means 'birth' and the concept of 'natio' refers to the specific ethnic characteristics of communities.
- The concept nation, as it evolved through the British Industrial Revolution and the French Revolution in the seventeenth and the eighteenth centuries came to be associated with characteristics like common ethnic origin, common language, common history and tradition, and a consciousness about common identity.
- Nation and nationhood refer primarily to a sentiment of 'belonging together' State may or may not coincide with this sense of solidarity.
- State is a legal and political reality. 'Nation' refers primarily to a psychological and emotional solidarity among people. It refers to a deeply shared fundamental identificaion and/ or attitude among a set of people.
- The nation is a community of understanding, of communication, of trust. State is a territorial concept while nation refers to the civic aspect of people's consciousness and their expectations.

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State	Society
■ State came into existence after the origin of the society. ■ The scope of the state is limited. ■ The state has fixed territory. ■ The state is a political organization. ■ The state has the power to enforce laws.	■ Society is prior to the State. ■ The scope of society is much wider ■ Society has no fixed territory. ■ Society is a social organization. ■ Society has no power to enforce laws.

State	Government
■ The state consists of population, territory, government and sovereignty. ■ The state possesses original powers. ■ The state is permanent and continues forever. ■ State is abstract and invisible	■ Government is part of the state. ■ Powers of the government are derived from the State. ■ Government is temporary. Governments can be replaced with people's will. ■ Government is concrete and visible.

Nation and Nation-Building

- The idea of 'one nation-one state' was emphasised for long. But many states are in fact multi-national and multi-cultural. Switzerland and India are well-known example of such multiple and multi-layered diversities along several dimensions – culture, religion, language and regional history.
- Nations provide a system of values and a cultural framework for the functioning of state.
- It is because of its vast potentialities that the idea of nation is so important for every state. Strengthening the forces of integration in a society and emphasising social solidarity is a major policy of state. Hence, the importance of national integration in India.
- The cultural religious, linguistic and economic diversity posed problems for the process of national integration in independent India.
- Division of society into different caste groups has been another problem. The tribal population claims its separate identity. Many of these factors have often coincided to create strong regional feelings in certain areas. In some areas the slogan of 'sons of soil' is being raised to distinguish between the 'insiders' and 'outsiders' in a region.
- The process of nation-building remains an important item on the national agenda.

State and Citizen

- The people constitute one of the elements of state. It is in its relationship with the people that state's power and the laws become relevant.
- Everyone living within the territory of a state is not its citizen. Citizenship is acquired as per rules. Natural citizenship, for example, is granted to all those whose parents already have such citizenship. There are some states which recognise those born within its territory as its citizens even when the parents are not its citizens.

Justiciable and Non-justiciable Rights

- There are some rights where the court of law intervenes in case they are denied to the citizens. (e.g. Fundamental Rights in India).
- There may be other rights that represent the ideals that the state may keep in view while making laws and taking decisions, but which cannot be claimed by the citizens in court of law. (e.g. rights included in the Directive Principles of State Policy in the Indian Constitution).
- The two kinds of rights are called **justiciable** and **non-justiciable** rights respectively.
- The Fundamental Rights of citizens are justiciable, while Directive Principles are in the form of guidelines that the state should attempt to implement.
- Which rights are guaranteed by a state and to what extent, depend upon many factors.

Citizen and Subject

- Citizens are expected to participate in the affairs of the state. It is in this context that a distinction is made between a 'citizen' and 'subject'.
- In pre-democratic forms of state like the absolute monarchy, the people who were within the preview of the laws of state were known as subjects. They were affected by the decisions of the state, but they had little say in the making of such decisions.
- Citizenship in a democracy gives its citizens right to participate in the affairs of the state. Right to vote in elections is an exclusive and important right of citizens in democracies.
- Every citizen, however, cannot participate to the same extent in every affair of the state.
- The quality of participation is often regarded as important for evaluating a democracy.

CHAPTER 4

Government: Forms and Classification

What is Government?

- Every country needs a government to make decisions and get things done. These can be decisions about where to build roads and schools, or how to reduce the price of onions when they get too expensive or ways to increase the supply of electricity.
- The government also takes action on many social issues, like several programmes to help the poor and other important things such as running postal and railway services etc.
- The government also has the job of protecting the boundaries of the country and maintaining peaceful relations with other countries.
- It is responsible for ensuring that all its citizens have enough to eat and have good health facilities.
- When there are natural disasters like the tsunami or an earthquake, it is the government that mainly organises aid and assistance for the affected people.
- If there is a dispute or if someone has committed a crime, courts are required to decide the punishment. These courts are also part of the government.
- Government makes rules that apply to everyone and it also controls resources and protect the territory of a country so people can feel secure.
- Government by exercising leadership, taking decisions and implementing these among all the people living in their territory.

Levels of Government

- The government is responsible for so many different things and works at different levels.
- At the local level e.g. in village, town or locality
- At the level of the state e.g. in an entire state
- At the national level e.g. in the entire country

- The type of democracy in which the citizens delegate authority to their elected representatives.
- Universal Adult Franchise- All adults in the country are allowed to vote.
- Women's right to vote.
- The system or machinery present in each country in order to make decisions for the proper running of the country is called government.
- The rules laid down by the government for the proper functioning of the country are called laws.

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Forms of Governments and Their Classification

- Any scheme of classification of governments must decide upon the basis of classification. Aristotle preferred a combination of two criteria useful to classify the constitutions.
- The first basis was the location of sovereign power and the number of people who hold power. Thus, he distinguished between monarchy, aristocracy and polity, where one, few and many persons hold power in the three forms respectively.
- The second criterion pertaining to the qualitative norms for evaluating institutions refers to the question as to whose interest the government works for.
- The three forms mentioned above are the governments that work in the interest of the society but they may also function only in the interest of the persons who hold power. Such governments are their perverted forms.
- The respective perverted forms of the three types are tyranny, oligarchy and democracy or mobocracy as illustrated in the chart below.

Aristotle's Classification of Governments

Number of people having power	Working in general interest	Working in perverted form
One	Monarchy	Tyranny
Few	Aristocracy	Oligarchy
Many	Polity	Democracy or Mobocracy

- Aristotle also suggested a cycle of change in the forms of government where a particular form undergoes degeneration before it is replaced by another normal form.
- Thus, Aristotle's classification also includes a theory of change of governments.
- Aristotle's classification of governments was followed by later writers as well. Notable names in this regard are Jean Bodin.
- Thomas Hobbes and James Harrington, and Montesquieu Bodin agreed with Aristotle that location of sovereign power was a reliable basis for classification. He, however emphasised the influence of environmental factors like the economic and geographical factors.
- Hobbes elaborates Budin's criteria of location of sovereign power for classification of governments. James Harrington was more realistic.
- He agreed with the classification of governments into Absolute Monarchy, Mixed or Feudal Monarchy and Commonwealth.

Classification of Government

S. No.	Basis of Classification	First Type	Second Type
1.	Nature of exercise of power (in terms of importance given to individual rights and liberty)	Democratic	Authoritarian
2.	Nature of executive agency	Parliamentary	Presidential
3.	Distribution of power (territorial)	Unitary	Federal
4.	Nature of Constitution	Flexible Unwritten	Rigid Written

Features of Democracy

- Democracy is a form of government in which the rulers are elected by the people.
- In a democracy the final decision making power must rest with those elected by the people. So, the actual ruler(s) are the People.
- A democracy must be based on a free and fair election where those currently in power have a fair chance of losing.
- In a democracy, each adult citizen must have one vote and each vote must have one value.
- A democratic government rules within limits set by constitutional law and citizens' rights.
- Democracy is a form of government in which rulers elected by the people take all the major decisions.
- Elections offer a choice and fair opportunity to the people to change the current ruler.
- This choice and opportunity is available to all the people on an equal basis.
- The exercise of the democracy choice leads to a government limited by basic rules of the constitution and citizens' rights.

Types of Government

- Democratic and non-democratic or authoritarian governments are classified on the basis of popular accountability as an important criterion.
- The distinction between the parliamentary and the presidential forms of government refers to the relation between the legislature and the executive.
- The executive in the parliamentary form is based on the party support in the legislature.
- The political party or a coalition of parties that generally has the majority in the legislature controls the executive.
- The Prime Minister and the Cabinet in Great Britain are good examples of this form of

government. Among the new countries India, Ghana, Egypt and Tanzania have parliamentary form of government.

- In the presidential form, on the other hand the executive and the legislature are separate. The two institutions may or may not be controlled by the same party. U.S.A Chile and Brazil are examples of this form.
- There may still be other forms that combine the characteristics of both. India and France have devised a system where both the institutions of the President and the Prime Minister are in existence.
- The distinction between the federal and unitary forms of government refers to the organisation of centre of power in terms of the territorial coverage.
- When the entire territory is governed from one centre of power, it is called a unitary government. Great Britain, China and Chile are examples of such a government.
- In a federal form of government, power is divided into smaller segments, each having its own government, in addition to the central authority.
- Thus there are two levels of governments in a federation—one for the entire territory and the second for the smaller territorial segments.
- Comparison between governmental forms helps us to understand the basis of their power. This in turn helps in understanding their powers and functions as also their relation with other institutions of government.
- In India, we are familiar with the Union Government and the governments in the states. There are many more examples of this form of government Setup like U.S.A, Switzerland, Nigeria, Brazil and Malaysia.

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Difference between Unitary Form and Federal Form of Government

S. No.	Unitary Form of Government	Federal Form of Government
1.	Only one Level of Government or Subunits	Two Levels of Government
2.	Mostly single citizenship	Dual citizenship
3.	Sub units cannot Operate independently	Federal units are answerable to Central Government
4.	No Division of Power	Division of power
5.	Centralisation of power	Decentralisation of power

Democracy

- In a democracy it is the people who give the government this power.
- They do this through elections in which they vote for particular persons and elect them.
- Once elected these persons form the government. In a democracy the government has to explain its actions and defend its decisions.

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Definition

- **A.V. DICEY:** "Habitual exercise of supreme legislative authority is by one central power"
- **GARNER:** "Where the whole power of government is conferred by the constitution upon a single central organ"
- **C.F. STRONG:** "Two important qualities of the Unitary Government".

Monarchy

- In monarchy, the monarch (king or queen) has the power to make decisions and run the government.
- The monarch may have a small group of people to discuss matters with, but the final decision-making power remains with the monarch.
- Unlike democracy, kings and queens do not have to explain their actions or defend the decisions they take.

Democratic and Non-Democratic Governments

- The word 'democracy' is derived from two Greek terms *demos* and *kratia*. These two words together mean 'authority of the people'. Different aspects of democracy were influenced by the British experience, the French Revolution, the American Revolution and the October Revolution.
- The British constitutional history emphasised individual freedom and a government that is controlled by the people.
- Equality constituted one of the ideals (along with liberty and fraternity) of the French Revolution. The American Revolution added the concept of meaningful representation.
- Democratic theory is based on three basic ideals individual rights, liberty and equality. Democracy as a form of government ensures these three principles.
- Individual as the basic unit and the organisation of democracy emphasizes those ideals. Individual rights and liberty are regarded most important.
- Emphasis on equality advocates basic equality of individuals. Distinctions of any kind, e.g., on the basis of age, race, education or gender etc., are against the ideal of democracy.
- The most direct form of popular participation is adult franchise through which the government is constituted and representatives are elected.

Authoritarianism

- An authoritarian government places restrictions on the activities of individuals and groups. Restrictions apply especially to those activities that pertain to the state.
- A small group of people, a family a particular social class or a strong political party control all the decision-making in the government.
- Totalitarianism puts more severe restrictions and is usually guided by an ideology often aimed at drastic reorganisation of society.
  - Dictatorship is the government of one man who has not obtained his position by inheritance but by force or consent or a combination of both.
  - An authoritarian government can take quick decisions. It is efficient and it provides strong and stable government. This is the justification that is often put forward by the military rulers of some Third World countries.
  - An authoritarian regime is able to ensure high sense of patriotism among its citizens.
  - On the other hand, such a government does not give any importance to individual in the governance of the country.
  - They do not have any civil or political rights. Based on force, authoritarian governments are likely to use more violence.

Forms of Democracy: Direct and Indirect

- Direct rule by the people is the purest form of democracy where all the people take part in the activities of the government.
- Greek city states as described by Plato has such a system. The village republics in ancient India provided for direct participation of the people.
- In the modern democratic systems getting the people's verdict directly is still regarded as the final solution to important and controversial issues.
- The well known forms of direct democracy are Referendum Initiative, Recall and Plebiscite.
  - Referendum refers to a procedure where an issue is presented to the people for their verdict. This also may take another form when a decision is taken by the legislature but it can be enforced only when the people have given their verdict— a provision that is often applicable to constitutional amendment.
  - Initiative refers to a device where a group proposes a law or even a constitutional amendment supported by the signatures of a specified number of people. In some cases the proposal is first submitted to the legislature.
  - Under the system of recall, a certain number of voters can propose the removal of an elected representative and the final decision is taken after a popular verdict.

- Plebiscite obtains direct popular vote on a matter of importance but chiefly in order to create some more or less permanent political condition. It may be for a new political set up, as was the case when Napoleon Bonaparte used it in 1799 and again in 1802 and 1804 to define and redefine his role in the French political system.

- Plebiscite is a onetime affair when people express their option referendum initiative and recall are mechanisms that are in operation continuously.
- Switzerland has an old tradition of some forms of direct democracy. The constitution provides for referendum on matters affecting the constitution where the majority view of the people at large as also the majority of cantons is taken into account.
- In modern times where in states are larger both in area as well as in population direct democracy is not possible.
- Democracy is understood in modern times as a form of indirect rule by people. Smaller groups of people are elected or selected to act on behalf of the population. This is known as the system of representation. Proper and effective representation has been a matter of much debate among writers and philosophers since the days of Edmund Burke.

Characteristics of Democratic Government

- The democratic form of government ensures basic principles of liberty and equality. The government is based on the general consent of the people. This is known as public opinion. To achieve such consent and also to make it effective government is elected for a specified period of time. General elections are held after a fixed term, e.g., after every five years in U.K. and India. Such elections are held on the principle of Universal Adult Franchise. In U.S.A, the Presidential elections are held at an interval of four years.
- Vote of every individual carries equal weight. Free and fair elections are the basic of the formation of democratic government. Representatives who are thus elected make laws for the country. Election of representatives for specified period makes them directly responsible for the people.

Strengths and Weaknesses

- The principles, on which the democratic form of government is organised, are aimed primarily at establishing a direct link between the government and the governed.
- Democracy emphasises equality among individuals. It upholds the principle of natural rights, which assigns equal rights and opportunities to all. Participation of the people provides an occasion to understand the political process and institutions.
- The confidence shown in the capacity of the people to govern themselves creates a sense of self respect and dignity in the individual.
- A democratic government is constantly alert to make its working more conducive to the popular interest and general welfare. All the sections of the population are important for the election. Democratic government is more sensitive to the welfare of the people.
- A democratic form of government has some weaknesses as well. By treating all people equal, it fails to recognise individual talent. It lays more emphasis on quantity rather than quality. In fact, democracy becomes not a rule of the best, but a rule of the average.
- There is a possibility for the government to opt for the most popular rather than the most desirable decision.
- The system of elections forms the basis of a democratic government. There are problems in its actual working. It is based on the assumption of equality among human beings. This condition is never satisfied completely and there are different kinds of inequalities, some of which are inevitable. People who are better off have greater control over the process of elections.
- The majority rule at times results into what de. Tocqueville called, 'majority tyranny'. Either in general elections or in the case of decisions of democratic bodies like the legislature, there is always minority, which is unable to influence the outcomes of elections or decisions.
- The government that comes into power after all represents only the majority.
- The system of election and the democratic institutions are quite costly. The State incurs large expenditure in organising and managing the general elections involving large number of people.
- The system of popularly elected leaders in governmental positions mean the control by the amateurs in administration, while many governmental decisions in modern states require some amount of specialised knowledge of the issues as well as of the procedures which is time consuming.

Conditions for a Successful Democracy

- A democratic government comes into being as a result to popular participation. It is therefore, necessary for the people to have a sense of discrimination between what is 'desirable' and what is 'undesirable' for the society.
- A strong commonsense and a high level of consciousness about the affairs of the state are always helpful.
- Some conditions have specifically been mentioned by J.S. Mill.
- Capability of the people to have a democratic government and a sincere desire on their part is essential for the success of democracy.
- There are certain duties, like voting, that the citizens must perform in order to enjoy the right to get elected. It is through elections that a form of popular control on government is enforced.
- In order to exercise rights and perform duties, the citizens of a democracy should be able to express their choice freely.
- Democracy provides a place of importance to the electoral minorities who may not have expressed their voting preference in favour of the political party in power. Such minorities are not merely tolerated but their views and their interest are treated with respect.
- Parties and leaders in opposition have a place of importance in democracies. Specially in a parliamentary form of government the party which controls the majority of seats by itself or in coalition with other parties is in control of the government.
- There are members of legislature belonging to the political parties that are in minority and are not in power they form the opposition. They keep a constant watch on the activities and performance of the party in power.
- They ask questions and make alternative suggestions. In elections there is always a possibility that a party which has been in opposition may become a majority party at other times.
- In such situations the oppositions should be in a position to provide a government to the country. In countries like U.K. and India, the opposition and its leader are important in the working of Parliament.
- Opposition acts as an effective check on the government. In the absence of an opposition a democracy may turn into a dictatorship of a party or a person.

CHAPTER 1

Measurements

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Measurement is about assigning a number to a characteristic of an object or event which can be compared with other objects or events. It is defined as the determination of the size or magnitude of a quantity. In this lesson, you will learn about units of measurements and the characteristics of measuring instruments.

Physical Quantities and Units

Physical Quantities

- Physical quantity is a quantity that can be measured. Physical quantities can be classified into two: fundamental quantities and derived quantities. Quantities which cannot be expressed in terms of any other physical quantities are called fundamental quantities. Example: Length, mass, time, temperature, etc. Quantities which can be expressed in terms of fundamental quantities are called derived quantities. Example: Area, volume, density, etc.
- Physical quantities have a numerical value and a unit of measurement (say, 3 kilogram). Suppose you are buying 3 kilograms of a vegetable in a shop. Here, 3 is the numerical value and kilogram is the unit. Let us study about units now.

Units

- A unit is a standard quantity with which the unknown quantities are compared. It is defined as a specific magnitude of a physical quantity that has been adopted by law or convention. For example, feet is the unit for measuring length. That means, 10 feet is equal to 10 times the definite pre-determined length, called feet.
- Earlier, different unit systems were used by people from different countries. Some of the unit systems followed earlier are given below in Table 1.1.

Table 1.1: Unit systems of earlier times

System	Length	Mass	Time
CGS	centimeter	gram	second
FPS	foot*	pound	second
MKS	metre	kilogram	second

*foot is the singular of feet

- At the end of the Second World War, there was a necessity to use worldwide system of measurement. Hence, SI (International System of Units) system of units was developed recommended by the General Conference on Weights and Measures at Paris in 1960 for international usage.

SI System of Units

- SI system of units is the modernized and improved form of the previous system of units. It is accepted in almost all the countries. It is based on a certain set of fundamental units from which derived units are obtained with proper combination. There are seven fundamental units in the SI system of units. They are also known as base units and they are given in Table 1.2.

Table 1.2: Fundamental quantities and their units

Fundamental quantities	Unit	Symbol
Length	metre	m
Mass	kilogram	kg

Time	second	s
Temperature	kelvin	K
Electric current	ampere	A
Luminous intensity	candela	cd
Amount of substance	mole	mol

- The units used to measure the fundamental quantities are called fundamental units and the units which are used to measure the derived quantities are called derived units.
- With the help of these seven fundamental units, the units for other derived quantities are obtained and their units are given below in Table 1.3.

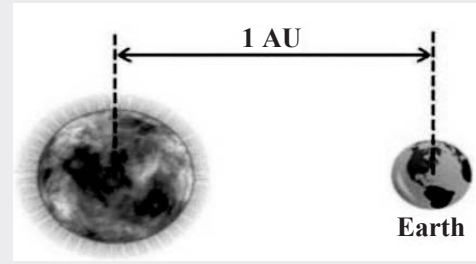
Table 1.3: Derived quantities and their units

S.No.	Physical quantity	Expression	Unit
1.	Area	length × breadth	m^2
2.	Volume	area × height	m^3
3.	Density	mass/volume	kgm^{-3}
4.	Velocity	displacement/time	ms^{-1}
5.	Momentum	mass × velocity	$kgms^{-1}$
6.	Acceleration	velocity/time	ms^{-2}
7.	Force	mass × acceleration	$kgms^{-2}$ or N
8.	Pressure	force/area	Nm^{-2} or Pa
9.	Energy (work)	force × distance	Nm or J
10.	Surface tension	force/length	Nm^{-1}

Fundamental Units

Length

- Length is the extent of something between two points. The SI unit of length is metre. One metre is the distance travelled by light through vacuum in 1/29,97,92,458 second.
- In order to measure very large distances (distance of astronomical objects), we use the following units.
  - Astronomical unit
  - Light year
  - Parsec
- Astronomical unit (AU): It is the mean distance of the centre of the Sun from the centre of the Earth. 1 AU = 1.496 × 10 11 m.



- **Light year:** It is the distance travelled by light in one year in vacuum and it is equal to 9.46×10^{15} m.
- **Parsec:** Parsec is the unit of distance used to measure astronomical objects outside the solar system.

  1 Parsec = 3.26 light years.

Table 1.4: Larger units

Larger units	In metre
Kilometre (km)	10^3 m
Astronomical unit (AU)	1.496×10^{11} m
Light year (ly)	9.46×10^{15} m
Parsec (pc)	3.08×10^{16} m

The nearest star, alpha centauri is about 1.34 parsec from the sun. Most of the stars visible to the unaided eye in the night sky are within 500 parsec distance from the sun.

- To measure small distances such as distance between two atoms in a molecule, size of the nucleus and wavelength, etc., we use submultiples of ten. These quantities are measured in Angstrom unit (Table 1.5).

Table 1.5: Smaller units

Smaller units	In metre
Fermi (f)*	10^{-15} m
Angstrom (A°)*	10^{-10} m
Nanometre (nm)	10^{-9} m
Micron (micrometre μm)	10^{-6} m
Millimetre (mm)	10^{-3} m
Centimetre (cm)	10^{-2} m

*Unit outside SI system and still accepted for use.

Mass

- Mass is the quantity of matter contained in a body. The SI unit of mass is kilogram (kg). One kilogram is the mass of a particular international prototype cylinder made of platinum-iridium alloy, kept at the International Bureau of Weights and Measures at Sevres, France. The units gram (g) and milligram (mg) are the submultiples of ten (1/10) of the unit kg.
- Similarly, quintal and metric tonne are multiples of ten (× 10) of the unit kg.

  1 g = 1/1000 × 1 kg = 0.001 kg

  1 mg = 1/1000000 × 1 kg = 0.000001 kg

  1 quintal = 100 × 1 kg = 100 kg

  1 metric tonne = 1000 × 1 kg = 10 quintal

More to Know

- Mass of 1 ml of water = 1 g
- Mass of 1 *l* of water = 1 kg
- Mass of the other liquids vary with their density.

Time

- Time is a measure of duration of events and the intervals between them. The SI unit of time is second. One second is the time required for the light to propagate 29,97,92,458 metres through vacuum. It is also defined as 1/86, 400th part of a mean solar day. Larger units for measuring time are day, month, year and millennium.

  1 millennium = 3.16 × 109 s.

Temperature

Temperature is the measure of hotness or coldness of a body. SI unit of temperature is kelvin (K). One kelvin is the fraction (1/273.16) of the thermodynamic temperature of the triple point of water (the temperature at which saturated water vapour, pure water and melting ice are in equilibrium). Zero kelvin (0 K) is commonly known as absolute zero. The other units for measuring temperature are degree celsius (°C) and degree fahrenheit (°F).

Unit Prefixes

- Unit prefixes are the symbols placed before the symbol of a unit to specify the order of magnitude of the quantity. They are useful to express very large and very small quantities. k (kilo) is the unit prefix in the unit, kilometer. A unit prefix stands for a specific positive or negative power of 10. Some unit prefixes are given in Table 1.6.

Table 1.6: Unit prefixes

Power of 10	Prefix	Symbol
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deca	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f

- The physical quantities vary in different proportions like from 10^{-15} m being the diameter of nucleus to 10^{26} m being the distance between two stars and 9.11×10^{-31} kg being the mass of electron to 2.2×10^{41} kg being the mass of the milky way galaxy.

Vernier Calipers

- In our daily life, we use metre scale for measuring lengths. They are calibrated in cm and mm. The smallest length which can be measured by metre scale is called least count. Usually the least count of a scale is 1 mm. We can measure the length of objects upto 1 mm accuracy with this scale. By using vernier calipers, we can have an accuracy of 0.1 mm and with screw gauge, we can have an accuracy of 0.01 mm.

Screw Gauge

- Screw gauge is an instrument that can measure the dimensions upto 1/100th of a millimetre or 0.01 mm. With the screw gauge, it is possible to measure the diameter of a thin wire and thickness of thin metallic plates.

Measuring Mass

- We commonly use the term 'weight' which is actually the 'mass'. Many things are measured in terms of 'mass' in the commercial world. The SI unit of mass is kilogram (kg). In any case, the units are based on the items purchased. For example, we buy gold in gram or milligram, medicines in milligram, provisions in gram and kilogram and express cargo in tonnes.
- Different measuring devices have to be used for items of smaller and larger masses.

Common (beam) balance

- A beam balance compares the sample mass with a standard reference mass (standard reference masses are 5g, 10g, 20g, 50g, 100g, 200g, 500g, 1kg, 2kg, 5kg).

Physical balance

- This balance is used in labs and is similar to the beam balance, but it is a lot more sensitive and can measure mass of an object correct to a milligram.

Digital balance

- Nowadays, for accurate measurements digital balances are used, which measure mass accurately even up to a few milligrams.

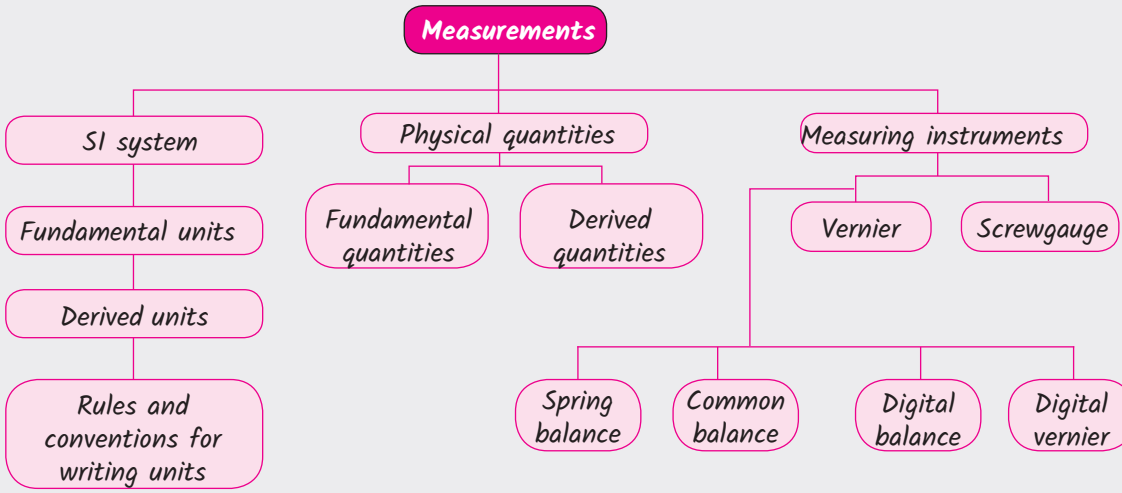
Spring balance

- This balance helps us to find the weight of an object. It consists of a spring fixed at one end and a hook attached to a rod at the other end. It works by 'Hooke's law' which states that the addition of weight produces a proportional increase in the length of the spring.

Difference between Mass and Weight

	Mass	Weight
1.	It is fundamental quantity.	It is a derived quantity.
2.	It has magnitude alone, so it is a scalar quantity.	It has magnitude and direction, so it is a vector quantity.
3.	It is the amount of matter contained in a body.	It is the normal force exerted by the surface on the object against gravitational pull.
4.	Remains the same everywhere.	Varies from place to place.
5.	It is measured using physical balance.	It is measured using spring balance.
6.	Its unit is kilogram.	Its unit is newton.

Concept Map



CHAPTER 2

Motion

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Motion

Motion is the change in the position of an object with respect to its surroundings.

- *Everything in the universe is in motion. Even though an object seems to be not moving, actually it is moving because the Earth is moving around the Sun.*
- *Cars along the road, trains along the track and aeroplanes in the sky are all moving. These movements are one type of motion.*
- *You may see the fan rotating in the ceiling. This is another type of motion.*
- *When you are playing in swing, it moves to and fro. This is also a type of motion.*
- *Motion is described in terms of distance, speed, acceleration and time.*

Rest

An object is said to be at rest if it does not change its position with respect to its surroundings with the passage of time.

Rest and Motion are Relative Terms

- Rest and motion are relative terms. A particle at rest with respect to an observer can be in motion with respect to another observer.
- To the passengers in a moving bus or train, trees, buildings and people on the roadsides observe that the bus or the train and its passengers are moving in the forward direction. At the same time, each passenger in a moving bus or train finds that fellow passengers are not moving, as the distance between them is not changing.

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Types of Motion

In physics, motion can be classified as:

- *Linear motion: Motion along a straight line.*
- *Circular motion: Motion along a circular path.*
- *Oscillatory motion: Repetitive to and fro motion of an object at regular intervals of time.*
- *Random motion: Motion of the object which does not fall in any of the above categories.*

Uniform and Non-Uniform Motion

Uniform motion

- *An object is said to be in uniform motion if it covers equal distances in equal intervals of time howsoever big or small these time intervals may be.*

Non-uniform motion

- *An object is said to be in non-uniform motion if it covers unequal distances in equal intervals of time.*

Distance and Displacement

- Motion is related to change of position. The length traveled in changing position may be expressed in terms of distance, the actual path length between two points. Distance is a scalar quantity, which has only a magnitude with no direction.
- *The direct straight line pointing from the initial point to the final point is called displacement* (change in position). Displacement only measures the change in position, not the details involved in the change in position. Displacement is a vector quantity, which has both magnitude and direction.

  Distance ≥ Displacement
- The displacement can be zero even if the distance is not zero.

Average Speed

- Average speed is defined as the total distance traveled divided by the time interval to travel that distance.
- Average speed $V_{av} = \frac{d}{t}, d$ is distance travelled, and t is time interval (change in time).
- It is a scalar quantity.

Uniform and Non-uniform Speed

- A body is said to be moving with uniform speed if it covers equal distances in equal time intervals and with non-uniform or variable speed if it covers unequal distances in the same time intervals.

Average Velocity

- Average velocity is defined as the ratio of change in position or displacement to the time taken.

$$\bar{v} = v_{av} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{\Delta x}{\Delta t}$$

Rate of change of velocity [acceleration]

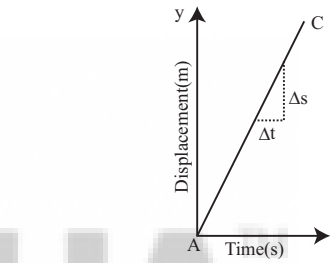
$$\text{Acceleration} = \frac{\text{Change in velocity}}{\text{Time taken}}$$

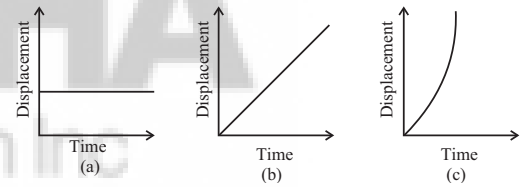
Average Acceleration

- Average acceleration is defined as *the change in velocity divided by the time interval to make the change.*
- **Positive acceleration:** If the velocity of an object increases in the same direction, the object has a positive acceleration.
- **Negative acceleration (Retardation):** If the velocity of a body decreases in the same direction, the body has a negative acceleration or it is said to be retarding, e.g, a train slows down.

Displacement-Time Graphs

- The slope of a displacement-time graph gives the velocity.



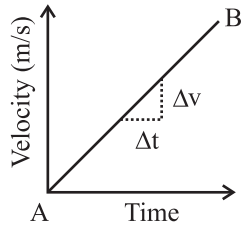


Graph (a) Shows the graph for an object stationary over a period of time. The gradient is zero, so the object has zero velocity.

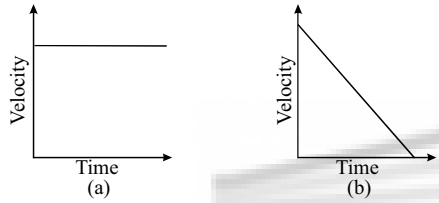
Graph (b) Shows the graph for an object moving at a constant velocity. You can see that the displacement is increasing as time goes on. The gradient, however, stays constant (remember it is the slope of straight line) so the velocity is constant. Here the gradient is positive, so the object is moving in the direction we have defined as positive.

Graph (c) Shows the graph for an object moving at a constant acceleration. You can see that both the displacement and the velocity (gradient of the graph) increases with time. The gradient is increasing with time, thus the velocity is increasing with time and the object is accelerating.

Velocity-Time Graphs



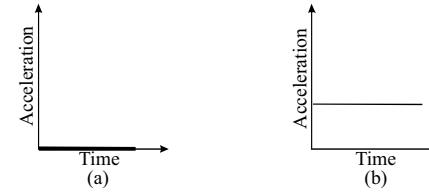
- *The slope of a velocity-time graph gives the acceleration.*
- *We can also calculate displacement travelled from velocity-time graph.*



Graph (a) Shows an object moving at a constant velocity over a period of time. The gradient is zero, so the object is not accelerating.

Graph (b) Shows an object which is decelerating. You can see that the velocity is decreasing with time. The gradient, however, stays constant so the acceleration is constant. Here the gradient is negative, so the object is accelerating in the opposite direction to its motion, hence it is decelerating.

Acceleration-Time Graphs



Graph (a) Shows an object which is either stationary or travelling at a constant velocity. Either way, the acceleration is zero over time.

Graph (b) Shows an object moving at a constant acceleration. In this case, the acceleration is positive - remember that it can also be negative.

Equations of Motion

(i) First equation (Equation for velocity-time relation) $v = u + at$

(ii) Second equation (Equation for position-time relation) $s = ut + \frac{1}{2}at^2$

(iii) Third equation (Equation for position-velocity relation) $v^2 = u^2 + 2as$

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Motion of freely falling body

The equation of motion for a freely falling body can be obtained by replacing 'a' in equations with g, the acceleration due to gravity. For a freely falling body which is initially at rest, u = 0. Thus, we get the following equations.

$v = gt,\ s = \frac{1}{2}gt^2,\ v^2 = 2gh$

When we throw an object vertically upwards, it moves against the acceleration due to gravity. Hence, 'a' is taken to be –g and when moving downwards 'a' is taken as +g.

Circular Motion

- Motion of a particle (small body) along a circle (circular path), is called a circular motion. *If the body covers equal distances along the circumference of the circle, in equal intervals of time, the motion is said to be a* ***uniform circular motion***.
- A uniform circular motion is a motion in which speed remains constant but direction of velocity changes.

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Centripetal Acceleration and Centripetal Force

- A body is said to be accelerated, if the velocity of the body changes either in magnitude or in direction. So, the motion of a stone in circular path with constant speed and continuous change of direction is an accelerated motion. In this case, there must be an acceleration acting along the string directed inwards, which makes the stone move in a circular path.
- This acceleration is known as centripetal acceleration and the force is known as centripetal force. Since the centripetal acceleration is directed radially towards the centre of the circle, the centripetal force must act on the object radially towards the centre.

Centrifugal Force

- A pulling force that acts away from the centre is called centrifugal force. Force acting on a body away from the centre of circular path is called centrifugal force. Thus, centrifugal force acts in a direction which is opposite to the direction of centripetal force. Its magnitude is same as that of centripetal force. The dryer in a washing machine is an example for the application of centrifugal force.

Force and Law of Motion

Force

Force is an external effort in the form of push or pull, which:

1. produces or tries to produce the motion of a static body.
2. stops or tries to stop a moving body.
3. changes or tries to change the direction of motion of a moving body.

Force has both magnitude and direction.
So, it is a vector quantity.

Types of Forces

Based on the direction in which the forces act, they can be classified into two types as:

(a) Like parallel forces and
(b) Unlike parallel forces.

(a) Like parallel forces: Two or more forces of equal or unequal magnitude acting along the same direction, parallel to each other are called like parallel forces.

(b) Unlike parallel forces: If two or more equal forces or unequal forces act along opposite directions parallel to each other, then they are called unlike parallel forces.

Resultant Force

- When several forces act simultaneously on the same body, then the combined effect of the multiple forces can be represented by a single force, which is termed as 'resultant force'. It is equal to the vector sum (adding the magnitude of the forces with their direction) of all the forces.

Balanced Forces

- If the resultant force of all the forces acting on a body is equal to zero, then the body will be in equilibrium. Such forces are called balanced forces.

Unbalanced Forces

- If the resultant force is not equal to zero, then it causes the motion of the body due to unbalanced forces.
- An object maintains it motion under the continuous application of an unbalanced force.
- If an unbalanced force is applied on the object, there will be a change either in its speed or in the direction of its motion.
- To accelerate the motion of an object, an unbalanced force is required.
- The change in its speed (or in the direction of motion) would continue as long as this unbalanced force is applied.

- If this force is removed completely, the object would continue to move with the velocity it has acquired till then.

Equilibrant

- A system can be brought to equilibrium by applying another force, which is equal to the resultant force in magnitude, but opposite in direction. Such force is called as 'Equilibrant'.

First Law of Motion

- This law states that everybody continues to be in its state of rest or the state of uniform motion along a straight line unless it is acted upon by some external force.
- An object remains in a state of rest or of uniform motion in a straight line unless compelled to change that state by an applied force.
- All objects resist a change in their state of motion.

Inertia and Mass

The inherent property of a body to resist any change in its state of rest or the state of uniform motion, unless it is influenced upon by an external unbalanced force, is known as 'inertia'.

- The first law of motion is also known as the law of inertia.
- Inertia is the natural tendency of an object to resist a change in its state of motion or of rest.
- The mass of an object is a measure of its inertia.

Types of Inertia

(a) **Inertia of rest:** The resistance of a body to change its state of rest is called inertia of rest.

(b) **Inertia of motion:** The resistance of a body change its state of motion and is thus called inertia of motion.

(c) **Inertia of direction:** The resistance of a body to change its direction of motion is called inertia of direction.

Second Law of Motion

According to this law, "the force acting on a body is directly proportional to the rate of change of linear momentum of the body and the change in momentum takes place in the direction of the force".

$$F = m \times a$$

Force = mass × acceleration

- The first law of motion indicates that when an unbalanced external force acts on an object, its velocity changes, that is, the object gets an acceleration.
- If an object is to be accelerated, we know that a greater force is required to give a greater velocity.
- Some quantity of importance that combines the object's mass and its velocity.
- One such property called momentum was introduced by Newton.

  $p = mv$
- Momentum has both direction and magnitude.
- Its direction is the same as that of velocity, v.
- The SI unit of momentum is kilogram-metre per second (kg m s^{-1}).
- The change of momentum of the car is not only determined by the magnitude of the force but also by the time during which the force is exerted.
- It may then also be concluded that the force necessary to change the momentum of an object depends on the time rate at which the momentum is changed.
- The second law of motion states that the rate of change of momentum of an object is proportional to the applied unbalanced force in the direction of force.

Third Law of Motion

Newton's third law states that 'for every action, there is an equal and opposite reaction. They always act on two different bodies'.

- The first two laws of motion tell us how an applied force changes the motion and provide us with a method of determining the force.
- Let's take two objects A and B. If object A exerts a force on object B, object B also exerts an equal and opposite force on object A.

- The two forces are always equal in magnitude but opposite in direction.
- The two opposing forces are also known as action and reaction forces.
- An alternative statement of the third law of motion, i.e., to every action there is an equal and opposite reaction.
- The action and reaction forces are always equal in magnitude, these forces may not produce accelerations of equal magnitudes.
- Each force acts on a different object that may have a different mass.

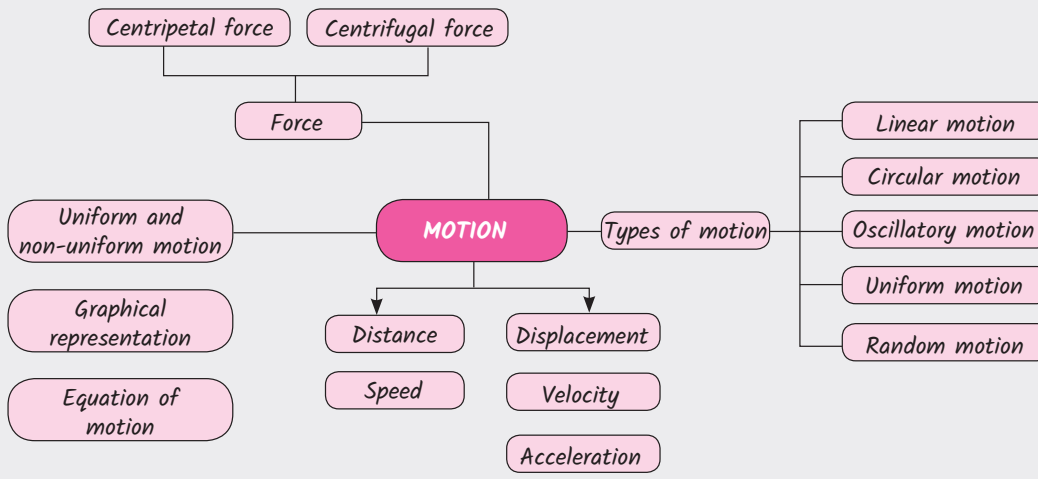
Examples:

- When birds fly, they push the air downwards with their wings (Action) and the air pushes the bird upwards (Reaction).
- When a person swims he pushes the water using the hands backwards (Action), and the water pushes the swimmer in the forward direction (Reaction).
- When you fire a bullet, the gun recoils backwards and the bullet is moving forward (Action) and the gun equalizes this forward action by moving (Reaction).

Conservation of Momentum

- The sum of momenta of the two objects before collision is equal, there is no external unbalanced force acting on them. This is known as the law of conservation of momentum.
- All conservation laws such as conservation of momentum, energy, angular momentum, charge, etc. are considered to be fundamental laws in physics.
- An experiment whose result is in conformity with the law verifies or substantiates the law.
- The law of conservation of momentum has been deduced from large number of observations and experiments.

Concept Map



CHAPTER 3

Work and Energy

Work

- In physics, if force applied on an object displaces the object in the direction of force then the work is said to be done. Here all three terms force, displacement and direction of force are important. If force is zero, work is zero; if force is non-zero but displacement is zero (like pushing the wall) work is zero and if force is non-zero, displacement is non-zero but no part of force is in the direction of displacement, work is zero.
- Hence, we define the work as *the product of the force and displacement in the direction of applied force or product of displacement and force in the direction of displacement*.
- W = Force × displacement in the direction of force

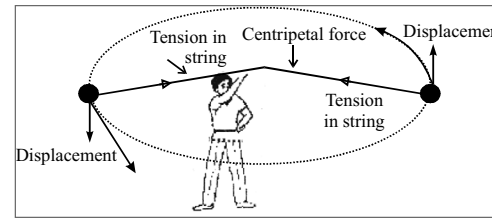
Unit of Work

- The **SI unit** of force is newton and the unit of length is metre (m). So, the **SI unit** of work is newton-metre which is written as Nm. This unit (Nm) is also called **joule (J)**, i.e., 1 joule = 1 newton . 1 metre

  1 J = 1 Nm
- When a force of 1 newton moves a body through a distance of 1 metre in its own direction, the work done is 1 joule.

Zero work:

- A coolie with a luggage on his head, moving on a horizontal platform, does no work, since the direction of force is vertically up and displacement horizontal (even though he might feel physically tired).



- A body attached to a string revolves in a horizontal circle (figure). The tension T in the string does no work on the body, because it has no component in the direction of displacement. In general, for a body moving with uniform speed the centripetal force is always perpendicular to displacement, hence no work will be done by this force.
- If a boy tries to push a heavy boulder, by applying a force, but unable to displace it, then work done by the boy is zero.

Positive work

- When a horse pulls a cart, the applied force and the displacement are in the same direction. So, work done is positive.

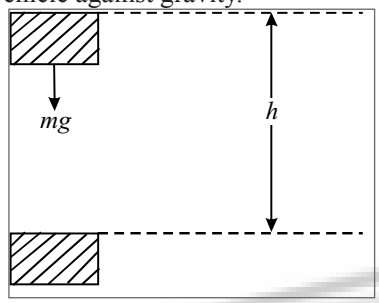
Negative work

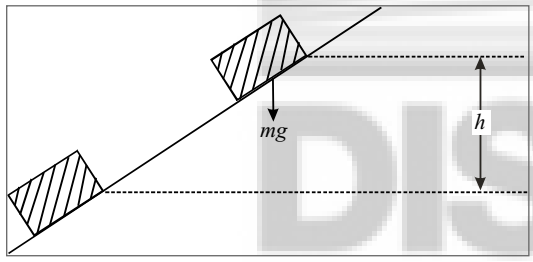
- When brakes are applied to a moving vehicle, the work done by the braking force is negative. This is because the braking force and the displacement act are in opposite directions.
- When a spring is compressed then the force applied by the spring and the displacement will be opposite to each other, so work done by the spring will be negative.

Work done Against Gravity

- Consider a body of mass m which is raised to a vertical distance h.

- The work done by the weight is – *mgh*. *mgh* is called the work done against gravity.
- If an agent, such as crane, is responsible for lifting the body, then *mgh* is referred to as the work done by the crane against gravity.
- Similarly if a vehicle of mass *m* climbs a hill, and in doing so raises itself to a vertical distance *h*, then *mgh* is called the work done by the vehicle against gravity.





Energy

- Some people have a lot of energy when they get up in the morning. Carbohydrates are high-energy foods. Oil is the main source of energy that keeps industry and cars going.
- The word energy has a different meaning in physics, the word energy has a very precise meaning, although it is a little difficult to define because energy takes many different forms. We can approach a definition by noting the relationship between energy and work. *Energy is defined as the capacity to do work.*
- In other words, anything which has the capacity to do work is said to possess energy. This implies that work can be done only at the expense (cost) of energy, i.e. to do work, we need to spend energy, whatsoever be its form.
- Its **S.I. unit** is same as that of work, i.e., joule (J).

Let us understand energy-work equivalence with some examples

- When a fast moving cricket ball hits a stationary stump, the stump is thrown away. Here the work is done on the stump by the ball and the ball has the capacity to do this work because of its motion (kinetic energy).
- A body can acquire the ability to do work when it is deformed temporarily. For example, a compressed watch spring is able to drive the wheels of a watch.
- If a boy (mass = *m*) climbs upstairs to a height (*h*) then work done by him would be *mgh* and consequently, he would have lost *mgh* joule of energy.

Mechanical Energy

- The energy in a body may be by virtue of its motion (kinetic energy) or by virtue of its position (potential energy). Energy in a body due to these conditions is called mechanical energy. For example, energy of water in a water tank on the roof, energy of a moving bullet, energy of small spring in ball-pen, energy of moving air, etc. are the forms of mechanical energy.

Kinetic Energy

- *Energy possessed by a body by virtue of its state of motion is called kinetic energy.* Kinetic energy is always positive and is a scalar.

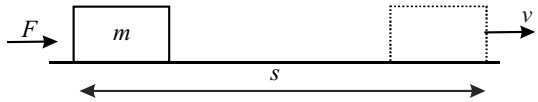
Examples:

- A stone thrown with some velocity, breaks the window pane.
- A moving vehicle, when accidently happens to collide with another vehicle at rest or motion, leads to destruction.

Expression of Kinetic Energy

- Suppose that a constant force *F* is applied on a body of mass *m*. Its velocity becomes *v* in a displacement *s*, then according to Newton's third equation of motion $v^2 = u^2 + 2$ as

$$v^2 = 0 + 2\left(\frac{F}{m}\right)s \quad \text{or} \quad (F) = m\left(\frac{v^2}{2s}\right)$$



- Work done by force F in displacing the body by a distance s in the direction of force

$$W = F.s = m\left(\frac{v^2}{2s}\right)s \quad \text{or} \quad W = \frac{1}{2}mv^2$$

- This work done by the force which makes a stationary body to move with a velocity v, is measured as its kinetic energy,

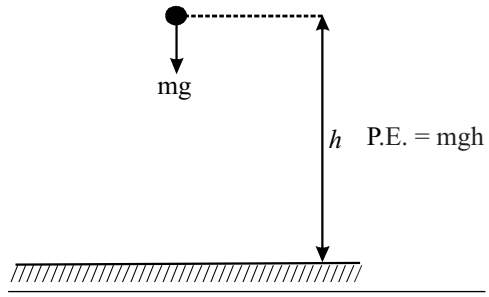
i.e., $K = \frac{1}{2}mv^2$

- From this expression, it is clear that the kinetic energy possessed by a moving body is directly proportional to its mass and to the square of its velocity; if velocity is doubled, KE becomes four times.

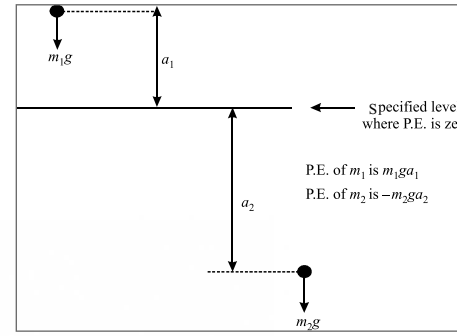
Potential Energy

- Potential energy is energy due to position. If a body is in a position such that if it were released it would begin to move, it has potential energy. There are two common forms of potential energy, gravitational and elastic.

Gravitational Potential Energy



- When an object is allowed to fall from higher level to a lower level it gains speed due to gravitational pull, i.e., it gains kinetic energy. Therefore, in possessing height, a body has the ability to convert its height into kinetic energy, i.e., it possesses potential energy.
- The magnitude of its gravitational potential energy is equivalent to the amount of work done by the weight of the body in causing the descent.
- If a mass m is at a height h above a lower level, the P.E. possessed by the mass is $(mg)\,(h)$.
- Since h is the height of an object above a specified level, an object below the specified level has negative potential energy.



Law of Conservation of Energy

- According to this law, *energy can only be converted from one form to another, it can neither be created nor destroyed*. The total energy before and after the transformation always remains the same.

Conservation of Mechanical Energy

- Kinetic and potential energy are both forms of mechanical energy. The total mechanical energy of a body or system of bodies will be changed in value if:

(a) An external force other than weight causes work to be done (work done by weight is potential energy and is therefore already included in the total mechanical energy),

(b) Some mechanical energy is converted into another form of energy (e.g., sound, heat, light, etc.). Such a conversion of energy usually takes place when a sudden change in the motion of the system occurs. For instance, when two moving objects collide some mechanical energy is converted into sound energy which is heard as bang at impact. Another common example is the

conversion of mechanical energy into heat energy when two rough objects rub against each other.

- If neither (a) nor (b) occurs, then the total mechanical energy of a system remains constant. This is the principle of conservation of Mechanical Energy which can be expressed in the form:
- The total mechanical energy (K.E. + P.E.) of a system remains constant provided that no external work is done and no mechanical energy is converted into another form of energy.

Power (Rate of Doing Work)

- In several situations, it is not enough only to know how much work is done but it is also required to know how quickly it is done, i.e, it is also important to know the rate of work done by the force.
- The *time rate of doing work is defined as power* (*P*). If equal works are done in different times, power will be different. More quickly the work is done, more will be the power

$$\text{Power (P)} = \frac{\text{work(w)}}{\text{time(t)}}$$

Unit of power : The unit of power is the joule per second and is called **watt** (W). When large amounts of power are involved, a more convenient unit is the kilowatt (kW) where 1 kW = 1000 W.

1 Megawatt (MW) = 10^6 watt

- Power was also measured earlier by a unit called **horse power**. Even these days, the unit of horse power is in common use.

1 horse power = 746 watt

Commercial Unit of Energy

- The SI unit of energy is joule (J). But the commonly used unit for electrical-energy consumption is kilowatt-hour (kWh). If energy is consumed at the rate of 1 kilojule/second, i.e., at the rate of 1 kilowatt, and this continues for 1 hour then the total energy consumed is called 1 kilowatt-hour.

Thus, 1kWh = 1kW × 1 hour
= (1000 W) × (3600 s)
= (1000 J/s) × (3600 s)
= (3600000 joules) = 3.6×10^6J.

- For electrical-energy consumption in houses, factories, shops, etc., kilowatt-hour is simply called 'unit' (*Board of trade unit, B.O.T.U.*). So, the cost of electrical energy is given in terms of ₹/unit. If electricity costs ₹ 5.00/ unit, it means that consumers pay ₹ 5.00 for every unit (kWh) of electrical energy consumed.

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CHAPTER 4

Gravitation

Newton's Universal Law of Gravitation

- Newton came to the conclusion that any two objects in the Universe exert gravitational attraction on each other, with the force having a universal form.
- *Any two particles of matter anywhere in the universe attract each other with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them, the direction of the force being along the line joining the particles,*

$$F \propto \frac{m_1 m_2}{r^2}$$

i.e.,

$$F = \frac{G m_1 m_2}{r^2}$$

or

- Here, the constant of proportionality G is known as the universal gravitational constant. It is termed as "universal constant" because it is thought to be the same at all places and all times, and thus universally characterizes the intrinsic strength of the gravitational force. If $m_1 = m_2 = 1\text{kg}$, $r = 1\text{m}$ then $F = G$.
- Gravitational constant is defined as the force of attraction acting between two unit masses placed at unit distance apart. G is a scalar quantity.

  $G = 6.673 \times 10^{-11}\ \text{N}m^2/\text{kg}^2$.

Important Characteristics of Gravitational Force

- Gravitational forces are always attractive and always acts along the line joining the two masses.
- Gravitational force is a mutual force hence it is action-reaction force, i.e., $\vec{F}_{12} = -\vec{F}_{21}$.
- Value of G is small, therefore, gravitational force is weaker than electrostatic and nuclear forces.
- Gravitational forces are conservative forces. Therefore, the work done by the gravitational force on a particle does not depend on the path described by the particle. It depends upon the initial and final position of the particle. Therefore, no work is done by the gravity if a particle moves in a closed path.
- Gravitational force is a central force because $F \propto \frac{1}{r^2}$.
- The gravitational force between two masses is independent of the presence of other objects and medium between the two masses.
- Gravitational force between any two particles does not depend upon the presence or absence of other particles (bodies).

Importance of the Universal Law of Gravitation

- The universal law of gravitation successfully explained several phenomena which were believed to be unconnected:
  - the force that binds us to the earth;
  - the motion of the moon around the earth;
  - the motion of planets around the Sun; and
  - the tides due to the moon and the Sun.

Mass and Weight

- The quantity of matter in a body is known as the mass of the body.
- Mass is quantitative measure of inertia. Mass is an intrinsic property of matter and does not change as an object is moved from one location to another.
- Weight, in contrast, is the gravitational force that the earth exerts on the object and can vary, depending on how far the object is above the earth's surface or whether it is located near another body such as the moon.

- The relation between weight W and mass m can be written in one of the two ways:

$$W = \frac{GM_E m}{r^2}; \qquad W = mg$$

- As acceleration due to gravity on the surface of the moon is $\frac{1}{6}$th of acceleration due to gravity on the surface of the earth.

i.e., $g_{moon} = \frac{1}{6} g_{earth}$ therefore, weight of a body on the surface of the moon is $\frac{1}{6}$ the weight on the surface of the earth.

i.e., $w_{moon} = \frac{1}{6} w_{earth}$

- According to the Newton's second law:
Force = mass × acceleration or

$$\text{mass} = \frac{\text{force}}{\text{acceleration}}$$

- Let us now differentiate between 'mass' and 'weight' of a body.

Mass	Weight
It is the amount of matter contained in a body.	It is the gravitational pull of the Earth on a body.
It is a scalar quantity.	It is a vector quantity.
It is constant anywhere in the universe.	It varies according to variation in the acceleration due to gravity.
It is measured in gram (C.G.S. unit) or kilogram (S.I. unit).	It is measured in dyne (C.G.S. unit) or newton (S.I. unit). It is also measured in gram-weight (g_{wt}) or kilogram-weight (kg_{wt}).
It is measured using a common balance.	It is measured using a spring balance.

Acceleration Due to Gravity of The Earth

- When a body is dropped from a certain height above the ground, it begins to fall towards the earth under gravity. The acceleration produced in the body due to gravity is called the acceleration due to gravity. It is denoted by g. Its value close to the Earth's surface is 9.8 m/s^2.
- Suppose that the mass of the Earth is M, its radius R, then the force of attraction acting on a body of mass m close to the surface of Earth is

$$F = \frac{GMm}{R^2}$$

- According to Newton's second law, the acceleration due to gravity is

$$g = \frac{F}{m}$$

$$g = \frac{GM}{R^2} \text{ at the surface of the Earth}$$

- This is the relation between acceleration due to gravity (g) and universal gravitational constant (G).

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Variation of acceleration due to gravity (g)

- *Since g depends on the geometric radius of the Earth, ($g \propto 1/R2$), its value changes from one place to another on the surface of the Earth. Since the geometric radius of the Earth is maximum in the equatorial region and minimum in the polar region, the value of g is maximum in the polar region and minimum at the equatorial region.*
- *When you move to a higher altitude from the surface of the Earth, the value of g reduces.*
- *In the same way, when you move deep below the surface of the Earth, the value of g reduces. Value of g is zero at the centre of the Earth.*

Apparent Weight

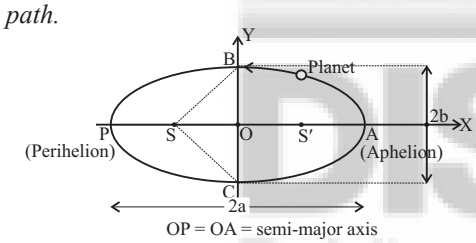
- The weight that you feel to possess during up and down motion, is not same as your actual weight. Apparent weight is the weight of the body acquired due to the action of gravity and other external forces acting on the body.
- If a person of mass m is travelling in a lift. The actual weight of the person is W = mg which is acting vertically downwards. The reaction force exerted by the lift's surface 'R', taken as apparent weight is acting vertically upwards.

Weightlessness

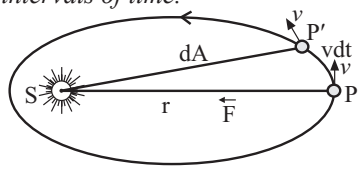
- If a lift moves down with an acceleration (a) equal to the acceleration due to gravity (g), i.e., when a = g, this motion is called a 'free fall'. Here, the apparent weight (R = m (g–g) = 0) of the person is zero. This condition or state refers to the state of weightlessness.

Kepler's Laws of Planetary Motion

- **Law of orbits (first law):** *All planets revolve in elliptical orbits around the sun and the sun is situated at one of the two foci of the elliptical path.*



- **Law of areas (second law):** *The areal velocity* $\left(\frac{dA}{dt}\right)$ *of a planet remains constant, i.e., the line joining the sun to planet covers equal areas in same intervals of time.*

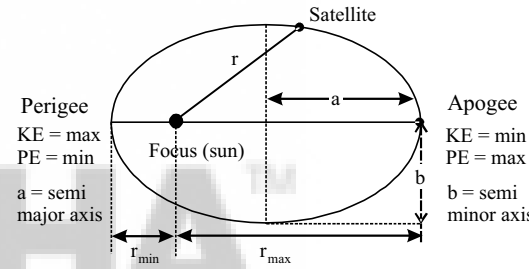


i.e., $\frac{dA}{dt}$ = constant

$$= \frac{1}{2}\frac{r(vdt)}{dt} = \frac{1}{2}rv = \frac{L}{2m}$$

[since angular momentum L = mvr]

- **Law of periods (third law):** *The square of the period of revolution of the planet is directly proportional to the cube of semi major axis of its orbit.*



FREE FALL

- The motion of a body under the influence of gravity alone is called a free fall. When a body falls freely towards the earth, its velocity continuously increases. The acceleration developed in its motion is called acceleration due to gravity (g).
- If the point mass *m* is situated on the earth's surface, then *r* = R, and the gravitational force on mass *m* is

$$F = \frac{GMm}{R^3}R \text{ or } F = \frac{GMm}{R^2} \text{ (for r = R)}$$

Suppose the mass *m* experiences acceleration g, called the acceleration due to gravity, then according to Newton's second law of motion, F = mg

$$\therefore \quad mg = \frac{GMm}{R^2} \text{ or } g = \frac{GM}{R^2}$$

This gives the acceleration due to gravity on the surface of the earth.

- Putting the value of G = 6.67 × 10^{-11} Nm^2/kg^2; M (mass of earth) = 6 × 10^{24} kg; R (radius of earth) = 6.4 × 10^6 m we get, g = 9.8 m/s^2

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Weightlessness of the Astronauts

- *Some of us believe that the astronauts in the orbiting spacestation do not experience any gravitational force of the Earth. So they float. But this is absolutely wrong.*
- *Astronauts are not floating but falling freely around the earth due to their huge orbital velocity. Since spacestation and astronauts have equal acceleration, they are under free fall condition; (R = 0; refer case 4 in Table 1.2). Hence, both the astronauts and the spacestation are in the state of weightlessness.*

Application of Newton's law of gravitation

1. *Dimensions of the heavenly bodies can be measured using the gravitation law. Mass of the Earth, radius of the Earth, acceleration due to gravity, etc. can be calculated with a higher accuracy.*
2. *Helps in discovering new stars and planets.*
3. *One of the irregularities in the motion of stars is called 'Wobble' leading to the disturbance in the motion of a planet nearby. In this condition, the mass of the star can be calculated using the law of gravitation.*
4. *Helps to explain germination of roots due to the property of geotropism which is the property of a root responding to the gravity.*
5. *Helps to predict the path of the astronomical bodies.*

Acceleration Due to Gravity on other Celestial Bodies

Celestial body	Mass (kg)	Radius (m)	Acceleration due to gravity ($m\ s^{-2}$)
Sun	2 ×10^{30}	7 × 10^8	273
Earth	6 × 10^{24}	6.4 × 10^6	9.77
Moon	7.3 × 10^{22}	1.74 × 10^6	1.67
Mars	6 × 10^{20}	43 × 10^6	2.16
Jupiter	2 × 10^{27}	7 × 10^7	27.22
Saturn	6 × 10^{26}	6 × 10^7	11.12