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NEET 2024 Solved Paper

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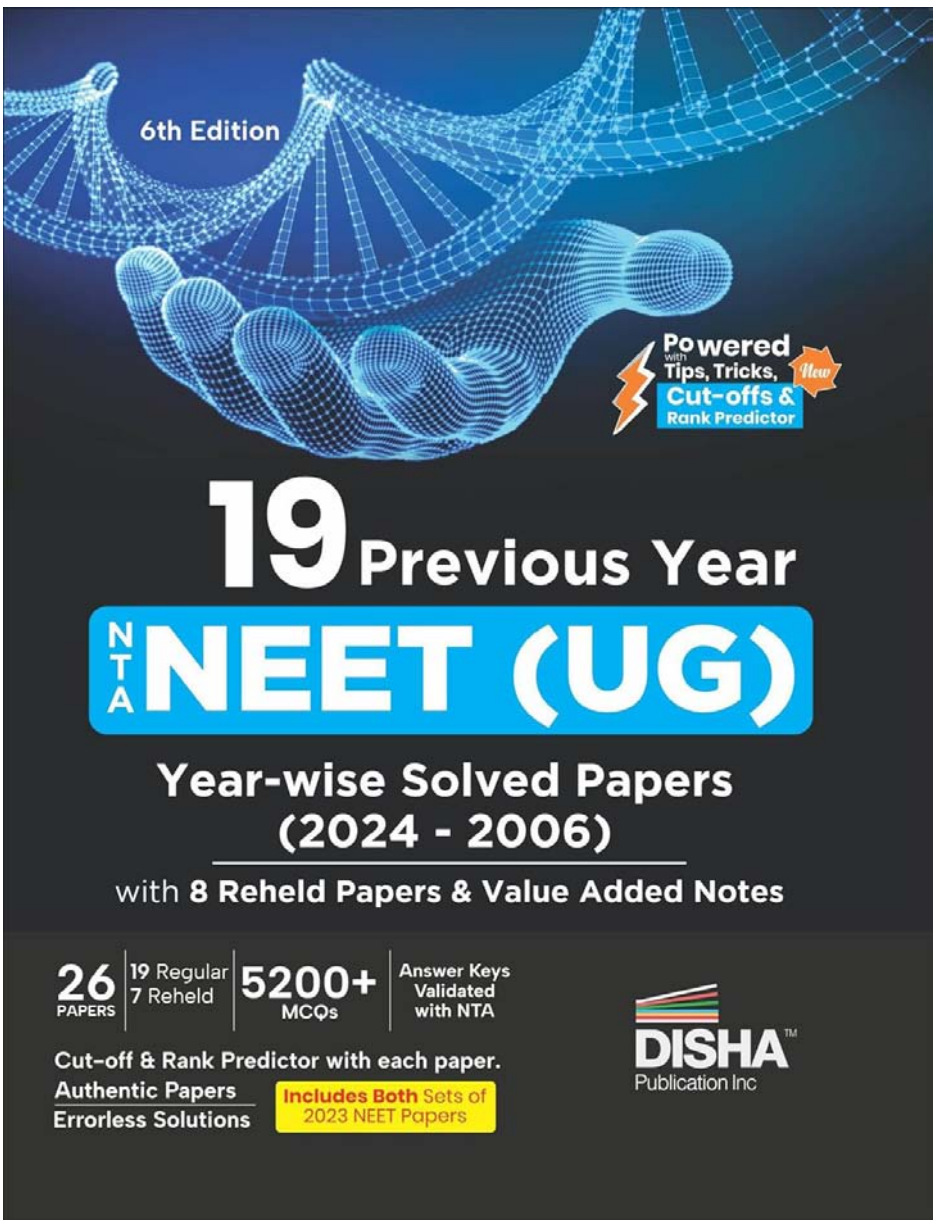


ISBN - 978-9362254108

NEET-2024
Solved Paper

Time : 3 hrs, 20 Min. **MM : 720**

PHYSICS

Section-A

1. In a vernier callipers, (N + 1) divisions of vernier scale coincide with N divisions of main scale. If 1 MSD represents 0.1 mm, the vernier constant (in cm) is:

(a) $\frac{1}{10N}$

(b) $\frac{1}{100(N+1)}$

(c) 100 N

(d) 10 (N + 1)

2. If the monochromatic source in Young's double slit experiment is replaced by white light, then

(a) Interference pattern will disappear.

(b) There will be a central dark fringe surrounded by a few coloured fringes.

(c) There will be a central bright white fringe surrounded by a few coloured fringes.

(d) All bright fringes will be of equal width.

3. A logic circuit provides the output Y as per the following truth table :

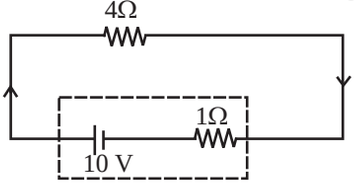
A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

The expression for the output Y is :

(a) $A.B+\overline{A}$ (b) $A.\overline{B}+\overline{A}$

(c) $\overline{B}$ (d) B

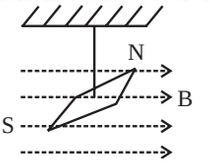
4. The terminal voltage of the battery, whose emf is 10 V and internal resistance 1 Ω, when connected through an external resistance of 4 Ω as shown in the figure is:



(a) 4 V (b) 6 V

(c) 8 V (d) 10 V

5. In a uniform magnetic field of 0.049 T, a magnetic needle performs 20 complete oscillations in 5 seconds as shown. The moment of inertia of the needle is 9.8×10^{-6} kg m^2. If the magnitude of magnetic moment of the needle is $x \times 10^{-5}$ Am^2, then the value of 'x' is :



(a) $5\pi^2$ (b) $128\pi^2$

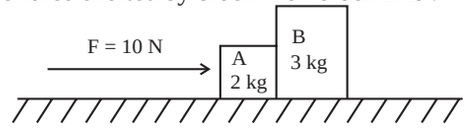
(c) $50\pi^2$ (d) $1280\pi^2$

6. A wire of length 'l' and resistance 100 Ω is divided into 10 equal parts. The first 5 parts are connected in series while the next 5 parts are connected in parallel. The two combinations are again connected in series. The resistance of this final combination is:

(a) 26 Ω (b) 52 Ω

(c) 55 Ω (d) 60 Ω

7. A horizontal force 10 N is applied to a block A as shown in figure. The mass of blocks A and B are 2 kg and 3 kg respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is :



(a) Zero (b) 4 N

(c) 6 N (d) 10 N

8. A tightly wound 100 turns coil of radius 10 cm carries a current of 7A. The magnitude of the magnetic field at the centre of the coil is (Take permeability of free space as $4\pi \times 10^{-7}$ SI units):

(a) 44 mT (b) 4.4 T

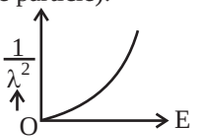
(c) 4.4 mT (d) 44 T

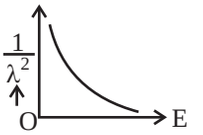
9. In an ideal transformer, the turns ratio is $\frac{N_P}{N_S}=\frac{1}{2}$. The ratio $V_S : V_P$ is equal to (the symbols carry their usual meaning) :

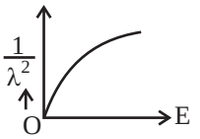
(a) 1 : 2 (b) 2 : 1

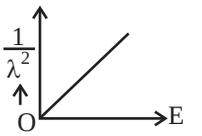
(c) 1 : 1 (d) 1 : 4

10. The graph which shows the variation of $\left(\frac{1}{\lambda^2}\right)$ and its kinetic energy, E is (where λ is de Broglie wavelength of a free particle):

(a) 

(b) 

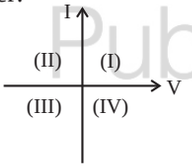
(c) 

(d) 

11. Given below are two statements:
Statement I: Atoms are electrically neutral as they contain equal number of positive and negative charges.
Statement II: Atoms of each element are stable and emit their characteristic spectrum.
In the light of the above statements, choose the most appropriate answer from the options given below.
(a) Both Statement I and Statement II are correct
(b) Both Statement I and Statement II are incorrect
(c) Statement I is correct but Statement II is incorrect
(d) Statement I is incorrect but Statement II is correct

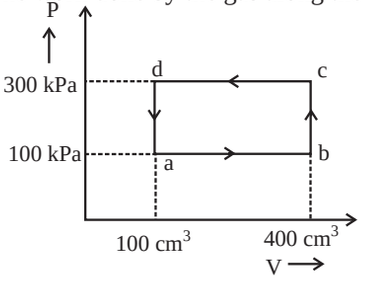
12. A bob is whirled in a horizontal plane by means of a string with an initial speed of ω rpm. The tension in the string is T. If speed becomes 2ω while keeping the same radius, the tension in the string becomes:
(a) T (b) 4T
(c) $\frac{T}{4}$ (d) $\sqrt{2}T$

13. Consider the following statements A and B and identify the correct answer:



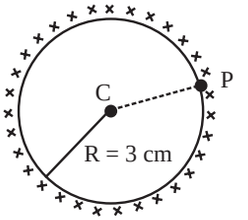
A. For a solar-cell, the I-V characteristics lies in the IV quadrant of the given graph.
B. In a reverse biased pn junction diode, the current measured in (μA), is due to majority charge carriers.
(a) A is correct but B is incorrect
(b) A is incorrect but B is correct
(c) Both A and B are correct
(d) Both A and B are incorrect

14. A thermodynamic system is taken through the cycle abcda. The work done by the gas along the path bc is:



(a) Zero
(b) 30 J
(c) –90 J
(d) –60 J

15. A thin spherical shell is charged by some source. The potential difference between the two points C and P (in V) shown in the figure is:
(Take $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ SI units)



(a) 3×10^5 (b) 1×10^5
(c) 0.5×10^5 (d) Zero

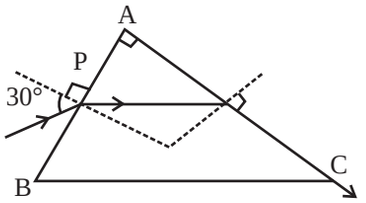
16. The moment of inertia of a thin rod about an axis passing through its mid point and perpendicular to the rod is 2400 g cm^2. The length of the 400 g rod is nearly:
(a) 8.5 cm (b) 17.5 cm
(c) 20.7 cm (d) 72.0 cm

17. A particle moving with uniform speed in a circular path maintains:
(a) Constant velocity
(b) Constant acceleration
(c) Constant velocity but varying acceleration
(d) Varying velocity and varying acceleration

18. If c is the velocity of light in free space, the correct statements about photon among the following are:
A. The energy of a photon is E = hν.
B. The velocity of a photon is c.
C. The momentum of a photon, $p = \frac{h\nu}{c}$.
D. In a photon-electron collision, both total energy and total momentum are conserved.
E. Photon possesses positive charge.
Choose the correct answer from the options given below:
(a) A and B only
(b) A, B, C and D only
(c) A, C and D only
(d) A, B, D and E only

19. At any instant of time t, the displacement of any particle is given by 2t – 1 (SI unit) under the influence of force of 5N. The value of instantaneous power is (in SI unit):
(a) 10 (b) 5
(c) 7 (d) 6

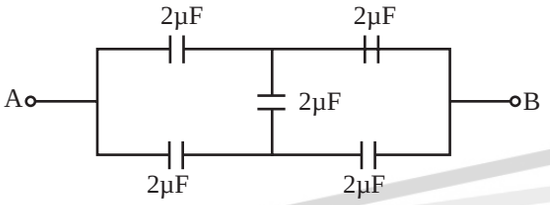
20. A light ray enters through a right angled prism at point P with the angle of incidence 30° as shown in figure. It travels through the prism parallel to its base BC and emerges along the face AC. The refractive index of the prism is :



(a) $\frac{\sqrt{5}}{4}$ (b) $\frac{\sqrt{5}}{2}$

(c) $\frac{\sqrt{3}}{4}$ (d) $\frac{\sqrt{3}}{2}$

21. In the following circuit, the equivalent capacitance between terminal A and terminal B is :



(a) 2 μF (b) 1 μF

(c) 0.5 μF (d) 4 μF

22. The quantities which have the same dimensions as those of solid angle are :

(a) strain and angle

(b) stress and angle

(c) strain and arc

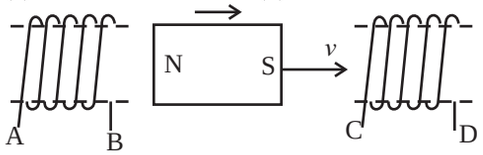
(d) angular speed and stress

23. The maximum elongation of a steel wire of 1 m length if the elastic limit of steel and its Young's modulus, respectively, are 8×10^8 N m^{-2} and 2×10^{11} N m^{-2}, is:

(a) 4 mm (b) 0.4 mm

(c) 40 mm (d) 8 mm

24.



Solenoid-1 Solenoid-2

In the above diagram, a strong bar magnet is moving towards solenoid-2 from solenoid-1. The direction of induced current in solenoid-1 and that in solenoid-2, respectively, are through the directions:

(a) AB and DC (b) BA and CD

(c) AB and CD (d) BA and DC

25. The mass of a planet is $\frac{1}{10}$th that of the earth and its diameter is half that of the earth. The acceleration due to gravity on that planet is:

(a) 19.6 m s^{-2}

(b) 9.8 m s^{-2}

(c) 4.9 m s^{-2}

(d) 3.92 m s^{-2}

26. Match List I with List II.

List I (Spectral Lines of Hydrogen for transitions from)	**List II (Wavelengths (nm))**
A. $n_2 = 3$ to $n_1 = 2$	I. 410.2
B. $n_2 = 4$ to $n_1 = 2$	II. 434.1
C. $n_2 = 5$ to $n_1 = 2$	III. 656.3
D. $n_2 = 6$ to $n_1 = 2$	IV. 486.1

Choose the correct answer from the options given below:

(a) A-II, B-I, C-IV, D-III

(b) A-III, B-IV, C-II, D-I

(c) A-IV, B-III, C-I, D-II

(d) A-I, B-II, C-III, D-IV

27. An unpolarised light beam strikes a glass surface at Brewster's angle. Then

(a) The reflected light will be partially polarised.

(b) The refracted light will be completely polarised.

(c) Both the reflected and refracted light will be completely polarised.

(d) The reflected light will be completely polarised but the refracted light will be partially polarised.

28. Match List-I with List-II.

List-I (Material)	**List-II (Susceptibility (χ))**
A. Diamagnetic	I. $\chi = 0$
B. Ferromagnetic	II. $0 > \chi \geq -1$
C. Paramagnetic	III. $\chi >> 1$
D. Non-magnetic	IV. $0 < \chi < \varepsilon$ (a small positive number)

Choose the correct answer from the options given below

(a) A-II, B-III, C-IV, D-I

(b) A-II, B-I, C-III, D-IV

(c) A-III, B-II, C-I, D-IV

(d) A-IV, B-III, C-II, D-I

29. Two bodies A and B of same mass undergo completely inelastic one dimensional collision. The body A moves with velocity v_1 while body B is at rest before collision. The velocity of the system after collision is v_2. The ratio $v_1 : v_2$ is

(a) 1 : 2 (b) 2 : 1

(c) 4 : 1 (d) 1 : 4

30. $^{290}_{82}X \xrightarrow{\alpha} Y \xrightarrow{e^+} Z \xrightarrow{\beta^-} P \xrightarrow{e^-} Q$

In the nuclear emission stated above, the mass number and atomic number of the product Q respectively, are

(a) 280, 81 (b) 286, 80

(c) 288, 82 (d) 286, 81

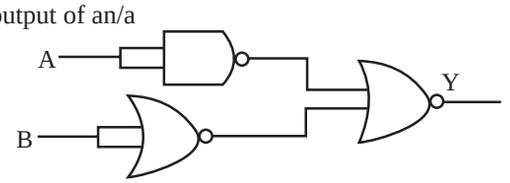
31. If $x = 5\sin\left(\pi t + \frac{\pi}{3}\right)$ m represents the motion of a particle executing simple harmonic motion, the amplitude and time period of motion, respectively, are

(a) 5 cm, 2 s (b) 5 m, 2 s

(c) 5 cm, 1 s (d) 5 m, 1 s

32. A thin flat circular disc of radius 4.5 cm is placed gently over the surface of water. If surface tension of water is 0.07 Nm^{-1}, then the excess force required to take it away from the surface is
(a) 19.8 mN (b) 198 N
(c) 1.98 mN (d) 99 N

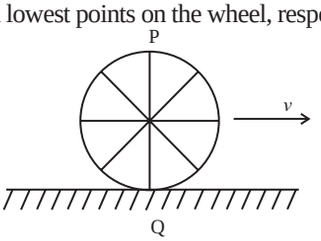
33. The output (Y) of the given logic gate is similar to the output of an/a



(a) NAND gate (b) NOR gate
(c) OR gate (d) AND gate

34. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: The potential (V) at any axial point, at 2 m distance (r) from the centre of the dipole of dipole moment vector $\vec{p}$ of magnitude, 4×10^{-6} C m, is $\pm 9 \times 10^3$ V.
(Take $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ SI units)
Reason R: $V = \pm\frac{2P}{4\pi\varepsilon_0 r^2}$, where r is the distance of any axial point, situated at 2 m from the centre of the dipole.
In the light of the above statements, choose the correct answer from the options given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

35. A wheel of a bullock cart is rolling on a level road as shown in the figure below. If its linear speed is v in the direction shown, which one of the following options is correct (P and Q are any highest and lowest points on the wheel, respectively)?



(a) Point P moves slower than point Q
(b) Point P moves faster than point Q
(c) Both the points P and Q move with equal speed
(d) Point P has zero speed

Section-B

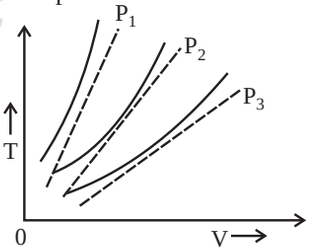
36. A parallel plate capacitor is charged by connecting it to a battery through a resistor. If I is the current in the circuit, then in the gap between the plates:
(a) There is no current
(b) Displacement current of magnitude equal to I flows in the same direction as I
(c) Displacement current of magnitude equal to I flows in a direction opposite to that of I
(d) Displacement current of magnitude greater than I flows but can be in any direction

37. The property which is not of an electromagnetic wave travelling in free space is that:
(a) They are transverse in nature
(b) The energy density in electric field is equal to energy density magnetic field
(c) They travel with a speed equal to $\frac{1}{\sqrt{\mu_0\varepsilon_0}}$
(d) They originate from charges moving with uniform speed

38. A small telescope has an objective of focal length 140 cm and an eye piece of focal length 5.0 cm. The magnifying power of telescope for viewing a distant object is:
(a) 34 (b) 28
(c) 17 (d) 32

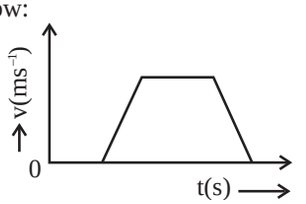
39. Two heaters A and B have power rating of 1 kW and 2 kW, respectively. Those two are first connected in series and then in parallel to a fixed power source. The ratio of power outputs for these two cases is:
(a) 1 : 1 (b) 2 : 9
(c) 1 : 2 (d) 2 : 3

40. The following graph represents the T-V curves of an ideal gas (where T is the temperature and V the volume) at three pressures P_1, P_2 and P_3 compared with those of Charles's law represented as dotted lines.



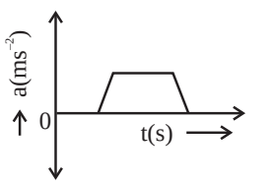
Then the correct relation is:
(a) $P_3 > P_2 > P_1$ (b) $P_1 > P_3 > P_2$
(c) $P_2 > P_1 > P_3$ (d) $P_1 > P_2 > P_3$

41. The velocity (v) – time (t) plot of the motion of a body is shown below:

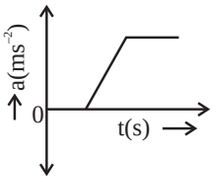


The acceleration (a) – time (t) graph that best suits this motion is :

(a)



(b)



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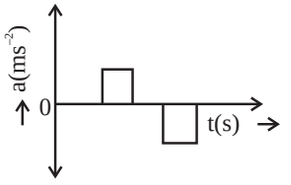
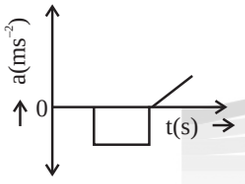
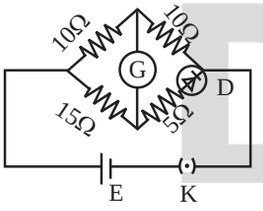


(d)

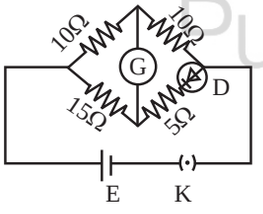


42. Choose the correct circuit which can achieve the bridge balance.

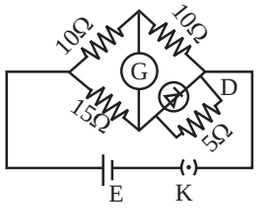
(a)



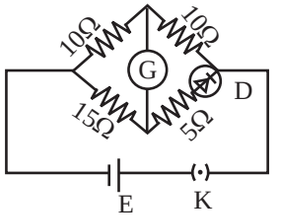
(b)



(c)



(d)



43. If the mass of the bob in a simple pendulum is increased to thrice its original mass and its length is made half its original length, then the new time period of oscillation is $\frac{x}{2}$ times its original time period. Then the value of x is:

(a) $\sqrt{3}$ (b) $\sqrt{2}$

(c) $2\sqrt{3}$ (d) 4

44. The minimum energy required to launch a satellite of mass m from the surface of earth of mass M and radius R in a circular orbit at an altitude of 2R from the surface of the earth is:

(a) $\frac{5GmM}{6R}$ (b) $\frac{2GmM}{3R}$

(c) $\frac{GmM}{2R}$ (d) $\frac{GmM}{3R}$

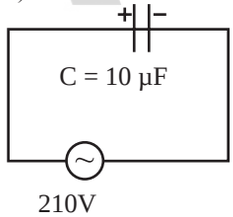
45. A sheet is placed on a horizontal surface in front of a strong magnetic pole. A force is needed to:

A. hold the sheet there if it is magnetic.
B. hold the sheet there if it is non-magnetic.
C. move the sheet away from the pole with uniform velocity if it is conducting.
D. move the sheet away from the pole with uniform velocity if it is both, non-conducting and non-polar.

Choose the correct statement(s) from the options given below:

(a) B and D only (b) A and C only
(c) A, C and D only (d) C only

46. A 10 μF capacitor is connected to a 210 V, 50 Hz source as shown in figure. The peak current in the circuit is nearly ($\pi = 3.14$):



(a) 0.58 A (b) 0.93 A
(c) 1.20 A (d) 0.35 A

47. A metallic bar of Young's modulus, 0.5×10^{11} Nm^{-2} and coefficient of linear thermal expansion 10^{-5} $°C^{-1}$, length 1 m and area of cross-section 10^{-3} m^2 is heated from 0°C to 100°C without expansion or bending. The compressive force developed in it is :

(a) 5×10^3 N (b) 50×10^3 N
(c) 100×10^3 N (d) 2×10^3 N

48. An iron bar of length L has magnetic moment M. It is bent at the middle of its length such that the two arms make an angle 60° with each other. The magnetic moment of this new magnet is :

(a) M (b) $\frac{M}{2}$

(c) 2M (d) $\frac{M}{\sqrt{3}}$

49. If the plates of a parallel plate capacitor connected to a battery are moved close to each other, then

A. the charge stored in it, increases.
B. the energy stored in it, decreases.
C. its capacitance increases.
D. the ratio of charge to its potential remains the same.
E. the product of charge and voltage increases.

Choose the most appropriate answer from the options given below:

(a) A, B and E only (b) A, C and E only
(c) B, D and E only (d) A, B and C only

50. A force defined by $F = \alpha t^2 + \beta t$ acts on a particle at a given time t. The factor which is dimensionless, if α and β are constants, is:

(a) $\beta t / \alpha$ (b) $\alpha t / \beta$
(c) $\alpha\beta t$ (d) $\alpha\beta / t$

CHEMISTRY

Section-A

51. Match List I with List II.

	List I (Molecule)		List II (Number and types of bond/s between two carbon atoms)
A.	ethane	I.	one σ-bond and two π-bonds
B.	ethene	II.	two π-bonds
C.	carbon molecule, C_2	III.	one σ-bonds
D.	ethyne	IV.	one σ-bond and one π-bond

Choose the correct answer from the options given below

(a) A-I, B-IV, C-II, D-III
(b) A-IV, B-III, C-II, D-I
(c) A-III, B-IV, C-II, D-I
(d) A-III, B-IV, C-I, D-II

52. The Henry's law constant (K_H) values of three gases (A, B, C) in water are 145, 2×10^{-5} and 35 kbar, respectively. The solubility of these gases in water follow the order:

(a) B > A > C (b) B > C > A
(c) A > C > B (d) A > B > C

53. Given below are two statements:

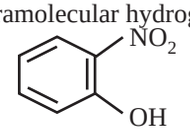
Statement I: The boiling point of hydrides of Group 16 elements follow the order
$H_2O > H_2Te > H_2Se > H_2S$.

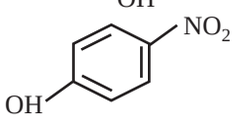
Statement II: On the basis of molecular mass, H_2O is expected to have lower boiling point than the other members of the group but due to the presence of extensive H-bonding in H_2O, it has higher boiling point.

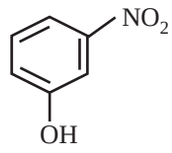
In the light of the above statements, choose the correct answer from the options given below:

(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

54. Intramolecular hydrogen bonding is present in

(a) 

(b) 

(c) 

(d) HF

55. Given below are two statements:

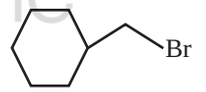
Statement I : The boiling point of three isomeric pentanes follows the order n-pentane > isopentane > neopentane

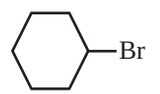
Statement II : When branching increases, the molecule attains a shape of sphere. This results in smaller surface area for contact, due to which the intermolecular forces between the spherical molecules are weak, thereby lowering the boiling point.

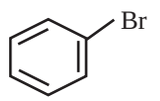
In the light of the above statements, choose the most appropriate answer from the options given below:

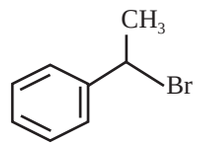
(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct but Statement II is incorrect.
(d) Statement I is incorrect but Statement II is correct.

56. The compound that will undergo S_N1 reaction with the fastest rate is

(a) 

(b) 

(c) 

(d) 

57. Which one of the following alcohols reacts instantaneously with Lucas reagent?

(a) $CH_3 - CH_2 - CH_2 - CH_2OH$
(b) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - OH$

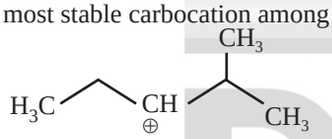
(c) $CH_3-CH(CH_3)-CH_2OH$

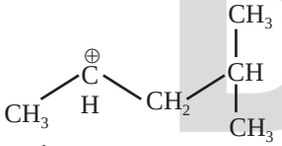
(d) $CH_3-C(CH_3)_2-OH$

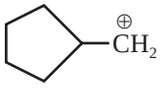
58. 1 gram of sodium hydroxide was treated with 25 mL of 0.75 M HCl solution, the mass of sodium hydroxide left unreacted is equal to
(a) 750 mg
(b) 250 mg
(c) Zero mg
(d) 200 mg

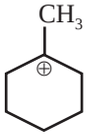
59. Arrange the following elements in increasing order of first ionization enthalpy:
Li, Be, B, C, N
Chose the correct answer from the options given below:
(a) Li < Be < B < C < N
(b) Li < B < Be < C < N
(c) Li < Be < C < B < N
(d) Li < Be < N < B < C

60. The most stable carbocation among the following is :

(a) 

(b) 

(c) 

(d) 

61. Activation energy of any chemical reaction can be calculated if one knows the value of
(a) rate constant at standard temperature
(b) probability of collision
(c) orientation of reactant molecules during collision
(d) rate constant at two different temperatures

62. Given below are two statements:
Statement I : Aniline does not undergo Friedel-Crafts alkylation reaction.
Statement II : Aniline cannot be prepared through Gabriel synthesis .
In the light of the above statements, choose the correct answer from the options given below:
(a) Both statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is correct but Statement II is false
(d) Statement I is incorrect but Statement II is true

63. Arrange the following elements in increasing order of electronegativity:
N, O, F, C, Si
Choose the correct answer from the options given below:
(a) Si < C < N < O < F
(b) Si < C < O < N < F
(c) O < F < N < C < Si
(d) F < O < N < C < Si

64. Match List I with List II.

	List I (Conversion) required)		**List II (Number of Faraday**
A.	1 mol of H_2O to O_2	I.	3F
B.	1 mol of MnO_4^- to Mn^{2+}	II.	2F
C.	1.5 mol of Ca from molten $CaCl_2$	III.	1F
D.	1 mol of FeO to Fe_2O_3	IV.	5F

Choose the correct answer from the options given below:
(a) A-II, B-IV, C-I, D-III
(b) A-III, B-IV, C-I, D-II
(c) A-II, B-III, C-I, D-IV
(d) A-III, B-IV, C-II, D-I

65. Match List I with List II.

	List I (Complex)		**List II (Type of isomerism)**
A.	$[Co(NH_3)_5(NO_2)]Cl_2$	I.	Solvate isomerism
B.	$[Co(NH_3)_5(SO_4)]Br$	II.	Linkage isomerism
C.	$[Co(NH_3)_6][Cr(CN)_6]$	III.	Ionization isomerism
D.	$[Co(H_2O)_6]Cl_3$	IV.	Coordination isomerism

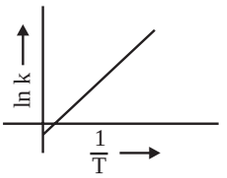
Choose the correct answer from the options given below:
(a) A-II, B-III, C-IV, D-I
(b) A-I, B-III, C-IV, D-II
(c) A-I, B-IV, C-III, D-II
(d) A-II, B-IV, C-III, D-I

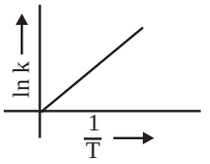
66. Match List I with List II.

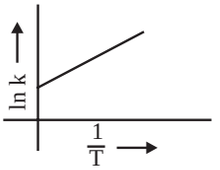
	List I (Compound)		**List II (Shape/ geometry)**
A.	NH_3	I.	Trigonal Pyramidal
B.	BrF_5	II.	Square Planar
C.	XeF_4	III.	Octahedral
D.	SF_6	IV.	Square Pyramidal

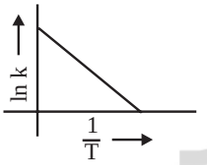
Choose the correct answer from the options given below:
(a) A-I, B-IV, C-II, D-III
(b) A-II, B-IV, C-III, D-I
(c) A-III, B-IV, C-I, D-II
(d) A-II, B-III, C-IV, D-I

67. Which plot of ln k vs $\frac{1}{T}$ is consistent with Arrhenius equation?

(a) 

(b) 

(c) 

(d) 

68. The energy of an electron in the ground state (n = 1) for He^+ ion is –x J, then that for an electron in n = 2 state for Be^{3+} ion in J is

(a) –x (b) $-\frac{x}{9}$

(c) –4x (d) $-\frac{4}{9}x$

69. In which of the following processes entropy increases?

A. A liquid evaporates to vapour.

B. Temperature of a crystalline solid lowered from 130 K to 0 K.

C. $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$

D. $Cl_2(g) \rightarrow 2Cl(g)$

Choose the correct answer from the options given below:

(a) A and C (b) A, B and D

(c) A, C and D (d) C and D

70. Which reaction is **NOT** a redox reaction?

(a) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

(b) $2KClO_3 + I_2 \rightarrow 2KIO_3 + Cl_2$

(c) $H_2 + Cl_2 \rightarrow 2HCl$

(d) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$

71. Match List I with List II

	List I (Quantum Number)		**List II (Information provided)**
A.	m_l	I.	Shape of orbital
B.	m_s	II.	Size of orbital
C.	l	III.	Orientation of orbital
D.	n	IV.	Orientation of spin of electron

Choose the correct answer from the options given below:

(a) A-I, B-III, C-II, D-IV

(b) A-III, B-IV, C-I, D-II

(c) A-III, B-IV, C-II, D-I

(d) A-II, B-I, C-IV, D-III

72. 'Spin only' magnetic moment is same for which of the following ions?

A. Ti^{3+} B. Cr^{2+}

C. Mn^{2+} D. Fe^{2+}

E. Sc^{3+}

Choose the most appropriate answer from the options given below.

(a) B and D only (b) A and E only

(c) B and C only (d) A and D only

73. The highest number of helium atoms is in

(a) 4 mol of helium

(b) 4 u of helium

(c) 4 g of helium

(d) 2.271098 L of helium at STP

74. Among Group 16 elements, which one does **NOT** show –2 oxidation state?

(a) O (b) Se

(c) Te (d) Po

75. The E° value for the Mn^{3+}/Mn^{2+} couple is more positive than that of Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+} due to change of

(a) d^5 to d^4 configuration

(b) d^5 to d^2 configuration

(c) d^4 to d^5 configuration

(d) d^3 to d^5 configuration

76. The reagents with which glucose does **NOT** react to give the corresponding tests/products are

A. Tollen's reagent

B. Schiff's reagent

C. HCN

D. NH_2OH

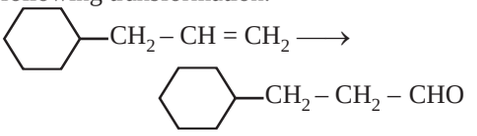
E. $NaHSO_3$

Choose the correct options from the given below:

(a) B and C (b) A and D

(c) B and E (d) E and D

77. Identify the correct reagents that would bring about the following transformation.



(a) (i) H_2O/H^+ (b) (i) BH_3

(ii) CrO_3 (ii) $H_2O_2 / \overset{\ominus}{O}H$

(iii) PCC

(c) (i) BH_3 (d) (i) H_2O/H^+

(ii) $H_2O_2 / \overset{\ominus}{O}H$ (ii) PCC

(iii) alk.$KMnO_4$

(iv) $H_3O^{\oplus}$

78. In which of the following equilibria, K_p and K_c are **NOT** equal?

(a) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(b) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(c) $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$

(d) $2BrCl(g) \rightleftharpoons Br_2(g) + Cl_2(g)$

79. A compound with a molecular formula of C_6H_{14} has two tertiary carbons. Its IUPAC name is:
(a) n-hexane
(b) 2-methylpentane
(c) 2,3-dimethylbutane
(d) 2,2-dimethylbutane

80. Fehling's solution 'A' is
(a) aqueous copper sulphate
(b) alkaline copper sulphate
(c) alkaline solution of sodium potassium tartrate (Rochelle's salt)
(d) aqueous sodium citrate

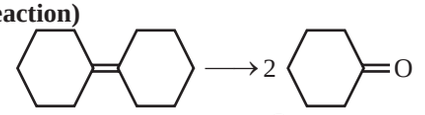
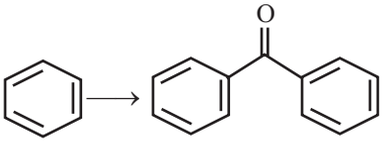
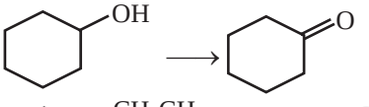
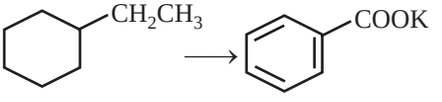
81. Match List I with List II.

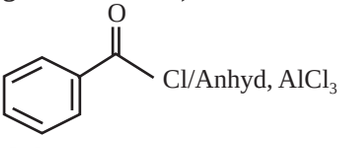
List-I (Process)		**List-II (Conditions)**
A. Isothermal process	I.	No heat exchange
B. Isochoric process	II.	Carried out at constant temperature
C. Isobaric process	III.	Carried out at constant volume
D. Adiabatic process	IV.	Carried out at constant pressure

Choose the correct answer from the options given below:
(a) A-IV, B-III, C-II, D-I
(b) A-IV, B-II, C-III, D-I
(c) A-I, B-II, C-III, D-IV
(d) A-II, B-III, C-IV, D-I

82. Given below are two statements :
Statement I: Both $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ complexes are octahedral but differ in their magnetic behaviour.
Statement II: $[Co(NH_3)_6]^{3+}$ is diamagnetic whereas $[CoF_6]^{3-}$ is paramagnetic.
In the light of the above statements, choose the correct answer from the options given below:
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

83. On heating, some solid substances change from solid to vapour state without passing through liquid state. The technique used for the purification of such solid substances based on the above principle is known as
(a) Crystallization (b) Sublimation
(c) Distillation (d) Chromatography

84. Match List I with List II.
List I
(Reaction)
A. 
B. 
C. 
D. 

List II
(Reagents/Condition)
I. 
II. CrO_3
III. $KMnO_4/KOH, \Delta$
IV. (i) O_3
(ii) Zn-H_2O

Choose the correct answer from the options given below:
(a) A-IV, B-I, C-III, D-II
(b) A-III, B-I, C-II, D-IV
(c) A-IV, B-I, C-II, D-III
(d) A-I, B-IV, C-II, D-III

85. For the reaction $2A \rightleftharpoons B + C$, $K_C = 4 \times 10^{-3}$. At a given time, the composition of reaction mixture is:
$[A] = [B] = [C] = 2 \times 10^{-3}$ M.
Then, which of the following is correct?
(a) Reaction is at equilibrium.
(b) Reaction has a tendency to go in forward direction.
(c) Reaction has a tendency to go in backward direction.
(d) Reaction has gone to completion in forward direction.

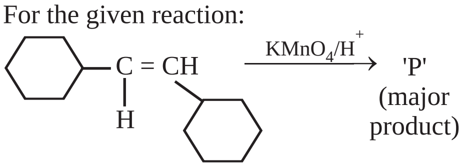
Section-B

86. The pair of lanthanoid ions which are diamagnetic is
(a) Ce^{4+} and Yb^{2+} (b) Ce^{3+} and Eu^{2+}
(c) Gd^{3+} and Eu^{3+} (d) Pm^{3+} and Sm^{3+}

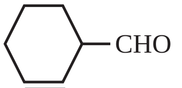
87. Given below are two statements :
Statement I : $[Co(NH_3)_6]^{3+}$ is a homoleptic complex whereas $[Co(NH_3)_4Cl_2]^{+}$ is a heteroleptic complex.
Statement II : Complex $[Co(NH_3)_6]^{3+}$ has only one kind of ligands but $[Co(NH_3)_4Cl_2]^{+}$ has more than one kind of ligands.
In the light of the above statements, choose the correct answer from the options given below.
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

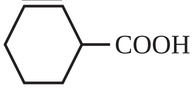
88. Mass in grams of copper deposited by passing 9.6487 A current through a voltmeter containing copper sulphate solution for 100 seconds is (Given : Molar mass of Cu : 63 g mol^{-1}, 1 F = 96487 C)
(a) 3.15 g (b) 0.315 g
(c) 31.5 g (d) 0.0315 g

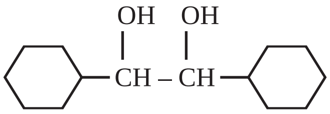
89. For the given reaction:

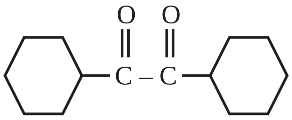


'P' is

(a) 

(b) 

(c) 

(d) 

90. The products A and B obtained in the following reactions, respectively, are

$3ROH + PCl_3 \rightarrow RCl + A$

$ROH + PCl_5 \rightarrow RCl + HCl + B$

(a) $POCl_3$ and H_3PO_3 (b) $POCl_3$ and H_3PO_4

(c) H_3PO_4 and $POCl_3$ (d) H_3PO_3 and $POCl_3$

91. The rate of a reaction quadruples when temperature changes from 27°C to 57°C. Calculate the energy of activation. Given R = 8.314 J K^{-1} mol^{-1}, log4 = 0.6021

(a) 38.04 kJ/mol (b) 380.4 kJ/mol

(c) 3.80 kJ/mol (d) 3804 kJ/mol

92. During the preparation of Mohr's salt solution (Ferrous ammonium sulphate), which of the following acid is added to prevent hydrolysis of Fe^{2+} ion?

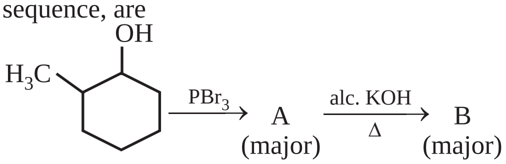
(a) dilute hydrochloric acid

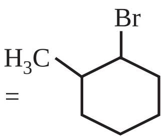
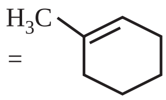
(b) concentrated sulphuric acid

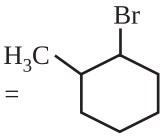
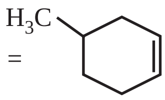
(c) dilute nitric acid

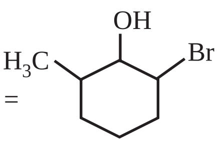
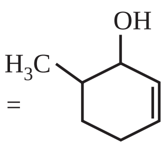
(d) dilute sulphuric acid

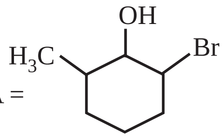
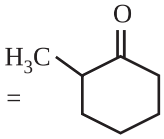
93. Major products A and B formed in the following reaction sequence, are



(a) A =  ; B = 

(b) A =  ; B = 

(c) A =  ; B = 

(d) A =  ; B = 

94. The plot of osmotic pressure (π) vs concentration (mol L^{-1}) for a solution gives a straight line with slope 25.73 L bar mol^{-1}. The temperature at which the osmotic pressure measurement is done is

(Use R = 0.083 L bar mol^{-1} K^{-1})

(a) 37°C (b) 310°C

(c) 25.73°C (d) 12.05°C

95. Identify the **correct** answer.

(a) Three resonance structures can be drawn for ozone

(b) BF_3 has non-zero dipole moment

(c) Dipole moment of NF_3 is greater than that of NH_3

(d) Three canonical forms can be drawn for CO_3^{2-} ion

96. Identify the major product C formed in the following reaction sequence:

$$CH_3 - CH_2 - CH_2 - I \xrightarrow{NaCN} A$$

$$\xrightarrow[\text{Partial hydrolysis}]{OH^-} B \xrightarrow[Br_2]{NaOH} \underset{\text{(major)}}{C}$$

(a) propylamine

(b) butylamine

(c) butanamide

(d) α–bromobutanoic acid

97. Given below are certain cations. Using inorganic qualitative analysis, arrange them in increasing group number from 0 to VI.

A. Al^{3+} B. Cu^{2+}

C. Ba^{2+} D. Co^{2+}

E. Mg^{2+}

Choose the correct answer from the options given below.

(a) B, A, D, C, E (b) B, C, A, D, E

(c) E, C, D, B, A (d) E, A, B, C, D

98. The work done during reversible isothermal expansion of one mole of hydrogen gas at 25°C from pressure of 20 atmosphere to 10 atmosphere is

(Given R = 2.0 cal K^{-1} mol^{-1})

(a) 0 calorie (b) –413.14 calories

(c) 413.14 calories (d) 100 calories

99. Consider the following reaction in a sealed vessel at equilibrium with concentrations of $N_2 = 3.0 \times 10^{-3}$ M, $O_2 = 4.2 \times 10^{-3}$ M and NO = 2.8×10^{-3} M.

$2NO(g) \rightleftharpoons N_2(g) + O_2(g)$

If 0.1 mol L^{-1} of NO(g) is taken in a closed vessel, what will be degree of dissociation (α) of NO(g) at equilibrium?

(a) 0.00889 (b) 0.0889

(c) 0.8889 (d) 0.717

100. A compound X contains 32% of A, 20% of B and remaining percentage of C. Then, the empirical formula of X is :

(Given atomic masses of A = 64; B = 40; C = 32 u)

(a) A_2BC_2 (b) ABC_3

(c) AB_2C_2 (d) ABC_4

BOTANY

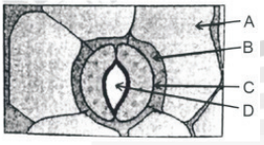
Section-A

101. Lecithin, a small molecular weight organic compound found in living tissues, is an example of:
(a) Amino acids (b) Phospholipids
(c) Glycerides (d) Carbohydrates

102. How many molecules of ATP and NADPH are required for every molecule of CO_2 fixed in the Calvin cycle?
(a) 2 molecules of ATP and 3 molecules of NADPH
(b) 2 molecules of ATP and 2 molecules of NADPH
(c) 3 molecules of ATP and 3 molecules of NADPH
(d) 3 molecules of ATP and 2 molecules of NADPH

103. Hind II always cuts DNA molecules at a particular point called recognition sequence and it consists of:
(a) 8 bp (b) 6 bp
(c) 4 bp (d) 10 bp

104. In the given figure, which component has thin outer walls and highly thickened inner walls?



(a) C (b) D
(c) A (d) B

105. The cofactor of the enzyme carboxypeptidase is:
(a) Zinc (b) Niacin
(c) Flavin (d) Haem

106. The capacity to generate a whole plant from any cell of the plant is called:
(a) Totipotency (b) Micropropagation
(c) Differentiation (d) Somatic hybridization

107. Match List I with List II

List-I	List-II
A. Rhizopus	I. Mushroom
B. Ustilago	II. Smut fungus
C. Puccinia	III. Bread mould
D. Agaricus	IV. Rust fungus

Choose the correct answer from the options given below:
(a) A-III, B-II, C-IV, D-I
(b) A-I, B-III, C-II, D-IV
(c) A-III, B-II, C-I, D-IV
(d) A-IV, B-III, C-II, D-I

108. Given below are two statements:
Statement I : Bt toxins are insect group specific and coded by a gene cry IAc.
Statement II : Bt toxin exists as inactive protoxin in B. thuringiensis. However, after ingestion by the insect the inactive protoxin gets converted into active form due to acidic pH of the insect gut.
In the light of the above statements, choose the correct answer from the options given below:
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

109. Which of the following is an example of actinomorphic flower?
(a) Datura (b) Cassia
(c) Pisum (d) Sesbania

110. The type of conservation in which the threatened species are taken out from their natural habitat and placed in special setting where they can be protected and given special care is called;
(a) *in-situ* conservation
(b) Biodiversity conservation
(c) Semi-conservative method
(d) Sustainable development

111. Identify the set of correct statement:
A. The flowers of Vallisneria are colourful and produce nectar.
B. The flowers of waterlily are not pollinated by water.
C. In most of water-pollinated species, the pollen grains are protected from wetting.
D. Pollen grains of some hydrophytes are long and ribbon like.
E. In some hydrophytes, the pollen grains are carried passively inside water.
Choose the correct answer from the options given below.
(a) C, D and E only
(b) A, B, C and D only
(c) A, C, D and E only
(d) B, C, D and E only

112. The lactose present in the growth medium of bacteria is transported to the cell by the action of
(a) Beta-galactosidase (b) Acetylase
(c) Permease (d) Polymerase

113. Match List I with List II

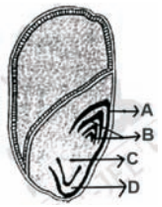
List I	List II
A. Clostridium butylicum	I. Ethanol
B. Saccharomyces cerevisiae	II. Streptokinase
C. Trichoderma polysporum	III. Butyric acid
D. Streptococcus sp.	IV. Cyclosporin-A

Choose the correct answer from the options given below:
(a) A-III, B-I, C-II, D-IV
(b) A-II, B-IV, C-III, D-I
(c) A-III, B-I, C-IV, D-II
(d) A-IV, B-I, C-III, D-II

114. The equation of Verhulst-Pearl logistic growth is $\frac{dN}{dt} = rN\left[\frac{K - N}{K}\right]$.
From this equation, K indicates:
(a) Intrinsic rate of natural increase
(b) Biotic potential
(c) Carrying capacity
(d) Population density

115. Auxin is used by gardeners to prepare weed-free lawns. But no damage is caused to grass as auxin
(a) promotes apical dominance.
(b) promotes abscission of mature leaves only.
(c) does not affect mature monocotyledonous plants.
(d) can help in cell division in grasses, to produce growth.

116. Identify the part of the seed from the given figure which is destined to form root when the seed germinates.



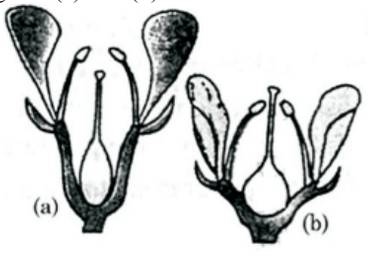
(a) A (b) B
(c) C (d) D

117. Given below are two statements:
Statement I : Parenchyma is living but collenchyma is dead tissue.
Statement II : Gymnosperms lack xylem vessels but presence of xylem vessels is the characteristic of angiosperms.
In the light of the above statements, choose the correct answer from the options given below:
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

118. These are regarded as major causes of biodiversity loss:
A. Over exploitation
B. Co-extinction
C. Mutation
D. Habitat loss and fragmentation
E. Migration
Choose the correct option:
(a) A, C and D only (b) A, B, C and D only
(c) A, B and E only (d) A, B and D only

119. Which one of the following is not a criterion for classification of fungi?
(a) Morphology of mycelium
(b) Mode of nutrition
(c) Mode of spore formation
(d) Fruiting body

120. Identify the type of flowers based on the position of calyx, corolla and androecium with respect to the ovary from the given figures (a) and (b)



(a) (a) Epigynous; (b) Hypogynous
(b) (a) Hypogynous; (b) Epigynous
(c) (a) Perigynous; (b) Epigynous
(d) (a) Perigynous; (b) Perigynous

121. List of endangered species was released by-
(a) GEAC (b) WWF
(c) FOAM (d) IUCN

122. What is the fate of a piece of DNA carrying only gene of interest which is transferred into an alien organism?
A. The piece of DNA would be able to multiply itself independently in the progeny cells of the organism.
B. It may get integrated into the genome of the recipient.
C. It may multiply and be inherited along with the host DNA.
D. The alien piece of DNA is not an integral part of chromosome.
E. It shows ability to replicate.
Choose the correct answer from the options given below:
(a) A and B only (b) D and E only
(c) B and C only (d) A and E only

123. Which one of the following can be explained on the basis of Mendel's Law of Dominance?
A. Out of one pair of factors one is dominant and the other is recessive.
B. Alleles do not show any expression and both the characters appear as such in F_2 generation.
C. Factors occur in pairs in normal diploid plants.
D. The discrete unit controlling a particular character is called factor.
E. The expression of only one of the parental characters is found in a monohybrid cross.
Choose the correct answer from the options given below:
(a) A, B and C only
(b) A, C, D and E only
(c) B, C and D only
(d) A, B, C, D and E

124. Inhibition of Succinic dehydrogenase enzyme by malonate is a classical example of:
(a) Cofactor inhibition
(b) Feedback inhibition
(c) Competitive inhibition
(d) Enzyme activation

125. Formation of interfascicular cambium from fully developed parenchyma cells is an example for
(a) Differentiation (b) Redifferentiation
(c) Dedifferentiation (d) Maturation

126. Spindle fibers attach to kinetochores of chromosomes during
(a) Prophase (b) Metaphase
(c) Anaphase (d) Telophase

127. Tropical regions show greatest level of species richness because
A. Tropical latitudes have remained relatively undisturbed for millions of years, hence more time was available for species diversification.
B. Tropical environments are more seasonal.

C. More solar energy is available in tropics.
D. Constant environments promote niche specialization.
E. Tropical environments are constant and predictable.
Choose the correct answer from the options given below.
(a) A, C, D and E only (b) A and B only
(c) A, B and E only (d) A, B and D only

128. Given below are two statements:
Statement I : Chromosomes become gradually visible under light microscope during leptotene stage.
Statement II : The beginning of diplotene stage is recognized by dissolution of synaptonemal complex.
In the light of the above statements, choose the correct answer from the options given below:
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

129. Match List I with List II

List-I	**List-II**
A. Nucleolus	I. Site of formation of glycolipid
B. Centriole	II. Organization like the cartwheel
C. Leucoplasts	III. Site for active ribosomal RNA synthesis
D. Golgi apparatus	IV. For storing nutrients

Choose the correct answer from the options given below:
(a) A-III, B-II, C-IV, D-I
(b) A-II, B-III, C-I, D-IV
(c) A-III, B-IV, C-II, D-I
(d) A-I, B-II, C-III, D-IV

130. Bulliform cells are responsible for
(a) Inward curling of leaves in monocots.
(b) Protecting the plant from salt stress.
(c) Increased photosynthesis in monocots.
(d) Providing large spaces for storage of sugars.

131. A pink flowered Snapdragon plant was crossed with a red flowered Snapdragon plant. What type of phenotype/s is/are expected in the progeny?
(a) Only red flowered plants
(b) Red flowered as well as pink flowered plants
(c) Only pink flowered plants
(d) Red, Pink as well as white flowered plants

132. A transcription unit in DNA is defined primarily by the three regions in DNA and these are with respect to upstream and down stream end;
(a) Repressor, Operator gene, Structural gene
(b) Structural gene, Transposons, Operator gene
(c) Inducer, Repressor, Structural gene
(d) Promotor, Structural gene, Terminator

133. In a plant, black seed color (BB/Bb) is dominant over white seed color (bb). In order to find out the genotype of the black seed plant, with which of the following genotype will be cross it?
(a) BB (b) bb
(c) Bb (d) BB/Bb

134. Which of the following are required for the dark reaction of photosynthesis?
A. Light
B. Chlorophyll
C. CO_2
D. ATP
E. NADPH
Choose the correct answer from the options given below:
(a) A, B and C only (b) B, C and D only
(c) C, D and E only (d) D and E only

135. Match List I with List II

List I	**List II**
A. Two or more alternative forms of a gene	I. Back cross
B. Cross of F_1 progeny with homozygous recessive parent	II. Ploidy
C. Cross of F_1 progeny with any of the parents	III. Allele
D. Number of chromosome sets in plant	IV. Test cross

Choose the correct answer from the options given below:
(a) A-I, B-II, C-III, D-IV
(b) A-II, B-I, C-III, D-IV
(c) A-III, B-IV, C-I, D-II
(d) A-IV, B-III, C-II, D-I

Section-B

136. The DNA present in chloroplast is:
(a) Linear, double stranded
(b) Circular, double stranded
(c) Linear, single stranded
(d) Circular, single stranded

137. Match List I with List II

List I	**List II**
A. Robert May	I. Species-Area relationship
B. Alexander von Humboldt	II. Long term ecosystem experiment using out door plots
C. Paul Ehrlich	III. Global species diversity at about 7 million
D. David Tilman	IV. Rivet popper hypothesis

Choose the correct answer from the options given below:
(a) A-II, B-III, C-I, D-IV
(b) A-III, B-I, C-IV, D-II
(c) A-I, B-III, C-II, D-IV
(d) A-III, B-IV, C-II, D-I

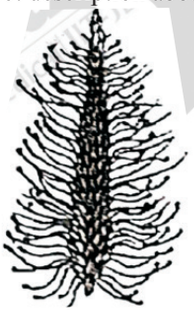
138. Match List I with List II

	List I		List II
A.	Rose	I.	Twisted aestivation
B.	Pea	II.	Perigynous flower
C.	Cotton	III.	Drupe
D.	Mango	IV.	Marginal placentation

Choose the correct answer from the options given below:
(a) A-II, B-IV, C-I, D-III
(b) A-I, B-II, C-III, D-IV
(c) A-IV, B-III, C-II, D-I
(d) A-II, B-III, C-IV, D-I

139. Which of the following statement is correct regarding the process of replication in E.coli?
(a) The DNA dependent DNA polymerase catalyses polymerization in one direction that is 3' → 5'
(b) The DNA dependent RNA polymerase catalyses polymerization in one direction, that is 5' → 3'
(c) The DNA dependent DNA polymerase catalyses polymerization in 5' → 3' as well as 3' → 5' direction
(d) The DNA dependent DNA polymerase catalyses polymerization in 5' → 3' direction

140. Identify the correct description about the given figure:



(a) Wind pollinated plant inflorescence showing flowers with well exposed stamens.
(b) Water pollinated flowers showing stamens with mucilaginous covering.
(c) Cleistogamous flowers showing autogamy.
(d) Compact inflorescence showing complete autogamy

141. Match List I with List II

	List I		List II
A.	Citric acid cycle	I.	Cytoplasm
B.	Glycolysis	II.	Mitochondrial matrix
C.	Electron transport system	III.	Intermembrane space of mitochondria
D.	Proton gradient	IV.	Inner mitochondrial membrane

Choose the correct answer from the options given below:
(a) A-I, B-II, C-III, D-IV
(b) A-II, B-I, C-IV, D-III
(c) A-III, B-IV, C-I, D-II
(d) A-IV, B-III, C-II, D-I

142. Read the following statements and choose the set of correct statements:
In the members of Phaeophyceae,
A. Asexual reproduction occurs usually by biflagellate zoospores.
B. Sexual reproduction is by oogamous method only.
C. Stored food is in the form of carbohydrates which is either mannitol or laminarin.
D. The major pigments found are chlorophyll a, c and carotenoids and xanthophyll.
E. Vegetative cells have a cellulosic wall, usually covered on the outside by gelatinous coating of algin.
Choose the correct answer from the options given below:
(a) A, B, C and D only (b) B, C, D and E only
(c) A, C, D and E only (d) A, B, C and E only

143. In an ecosystem if the Net Primary Productivity (NPP) of first trophic level is 100x (kcal m^{-2}) yr^{-1}, what would be the GPP (Gross Primary Productivity) of the third trophic level of the same ecosystem?
(a) $\frac{x}{10}\left(\text{kcal m}^{-2}\right)\text{yr}^{-1}$
(b) x(kcal m^{-2})yr^{-1}
(c) 10x(kcal m^{-2})yr^{-1}
(d) $\frac{100x}{3x}\left(\text{kcal m}^{-2}\right)\text{yr}^{-1}$

144. Match List-I with List-II

	List-I		List-II
A.	GLUT-4	I.	Hormone
B.	Insulin	II.	Enzyme
C.	Trypsin	III.	Intercellular ground substance
D.	Collagen	IV.	Enables glucose transport into cells

Choose the correct answer from the options given below.
(a) A-IV, B-I, C-II, D-III
(b) A-I, B-II, C-III, D-IV
(c) A-II, B-III, C-IV, D-I
(d) A-III, B-IV, C-I, D-II

145. Identify the step in tricarboxylic acid cycle, which does not involve oxidation of substrate.
(a) Malic acid → Oxaloacetic acid
(b) Succinic acid → Malic acid
(c) Succinyl-CoA → Succinic acid
(d) Isocitrate → α-ketoglutaric acid

146. Given below are two statements:
Statement I: In C_3 plants, some O_2 binds to RuBisCO, hence CO_2 fixation is decreased.
Statement II: In C_4 plants, mesophyll cells show very little photorespiration while bundle sheath cells do not show photorespiration.

In the light of the above statements, choose the correct answer from the options given below:
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

147. Match List I with List II

List I (Types of Stamens)	**List II (Example)**
A. Monoadelphous	I. Citrus
B. Diadelphous	II. Pea
C. Polyadelphous	III. Lily
D. Epiphyllous	IV. China-rose

Choose the correct answer from the options given below:
(a) A-IV, B-II, C-I, D-III
(b) A-IV, B-I, C-II, D-III
(c) A-I, B-II, C-IV, D-III
(d) A-III, B-I, C-IV, D-II

148. Match List I with List II

List I	**List II**
A. Frederick Griffith	I. Genetic code
B. Francois Jacob mode of DNA	II. Semi-conservative & Jacque replication
C. Har Gobind Khorana	III. Transformation
D. Meselson & Stahl	IV. Lac operon

Choose the correct answer from the options given below:
(a) A-III, B-II, C-I, D-IV
(b) A-III, B-IV, C-I, D-II
(c) A-II, B-III, C-IV, D-I
(d) A-IV, B-I, C-II, D-III

149. Which of the following are fused in somatic hybridization involving two varieties of plants?
(a) Callus (b) Somatic embryos
(c) Protoplasts (d) Pollens

150. Spraying sugarcane crop with which of the following plant growth regulators, increases the length of stem, thus, increasing the yield?
(a) Auxin (b) Gibberellin
(c) Cytokinin (d) Abscisic acid

ZOOLOGY

Section-A

151. Following are the stages of pathway for conduction of an action potential through the heart
A. AV bundle B. Purkinje fibres
C. AV node D. Bundle branches
E. SA node
Choose the correct sequence of pathway from the options given below
(a) E-C-A-D-B (b) A-E-C-B-D
(c) B-D-E-C-A (d) E-A-D-B-C

152. In both sexes of cockroach, a pair of jointed filamentous structures called anal cerci are present on
(a) 5^{th} segment (b) 10^{th} segment
(c) 8^{th} and 9^{th} segment (d) 11^{th} segment

153. The flippers of the Penguins and Dolphins are the example of the
(a) Adaptive radiation
(b) Natural selection
(c) Convergent evolution
(d) Divergent evolution

154. Which of the following is not a component of Fallopian tube?
(a) Uterine fundus (b) Isthmus
(c) Infundibulum (d) Ampulla

155. Given below are some stages of human evolution.
Arrange them in correct sequence. (Past to Recent)
A. Homo habilis
B. Homo sapiens
C. Homo neanderthalensis
D. Homo erectus
Choose the correct sequence of human evolution from the options given below:
(a) D-A-C-B (b) B-A-D-C
(c) C-B-D-A (d) A-D-C-B

156. Which of the following is not a steroid hormone?
(a) Cortisol (b) Testosterone
(c) Progesterone (d) Glucagon

157. Match List I with List II :

List I	**List II**
A. α –I antitrypsin	I. Cotton bollworm
B. Cry IAb	II. ADA deficiency
C. Cry IAc	III. Emphysema
D Enzyme replacement therapy	IV Corn borer

Choose the correct answer form the options given below:
(a) A-II, B-I, C-IV, D-III
(b) A-III, B-I, C-II, D-IV
(c) A-III, B-IV, C-I, D-II
(d) A-II, B-IV, C-I, D-III

158. Following are the stages of cell division :
A. Gap 2 phase B. Cytokinesis
C. Synthesis phase D. Karyokinesis
E. Gap 1 phase
Choose the correct sequence of stages from the options given below :
(a) C-E-D-A-B (b) E-B-D-A-C
(c) B-D-E-A-C (d) E-C-A-D-B

159. Which one of the following factors will not affect the Hardy-Weinberg equilibrium?
(a) Genetic recombination
(b) Genetic drift
(c) Gene migration
(d) Constant gene pool

160. Which of the following are Autoimmune disorders?

A. Myasthenia gravis B. Rheumatoid arthritis
C. Gout D. Muscular dystrophy
E. Systemic Lupus Erythematosus (SLE)

Choose the most appropriate answer from the options given below:

(a) A, B & D only (b) B & E only
(c) B, C & E only (d) C, D & E only

161. Match List I with List II :

	List I		List II
A.	Typhoid	I.	Fungus
B.	Leishmaniasis	II.	Nematode
C.	Ringworm	III.	Protozoa
D.	Filariasis	IV.	Bacteria

Choose the correct answer from the options given below:

(a) A-I, B-III, C-II, D-IV
(b) A-IV, B-III, C-I, D-II
(c) A-III, B-I, C-IV, D-II
(d) A-II, B-IV, C-III, D-I

162. Match List I with List II

	List I		List II
A.	Expiratory capacity	I.	Expiratory reserve volume + Tidal volume + Inspiratory reserve volume
B.	Functional residual capacity	II.	Tidal volume +Expiratory reserve volume
C.	Vital capacity	III.	Tidal volume + Inspiratory reserve volume
D.	Inspiratory capacity	IV.	Expiratory reserve volume + Residual volume

Choose the correct answer from the options given below:

(a) A-II, B-IV, C-I, D-III
(b) A-III, B-II, C-IV, D-I
(c) A-II, B-I, C-IV, D-III
(d) A-I, B-III, C-II, D-IV

163. Match List I with List II

	List I		List II
A.	Down's syndrome	I.	11^{th} chormosome
B.	α-Thalassemia	II.	'X' chromosome
C.	β-Thalassemia	III.	21^{st} chromosome
D.	Klinefelter's syndrome	IV.	16^{th} chromosome

Choose the correct answer from the options given below:

(a) A-I, B-II, C-III, D-IV
(b) A-II, B-III, C-IV, D-I
(c) A-III, B-IV, C-I, D-II
(d) A-IV, B-I, C-II, D-III

164. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : FSH acts upon ovarian follicles in female and Leydig cells in male.

Reason R : Growing ovarian follicles secrete estrogen in female while interstitial cells secrete androgen in male human being.

In the light of the above statements, choose the correct answer from the options given below :

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

165. Match List I with List II :

	List I		List II
A.	Pleurobrachia	I.	Mollusca
B.	Radula	II.	Ctenophora
C.	Stomochord	III.	Osteichthyes
D.	Air bladder	IV.	Hemichordata

Choose the correct answer from the options given below

(a) A-IV, B-II, C-III, D-I
(b) A-II, B-I, C-IV, D-III
(c) A-II, B-IV, C-I, D-III
(d) A-IV, B-III, C-II, D-I

166. Match List I with List II

	List I (Sub Phases of Prophase I)		List II (Specific characters)
A.	Diakinesis	I.	Synaptonemal complex formation
B.	Pachytene	II.	Completion of terminalisation of chiasmata
C.	Zygotene	III.	Chromosomes look like thin threads
D.	Leptotene	IV.	Appearance of recombination nodules

Choose the correct answer from the options given below

(a) A-IV, B-II, C-III, D-I
(b) A-I, B-II, C-IV, D-III
(c) A-II, B-IV, C-I, D-III
(d) A-IV, B-III, C-II, D-I

167. The "Ti plasmid" of Agrobacterium tumefaciens stands for

(a) Tumour inhibiting plasmid
(b) Tumor independent plasmid
(c) Tumor inducing plasmid
(d) Temperature independent plasmid

168. Match List I with List II :

	List I		List II
A.	Cocaine	I.	Effective sedative in surgery
B.	Heroin	II.	Connabis sativa
C.	Morphine	III.	Erythroxylum
D.	Marijuana	IV.	Papaver somniferum

Choose the correct answer from the options given below:

(a) A-IV, B-III, C-I, D-II
(b) A-I, B-III, C-II, D-IV
(c) A-II, B-I, C-III, D-IV
(d) A-III, B-IV, C-I, D-II

169. Which one is the correct product of DNA dependent RNA polymerase to the given template?
3'TACATGGCAAATATCCATTCA5'
(a) 5'AUGUACCGUUUAUAGGUAAGU3'
(b) 5'AUGUAAAGUUUAUAGGUAAGU3'
(c) 5'AUGUACCGUUUAUAGGGAAGU3'
(d) 5'ATGTACCGTTTATAGGTAAGT3'

170. Match List I with List II :

	List-I		**List-II**
A.	Pons	I.	Provides additional space for Neurons, regulates posture and balance.
B.	Hypothalamus	II.	Controls respiration and gastric secretions.
C.	Medulla	III.	Connects different regions of the brain.
D.	Cerebellum	IV	Neurosecretory cells

Choose the correct answer from the options given below:
(a) A-II, B-III, C-I, D-IV
(b) A-III, B-IV, C-II, D-I
(c) A-I, B-III, C-II, D-IV
(d) A-II, B-I, C-III, D-IV

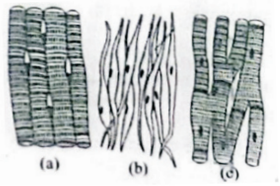
171. Match List I with List II :

	List-I		**List-II**
A.	Lipase	I.	Peptide bond
B.	Nuclease	II.	Ester bond
C.	Protease	III.	Glycosidic bond
D.	Amylase	IV	Phosphodiester bond

Choose the correct answer from the options given below:
(a) A-IV, B-II, C-III, D-I
(b) A-III, B-II, C-I, D-IV
(c) A-II, B-IV, C-I, D-III
(d) A-IV, B-I, C-III, D-II

172. Which of the following is not a natural/traditional contraceptive method?
(a) Coitus interruptus
(b) Periodic abstinence
(c) Lactational amenorrhea
(d) Vaults

173. Three types of muscles are given as a, b and c. Identify the correct matching pair along with their location in human body:



Name of muscle/location
(a) (a) Smooth - Toes
(b) Skeletal – Legs
(c) Cardiac – Heart
(b) (a) Skeletal - Triceps
(b) Smooth – Stomach
(c) Cardiac – Heart
(c) (a) Skeletal - Biceps
(b) Involuntary – Intestine
(c) Smooth – Heart
(d) (a) Involuntary – Nose tip
(b) Skeletal – Bone
(c) Cardiac – Heart

174. Which of the following statements is incorrect?
(a) A bio-reactor provides optimal growth conditions for achieving the desired product
(b) Most commonly used bio-reactors are of stirring type
(c) Bio-reactors are used to produce small scale bacterial cultures
(d) Bio-reactors have an agitator system, an oxygen delivery system foam control system

175. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:
Assertion A : Breast-feeding during initial period of infant growth is recommended by doctors for bringing a healthy baby.
Reason R : Colostrum contains several antibodies absolutely essential to develop resistance for the new born baby.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both A and R are correct and R is the correct explanation of A
(b) Both A and R are correct but R is NOT the correct explanation of A
(c) A is correct but R is not correct
(d) A is not correct but R is correct

176. Which of the following factors are favourable for the formation of oxyhaemoglobin in alveoli?
(a) High pO_2 and High pCO_2
(b) High pO_2 and Lesser H^+ concentration
(c) Low pCO_2 and High H^+ concentration
(d) Low pCO_2 and High temperature

177. Match List I with List II :

	List I		**List II**
A.	Common cold	I.	Plasmodium
B.	Haemozoin	II.	Typhoid
C.	Widal test	III.	Rhinoviruses
D.	Allergy	IV.	Dust mites

Choose the correct answer from the options given below:
(a) A-II, B-IV, C-III, D-I
(b) A-I, B-III, C-II, D-IV
(c) A-III, B-I, C-II, D-IV
(d) A-IV, B-II, C-III, D-I

178. Consider the following statements :
A. Annelids are true coelomates
B. Poriferans are pseudocoelomates
C. Aschelminthes are acoelomates
D. Platyhelminthes are pseudocoelomates
Choose the correct answer from the options given below:
(a) B only (b) A only
(c) C only (d) D only

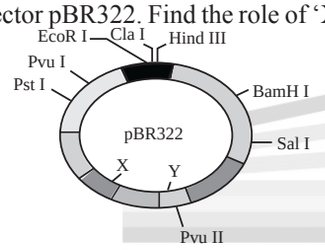
179. Match List I with List II

	List I		**List -II**
A.	Non-medicated IUD	I.	Multiload 375
B.	Copper releasing IUD	II.	Progestogens
C.	Hormone releasing IUD	III.	Lipper loop
D.	Implants	V.	LNG-20

Choose the correct answer from the option given below:
(a) A-III, B-I, C-II, D-IV
(b) A-I, B-III, C-IV, D-II
(c) A-IV, B-I, C-II, D-III
(d) A-III, B-I, C-IV, D-II

180. Given below are two statements :
Statement I : In the nephron, the descending limb of loop of Henle is impermeable to water and permeable to electrolytes.
Statement II : The proximal convoluted tubule is lined by simple columnar brush border epithelium and increases the surface area for reabsorption.
In the light of the above statements, choose the correct answer from the option given below :
(a) Both statement I and Statement II are true
(b) Both statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

181. The following diagram shown restriction sites in E. coli cloning vector pBR322. Find the role of 'X' and 'Y' gens:



(a) The gene 'X' is responsible for resistance to antibiotics and 'Y' for protein involved in the replication of Plasmid.
(b) The gene 'X' is responsible for controlling the copy number of the linked DNA and 'Y' for protein involved in the replication of Plasmid.
(c) The gene 'X' is for protein involved in replication of Plasmid and 'Y' for resistance to antibiotics.
(d) Gene 'X' is responsible for recognitions sites and 'Y' is responsible for antibiotic resistance

182. Match List I with List II :

	List I		List II
A.	Axoneme	I.	Centriole
B.	Cartwheel pattern	II.	Cilia and flagella
C.	Crista	III.	Chromosome
D.	Satellite	IV.	Mitochondria

Choose the correct answer from the options given below:
(a) A-IV, B-III, C-II, D-I
(b) A-IV, B-II, C-III, D-I
(c) A-II, B-IV, C-I, D-III
(d) A-II, B-I, C-IV, D-III

183. Match List I with List II :

	List I		List II
A.	Pterophyllum	I.	Hag fish
B.	Myxine	II.	Saw fish
C.	Pristis	III.	Angel fish
D.	Exocoetus	IV.	Flying fish

Choose the correct answer from the options given below:
(a) A-II, B-I, C-IIII, D-IV
(b) A-III, B-I, C-II, D-IV
(c) A-IV, B-I, C-II, D-III
(d) A-III, B-II, C-I, D-IV

184. Match List I with List II :

	List I		List II
A.	Fibrous joints	I.	Adjacent vertebrae, limited movement
B.	Cartilaginous joints	II.	Humerus and Pectoral girdle, rotational movement
C.	Hinge joints	III.	Skull, don't allow any movement
D.	Ball and socket joints	IV.	Knee, help in locomotion

Choose the correct answer from the options given below:
(a) A-IV, B-II, C-III, D-I
(b) A-I, B-III, C-II, D-IV
(c) A-II, B-III, C-I, D-IV
(d) A-III, B-I, C-IV, D-II

185. Given below are two statements:
Statement I: The presence or absence of hymen is not a reliable indicator of virginity.
Statement II: The hymen is torn during the first coitus only.
In the light of the above above statements, choose the correct answer from the options given below :
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

Section-B

186. Given below are two statements:
Statement I: Gause's competitive exclusion principle states that two closely related species competing for different resources cannot exist indefinitely.
Statement II: According to Gause's principle, during competition, the inferior will be eliminated. This may be true if resources are limiting.
In the light of the above statements, choose the correct answer from the options given below :
(a) Both Statement I and Statement II are true.
(b) Both Statement I and Statement II are false.
(c) Statement I is true but Statement II is false.
(d) Statement I is false but Statement II is true.

187. Match List I with List II related to digestive system of cockroach.

	List-I		List-II
A.	The structures used for storing of food.	I.	Gizzard
B.	Ring of 6-8 blind tubules at junction of foregut and midgut.	II.	Gastric Caeca
C.	Ring of 100-150 yellow coloured thin filaments at junction of midgut and hindgut.	III.	Malpighian tubules

D. The structures used for grinding the food. IV. Crop

Choose the correct answer from the options given below:
(a) A-IV, B-II, C-III, D-I
(b) A-I, B-II, C-III, D-IV
(c) A-IV, B-III, C-II, D-I
(d) A-III, B-II, C-IV, D-I

188. The following are the statements about non-chordates:
A. Pharynx is perforated by gill slits.
B. Notochord is absent.
C. Central nervous system is dorsal.
D. Heart is dorsal if present.
E. Post anal tail is absent.

Choose the most appropriate answer from the options given below:
(a) A & C only (b) A, B & D only
(c) B, D & E only (d) B, C & D only

189. Choose the correct statement given below regarding juxta medullary nephron.
(a) Juxta medullary nephrons are located in the columns of Bertini.
(b) Renal corpuscle of juxta medullary nephron lies in the outer portion of the renal medulla.
(c) Loop of Henle of juxta medullary nephron runs deep into medulla.
(d) Juxta medullary nephrons outnumber the cortical nephrons.

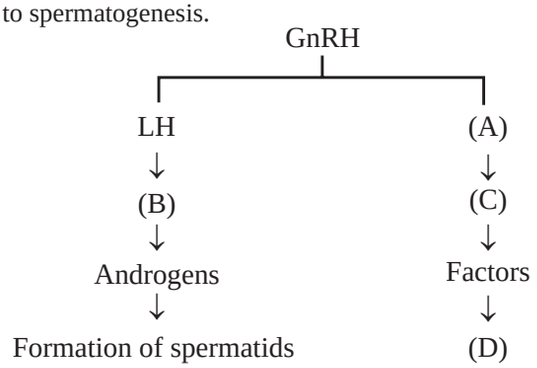
190. Given below are two statements:
Statement I: The cerebral hemispheres are connected by nerve tract known as corpus callosum.
Statement II: The brain stem consists of the medulla oblongata, pons and cerebrum.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct but Statement II is incorrect.
(d) Statement I is incorrect but Statement II is correct.

191. Given below are two statements :
Statement I : Bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.
Statement II : Both bone marrow and thymus provide micro environments for the development and maturation of T-lymphocytes.
In the light of above statements, choose the most appropriate answer from the options given below :
(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct but Statement II is incorrect.
(d) Statement I is incorrect but Statement II is correct.

192. Regarding catalytic cycle of an enzyme action, select the correct sequential steps :
A. Substrate enzyme complex formation.
B. Free enzyme ready to bind with another substrate.
C. Release of products.
D. Chemical bonds of the substrate broken.
E. Substrate binding to active site.

Choose the correct answer from the options given below:
(a) E, A, D, C, B
(b) A, E, B, D, C
(c) B, A, C, D, E
(d) E, D, C, B, A

193. Identify the correct option (A), (B), (C), (D) with respect to spermatogenesis.



(a) FSH, Leydig cells, Sertoli cells, Spermiogenesis.
(b) ICSH, Interstitial cells, Leydig cells, spermiogenesis.
(c) FSH, Sertoli cells, Leydig cells, spermatogenesis.
(d) ICSH, Leydig cells, Sertoli cells, spermatogenesis.

194. Match List I with List II:

	List I		**List II**
A.	Mesozoic Era	I.	Lower invertebrates
B.	Proterozoic Era	II.	Fish & Amphibia
C.	Cenozoic Era	III.	Birds & Reptiles
D.	Paleozoic Era	IV.	Mammals

Choose the correct answer from the options given below:
(a) A-II, B-I, C-III, D-IV
(b) A-III, B-I, C-II, D-IV
(c) A-I, B-II, C-IV, D-III
(d) A-III, B-I, C-IV, D-II

195. Match List I with List II:

	List I		**List II**
A.	Unicellular glandular epithelium	I.	Salivary glands
B.	Compound epithelium	II.	Pancreas
C.	Multicellular glandular epithelium	III.	Goblet cells of alimentary canal
D.	Endocrine glandular epithelium	IV.	Moist surface of buccal cavity

Choose the correct answer from the options given below:
(a) A-II, B-I, C-III, D-IV
(b) A-IV, B-III, C-I, D-II
(c) A-III, B-IV, C-I, D-II
(d) A-II, B-I, C-IV, D-III

196. Match List I with List II:

	List I		List II
A.	RNA polymerase III	I.	snRNPs
B.	Termination of transcription	II.	Promotor
C.	Splicing of Exons	III.	Rho factor
D.	TATA box	IV.	SnRNAs, tRNA

Choose the correct answer from the options given below:
(a) A-II, B-IV, C-I, D-III
(b) A-III, B-II, C-IV, D-I
(c) A-III, B-IV, C-I, D-II
(d) A-IV, B-III, C-I, D-II

197. As per ABO blood grouping system, the blood group of father is B^+, mother is A^+ and child is O^+. Their respective genotype can be
A. $I^Bi/I^Ai/ii$
B. $I^BI^B/I^AI^A/ii$
C. $I^AI^B/iI^A/I^Bi$
D. $I^Ai/I^Bi/I^Ai$
E. $iI^B/iI^A/I^AI^B$
Choose the most appropriate answer from the options given below :
(a) A only
(b) B only
(c) C & B only
(d) D & E only

198. Given below are two statements:
Statement I: Mitochondria and chloroplasts both double membranes bound organelles.
Statement II: Inner membrane of mitochondria is relatively less permeable, as compared chloroplast.
In the light of the above statements, choose the mis appropriate answer from the options given below
(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct but Statement Il is incorrect.
(d) Statement I is incorrect but Statement Il is correct.

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(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct but Statement Il is incorrect.
(d) Statement I is incorrect but Statement Il is correct.

200. Match List I with List II :

	List - I		List - II
A.	Exophthalmic goiter	I.	Excess secretion of cortisol, moon face & hypergylcemia.
B.	Acromegaly	II.	Hypo-secretion of thyroid hormone and stunted growth.
C.	Cushing's syndrome	III.	Hyper secretion of thyroid hormone & protruding eye balls.
D.	Cretinism	IV.	Excessive secretion of growth hormone.

Choose the correct answer from the options given below
(a) A-I, B-III, C-II, D-IV
(b) A-IV, B-II, C-I, D-III
(c) A-III, B-IV, C-II, D-I
(d) A-III, B-IV, C-I, D-II

NEET Rank Predictor 2024

Marks Scored	All India Rank	Marks Scored	All India Rank
720 – 691	1 – 15	610 – 591	4601 – 9000
690 – 671	16 – 175	590 – 571	9001 – 12000
670 – 651	176 –850	570 – 551	12001 – 18000
650 – 631	851 – 2400	550 – 531	18001 – 26000
630 – 611	2401 – 4600	530 – 500	26001 – 40000

HINTS & SOLUTIONS

PHYSICS

1. **(b)** Vernier Constant V. C. = MSD –VSD ... (i)
where MSD = Main scale division and VSD = Vernier scale division
Given : (N + 1) VSD = N MSD

$$VSD = \left(\frac{N}{N+1}\right) MSD \quad \text{... (ii)}$$

From eq. (i) and (ii)

$$V.C. = (MSD) - \frac{N}{N+1}(MSD)$$

$$= MSD\left(1 - \frac{N}{N+1}\right) = \frac{MSD}{N+1}$$

$$= \frac{0.01}{N+1} = \frac{1}{100(N+1)}$$

2. **(c)** Central bright fringe is white as at central point on screen, path difference is zero for all wavelength. Other fringes depend on wavelength as $\beta = \frac{\lambda D}{d}$ so other fringes will be coloured.

3. **(c)** As per given truth table, output is independent of input A
$\therefore$ Output Y = $\overline{B}$

4. **(c)** Current in circuit $i = \frac{E}{R+r} = \frac{10}{4+1} = 2A$

Terminal voltage V = E – iR
= 10 – 2 × 1 = 8 V

5. **(d)** Time period of oscillation, $T = 2\pi\sqrt{\frac{I}{MB}}$

$$\Rightarrow \quad \frac{1}{4} = 2\pi\sqrt{\frac{9.8\times10^{-6}}{M\times0.049}}$$

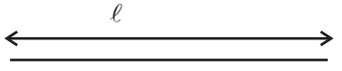
$$\Rightarrow \quad \frac{1}{16} = 4\pi^2 \times \frac{9.8\times10^{-6}}{M\times49\times10^{-3}}$$

$$\Rightarrow \quad M = \frac{4\pi^2\times9.8\times10^{-6}}{49\times10^{-3}}\times16$$

$$= \frac{4\pi^2\times9.8\times16\times10^{-3}}{49}$$

$= 12.8\pi^2 \times 10^{-3} \times 10^{-2} \times 10^2$
$= 1280\pi^2 \times 10^{-5}\ Am^2$
$\therefore$ x = 1280 π^2

6. **(b)** Resistance $R = \frac{\rho\ell}{A}$



Divided into 10 parts
$\therefore$ resistance of each part = 5Ω
Resistance in series $R_s = 5 \times 10 = 50\Omega$
Resistance in parallel, $R_p = \frac{10}{5} = 2\Omega$

$\therefore$ $R_{eq} = R_S + R_P = 52\ \Omega$

NOTES A wire of resistance R is cut into n equal part and all parts are connected in parallel then $R_{eq} = R/n^2$

7. **(c)** Force $F = (M_1 + M_2)a \Rightarrow a = \frac{F}{M_1 + M_2}$

or, $a = \frac{10}{2+3} = 2\ ms^{-2}$

$\therefore$ Force exerted by block A on block B
$F' = M_2(2) = 3 \times 2 = 6$ N

NOTES Force acting on a body depends on its current situation, not its past motion. It is not carried from earlier motion.

8. **(c)** The magnitude of magnetic field due to circular coil of N turns

$$B_C = \frac{\mu_0 iN}{2R} = \frac{4\pi\times10^{-7}\times7\times100}{2\times0.1}$$

$= 4.4 \times 10^{-3}$ T = 4.4 mT

9. **(b)** Transformer ratio,

$$\frac{N_P}{N_S} = \frac{V_P}{V_S} = \frac{1}{2}$$

$\therefore$ $V_S : V_P = 2 : 1$

NOTES When $V_S > V_P$ step-up transformer and when $V_S < V_P$ step-down transformer.

10. **(d)** de-Broglie wavelength $\lambda = \frac{h}{P} = \frac{h}{mv}$

$$= \frac{h}{\sqrt{2mE}} \text{ where } E = \frac{1}{2}mv^2$$

Squaring both sides,

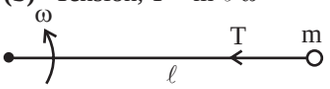
$$\lambda^2 = \frac{h^2}{4m^2E} \qquad \Rightarrow \quad \frac{1}{\lambda^2} \propto E$$

Hence $\frac{1}{\lambda^2}$ versus E graph is a straight line passes through the origin.

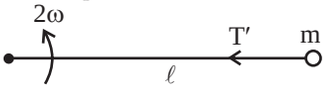
11. **(c)** Statement I is correct as atoms are electrically neutral as they contain equal number of positive and negative charges.

Statement II is incorrect as atom of most of the elements but not every atom are stable and emit characteristic spectrum. This statement is not true for every atom.

12. **(b)** Tension, $T = m\ell\omega^2$



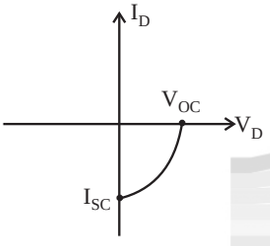
When speed becomes 2ω



Tension, $T' = m\ell(2\omega)^2$

$\therefore \quad T' = 4T$

13. **(a)** In reverse biased *pn* junction diode, the current measured in (μA), is due to minority charge carrier. Solar cell I - V characteristics is as shown in figure.



14. **(a)** Path bc is an isochoric process i.e., volume is constant i.e., $\Delta V = 0$

$\therefore$ Work done by gas along path bc,

$W_{bc} = P.\ \Delta V = 0$

NOTES In Isobaric process, pressure is kept constant, in isochoric process volume is kept constant and in adiabatic process no exchange of heat $\Delta Q = 0$

15. **(d)** For uniformly charged spherical shell,

Potential $V = \dfrac{kq}{R}$ (For $r \le R$)

$\therefore \quad V_C = V_P$

or, $\quad V_C - V_P = 0$

16. **(a)** Moment of inertia of rod = $I = \dfrac{m\ell^2}{12}$

$$\Rightarrow \quad 2400 = 400\frac{\ell^2}{12}$$

$$\Rightarrow \quad 72 = \ell^2$$

$$\therefore \quad \ell = \sqrt{72} = 8.48\ \text{cm} \simeq 8.5\ \text{cm}$$

17. **(d)** When a particle is moving with uniform speed in a circular path then direction changes continuously. Therefore particle maintains varying velocity and varying acceleration.

18. **(b)**

(A) The energy of a photon $E = h\nu$

(B) Velocity of photon is equal to velocity of light i.e. c.

(C) Since $\lambda = \dfrac{h}{p} \Rightarrow p = \dfrac{h}{\lambda} \Rightarrow p = \dfrac{h\nu}{c}$

(D) In photon-electron collision both total energy and total momentum are conserved.

19. **(a)** Given, displacement $x = 2t - 1$

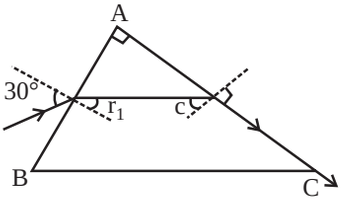
$\therefore$ velocity $v = \dfrac{dx}{dt} = 2\text{ms}^{-1}$

Therefore power $P = F.\ v = 2 \times 5 = 10$ W

20. **(b)** In prism, $r_1 + c = A$

$\Rightarrow \quad r_1 = 90° - c$ ... (i)

$$\sin c = \frac{1}{\mu} \Rightarrow \cos c = \frac{\sqrt{\mu^2 - 1}}{\mu}$$



From Snell's law, on incidence surface

$$1 \sin 30° = \mu \sin(r_1) \Rightarrow 1 \times \frac{1}{2} = \mu \times \sin(90° - c)$$

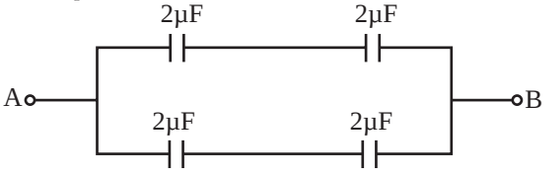
or, $\dfrac{1}{2} = \mu \times \dfrac{\sqrt{\mu^2 - 1}}{\mu}$ ... (ii)

On squaring eq. (ii)

$$\frac{1}{4} = \mu^2 - 1 \quad \Rightarrow \quad \mu^2 = \frac{5}{4} \ \therefore \ \mu = \frac{\sqrt{5}}{2}$$

NOTES The angle of deviation depends on the angle of incidence. At the minimum deviation δ_m, the refracted ray inside the prism becomes parallel to its base.

21. **(a)** Given circuit is balanced Wheatstone bridge so equivalent circuit is as shown



$\therefore$ Equivalent capacitance

$$C_{AB} = \left(\frac{1}{2} + \frac{1}{2}\right) + \left(\frac{1}{2} + \frac{1}{2}\right) = 2\mu\text{F}$$

22. **(a)** Solid angle $d\Omega = \dfrac{dA}{r^2}$ has dimensions $[M^0L^0T^0]$

Strain $= \dfrac{\Delta\ell}{\ell}$ has dimensions $[M^0L^0T^0]$

Angle measured in radians $\theta = \dfrac{\ell}{r}$ is also dimensionless $[M^0L^0T^0]$

Solid angle, strain and angle are dimensionless.

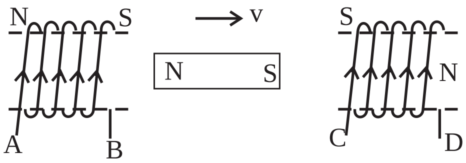
NOTES Angle, trigonometric function, $(\cos\theta, \sin\theta, \tan\theta)$ Logarithmic function (log x), exponential function (e^x), Ratio, Pure number are dimensionless.

23. **(a)** For maximum elongation,
Stress = Elastic limit
Maximum elongation

$$= \frac{\sigma_{elastic} \times L}{\text{Young's modulus}} = \frac{8 \times 10^8 \times 1}{2 \times 10^{11}} = 4 \times 10^{-3}$$

$= 4$ mm

24. **(a)** North of magnet is moving away from solenoid 1 so end B of solenoid 1 is South and as south of magnet is approaching solenoid 2 so end C of solenoid 2 is South.



Solenoid-1 Solenoid-2

25. **(d)** Acceleration due to gravity $g = \frac{GM}{R^2}$

So acceleration due to gravity on the surface of the planet $g' = \frac{GM'}{R'^2} = \frac{GM}{10\left(\frac{R}{2}\right)^2}$

or, $g' = \frac{4}{10}\frac{GM}{R^2} = 0.4 \times g = 0.4 \times 9.8$

$\therefore \quad g' = 3.92 \text{ ms}^{-2}$

26. **(b)** Energy of transition, $\Delta E = \frac{hc}{\lambda}$

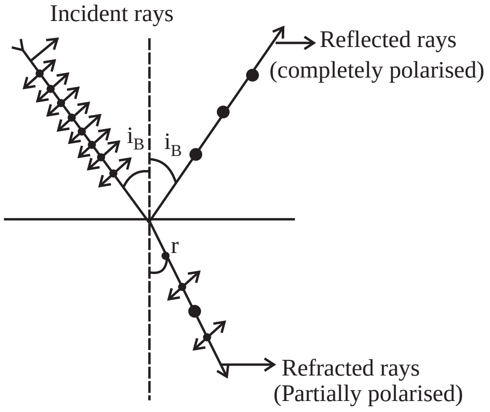
$\therefore \quad \lambda \propto \frac{1}{\Delta E}$

As, $(\Delta E)_{6-2} > (\Delta E)_{5-2} > (\Delta E)_{4-2} > (\Delta E)_{3-2}$

$\Rightarrow \quad \lambda_{6-2} < \lambda_{5-2} < \lambda_{4-2} < \lambda_{3-2}$

A – III, B – IV, C – II, D – I

27. **(d)**



According to Brewster's law when an unpolarised light beam strikes a glass at Brewster's angle, then reflected rays are completely polarized and refracted rays are partially polarized.

NOTES When an unpolarised light beam is incident at angle of incidence equal to Brewster's angle, then the angle between reflected and refracted ray will be 90°.

28. **(a)** The susceptibility of different magnetic materials are given below

Material	**Susceptibility**
Diamagnetic	(II) $0 > \chi \geq -1$
Ferromagnetic	(III) $\chi >> 1$
Paramagnetic	(IV) $0 < \chi < \varepsilon$
Non-magnetic	(I) $\chi = 0$

29. **(b)** (A) $\rightarrow v_1$ (B) rest $\Rightarrow$ (A)(B) $\rightarrow v_2$
(Before collision) (After collision)

By conservation of linear momentum,

$P_i = P_f$

$\Rightarrow \quad mv_1 = mv_2 + mv_2 \Rightarrow \quad mv_1 = 2mv_2$

$\therefore \quad \frac{v_1}{v_2} = \frac{2}{1}$

30. **(d)** ${}^{290}_{82}X \xrightarrow{\alpha} {}^{286}_{80}Y \xrightarrow{e^+} {}^{286}_{79}Z \xrightarrow{\beta^-}$

${}^{286}_{80}P \longrightarrow {}^{286}_{81}Q$

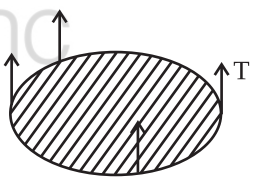
For the product Q, A $\rightarrow$ 286 and Z = 81.

31. **(b)** $x = 5\sin\left(\pi t + \frac{\pi}{3}\right)$ m

Amplitude, A = 5m

Time period, $T = \frac{2\pi}{\omega} = \frac{2\pi}{\pi} = 2s$

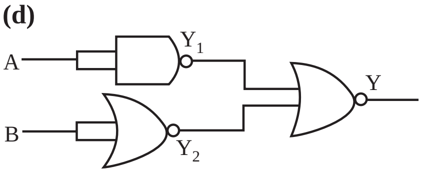
32. **(a)**



Excess force = T × length = T × 2πR

$$= \frac{7}{100} \times 2 \times 3.14 \times \frac{4.5}{100} = 19.8 \text{ mN}$$

33. **(d)**



$Y_1 = \overline{A \cdot A} = \overline{A}$

$Y_2 = \overline{B + B} = \overline{B}$

$\therefore \quad$ Output, $Y = \overline{Y_1 + Y_2} = \overline{\overline{A} + \overline{B}} = \overline{\overline{A}} \cdot \overline{\overline{B}}$

$= A \cdot B$

$\therefore \quad$ The given logic gate is similar to AND gate.

34. **(c)** The potential V at any point, at distance r from centre of dipole $= \frac{1}{4\pi\varepsilon_0}.\frac{P\cos\theta}{r^2}$

At axial point where $\theta = 0°, V = \frac{1}{4\pi\varepsilon_0}.\frac{P}{r^2}$

$= \frac{9\times10^9\times4\times10^{-6}}{2^2} = 9\times10^3\,V$

$V = -\frac{1}{4\pi\varepsilon_0}.\frac{P}{r^2} = -9\times10^3\,V$

At axial point where $\theta = 180°$,

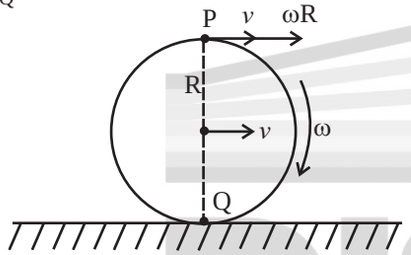
NOTES

For point charges, $V \propto \frac{1}{r}$ and for electric dipole, $V \propto \frac{1}{r^2}$

35. **(b)** In the case of pure rolling, $v = \omega R$

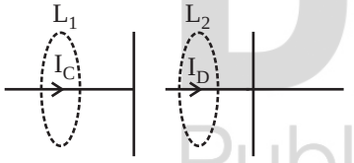
$\therefore$ $v_P = v + \omega R = 2v$

$v_Q = v - \omega R = 0$



Hence, point P moves faster than point Q.

36. **(b)**



According to modified Ampere's law,

$\oint \vec{B}.\vec{d\ell} = \mu_0(I_C + I_D)$

For Loop L_1, $I_C \neq 0$ and $I_D = 0$

$\Rightarrow \oint \vec{B}.\vec{dl} = \mu_0 I_C$ ... (i)

For Loop L_2, $I_C = 0$ and $I_D \neq 0$

$\Rightarrow \oint \vec{B}.\vec{dl} = \mu_0 I_D$ ... (ii)

From eqs (i) and (ii), we get

$I_C = I_D$

37. **(d)** The accelerating charge radiates EM waves and charge moving with uniform velocity produces steady state magnetic field.

38. **(b)** $f_0 = 140$ cm and $f_e = 5$ cm

For distant object, the magnifying power is given by

$m = \frac{f_0}{f_e} = \frac{140}{5} = 28$

39. **(b)** Rated power, $P = \frac{V^2}{R} \Rightarrow P \propto \frac{1}{R}$

$\frac{P_A}{P_B} = \frac{R_B}{R_A} \Rightarrow R_A = 2R_B$

For Series Combination,

$P_S = \frac{V^2}{R_A + R_B} = \frac{V^2}{3R_B}$

For Parallel Combination,

$P_P = \frac{V^2(R_A + R_B)}{R_A.R_B} = \frac{3V^2}{2R_B}$ $\therefore$ $\frac{P_S}{P_P} = \frac{2}{9}$

40. **(d)** Using Charle's law, $T \propto V$

$\therefore$ $T = \text{Slope} \times V$ ... (i)

From ideal gas equation,

$P^V = nRT \Rightarrow T = \left(\frac{P}{nR}\right)V$ ... (ii)

From eqs (i) and (ii), we get, slope $\propto P$

As, $(\text{slope})_1 > (\text{slope})_2 > (\text{slope})_3$

$\Rightarrow$ $P_1 > P_2 > P_3$

41. **(c)** As, acceleration = slope of v-t curve

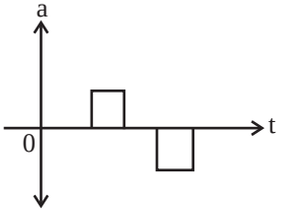
$\therefore$ Initially, a = 0

After sometime, a = constant (+ve)

Again, a = 0

Again, a = constant (–ve)

$\therefore$ The corresponding a - t graph is



NOTES

The area under velocity-time curve given displacement, not distance.

i.e. Area $= \int_{t_1}^{t_2} \vec{v}\,dt = \overrightarrow{x_2} - \overrightarrow{x_1}$ = Displacement

42. **(a)** For bridge balance,

$\frac{R_1}{R_2} = \frac{R_3}{R_4} \Rightarrow \frac{10}{15} = \frac{10}{R_4}$

$\therefore$ $R_4 = 15\Omega$

As, R_4 is a combination of 5Ω resistance and diode resistance.

$\therefore$ The diode should be in forward biased and connected in series with 5Ω resistance.

43. **(b)** Time period of simple pendulum is

$$T = 2\pi\sqrt{\frac{\ell}{g}} \Rightarrow T \propto \sqrt{\ell}$$

$$\Rightarrow \quad \frac{T_2}{T_1} = \sqrt{\frac{\ell_2}{\ell_1}} = \frac{1}{\sqrt{2}} \quad \left[\because \ell_2 = \frac{\ell_1}{2}\right]$$

$$\Rightarrow \quad T_2 = \frac{1}{\sqrt{2}} T_1 = \frac{x}{2} T_1 \,(\text{given})$$

$$\therefore \quad x = \sqrt{2}$$

NOTES The time period of simple pendulum is independent of mass of the bob.

44. **(a)** Apply energy conservation,

$U_i + K_i = U_f + K_f$

$$\Rightarrow \quad -\frac{GMm}{R} + K_i = -\frac{GMm}{3R} + \frac{1}{2} m v_0^2$$

$$\Rightarrow \quad -\frac{GMm}{R} + K_i = -\frac{GMm}{3R} + \frac{1}{2} \times m \times \frac{GM}{3R}$$

$$\left[\because v_0 = \sqrt{\frac{GM}{r}} \text{ and } r = 3R\right]$$

$$\Rightarrow \quad K_i = -\frac{1}{6}\frac{GMm}{R} + \frac{GMm}{R}$$

$\therefore$ Minimum energy required,

$$K_i = \frac{5}{6} \cdot \frac{GMm}{R}$$

45. **(b)**

A. A magnetic pole will repel or attract magnetic sheet, so force is need to hold the sheet.

B. If sheet is non-magnetic, then magnetic pole will not exert force on it.

C. If it is conducting, then there will be eddy current in sheet, which opposes the motion. So forces is needed to move sheet with uniform speed.

D. The non-conducting and non-polar sheet do not interact with magnetic poles of magnet.

46. **(b)** Capacitive Reactance, $X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C}$

$$= \frac{1}{2 \times 3.14 \times 50 \times 10 \times 10^{-6}} = \frac{1000}{3.14}$$

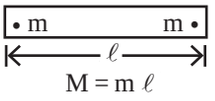
Peak current, $i_0 = \sqrt{2} i_{rms} = \sqrt{2} . \frac{V_{rms}}{X_C}$

$$= \sqrt{2} \times \frac{210}{1000} \times 3.14 = 0.932 \simeq 0.93 A$$

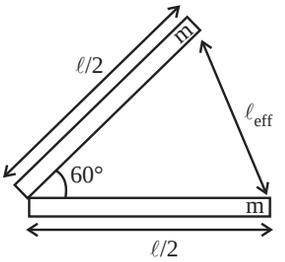
47. **(b)** The compressive force developed in the metallic bar is $F = YA\,\alpha\,\Delta T$

$= 0.5 \times 10^{11} \times 10^{-3} \times 10^{-5} \times 100 = 50 \times 10^3$ N

48. **(b)**



M = m ℓ



Effective length, $\ell_{eff} = 2\frac{\ell}{2}\sin 30° = \frac{\ell}{2}$

$\therefore$ New magnetic moment, $M' = m\,\ell_{eff} = m\,\ell/2 = M/2$

NOTES When a magnet is cut along perpendicular to its length, then its pole strength remains unchanged, whereas by cutting it along its axis, its pole strength becomes half.

49. **(b)** When the plates of a parallel plate capacitor is connected to a battery, then potential difference remains constant.

i.e., $V' = V =$ Constant

(i) $C' = \frac{\varepsilon_0 A}{d'}, C = \frac{\varepsilon_0 A}{d}$

$d' < d \Rightarrow C' > C$

Hence, final capacitance is greater than initial capacitance,

(ii) $U' = \frac{1}{2} C' V^2$ and $U = \frac{1}{2} C V^2$

$\Rightarrow \quad U' > U \qquad [\because C' > C]$

Hence, final energy is greater than initial energy

(iii) $\frac{Q'}{V'} = C'$ and $\frac{Q}{V} = C \Rightarrow \frac{Q'}{V'} \neq \frac{Q}{V}$

(iv) Product of charge and voltage

$X' = Q' V = C' V^2$ and $X = QV = CV^2$

$\Rightarrow \quad X' > X \qquad [\because C' > C]$

NOTES For an isolated parallel plate capacitor i.e. the plates of the capacitor is disconnected from a battery, charge remains constant.

50. **(b)** From principle of homogeneity

$[F] = [\alpha t^2] = [\beta t]$

$$\Rightarrow \quad [\alpha t] = \frac{[F]}{[t]} \text{ and } [\beta] = \frac{[F]}{[t]}$$

$$\therefore \quad \frac{[\alpha t]}{[\beta]} = [F^0 t^0]$$

$$\therefore \quad \frac{\alpha t}{\beta} = \text{dimensionless}$$

CHEMISTRY

51. **(c)** $CH_3–CH_3$: 1σ, $CH_2 = CH_2$: 1σ, 1π
C_2 : 2π, CH ≡ CH: 1σ, 2π.

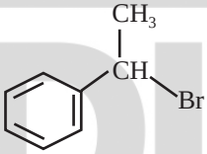
52. **(b)** According to Henry's Law: $P = K_H x$
Thus, a lower value of K_H indicates higher value of x (mole fraction/concentration) for a given pressure and therefore higher solubility.
Since, K_H: B < C < A; Solubility : B > C > A.

NOTES
The values of KH are constant at a specific temperature and are characteristics of gases.

53. **(a)** H_2O has the highest boiling point due to extensive intermolecular H-bonding and H_2Te comes next due to highest molecular mass. Thus, both, statement I and II are correct.

54. **(a)** *o*-Nitrophenol ⇒ intramolecular H-bonding.
p-Nitrophenol, *m*-nitrophenol, HF⇒ intermolecular H-bonding

55. **(a)** The boiling point of isomeric alkanes decreases with branching due to a decrease in the exposed surface area that decrease the strength of the intermolecular faces.
Thus, boiling point order for isomers of pentane is:
n-pentane > iso-pentane > neo-pentane
Thus, both statement I and II are correct.

56. **(d)** The compound  will react towards S_N1 the fastest as it will form a secondary carbocation which will also be stabilized by resonance of the aromatic ring attached to the α-carbon.

57. **(d)** Reaction of alcohols with Lucas reagent (Anhydrous $ZnCl_2$ + conc. HCl) follows S_N1 mechanism so a 3° alcohol which will form the most stable carbocation, will react instantaneously with Lucas reagent.

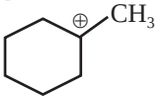
NOTES
Lucas test allows us to differentiate between 1°, 2° and 3° alcohols based on the rates with which they react or show turbidity.
1° alcohols shows no turbidity while 3° shows immediately.

58. **(b)** $NaOH + HCl \longrightarrow NaCl + H_2O$
Thus, 1 mole o f NaOH reacts with 1 mole of HCl.
Now, Number of moles present are:-

$$NaOH = \frac{1g}{40g\ mol^{-1}} = 0.025\ mol$$

HCl = 0.025L × 0.75 M = 0.01875 mol.
⇒ Number of moles of NaOH left = Number of moles of NaOH present - Number of moles of HCl present (limiting reagent)
= 0.025 – 0.01875 = 0.00625 mol
⇒ Mass of NaOH left = 0.00625 × 40
= 0.25g = 250 mg

59. **(b)** Ionization enthalpy increases in a period from left to right due to an increase in the effective nuclear charge and also depends on the electronic configuration of the species.
The configurations of the given species are:
Li = $1s^2\ 2s^1$, Be = $1s^2\ 2s^2$, B = $1s^2\ 2s^2\ 2p^1$.
C = $1s^2\ 2s^2\ 2p^2$, N = $1s^2\ 2s^2 2p^3$.
Thus, it is easier to remove first electron from Li and B but difficult from C and N - (due to attainment of stable configuration in Li and B and disturbance of it in N)

60. **(d)** 
is most stable as it is a tertiary carbocation stabilized by three + I groups.
The stability follows the order: 1° < 2° < 3°.

61. **(d)** We can use Arrhenius equation to calculate the activation energy:-

$$\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

62. **(a)** Aniline does not undergo Friedel-Crafts reactions as the $–NH_2$ group reacts with acidic groups to form salts instead. The $\overset{+}{N}H_3$ group acts as a strong de-activating group. Thus, statement I is true.
Aromatic primary amines (aniline here) cannot be prepared by Gabriel - phthalimide synthesis as aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide. Thus, statement II is true.

63. **(a)** Electronegativity increases from left to right in a period and decreases down the group.

64. **(a)** $\overset{+1}{H_2O} \longrightarrow \overset{0}{H_2} + \frac{1}{2}O_2$,
2 moles of e^- required
= 2 F electricity (For two H^+ ions)
$\overset{+7}{Mn}O_4^- \longrightarrow \overset{+2}{Mn}^{2+}$;
2 moles of e^- required = 5 F
$CaCl_2 \longrightarrow Ca^{2+} + 2Cl^- \xrightarrow{2e^-} Ca$
Thus, $\frac{3}{2}Ca^{2+} \longrightarrow \frac{3}{2}Ca$
which requires 3 moles of e^- = 3F of electricity
$\overset{+3}{Fe_2}O_3 \longrightarrow \overset{+2}{Fe}O$; requires 1 mole of e^- = 1F

65. **(a)** $[Co(NH_3)_5(NO_2)]Cl_2$ and
$[Co(NH_3)_5(ONO)]Cl_2 \longrightarrow$ Linkage isomerism.
$[Co(NH_3)_5(SO_4)]Br$ and
$[Co(NH_3)_5Br]SO_4 \longrightarrow$ Ionization isomerism.

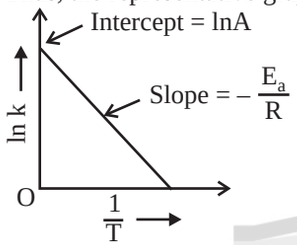
$[Co(NH_3)_6]$ $[Cr(CN)_6]$ and
$[Cr(NH_3)_6]$ $[Co(CN)_6]$ ⟶ Coordination isomerism.
$[Co(H_2O)_6]$ Cl_3 and
$[Co(H_2O)_5Cl]Cl_2H_2O$ ⟶ Solvate (Hydrate) isomerism.

66. **(a)** NH_3 (1 lp, 3 bp) ⟶ Trigonal pyramidal (shape)
BrF_5 (1 lp, 5 bp) ⟶ square pyramidal (shape)
XeF_4 (2 lp, 4 bp) ⟶ square planar (shape)
SF_6 (0 lp, 6 bp) ⟶ octahedral (shape/geometry)

67. **(d)** Arrhenius equation:

$$\ln k = -\frac{E_a}{RT} + \ln A$$

(equivalent to y = mx + c)
Thus, the representative graph will be:



68. **(a)** For H-like species:

$$E = -2.18\times10^{-18}\left(\frac{Z^2}{n^2}\right)J$$

For n = 1 of He^+:

$$E = -2.18\times10^{-18}\left(\frac{2^2}{1^2}\right)$$

$= -2.18 \times 10^{-18} \times 4$
$= -x$ (Given)

For n = 2 of Be^{3+}: $E = -2.18\times10^{-18}\left(\frac{4^2}{2^2}\right)$

$= 2.18 \times 10^{-18} \times 4 = -x$
Thus, Energy of Be^{3+} for n = 2 would be –x Joules.

69. **(c)** Entropy represents degree of Randomness.
Thus, it increases for those processes that involve a decrease in the order of arrangement or stability of the system.
Process A involves change of state from liquid to gas which is less ordered, so entropy increases.
Process B involves lowering of T which makes the system more stable so entropy decreases.
Process C involves formation of gaseous products from solid reactant, so entropy increases.
Process D involves an increase in the number of gaseous moles so disorderliness or entropy increases.

70. **(d)**

$$\overset{+2\ -1}{Ba}\overset{}{Cl_2} + \overset{+1}{Na_2}\overset{+6-2}{SO_4} \longrightarrow \overset{+2\ +6-2}{Ba\ SO_4} + 2\overset{+1\ -1}{Na\ Cl}$$

(No change in oxidation states)

71. **(b)** n = principal quantum number ⟶ size of orbital/shell.
l = Azimuthal quantum number ⟶ shape of orbital
m_l = Magnetic orbital quantum number ⟶ orientation of orbital.
m_s = Magnetic spin quantum number ⟶ spin of electron.

72. **(a)** $\mu = \sqrt{n(n+2)}$ B.M., where n = number of unpaired electrons.
$Ti^{3+} = [Ar]\ 3d^1 \Rightarrow n = 1$, $Cr^{2+} = [Ar]\ 3d^4 \Rightarrow n = 4$
$Mn^{2+} = [Ar]\ 3d^5 \Rightarrow n = 5$, $Fe^{2+} = [Ar]\ 3d^6 \Rightarrow n = 4$
$SC^{3+} = [Ar]\ 3d^0 \Rightarrow n = 0$
Thus, Cr^{2+} and Fe^{2+} will have the same μ. (magnetic moment)

73. **(a)** $4\ g\ of\ He = \frac{4g}{4g\ mol^{-1}} = 1\ mol,$

$$2.271\ L\ of\ He = \frac{2.271}{22.7} = 0.1\ mol$$

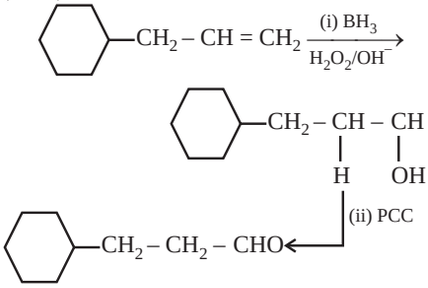
Thus, 4 mol of He has the highest number of atoms.

74. **(d)** Polonium (Po) does not show-2 oxidation state due to low electron affinity and large atomic size.

75. **(c)** $Mn^{3+} = [Ar]3d^4 \longrightarrow Mn^{2+} = [Ar]\ 3d^5$ (more stable configuration)

76. **(c)** Glucose does not give Schiff's test and it does not form the hydrogen sulphite addition product with $NaHSO_3$ due to its cyclic structure (absence of free –CHO grop).
Glucose does reacts with NH_2OH but its pentaacetate does not react with NH_2OH due to absence of free –CHO group.

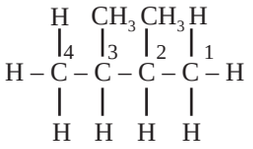
77. **(b)** Hydroboration - oxidation gives Anti-Markovnikoff product (alcohol) which is then oxidized to aldehyde by a mild oxidizing agent, which is Pyridinium chlorochromate (PCC) here.



78. **(a)** $K_P = K_C(RT)^{\Delta n_g}$. Thus, K_P and K_C will not be equal if $(RT)^{\Delta n_g} \neq 1$
$\Rightarrow \Delta n_g \neq 0$
For PCl_5 (g) ⇌ (g) PCl_3(g) + Cl_2(g),
$\Delta n_g = (1 + 1) - 1 = 2 - 1 = 1$

NOTES Δn_g = number of moles of gaseous products – number of moles of gaseous reactants

79. **(c)**



2, 3-dimethylbutane

80. **(a)** Fehling solution 'A' = Aqueous $CuSO_4$ solution.
Fehling solution 'B' = Alkaline sodium potassium Tartarate (Rochelle salt).

81. **(d)** Isothermal ⇒ Constant T, Isochoric ⇒ Constant V, Isobaric ⇒ Constant P, Adiabatic ⇒ Constant heat/No exchange of heat.

82. **(a)** $[Co(NH_3)_6]^{3+} \Rightarrow Co^{3+} = [Ar]3d^6$
Due to strong field NH_3 ligand, all six electrons are paired and the complex is diamagnetic.
In case of $[CoF_6]^{3-}$ weak held F^- ligand is present and there are four unpaired electrons making the complex paramagnetic.
Due to both complexes having the same number of ligands and the hybridizations of $d^2 sp^3$ and sp^3 and $sp^3 d^2$ respectively, they are both octahedral.
Thus, both statement I and II are true.

NOTES
Strong-field ligands pair up the electrons while weak - field ligands are unable to counter the pairing energy and the $\Delta < P$.

83. **(b)** The process of directly changing into a gas from solid state is called sublimation. Thus, such substances can be separated from other substances by sublimation.

84. **(c)** Reaction 'A' represents ozonolysis of an alkene which will required O_3 and $Zn - H_2O$.
Reaction 'B' represents Friedel-Crafts Acylation of benzene which requires ArCOCl in Anhydrous $AlCl_3$.
Reaction 'C' represents oxidation of an alcohol to ketone which neeeds CrO_3 agent.
Reaction 'D' represents side-chain oxidation of ethyl benzene which requires $KMnO_4$ in KOH and heating.

85. **(c)** $$Q_C = \frac{[B][C]}{[A]^2} = \frac{\left(2\times10^{-3}\right)\left(2\times10^{-3}\right)}{\left(2\times10^{-3}\right)^2} = 1$$

$\Rightarrow \quad Q_C > K_C$
Thus, reaction will process in the backward direction, towards the reactants to reach equilibrium (K_C).

NOTES
Q_C is called reaction quotient which represents relative concentrations of reactants and products at any time.

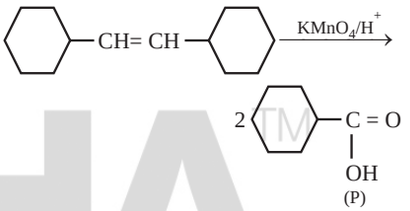
86. **(a)** $Ce^{4+} = [Xe]\ 4f^0$, $Yb^{2+} = [Xe]\ 4f^{14}$, $Ce^{3+} = [Xe]\ 4f^1$
$Eu^{2+} = [Xe]\ 4f^7$, $Gd^{3+} = [Xe]\ 4f^7$, $E4^{3+} = [Xe]\ 4f^6$
$Pm^{3+} = [Xe]\ 4f^4$, $Sm^{3+} = [Xe]\ 4f^5$
Thus, Ce^{4+} and Yb^{2+} are diamagnetic due to all electrons being paired.

87. **(a)** Homoleptic complex ⇒ has only one type of ligand $[Co(NH_3)_6]^{3+}$.
Heteroleptic complex ⇒ has different types of ligands. $[Co(NH_3)_4Cl_2]^+$.
Thus, Statement I and II, both are correct.

88. **(b)** t = 100 seconds, I = 9.6487 A.
Charge (Q) = I × t = 9.6487 × 100 = 964. 87C
Now, $Cu^{2+}(aq.) + 2e^- \longrightarrow Cu(s)$
Thus, 2 moles or 2F = 2 × 96487 C of electricity gives 1 mol or 63g of = Cu.
Therefore, 964. 87 C of electricity will give:

$$M = \frac{63\times964.87}{2\times96487} = 0.315g \text{ of Cu.}$$

89. **(b)** Acidic $KMnO_4$ oxidizes alkenes, that are substituted to carboxylic acids or Ketones.
Both doubly-bonded carbon atoms have one H-atom that will also get oxidized to –OH.
Thus,



(P)

90. **(d)** $3\ ROH + PCl_3 \rightarrow 3\ RCl + H_3PO_3$
(A)
$ROH + PCl_5 \rightarrow RCl + HCl + POCl_3$
(B)

91. **(a)** Using Arrhenius equation:

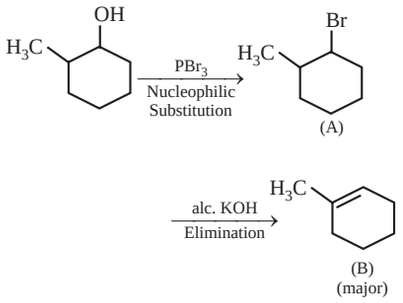
$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right]$$

$$\log\frac{4k_1}{k_1} = \log(4) = \frac{E_a}{2.303(8.314)}\left[\frac{330-300}{300\times330}\right]$$

$0.6021 = E_a \times (1.582 \times 10^{-5})$
$\Rightarrow \quad E_a = 38040\ J = 38.04kJ$

92. **(d)** Dilute Sulphuric acid (H_2SO_4) is added to aqueous solutions of Mohr's salt to prevent the hydrolysis of ferrous sulphate.
This is in accordance with Le-Chatelier's principle according to which addition of more SO_4^{2-} ions in the solution will favour the formation of more of $FeSO_4$ to decrease the concentration of SO_4^{2-} ions and prevent the hydrolysis.
Concentrated H_2SO_4 is not added because it is a stronger oxidizing agent and might oxidize Fe^{2+} to Fe^{3+} and will also not dissociate completely.

93. (a)



94. (a) Osmotic pressure (π) = CRT

$\Rightarrow$ Slope = RT = 25.73 L bar mol^{-1}

$$\Rightarrow T = \frac{25.73}{R} = \frac{25.73 \text{ L bar mol}^{-1}}{0.083 \text{ L bar mol}^{-1}\text{K}^{-1}}$$

= 310 K = 37°C

95. (d) Ozone has only two resonance structures.

BF_3 is a non-polar molecule due to zero dipole moment.

Dipole moment of NF_3 is less than that of NH_3 due to F being more electronegative than H and N pulling electrons towards itself and resulting in cancellation of bond dipoles.

Carbonate ion CO_3^{2-} has three canonical structures with each oxygen atom forming a double bond with carbon

96. (a)

$$CH_3 - CH_2 - CH_2 - I \xrightarrow[\text{Nu - Substitution}]{\text{NaCN}}$$

$$CH_3 - CH_2 - CH_2 - CN \xrightarrow[\text{hydrolysis}]{OH^-,\ \text{Partial}}$$

(A)

$$CH_3 - CH_2 - CH_2 - \underset{\underset{\text{O}}{\|}}{\text{C}} - NH_2 \xrightarrow[\text{(Hoffmann-Bromamide degradation}]{\text{NaOH}\ Br_2}$$

amide (B)

$$CH_3 - CH_2 - CH_2 - NH_2$$

(C)

Propylamine

97. (a) Al^{3+} = Group III, Cu^{2+} = Group II,

Ba^{2+} = Group V,

Co^{2+} = Group IV, Mg^{2+} = Group VI

Thus, the correct increasing order is

$B \rightarrow A \rightarrow D \rightarrow C \rightarrow E$

98. (b) For Reversible isothermal process:

$$W = -2.303\ n\ RT\ \log\left(\frac{P_1}{P_2}\right)$$

$$= -2.303\ (1)\ (2.0)\ (298)\ \log\left(\frac{20}{10}\right)$$

= – 413. 14 cal.

99. (d) $K_C = \dfrac{[N_2][O_2]}{[NO]^2}$

$$= \frac{(3.0\times10^{-3})(4.2\times10^{-3})}{(2.8\times10^{-3})^2} = 1.607$$

Now,

	$2NO$	$\rightleftharpoons$	N_2	+	O_2
Initial	0.1		0		0
at equilibrium	0.1 – 0.1 α		0.05 α		0.05α

$$\Rightarrow K_C = \frac{(0.05\alpha)^2}{0.01(1-\alpha)^2} = 1.607$$

$$\Rightarrow \frac{\alpha^2}{(1-\alpha)^2} = \frac{1.607\times(0.1)^2}{(0.05)^2}$$

$$\Rightarrow \frac{\alpha}{1-\alpha} = \frac{1.27\times0.1}{0.05}$$

$$\Rightarrow \alpha = 2.54 - 2.54\ \alpha \Rightarrow \alpha = \frac{2.54}{3.54} = 0.717$$

100. (b) Let's take 100g of this compound.

$\Rightarrow$ Masses present : A = 32g, B = 20g, C = 48g.

$\Rightarrow$ Number of moles :

$$A = \frac{32}{64} = 0.5, B = \frac{20}{40} = 0.5, C = \frac{48}{32} = 1.5$$

Dividing these moles by smallest mole value:

A : B : C = 1 : 1 : 3

$\Rightarrow$ Empirical Formula = ABC_3

BOTANY

101. (b) Lecithin is a low molecular weight phospholipid found in living tissues.

Glycerides, are esters formed from glycerol and fatty acids, and are generally very hydrophobic.

Amino acids and carbohydrates belongs to separate classes of biomolecules.

NOTES

Phospholipids are the main constituents of cell membranes. They resemble the triglycerides in being ester or amide derivatives of glycerol or sphingosine with fatty acids and phosphoric acid. The phosphate moiety of the resulting phosphatidic acid is further esterified with ethanolamine, choline or serine in the phospholipid itself..

102. (d) Three molecules of ATP and two molecules NADPH are required for fixing one molecule of carbon dioxide.

103. (b) Hind II was the first restriction endonuclease discovered.

The functioning of restriction endonuclease depends on a specific DNA nucleotide sequence that was isolated.

Hind II is a 6 base pair cutter.

Hence Option (a), (c) and (d) are incorrect .

104. (a) C represents the Guard cells of stomata that have thin outer wall and highly thickened inner walls. These are the structural modification to facilitate opening and closing of stomata.

105. (a) Zinc is the cofactor of enzyme carboxypeptidase.
Niacin is related with coenzyme NAD and NADP.
Haem represents the prosthetic group of enzymes peroxidase and catalase.

106. (a) Totipotency is the ability of plants to generate whole plant body from any cell of the plant.

107. (a) A-III, B-II, C-IV, D-I

108. (c) Sol. Bt toxin exists as inactive protoxins in B. thuringiensis. However, after ingestion by the insect the inactive protoxin gets converted into active form due to alkaline pH of the insect gut.

NOTES

Bt toxins are not activated when eaten by people, and no harm occurs. However, some products that contain Bt may cause eye and skin irritation. Some signs and symptoms of exposure to Bt include:
Inhaling Bt, Eating Bt, Skin irritation, Eye irritation, Burning, Itchy eyes, Red skin rash, Laryngitis, Watery eyes, and Breathing problems.

109. (a) Actinomorphic condition is observed in flowers of Datura. Rest plants given in option b, c and d have, zygomorphic flowers .

110. (b) Ex-situ conservation is the type of conservation in which threatened species are taken out from their natural habitat and placed in special setting where they can be protected and given special care . Although from the point of conservation in-situ conservation is more favourable.

111. (d) As flowers of Vallisneria are pollinated by water so they are not colourful and do not produce nectar.

112. (c) The permease enzyme is responsible for the permeability of cell to lactoses. So, the lactose present in the growth medium of bacteria is transported into the cell by the action of permease.

113. (c) A-III, B-I, C-IV, D-II

114. (c) In the given equation K denotes the carrying capacity.

115. (c) Auxins have no effect on mature monocotyledonous plants as they show very limited translocation and they degrade the auxins that are applied externally.

NOTES

Auxin is a plant hormone that can be used as a herbicide to destroy weeds. When present at low concentrations, auxin herbicides stimulate growth and developmental processes in plants. However, as the concentration of auxin increases, it can disturb growth and damage the plant. Gardeners with large lawns use auxins to prepare weed-free lawns

116. (c) C represents the radicle that is destined to form root.

117. (d) Collenchyma is also a living tissue.

118. (d) Habitat loss and fragmentation , Over-exploitation , Alien species invasions ,and Co-extinctions are the major causes of biodiversity losses.
So, correct options are A, B and D only.

119. (b) Mode of nutrition is not considered for classifying fungi as they are classified on the basis of
1. Morphology of mycelium
2. Mode of spore formation
3. Fruiting Body

NOTES

Kingdom Fungi is a part of the five kingdom classifications given by R.H Whittaker. Kingdom Fungi characteristics include a chitinous cell wall, heterotrophic nutrition, and a filamentous body structure known as mycelium. Fungi are eukaryotic, heterotrophic organisms. Kingdom fungi classification is constantly evolving but currently includes major phyla like Ascomycota (sac fungi), Basidiomycota (club fungi), and Chytridiomycota (chytrids).

120. (d) Both diagram a and b shows perigynous condition.
If gynoecium and other parts of the flower are almost at the same level then it is called perigynous condition ..

121. (d) IUCN (International Union for Conservation of Nature) is the organisation that releases list of endangered species.

122. (c) The DNA carrying only gene of interest which may get integrated into the genome of the recipient, hence multiply and be inherited along with the host DNA .
The piece of DNA not be able to multiply itself in the progeny cells of the organism independently. It needs to be integrated into the genome of the recipient.

123. (b) Alleles do not show any expression and both the characters appear as such in F2 generation can be explained on the basis of Law of Segregation.

NOTES

Mendel made two innovations to the science of genetics:
1. developed pure lines
2. counted his results and kept statistical notes
Pure Line - a population that breeds true for a particular trait [this was an important innovation because any non-pure (segregating) generation would and did confuse the results of genetic experiments]

124. (c) Malonate shows structural similarity with the substrate Succinic Dehydrogenase and it competes with the substrate for the active site of the enzyme succinic dehydrogenase.
Hence option (a), (b) and (d) are incorrect.

125. (c) When parenchyma cells that are fully differentiated forms interfascicular cambium, they represents the phenomenon of dedifferentiation.

126. (b) Attachment of spindle fibres to kinetochores of chromosomes is observed in Metaphase stage,.

127. (a) Tropical environment are less seasonal, and relatively more constant and predictable when compared to temperate or other environments.

NOTES

The tropics are regions of Earth that lie roughly in the middle of the globe. The tropics between the latitude lines of the Tropic of Cancer and the Tropic of Capricorn. The tropics include the Equator and parts of North America, South America, Africa, Asia, and Australia. The tropics account for 36 percent of Earth's landmass and are home to about a third of the world's people.

128. (a) Both the statement I and II are true..

129. (a) A-III, B-II, C-IV, D-I

130. (a) In monocots, some particular epidermal cells present adaxially modify themselves into large, empty, colourless cells. These are called bulliform cells. When these cells in the leaves have absorbed water and becomes turgid, the leaf surface is exposed. When Bulliform Cells are flaccid due to water stress, they make the leaves curl inwards to minimise transpiritaional loss.

131. (b) Both red as well as pink flowered plants are expected in the progeny as per the below cross:

Pink colour flower in snapdragon : Rr

Red flowered snapdragon : RR

when both pink and red are crossed

Phenotype

Red : Pink : White

2 2 0

So the progeny that we get are red and pink flowered plants only.

132. (d) A transcription unit consists of three regions in the DNA:

(i) A promoter

(ii) The structural gene

(iii) A terminator

NOTES

Transcription, as related to genomics, is the process of making an RNA copy of a gene's DNA sequence. This copy, called messenger RNA (mRNA), carries the gene's protein information encoded in DNA. In humans and other complex organisms, mRNA moves from the cell nucleus to the cell cytoplasm (watery interior), where it is used for synthesizing the encoded protein.

133. (b) To determine the genotype of the black seed plant, test cross is performed .

So the given black seed plant is crossed with white seed plant (recessive parent) having genotype bb.

134. (c) Light and chlorophyll are required in light reaction not in dark reaction.

135. (c) A-III, B-IV, C-I, D-II

136. (b) Double stranded circular DNA is present in chloroplast.

NOTES

Chloroplast DNA (cpDNA) is the DNA found in chloroplasts, which are photosynthetic organelles in some eukaryotic organisms. Chloroplasts have a separate genome from the cell nucleus, and cpDNA is highly conserved between species in terms of gene content and organization.

137. (b) A-III, B-I, C-IV, D-II

138. (a) A-II, B-IV, C-I, D-III

139. (d) In replication in Prokaryotes, like E.coli, DNA dependent DNA polymerase catalyse polymerization only in one direction, that is 5' → 3'

140. (a) The depicted diagram shows a wind pollinated plant showing flowers with well exposed stamens. Stamens are exposed to assist pollination by wind.

NOTES

Wind pollination, also known as anemophily, is a process that uses wind to transfer pollen from a flower's male reproductive organ to the female organ, fertilizing the flower. Wind pollination is less complex than animal pollination and is most effective when a species grows in high densities. It's most common in grasses, sedges, rushes, and forest trees in temperate climates.

141. (b) A-II, B-I, C-IV, D-III

142. (c) In Phaeophyceae sexual reproduction can occur by oogamy, isogamy or anisogamy .

Hence correct statements are A, C, D and E.

143. (c) NPP of first trophic level can act as GPP for second trophic level and NPP of second trophic level can act as GPP for third trophic level.

So, 100x (kcal/m2/yr) would be GPP of second trophic level and 100x × 10% (kcal/m2/yr) i.e., 10x (kcal/m2/yr) energy would be GPP of third trophic level.

144. (a) A-IV, B-I, C-II, D-III

145. (c) Oxidation refers to the loss of electrons from a molecule resulting in increase in its oxidation state. So the electron is transferred to an electron acceptor which is reduced in the process.

During formation of succinic acid from succinyl CoA does not involve oxidation of substrate.

NOTES

The tricarboxylic acid (TCA) cycle, also known as the Krebs cycle or citric acid cycle, is an important cell's metabolic hub. It is composed of eight enzymes, all of which are within the mitochondrial matrix except the outlier succinate dehydrogenase, which is related to the respiratory chain on the inner mitochondrial membrane. The cycle serves as a gateway for aerobic metabolism for molecules that can convert to an acetyl group or dicarboxylic acid. Regulation of the TCA cycle occurs at three distinct points that include the three following enzymes: citrate synthase, isocitrate dehydrogenase, and alpha-ketoglutarate dehydrogenase. The cycle also plays a role in replenishing precursors for the storage form of fuels such as amino acids and cholesterol.

146. (c) In C4 plants photorespiration does not occur

147. (a) A-IV, B-II, C-I, D-III

148. (b) A-III, B-IV, C-I, D-II

149. (c) Somatic hybridization involves the fusion of protoplasts isolated from two varieties of plants.

NOTES

Somatic hybridization in higher plants has come into focus since methods have been established for protoplast fusion and uptake of foreign DNA and organelles by protoplasts. Polyethylene glycol (PEG) was effective agent for inducing fusion. Treatment of protoplasts with PEG resulted in 5 to 30% heterospecific fusion products. Protoplasts of different species, genera and even families were compatible when fused. A number of protoplast combinations (soybean + corn, soybean + pea, soybean + tobacco, carrot + barley, etc.) provided fusion products which underwent cell division and callus formation.

150. (b) Gibberellin helps in increasing the lengths of internode, hence increasing the yield of sugarcane crops as they store carbohydrates in stem.

ZOOLOGY

151. (a) The pathway that action potential follows when generated in heart is
Sino Atrial Node->Atrio Ventricular Node->Atrio Ventricular Bundle-> Bundle Branches->Purkinje Fibres

152. (b) The 10th segment present in abdomen region have anal cerci that represents a pair of jointed filamentous structures in both sexes of cockroach.

153. (c) Similar function is performed by the flippers of the Penguins and Dolphins perform but structurally they are not similar. Hence these structures represents convergent evolution.
Adaptive radiation occurs when different species in a given geographical area starting from a point and literally radiating to the other areas of geography in terms of evolution.
According to natural selection is the key mechanism behind evolution.
Divergent evolution represents homology.

154. (a) Uterine fundus is the part of the uterus,
Isthmus, Infundibulum and Ampulla are the different components of fallopian tube.

NOTES

The fallopian tubes are bilateral conduits between the ovaries and the uterus in the female pelvis. They function as channels for oocyte transport and fertilization. Given this role, the fallopian tubes are a common etiology of infertility as well as the target of purposeful surgical sterilization. They can also be sites of ascending infection or neoplasms.

155. (d) The sequence of Human Evolution from past to recent is as follows:
Homo habilis → Homo erectus → Homo neanderthalensis → Homo sapiens

156. (d) Glucagon belongs to class of proteinaceous hormone and it is secreted from pancreas. Cortisol, Testosterone and Progesterone are the steroidal hormone.

157. (c) A-III, B-IV, C-I, D-II

158. (d) The following sequence represents the stages of cell division in correct order:
Gap 1 phase->Synthesis phase->Gap 2 phase->Karyokinesis->Cytokinesis
(E) (C) (A) (D) (B)

NOTES

Depending on the type of cell, there are two ways cells divide—mitosis and meiosis. Each of these methods of cell division has special characteristics. One of the key differences in mitosis is a single cell divides into two cells that are replicas of each other and have the same number of chromosomes. This type of cell division is good for basic growth, repair, and maintenance. In meiosis a cell divides into four cells that have half the number of chromosomes. Reducing the number of chromosomes by half is important for sexual reproduction and provides for genetic diversity.

159. (d) The following factors affects the Hardy-Weinberg equilibrium:
1. Genetic recombination
2. Genetic Drift
3. Gene Migration
4. Mutation
5. Natural Selection

160. (b) Myasthenia gravis, Rheumatoid arthritis and Systemic Lupus Erythematosus (SLE) are the examples of auto immune disorders.
Muscular dystrophy is a genetic disorder which progressively affects the skeletal muscles.
Gout is the inflammation of joints due to deposition of uric acid crystals.

161. (b) A-IV, B-III, C-I, D-II

162. (a) A-II, B-IV, C-I, D-III

163. (c) A-III, B-IV, C-I, D-II

164. (d) FSH acts on ovarian follicles in females and stimulating the growth of follicles. In males LH affects Leydig cells leading to secretion of androgens.

NOTES

Regulation of the reproductive system is a process that requires the action of hormones from the pituitary gland, the adrenal cortex, and the gonads. During puberty, in both males and females, the hypothalamus produces gonadotropin-releasing hormone (GnRH), which stimulates the production and release of follicle stimulating hormone (FSH) and luteinizing hormone (LH) from the anterior pituitary gland. These hormones regulate the gonads (testes in males and ovaries in females); they are called gonadotropins. In both males and females, FSH stimulates gamete production and LH stimulates production of hormones by the gonads. An increase in gonad hormone levels inhibits GnRH production through a negative feedback loop.

165. (b) A-II, B-I, C-IV, D-III

166. (c) A-II, B-IV, C-I, D-III

167. (c) The Ti plasmid stands for Tumor inducing plasmid. Hence option a, b and d are incorrect.

168. (d) A-III, B-IV, C-I, D-II

169. (a) The mRNA synthesised from the given DNA template is

5'AUGUACCGUUUAUAGGUAAGU3'

170. (b) A-III, B-IV, C-II, D-I

171. (c) A-II, B-IV, C-I, D-III

172. (d) Vault belongs to the category of barrier method of contraception. Vault is made of rubber that is inserted into the female reproductive tract to cover the cervix during the coitus.

The traditional methods of contraception includes:

1. Coitus interruptus
2. Periodic abstinence
3. Lactational amenorrhoea

NOTES

Methods of contraception include oral contraceptive pills, implants, injectables, patches, vaginal rings, intra uterine devices, condoms, male and female sterilization, lactational amenorrhea methods, withdrawal and fertility awareness-based methods. These methods have different mechanisms of action and effectiveness in preventing unintended pregnancy. Effectiveness of methods is measured by the number of pregnancies per 100 women using the method per year. Methods are classified by their effectiveness as commonly used into:

- very effective (0–0.9 pregnancies per 100 women)
- effective (1–9 pregnancies per 100 women)
- moderately effective (10–19 pregnancies per 100 women)
- less effective (20 or more pregnancies per 100 women).

173. (b) Figure (a) depicts skeletal muscle fibres .These muscles are closely attached to skeletal bones.They are found in voluntary organs like triceps muscles .Figure (b) depicts smooth muscle fibres .They are found in walls of internal organs such as the blood vessels, stomach and intestine.Figure (c) depicts cardiac muscle fibres ,they are only found in heart.

174. (c) Bioreactors are used for large scale production i.e, processing of large volumes (100 – 1000 litres) of culture.

175. (a) Both A and R are correct and R is the correct explanation of A.

176. (b) High partial pressure of oxygen, Less H+ concentration, low partial pressure of carbon dioxide and low temperature are the favourable conditions required for the formation of oxyhaemoglobin.

NOTES

Hemoglobin (Hgb or Hb) is the primary carrier of oxygen in humans. Approximately 98% of total oxygen transported in the blood is bound to hemoglobin, while only 2% is dissolved directly in plasma. Hemoglobin is a metalloprotein with four subunits composed of an iron-containing heme group attached to a globin polypeptide chain.One molecule of oxygen can bind to the iron atom of a heme group, giving each hemoglobin the ability to transport four oxygen molecules. One molecule of oxygen can bind to the iron atom of a heme group, giving each hemoglobin the maximum capacity to transport four oxygen molecules. This ability to sequentially bind oxygen to each subunit results in the unique sigmoidal shape of the oxyhemoglobin dissociation curve. Various defects in the synthesis or structure of erythrocytes, hemoglobin, or the globin polypeptide chain can impair the oxygen-carrying capacity of the blood and lead to hypoxia.

177. (c) A-III, B-I, C-II, D-IV

178. (b) Poriferans are the acoelomates.

Aschelminths are pseudocoelomates.

Platyhelminths are acoelomates.

179. (d) A-III, B-I, C-IV, D-II.

180. (b) Descending limb of loop of Henle is impermeable to electrolytes and permeable to water.

Simple cuboidal brush border epithelium lines the proximal convoluted tubule and increases the surface area for reabsorption.

NOTES

Saving body water by optimal reabsorption of water filtered by the kidney leading to excretion of urine with concentrations of solutes largely above that of plasma allowed vertebrate species to leave the aquatic environment to live on solid ground. Filtered water is reabsorbed for 70% and 20% by proximal tubules and thin descending limbs of Henle, respectively. These two nephron segments express the water channel aquaporin-1 located along both apical and basolateral membranes. In the proximal tubule, the paracellular pathway accounts for at least 30% of water reabsorption.

181. (b) **^T'X'** in the given diagram represents the ori region which controls the copy number of plasmid and hence the copy number of linked DNA. 'Y' is rop region that codes for protein involved in replication of plasmid.

182. (d) A-II, B-I, C-IV, D-III

183. (b) A-III, B-I, C-II, D-IV

184. (d) A-III, B-I, C-IV, D-II.

NOTES

A joint is a point where two bones make contact. Joints can be classified either histologically or functionally. Histological classification is based on the dominant type of connective tissue, and functional classification is based on the amount of movement permitted. Histologically the three joints in the body are fibrous, cartilaginous, and synovial. Functionally the three types of joints are synarthrosis (immovable), amphiarthrosis (slightly moveable), and diarthrosis (freely moveable). The two classification schemes can be correlated: synarthroses are fibrous, amphiarthroses are cartilaginous, and diarthroses are synovial.

185. (c) It is not necessary that hymen is torn during the first coitus only it can be torn due to sudden jolt, insertion of a vaginal tampon, active participation in some sports and in some women the hymen persists even after coitus.

186. (d) Gause's competitive exclusion principle states that two closely related species competing for the same resources cannot exist indefinitely. Due to the competition the superior species will outnumber the inferior one leading to their elimination.

187. (a) A-IV, B-II, C-III, D-I

188. (c) Perforated pharyngeal gill slits and dorsal central nervous system are the characteristics of chordates.

NOTES

Characteristics of Non-Chordates

Non-chordates exhibit a wider range of body symmetries compared to chordates:

- They are cold-blooded.
- They can be acoelomates, pseudocoelomates, and coelomates.
- Also, their germ layer can be diploblastic or triploblastic.
- Post-anal tail is absent.
- Exoskeleton is present while the endoskeleton is absent.
- The regeneration power of non-chordates is good.
- They have a protoplasmic to organ system level of organization.
- The gut is present dorsal to the nerve cord.
- Anus is generally absent. If present, it opens on the last segment.
- Respiration in non-chordates occurs through diffusion across the body surface.
- Gill slits are absent.

189. (c) Juxta medullary nephrons have Renal corpuscle in inner cortical region. Their loop of Henle lies deep in medulla and they are fewer in number as compared to cortical nephrons.

190. (c) Mid brain, pons and medulla oblongata forms the brain stem.

191. (a) Both statement I and II are correct.

192. (a) The correct sequence of catalytic cycle of an enzyme action is:

(1) The substrate binds to the active site of the enzyme.

(2) The binding of the substrate causes the change in shape of the enzyme to alter its shape.

(3) Chemical bonds break and Enzyme Product complex is formed.

(4) Product is released by enzyme and enzyme becomes ready for the next substrate.

NOTES

Characteristics of Non-Chordates

Enzymes are mostly proteins. They have a primary structure i.e. linear chain of amino acids, which eventually form a three-dimensional shape. An enzyme like any protein has secondary and tertiary structures. In tertiary structure, the protein chains fold upon themselves, and the chain crisscrosses upon itself which creates many pockets or crevices. One such pocket is known as the 'active site' or the substrate-binding site. The substrate fits into a pocket or crevice which is the active site of an enzyme. Thus, the active site of an enzyme catalyzes the biochemical reactions at a high rate. The enzymes are able to break the bigger molecule into simpler molecules or vice versa. Enzymes get damaged at high temperatures (above 40oc) and high pressure, resulting in loss of enzyme activity. Thermal stability is thus an important factor of such enzymes.

193. (a)

(A) represents FSH (Follicle stimulating hormone) acts on sertoli cells in males.

(B) represents Leydig cells involved in synthesis of androgens.

(C) represents Sertoli cells plays vital role in secretion of factors inovolved in spermiogenesis.

(D) represents Spermiogenesis, the process of formation of sperms from spermatozoa.

194. (d) A-III, B-I, C-IV, D-II

195. (c) A-III, B-IV, C-I, D-II

196. (d) A-IV, B-III, C-I, D-II

197. (a) Genotype of child with blood group O+ = ii

So, genotype of father with blood group B+ will be = IBi and genotype of mother with blood group A+ will be =IAi

So only 'A' is correct.

198. (b) A-III, B-II, C-IV, D-I

NOTES

An electrocardiogram (ECG or EKG) is one of the simplest and fastest tests used to evaluate the heart. Electrodes (small, plastic patches that stick to the skin) are placed at certain spots on the chest, arms, and legs. The electrodes are connected to an ECG machine by lead wires. The electrical activity of the heart is then measured, interpreted, and printed out. No electricity is sent into the body.

199. (c) The inner membrane of mitochondria is relatively more permeable, as compared to chloroplast.

200. (d) A-III, B-IV, C-I, D-II