NEET 2023 Solved Paper

This sample is taken from the book **"Target NTA NEET (UG) 2024 - Previous 8 Year Solved Papers (2023 - 2017) & 10 Mock Tests 12th Edition | Physics, Chemistry & Biology"**

NEET-2023 Solved Paper
(Held On 7 May)

Time : 3 hours 20 minutes　　　　　　　　　　　　　　　　　　　**MM : 720**

PHYSICS

Section-A

1. The minimum wavelength of X-rays produced by an electron accelerated through a potential difference of V volts is proportional to

   (a) $\sqrt{V}$　　(b) $\dfrac{1}{V}$　　(c) $\dfrac{1}{\sqrt{V}}$　　(d) V2

2. A Carnot engine has an efficiency of 50% when its source is at a temperature 327°C. The temperature of the sink is
   (a) 27°C　　　　　　　　(b) 15°C
   (c) 100°C　　　　　　　(d) 200°C

3. A bullet is fired from a gun at the speed of 280 m s⁻¹ in the direction 30° above the horizontal. The maximum height attained by the bullet is (g = 9.8 m s⁻², sin30° = 0.5)
   (a) 2800 m　(b) 2000 m　(c) 1000 m　(d) 3000 m

4. In a series LCR circuit, the inductance L is 10 mH, capacitance C is 1 μF and resistance R is 100 Ω. The frequency at which resonance occurs is
   (a) 15.9 rad/s　　　　　(b) 15.9 kHz
   (c) 1.59 rad/s　　　　　(d) 1.59 kHz

5. Given below are two statements:
   Statement I: Photovoltaic devices can convert optical radiation into electricity.
   Statement II: Zener diode is designed to operate under reverse bias in breakdown region.
   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

6. Light travels a distance x in time t_1 in air and 10x in time t_2 in another denser medium. What is the critical angle for this medium?

   (a) $\sin^{-1}\left(\dfrac{t_2}{t_1}\right)$　　　(b) $\sin^{-1}\left(\dfrac{10t_2}{t_1}\right)$

   (c) $\sin^{-1}\left(\dfrac{t_1}{10t_2}\right)$　　　(d) $\sin^{-1}\left(\dfrac{10t_1}{t_2}\right)$

7. In hydrogen spectrum, the shortest wavelength in the Balmer series is λ. The shortest wavelength in the Bracket series is

   (a) 2l　　(b) 4l　　(c) 9l　　(d) 16l

8. If the galvanometer G does not show any deflection in the circuit shown, the value of R is given by
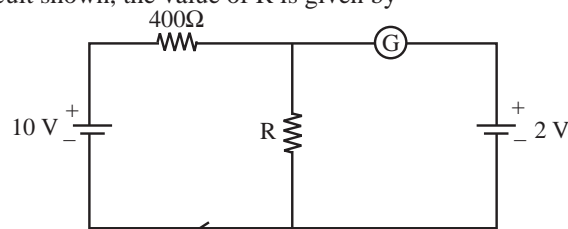
   (a) 200 W　(b) 50 W　(c) 100 W　(d) 400 W

9. The amount of energy required to form a soap bubble of radius 2 cm from a soap solution is nearly (surface tension of soap solution = 0.03 N m⁻¹)
   (a) 30.16 × 10–4 J　　　　(b) 5.06 × 10–4 J
   (c) 3.01 × 10–4 J　　　　(d) 50.1 × 10–4 J

10. The magnetic energy stored in an inductor of inductance 4 μH carrying a current of 2 A is
    (a) 4 mJ　　(b) 4 mJ　　(c) 8 mJ　　(d) 8 mJ

11. A 12 V, 60 W lamp is connected to the secondary of a step-down transformer, whose primary is connected to ac mains of 220 V. Assuming the transformer to be ideal, what is the current in the primary winding?
    (a) 0.27 A　(b) 2.7 A　(c) 3.7 A　(d) 0.37 A

12. An electric dipole is placed at an angle of 30° with an electric field of intensity 2×10^5 N C⁻¹. It experiences a torque equal to 4 N m. Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm.
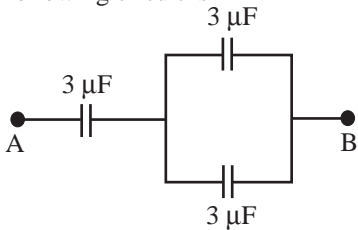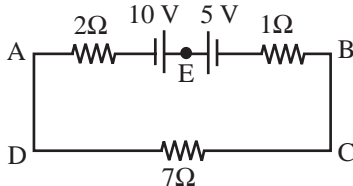   (a) 8 mC　　(b) 6 mC　　(c) 4 mC　　(d) 2 mC

13. A vehicle travels half the distance with speed v and the remaining distance with speed 2v. Its average speed is

    (a) $\dfrac{v}{3}$　　(b) $\dfrac{2v}{3}$　　(c) $\dfrac{4v}{3}$　　(d) $\dfrac{3v}{4}$

14. Let a wire be suspended from the ceiling (rigid support) and stretched by a weight W attached at its free end. The longitudinal stress at any point of cross-sectional area A of the wire is
   (a) 2W/A　　　　　　　(b) W/A
    (c) W/2A　　　　　　　(d) Zero

15. If $\oint_s \vec{E} \cdot \overline{dS} = 0$ over a surface, then

    (a) The number of flux lines entering the surface must be equal to the number of flux lines leaving it
    (b) The magnitude of electric field on the surface is constant
    (c) All the charges must necessarily be inside the surface
    (d) The electric field inside the surface is necessarily uniform

16. The work functions of Caesium (Cs), Potassium (K) and Sodium (Na) are 2.14 eV, 2.30 eV and 2.75 eV respectively. If incident electromagnetic radiation has an incident energy of 2.20 eV, which of these photosensitive surfaces may emit photoelectrons?
    (a) Cs only   (b) Both Na and K
    (c) K only   (d) Na only

17. The temperature of a gas is –50°C. To what temperature the gas should be heated so that the rms speed is increased by 3 times?
    (a) 669°C   (b) 3295°C   (c) 3097 K   (d) 223 K

18. The ratio of frequencies of fundamental harmonic produced by an open pipe to that of closed pipe having the same length is
    (a) 1 : 2   (b) 2 : 1   (c) 1 : 3   (d) 3 : 1

19. Resistance of a carbon resistor determined from colour codes is $(22000 \pm 5\%)$ Ω. The colour of third band must be
    (a) Red   (b) Green   (c) Orange   (d) Yellow

20. For Young's double slit experiment, two statements are given below:
    Statement I : If screen is moved away from the plane of slits, angular separation of the fringes remains constant.
    Statement II : If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes decreases.
    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.

21. A metal wire has mass (0.4 ± 0.002) g, radius (0.3 ± 0.001) mm and length (5 ± 0.02) cm. The maximum possible percentage error in the measurement of density will nearly be
    (a) 1.2%   (b) 1.3%   (c) 1.6%   (d) 1.4%

22. The equivalent capacitance of the system shown in the following circuit is

    (a) 2 μF   (b) 3 μF   (c) 6 μF   (d) 9 μF

23. Two bodies of mass m and $9m$ are placed at a distance R. The gravitational potential on the line joining the bodies where the gravitational field equals zero, will be (G = gravitational constant)
    (a) $-\dfrac{8Gm}{R}$ (b) $-\dfrac{12Gm}{R}$
    (c) $-\dfrac{16Gm}{R}$ (d) $-\dfrac{20Gm}{R}$

24. The venturi-meter works on
    (a) Huygen's principle
    (b) Bernoulli's principle
    (c) The principle of parallel axes
    (d) The principle of perpendicular axes

25. The half life of a radioactive substance is 20 minutes. In how much time, the activity of substance drops to $\left(\dfrac{1}{16}\right)^{th}$ of its initial value?
    (a) 20 minutes   (b) 40 minutes
    (c) 60 minutes   (d) 80 minutes

26. A football player is moving southward and suddenly turns eastward with the same speed to avoid an opponent. The force that acts on the player while turning is
    (a) Along eastward   (b) Along northward
    (c) Along north-east   (d) Along south-west

27. The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are
    (a) Instrumental errors   (b) Personal errors
    (c) Least count errors   (d) Random errors

28. The angular acceleration of a body, moving along the circumference of a circle, is
    (a) Along the radius, away from centre
    (b) Along the radius towards the centre (c) Along the tangent to its position
    (d) Along the axis of rotation

29. A full wave rectifier circuit consists of two p-n junction diodes, a centre–tapped transformer, capacitor and a load resistance. Which of these components remove the ac ripple from the rectified output?
    (a) A centre–tapped transformer
    (b) p–n junction diodes
    (c) Capacitor
    (d) Load resistance

30. The ratio of radius of gyration of a solid sphere of mass M and radius R about its own axis to the radius of gyration of the thin hollow sphere of same mass and radius about its axis is
    (a) 3 : 5   (b) 5 : 3   (c) 2 : 5   (d) 5 : 2

31. The magnitude and direction of the current in the following circuit is

(a) 0.2 *A* from *B* to *A* through *E*

(b) 0.5 *A* from *A* to *B* through *E*

(c) $\dfrac{5}{9}$ *A* from *A* to *B* through *E*

(d) 1.5 *A* from *B* to *A* through *E*

32. An ac source is connected to a capacitor C. Due to decrease in its operating frequency

(a) Capacitive reactance decreases

(b) Displacement current increases

(c) Displacement current decreases

(d) Capacitive reactance remains constant

33. The net magnetic flux through any closed surface is

(a) Zero

(b) Positive

(c) Infinity

(d) Negative

34. In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of 2.0×10^{10} Hz and amplitude 48 V m^{-1}. Then the amplitude of oscillating magnetic field is
(Speed of light in free space $= 3 \times 10^8$ m s^{-1})

(a) $1.6 \times 10{-9}$ T

(b) $1.6 \times 10{-8}$ T

(c) $1.6 \times 10{-7}$ T

(d) $1.6 \times 10{-6}$ T

35. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, potential energy stored in it will be

(a) 2 U   (b) 4 U   (c) 8 U   (d) 16 U

Section-B

36. A bullet from a gun is fired on a rectangular wooden block with velocity u. When bullet travels 24 cm through the block along its length horizontally, velocity of bullet becomes $\dfrac{u}{3}$. Then it further penetrates into the block in the same direction before coming to rest exactly at the other end of the block. The total length of the block is

(a) 27 cm   (b) 24 cm   (c) 28 cm   (d) 30 cm

37. A satellite is orbiting just above the surface of the earth with period T. If d is the density of the earth and G is the universal constant of gravitation, the quantity $\dfrac{3\pi}{Gd}$ represents

(a) T

(b) T2

(c) T3

(d) $\sqrt{T}$

38. The radius of inner most orbit of hydrogen atom is 5.3 $\times 10^{-11}$ m. What is the radius of third allowed orbit of hydrogen atom?

(a) 0.53 Å   (b) 1.06 Å   (c) 1.59 Å   (d) 4.77 Å

39. The net impedance of circuit (as shown in figure) will be
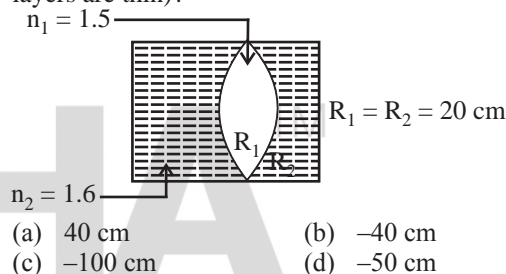

220 V, 50 Hz
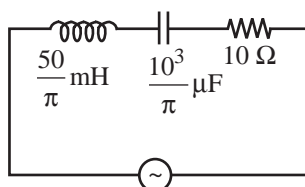
(a) $10\sqrt{2}\,\Omega$

(b) 15 W

(c) $5\sqrt{5}\,\Omega$

(d) 25 W

40. The x-t graph of a particle performing simple harmonic motion is shown in the figure. The acceleration of the particle at t = 2 s is
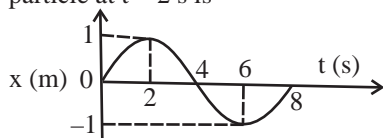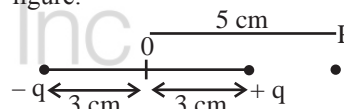

(a) $\dfrac{\pi^2}{8}\,\mathrm{m\,s}^{-2}$

(b) $-\dfrac{\pi^2}{8}\,\mathrm{m\,s}^{-2}$

(c) $\dfrac{\pi^2}{16}\,\mathrm{m\,s}^{-2}$

(d) $-\dfrac{\pi^2}{16}\,\mathrm{m\,s}^{-2}$

41. In the figure shown here, what is the equivalent focal length of the combination of lenses (Assume that all layers are thin)?


(a) 40 cm

(b) −40 cm

(c) −100 cm

(d) −50 cm

42. An electric dipole is placed as shown in the figure.

The electric potential (in 10^2 V) at point P due to the dipole is (ϵ_0 = permittivity of free space and $\dfrac{1}{4\pi\,\epsilon_0} = K$)

(a) $\left(\dfrac{3}{8}\right)qK$

(b) $\left(\dfrac{5}{8}\right)qK$

(c) $\left(\dfrac{8}{5}\right)qK$

(d) $\left(\dfrac{8}{3}\right)qK$

43. A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity 4 m s^{-1}. The ball strikes the water surface after 4 s. The height of bridge above water surface is (Take g = 10 m s^{-2})

(a) 56 m   (b) 60 m   (c) 64 m   (d) 68 m

44. Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 (g = 10 m s^{-2}).

(a) 1.2 m s–2 (b) 150 m s–2
(c) 1.5 m s–2 (d) 50 m s–2

45. 10 resistors, each of resistance R are connected in series to a battery of emf E and negligible internal resistance. Then those are connected in parallel to the same battery, the current is increased n times. The value of n is
(a) 10 (b) 100
(c) 1 (d) 1000

46. For the following logic circuit, the truth table is

(a)
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(b)
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(c)
A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0
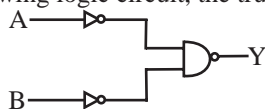
(d)
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

47. A very long conducting wire is bent in a semi-circular shape from A to B as shown in figure. The magnetic field at point P for steady current configuration is given by
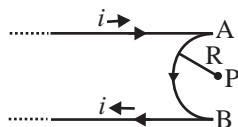
(a) $\dfrac{\mu_0 i}{4R}$ pointed into the page

(b) $\dfrac{\mu_0 i}{4R}$ pointed away from the page

(c) $\dfrac{\mu_0 i}{4R}\left[1-\dfrac{2}{\pi}\right]$ pointed away from page

(d) $\dfrac{\mu_0 i}{4R}\left[1-\dfrac{2}{\pi}\right]$ pointed into the page

48. The resistance of platinum wire at 0°C is 2 Ω and 6.8 Ω at 80°C. The temperature coefficient of resistance of the wire is
(a) 3×10^{-4} °C–1 (b) 3×10^{-3} °C–1
(c) 3×10^{-2} °C^{-1} (d) 3×10^{-1} °C^{-1}

49. A wire carrying a current I along the positive x-axis has length L. It is kept in a magnetic field $\vec{B} = \left(2\hat{i}+3\hat{j}-4\hat{k}\right)$ T. The magnitude of the magnetic force acting on the wire is
(a) $3\,IL$ (b) $\sqrt{5}\,IL$
(c) $5\,IL$ (d) $\sqrt{3}\,IL$

50. Two thin lenses are of same focal lengths (f), but one is convex and the other one is concave. When they are placed in contact with each other, th e equivalent focal length of the combination will be
(a) Zero (b) $\dfrac{f}{4}$
(c) $\dfrac{f}{2}$ (d) Infinite

CHEMISTRY

Section-A

51. Select the **correct** stateents from the following
   A. Atoms of all elements are composed of two fundamental particles.
   B. The mass of the electron is 9.10939 $\times 10^{-31}$ kg.
   C. All the isotopes of a given element show same chemical properties.
   D. Protons and electrons are collectively known as nucleons.
   E. Dalton's atomic theory, regarded the atom as an ultimate particle of matter.
   Choose the **correct** answer from the options given below

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

52. Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R** :
   Assertion A : A reaction can have zero activation energy.

   Reasons R : The minimum extra amount of energy absorbed by reactant molecules so that their energy becomes equal to threshold value, is called activation energy.
   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

53. A compound is formed by two elements A and B. The element B forms cubic close packed structure and atoms of A occupy 1/3 of tetrahedral voids. If the formula of the compound is A_xB_y, then the value of x + y is in option
   (a) 5 (b) 4 (c) 3 (d) 2

54. Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R :**
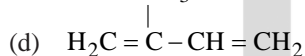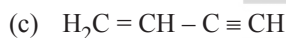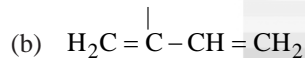**Assertion A :** Metallic sodium dissolves in liquid ammonia giving a deep blue solution, which is paramagnetic.
**Reason R :** The deep blue solution is due to the formation of amide.
In the light of the above statements, choose the **correct** answer from the options given below :
(a) Both **A** and **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

55. Amongst the following the total number of species NOT having eight electrons around central atom in its outermost shell, is
NH_3, $AlCl_3$, $BeCl_2$, CCl_4, PCl_5 :
(a) 3   (b) 2   (c) 4   (d) 1

56. Which amongst the following molecules on polymerization produces neoprene?
(a) $H_2C = CH - CH = CH_2$
(b) $H_2C = \underset{\underset{Cl}{|}}{C} - CH = CH_2$
(c) $H_2C = CH - C \equiv CH$
(d) $H_2C = \underset{\underset{CH_3}{|}}{C} - CH = CH_2$

57. In Lassaigne's extract of an organic compound, both nitrogen and sulphur are present, which gives blood red colour with Fe^{3+} due to the formation of
(a) $Fe_4[Fe(CN)_6]_3 \cdot xH_2O$
(b) $NaSCN$
(c) $[Fe(CN)_5NOS]^{4-}$
(d) $[Fe(SCN)]^{2+}$
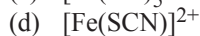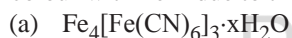
58. Weight (g) of two moles of the organic compound, which is obtained by heating sodium ethanoate with sodium hydroxide in presence of calcium oxide is :
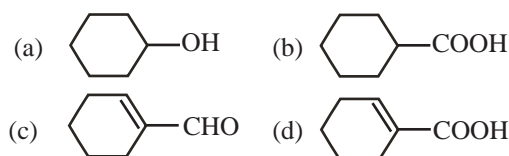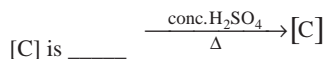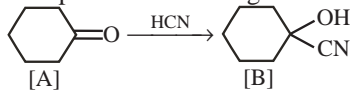(a) 16   (b) 32   (c) 30   (d) 18

59. Some tranquilizers are listed below. Which one from the following belongs to barbiturates?
(a) Chlordiazepoxide   (b) Meprobamate
(c) Valium   (d) Veronal

60. The conductivity of centimolar solution of KCl at 25°C is 0.0210 ohm^{-1} cm^{-1} and the resistance of the cell containing the solution at 25°C is 60 ohm. The value of cell constant is
(a) 1.34 cm^{-1} (b) 3.28 cm^{-1}
(c) 1.26 cm^{-1} (d) 3.34 cm^{-1}

61. Complete the following reaction

[A] $\xrightarrow{HCN}$ [B]

[C] is _____ $\xrightarrow[\Delta]{conc. H_2SO_4}$ [C]

(a) [benzene ring]—OH   (b) [benzene ring]—COOH
(c) [cyclohexene ring]—CHO   (d) [cyclohexene ring]—COOH

62. Homoleptic complex from the following complexes is
(a) Potassium trioxalatoaluminate (III)
(b) Diamminechloridonitrito-N-platinum (II)
(c) Pentaamminecarbonatocobalt (III) chloride
(d) Triamminetriaquachromium (III) chloride

63. The relation between n_m, (n_m = the number of permissible values of magnetic quantum number (m)) for a given value of azimuthal quantum number (l), is
(a) $l = \dfrac{n_m - 1}{2}$ (b) $l = 2n_m + 1$
(c) $n_m = 2l^2 + 1$ (d) $n_m = l + 2$

64. The stability of Cu^{2+} is more than Cu^+ salts in aqueous solution due to
(a) First ionisation enthalpy
(b) Enthalpy of atomization
(c) Hydration energy
(d) Second ionisation enthalpy

65. Taking stability as the factor, which one of the following represents **correct** relationship?
(a) $T\ell Cl_3 > T\ell Cl$ (b) $lnI_3 > lnI$
(c) $AlCl > AlCl_3$ (d) $T\ell I > T\ell I_3$
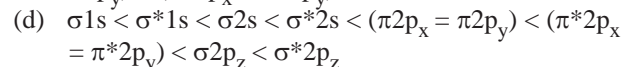
66. Which one is an example of heterogenous catalysis?
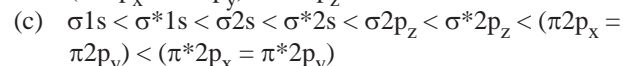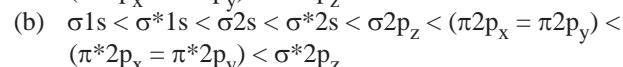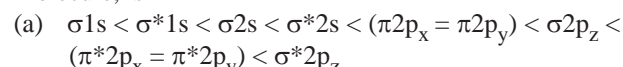(a) Oxidation of sulphur dioxide into sulphur trioxide in the presence of oxides of nitrogen
(b) Hydrolysis of sugar catalysed by H^+ ions
(c) Decomposition of ozone in presence of nitrogen monoxide
(d) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron

67. The number of σ bonds, π bonds and lone pair of electrons in pyridine, respectively are:
(a) 11, 2, 0   (b) 12, 3, 0
(c) 11, 3, 1   (d) 12, 2, 1

68. The **correct** order of energies of molecular orbitals of N_2 molecule, is
(a) $\sigma 1s < \sigma^*1s < \sigma 2s < \sigma^*2s < (\pi 2p_x = \pi 2p_y) < \sigma 2p_z < (\pi^*2p_x = \pi^*2p_y) < \sigma^*2p_z$
(b) $\sigma 1s < \sigma^*1s < \sigma 2s < \sigma^*2s < \sigma 2p_z < (\pi 2p_x = \pi 2p_y) < (\pi^*2p_x = \pi^*2p_y) < \sigma^*2p_z$
(c) $\sigma 1s < \sigma^*1s < \sigma 2s < \sigma^*2s < \sigma 2p_z < \sigma^*2p_z < (\pi 2p_x = \pi 2p_y) < (\pi^*2p_x = \pi^*2p_y)$
(d) $\sigma 1s < \sigma^*1s < \sigma 2s < \sigma^*2s < (\pi 2p_x = \pi 2p_y) < (\pi^*2p_x = \pi^*2p_y) < \sigma 2p_z < \sigma^*2p_z$

69. Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R**
Assertion A : Helium is used to dilute oxygen in diving apparatus.
**Reason R :** Helium has high solubility in O_2.
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

70. For a certain reaction, the rate $= k[A]^2[B]$, when the initial concentration of A is tripled keeping concentration of B constant, the initial rate would

(a) Decrease by a factor of nine

(b) Increase by a factor of six

(c) Increase by a factor of nine

(d) Increase by a factor of three

71. Identify product (A) in the following reaction:

$$\xrightarrow[\text{conc.HCl}]{\text{Zn}-\text{Hg}} (A) + 2H_2O$$
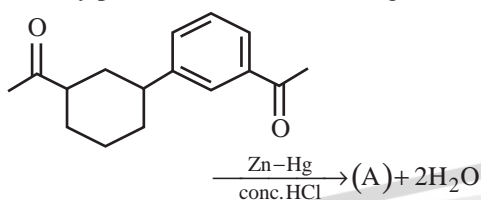
(a)

(b)

(c)

(d)

72. Which of the following reactions will NOT give primary amine as the product?

(a) $CH_3CONH_2 \xrightarrow{Br_2/KOH} Product$

(b) $CH_3CN \xrightarrow[\text{(ii)}\,H_3O^{\oplus}]{\text{(i)}\,LiAlH_4} Product$

(c) $CH_3NC \xrightarrow[\text{(ii)}\,H_3O^{\oplus}]{\text{(i)}\,LiAlH_4} Product$

(d) $CH_3CONH_2 \xrightarrow[\text{(ii)}\,H_3O^{\oplus}]{\text{(i)}\,LiAlH_4} Product$

73. Which amongst the following options is **correct** graphical representation of Boyle's law?

(a)

(b)

(c)

(d)
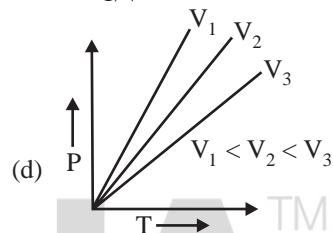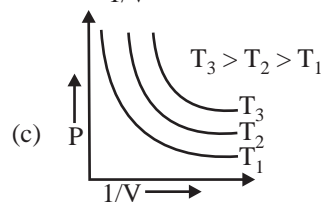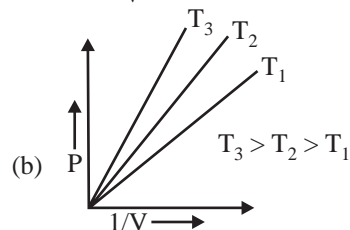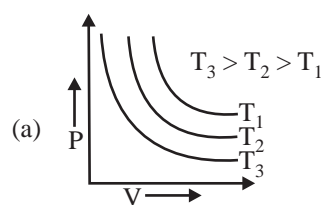
74. Amongst the given options which of the following molecules/ ion acts as a Lewis acid?

(a) NH_3 (b) H_2O (c) BF_3 (d) OH^-

75. The element expected to form largest ion to achieve the nearest noble gas configuration is

(a) O   (b) F   (c) N   (d) Na

76. The given compound

$$CH = CH - CH - CH_2\,CH_3$$

is an example of _____.

(a) Benzylic halide   (b) Aryl halide

(c) Allylic halide   (d) Vinylic halide

77. Given below are two statements :

Statement I : A unit formed by the attachment of a base to 1′ position of sugar is known as nucleoside.

Statement II : When nucleoside is linked to phosphorous acid at 5′–position of sugar moiety, we get nucleotide.

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

78. Intermolecular forces are forces of attraction and repulsion between interacting particles that will include :

A. dipole – dipole forces

B. dipole – induced dipole forces
C. hydrogen bonding
D. covalent bonding
E. dispersion forces

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

79. Which of the following statements are NOT correct?
A. Hydrogen is used to reduce heavy metal oxides to metals.
B. Heavy water is used to study reaction mechanism.
C. Hydrogen is used to make saturated fats from oils.
D. The H–H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any elements.
E. Hydrogen reduces oxides of metals that are more active than iron.

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

80. Which one of the following statements is correct?
(a) The daily requirement of Mg and Ca in the human body is estimated to be 0.2–0.3 g
(b) All enzymes that utilise ATP in phosphate transfer require Ca as the cofactor
(c) The bone in human body is an inert and unchanging substance
(d) Mg plays roles in neuromuscular function and interneuronal transmission

81. Match **List-I** with **List-II**.

|	List-I		List-II
A.	Coke	I.	Carbon atoms are sp^3 hybridised
B.	Diamond	II.	Used as a dry lubricant
C.	Fullerene	III.	Used as a reducing agent
D.	Graphite	IV.	Cage like molecules

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

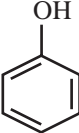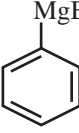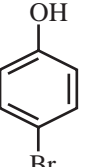**82.** The **right** option for the mass of CO_2 produced by heating 20 g of 20% pure limestone is (Atomic mass of Ca = 40)

$$\left[CaCO_3 \xrightarrow{1200\,K} CaO + CO_2\right]$$
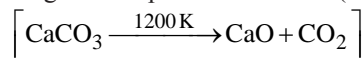
(a) 1.12 g   (b) 1.76 g
(c) 2.64 g   (d) 1.32 g

83. Identify the product in the following reaction:
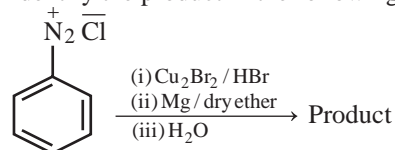
84. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A : In equation $\Delta_r G = -nFE_{cell}$, value of $\Delta_r G$ depends on n.
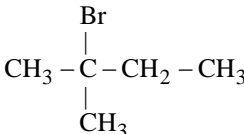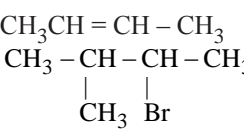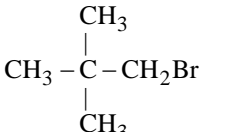
Reasons R : E_{cell} is an intensive property and $\Delta_r G$ is an extensive property.

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

85. Consider the following reaction and identify the product (P).

$$CH_3 - CH - CH - CH_3 \xrightarrow{HBr} Product(P)$$
$$\quad\quad\;\; | \quad\;\; |$$
$$\quad\quad CH_3 \; OH$$

3-Methylbutan−2−ol
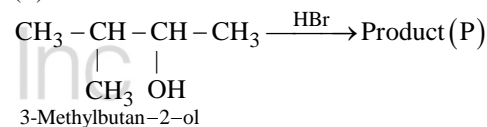
Section-B

86. Consider the following compounds/species:

vii.
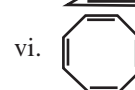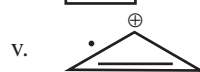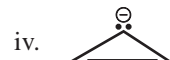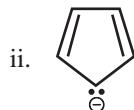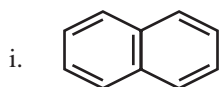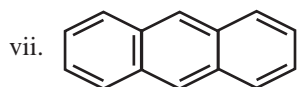
The number of compounds/species which obey Huckel's rule is _____.
(a) 4
(b) 6
(c) 2
(d) 5

87. Identify the major product obtained in the following reaction:

$3^- OH \xrightarrow{\Delta}$ major product

(a)
(b)
(c)
(d)
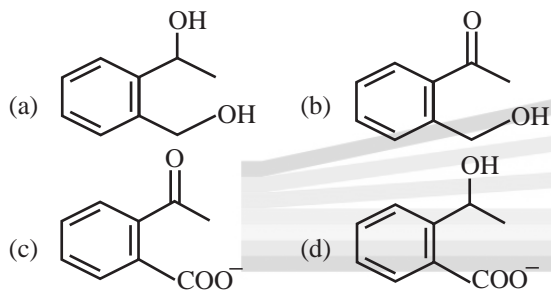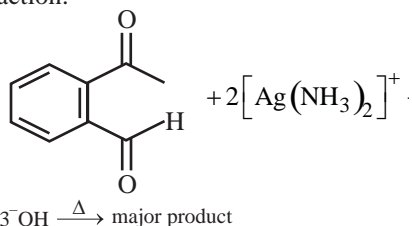
88. Which of the following statements are INCORRECT?
A. All the transition metals except scandium form MO oxides which are ionic.
B. The highest oxidation number corresponding to the group number in transition metal oxides is attained in Sc_2O_3 to Mn_2O_7.
C. Basic character increases from V_2O_3 to V_2O_4 to V_2O_5.
D. V_2O_4 dissolves in acids to give VO salts.
E. CrO is basic but Cr_2O_3 is amphoteric.
Choose the **correct** answer from the options given below:
(a) A and E only
(b) B and D only
(c) C and D only
(d) B and C only

89. Which amongst the following will be most readily dehydrated under acidic conditions?

(a)
(b)
(c)
(d)
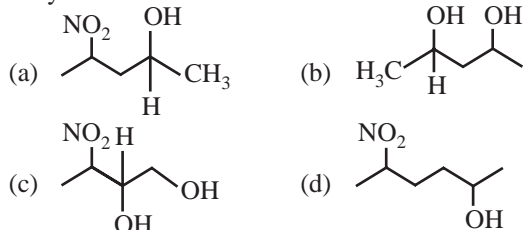
90. Consider the following reaction :
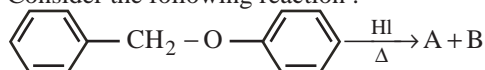
Identify products A and B.
(a) A = —CH_3 and B = —OH

(b) A = —CH_2OH and B = —I

(c) A = —CH_2I and B = —OH

(d) A = —CH_3 and B = —I
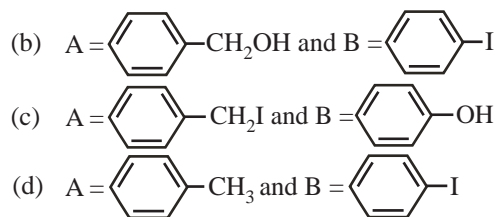
91. The reaction that does **NOT** take place in a blast furnace between 900 K to 1500 K temperature range during extraction of iron is :
(a) $Fe_2O_3 + CO \rightarrow 2FeO + CO_2$
(b) $FeO + CO \rightarrow Fe + CO_2$
(c) $C + CO_2 \rightarrow 2CO$
(d) $CaO + SiO_2 \rightarrow CaSiO_3$

92. Which amongst the following options is the **correct** relation between change in enthalpy and change in internal energy?
(a) $DH = DU - Dn_g RT$
(b) $DH = DU + Dn_g RT$
(c) $DH - DU = -DnRT$
(d) $DH + DU = DnR$

93. On balancing the given redox reaction,
$$aCr_2O_7^{2-} + bSO_3^{2-}(aq) + cH^+(aq) \rightarrow$$
$$2aCr^{3+}(aq) + bSO_4^{2-}(aq) + \frac{c}{2}H_2O(l)$$
the coefficients a, b and c are found to be, respectively–
(a) 1, 3, 8
(b) 3, 8, 1
(c) 1, 8, 3
(d) 8, 1, 3
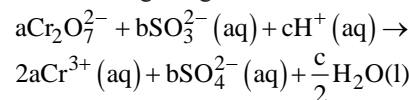
94. What fraction of one edge centred octahedral void lies in one unit cell of fcc?
(a) $\frac{1}{2}$
(b) $\frac{1}{3}$
(c) $\frac{1}{4}$
(d) $\frac{1}{12}$

95. Given below are two statements :
Statement I : The nutrient deficient water bodies lead to eutrophication
**Statement II :** Eutrophication leads to decrease in the level of oxygen in the water bodies.
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.

96. The equilibrium concentrations of the species in the reaction $A + B \rightleftharpoons C + D$ are 2, 3, 10 and 6 mol L^{-1}, respectively at 300 K. ΔG° for the reaction is (R = 2 cal/mol K)
(a) 1372.60 cal
(b) −137.26 cal
(c) −1381.80 cal
(d) −13.73 cal

97. Which complex compound is most stable?
(a) $[Co(NH_3)_4(H_2O)Br](NO_3)_2$

(b) $[Co(NH_3)_3(NO_3)_3]$

(c) $[CoCl_2(en)_2]NO_3$

(d) $[Co(NH_3)_6]_2(SO_4)_3$

98. Match **List-I** with **List-II** :

List-I (Oxoacids of Sulphur)		List-II (Bonds)
A.	Peroxodisulphuric	I. Two S–OH, acid Four S=O, One S–O–S
B.	Sulphuric acid	II. Two S–OH, One S=O
C.	Pyrosulphuric acid	III. Two S–OH, Four S=O, One S–O– O–S
D.	Sulphurous acid	IV. Two S–OH, Two S=O

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

99. Pumice stone is an example of
(a) Sol   (b) Gel
(c) Solid sol   (d) Foam

100. Identify the final product [D] obtained in the following sequence of reactions.

$$CH_3CHO \xrightarrow[\text{ii) } H_3O^+]{\text{i) } LiAlH_4} [A] \xrightarrow[\Delta]{H_2SO_4} [B]$$

$$\xrightarrow{HBr} [C] \xrightarrow[Na/dry\,ether]{} [D]$$
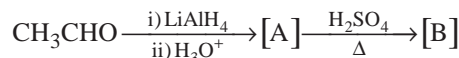
(a)

(b)

(c) C_4H_{10}

(d) $HC \equiv \overset{\ominus}{C} Na^+$

BOTANY

Section-A

101. Given below are two statements :
Statement I : The forces generated transpiration can lift a xylem–sized column of water over 130 meters height.
Statement II : Transpiration cools leaf surfaces sometimes 10 to 15 degrees evaporative cooling.
In the light of the above statements, choose the most appropriate answer from the options given below :
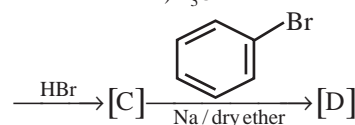(a) Both Statement I and Statement II are correct
(b) Both Statement I and Statement II are incorrect
(c) Statement I is correct but Statement II is incorrect
(d) Statement I is incorrect but Statement II is correct

102. In gene gun method used to introduce alien DNA into host cells, microparticles of _____ metal are used.
(a) Copper   (b) Zinc
(c) Tungsten or gold   (d) Silver

103. Given below are two statements : One labelled as Assertion A and the other labelled as Reason R:
Assertion A : The first stage of gametophyte in the life cycle of moss is protonema stage.
Reason R : Protonema develops directly from spores produced in capsule.
In the light of the above statements, choose the most appropriate answer from 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

104. Unequivocal proof that DNA is the genetic material was first proposed by
(a) Frederick Griffith
(b) Alfred Hershey and Martha Chase
(c) Avery, Macleoid and McCarthy
(d) Wilkins and Franklin

105. The thickness of ozone in a column of air in the atmosphere is measured in terms of :
(a) Dobson units   (b) Decibels
(c) Decamete   (d) Kilobase

106. In tissue culture experiments, leaf mesophyll cells are put in a culture medium to form callus. This phenomenon may be called as
(a) Differentiation   (b) Dedifferentiation
(c) Development   (d) Senescence

107. Large, colourful, fragrant flowers with nectar are seen in
(a) Insect pollinated plants
(b) Bird pollinated plants
(c) Bat pollinated plants
(d) Wind pollinated plants

108. Frequency of recombination between gene pairs on same chromosome as a measure of the distance between genes to map their position on chromosome, was used for the first time by
(a) Thomas Hunt Morgan
(b) Sutton and Boveri
(c) Alfred Sturtevant
(d) Henking

109. Which of the following stages of meiosis involves division of centromere?
(a) Metaphase I
(b) Metaphase II
(c) Anaphase II
(d) Telophase

110. What is the role of RNA polymerase III in the process of transcription in Eukaryotes?
(a) Transcription of rRNAs (28S, 18S and 5.8S)
(b) Transcription of tRNA, 5S rRNA and snRNA
(c) Transcription of precursor of mRNA
(d) Transcription of only snRNAs

111. Among 'The Evil Quartet', which one is considered the most important cause driving extinction of species?
(a) Habitat loss and fragmentation
(b) Over exploitation for economic gain
(c) Alien species invasions
(d) Co–extinctions

112. Given below are two statements :
Statement I : Endarch and exarch are the terms often used for describing the position of secondary xylem in the plant body.
Statement II : Exarch condition is the most common feature of the root system.
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

113. Axile placentation is observed in
(a) Mustard, Cucumber and Primrose
(b) China rose, Beans and Lupin
(c) Tomato, Dianthus and Pea
(d) China rose, Petunia and Lemon

114. Expressed Sequence Tags (ESTs) refers to
(a) All genes that are expressed as RNA.
(b) All genes that are expressed as proteins.
(c) All genes whether expressed or unexpressed.
(d) Certain important expressed genes.

115. What is the function of tassels in the corn cob?
(a) To attract insects
(b) To trap pollen grains
(c) To disperse pollen grains
(d) To protect seeds

116. Spraying of which of the following phytohormone on juvenile conifers helps hastening the maturity period, that leads early seed production?
(a) Indole-3-butyric Acid
(b) Gibberellic Acid
(c) Zeatin
(d) Abscisic Acid

117. In the equation $\boxed{GPP - R = NPP}$ GPP is Gross Primary Productivity NPP is Net Primary Productivity R here is _____.
(a) Photosynthetically active radiation
(b) Respiratory quotient
(c) Respiratory loss
(d) Reproductive allocation

118. Family Fabaceae differs from Solanaceae and Liliaceae. With respect to the stamens, pick out the characteristics specific to family Fabaceae but not found in Solanaceae or Liliaceae.
(a) Diadelphous and Dithecous anthers
(b) Polyadelphous and epipetalous stamens
(c) Monoadelphous and Monothecous anthers
(d) Epiphyllous and Dithecous anthers

119. In angiosperm, the haploid, diploid and triploid structures of a fertilized embryo sac sequentially are :

(a) Synergids, Primary endosperm nucleus and zygote
(b) Antipodals, synergids, and primary endosperm nucleus
(c) Synergids, Zygote and Primary endosperm nucleus
(d) Synergids, antipodals and Polar nuclei

120. Which hormone promotes internode/petiole elongation in deep water rice?
(a) GA3   (b) Kinetin
(c) Ethylene   (d) 2, 4–D

121. Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R** :
Assertion A : Late wood has fewer xylary elements with narrow vessels.
Reason R : Cambium is less active in winters.
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

122. Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R** :
Assertion A : ATP is used at two steps in glycolysis.
Reason R : First ATP is used in converting glucose into glucose–6–phosphate and second ATP is used in conversion of fructose–6–phosphate into fructose–1, 6–diphosphate.
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.

123. Identify the correct statements:
A. Detrivores perform fragmentation.
B. The humus is further degraded by some microbes during mineralization.
C. Water soluble inorganic nutrients go down into the soil and get precipitated by a process called leaching.
D. The detritus food chain begins with living organisms.
E. Earthworms break down detritus into smaller particles by a process called catabolism.
Choose the correct answer from the options given below:
(a) A, B, C only   (b) B, C, D only
(c) C, D, E only   (d) D, E, A only

124. The process of appearance of recombination nodules occurs at which sub stage of prophase I in meiosis?
(a) Zygotene   (b) Pachytene
(c) Diplotene   (d) Diakinesis

125. How many ATP and NADPH2 are required for the synthesis of one molecule of Glucose during Calvin cycle?

(a)   12 ATP and 12 $NADPH_2$
(b)   18 ATP and 12 NADPH2
(c)   12 ATP and 16 $NADPH_2$
(d)   18 ATP and 16 $NADPH_2$

126. The phenomenon of pleiotropism refers to
(a)   Presence of several alleles of a single gene controlling a single crossover
(b)   Presence of two alleles, each of the two genes controlling a single trait
(c)   A single gene affecting multiple phenotypic expression
(d)   More than two genes affecting a single character

127. Upon exposure to UV radiation, DNA stained with ethidium bromide will show
(a)   Bright red colour
(b)   Bright blue colour
(c)   Bright yellow colour
(d)   Bright orange colour

128. The reaction centre in PS II has an absorption maxima at
(a)   680 nm   (b)   700 nm   (c)   660 nm   (d)   780 nm

129. During the purification process for recombinant DNA technology, addition of chilled ethanol precipitates out
(a)   RNA   (b)   DNA
(c)   Histones   (d)   Polysaccharides

130. Which micronutrient is required for splitting of water molecule during photosynthesis?
(a)   Manganese   (b)   Molybdenum
(c)   Magnesium   (d)   Copper

131. Movement and accumulation of ions across a membrane against their concentration gradient can be explained by
(a)   Osmosis   (b)   Facilitated Diffusion
(c)   Passive Transport   (d)   Active Transport

132. Among eukaryotes, replication of DNA takes place in :
(a)   M phase   (b)   S phase
(c) G_1 phase   (d) G_2 phase

133. Cellulose does not form blue colour with Iodine because
(a)   It is a disaccharide
(b)   It is a helical molecule
(c)   It does not contain complex helices and hence cannot hold iodine molecules
(d)   It breaks down when iodine reacts with it

134. The historic Convention on Biological Diversity, 'The Earth Summit' was held in Rio de Janeiro in the year
(a)   1985   (b)   1992   (c)   1986   (d)   2002

135. Identify the pair of heterosporous pteridophytes among the following :
(a)   *Lycopodium* and *Selaginella*
(b)   *Selaginella* and *Salvinia*
(c)   *Psilotum* and *Salvinia*
(d)   *Equisetum* and *Salvinia*

Section-B

---

136. Match List I with List II :

List I	List II
A. M Phase	I. Proteins are synthesized
B. G_2 Phase	II. Inactive phase
C. Quiescent stage	III. Interval between mitosis and initiation of DNA replication
D. G_1 Phase	IV. Equational division

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

137. Match List I with List II:

List I	List II
A. Iron	I. Synthesis of auxin
B. Zinc	II. Component of nitrate reductase
C. Boron	III. Activator of catalase
D. Molybdenum	IV. Cell elongation and differentiation

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

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

138. Match List I with List II :

List I	List II
A. Cohesion	I. More attraction in liquid phase
B. Adhesion	II. Mutual attraction among water molecules
C. Surface tension	III. Water loss in liquid phase
D. Guttation	IV. Attraction towards polar surfaces

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

139. How many different proteins does the ribosome consist of?
(a)   80   (b)   60
(c)   40   (d)   20

140. Match List I with List II :

List I	List II
A. Oxidative decarboxylation	I. Citrate synthase
B. Glycolysis	II. Pyruvate dehydrogenase

C. Oxidative   III. Electron transport
    phosphorylation   system
D. Tricarboxylic   IV. EMP pathway
    acid cycle

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

141. Match List I with List II :

List I	List II
(Interaction)	**(Species A and B)**
A. Mutualism	I. +(A), 0(B)
B. Commensalism	II. –(A), 0(B)
C. Amensalism	III. +(A), –(B)
D. Parasitism	IV. +(A), +(B)

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

142. Main steps in the formation of Recombinant DNA are given below. Arrange these steps in a correct sequence.
A. Insertion of recombinant DNA into the host cell
B. Cutting of DNA at specific location by restriction enzyme
C. Isolation of desired DNA fragment
D. Amplification of gene of interest using PCR

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

143. Given below are two statements:
Statement I : Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely and competitively inferior one will be eliminated eventually.
Statement II : In general, carnivores are more adversely affected by competition than herbivores.

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 Statement II is false.
(d) Statement I is incorrect but Statement II is true.

144. Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R** :
Assertion A : A flower is defined as modified shoot wherein the shoot apical meristem changes to floral meristem.
Reason R : Internode of the shoot gets condensed to produce different floral appendages laterally at successive node instead of leaves.

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

145. Which of the following statements are correct about Klinefelter's Syndrome?
A. This disorder was first described by Langdon Down (1866).
B. Such an individual has overall masculine development. However, the feminine developement is also expressed.
C. The affected individual is short statured.
D. Physical, psychomotor and mental development is retarded.
E. Such individuals are sterile.

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

146. Melonate inhibits the growth of pathogenic bacteria by inhibiting the activity of
(a) Succinic dehydrogenase
(b) Amylase
(c) Lipase
(d) Dinitrogenase

147. Which one of the following statements is NOT correct?
(a) The micro-organisms involved in biodegradation of organic matter in a sewage polluted water body consume a lot of oxygen causing the death of aquatic organisms
(b) Algal blooms caused by excess of organic matter in water improve water quality and promote fisheries
(c) Water hyacinth grows abundantly in eutrophic water bodies and leads to an imbalance in the ecosystem dynamics of the water body
(d) The amount of some toxic substances of industrial waste water increases in the organisms at successive trophic levels

148. Which of the following combinations is required for chemiosmosis?
(a) Membrane, proton pump, proton gradient, ATP synthase
(b) Membrane, proton pump, proton gradient, NADP synthase
(c) Proton pump, electron gradient, ATP synthase
(d) Proton pump, electron gradient, NADP synthase

149. Identify the correct statements:
A. Lenticels are the lens-shaped openings permitting the exchange of gases.
B. Bark formed early in the season is called hard bark.
C. Bark is a technical term that refers to all tissues exterior to vascular cambium.
D. Bark refers to periderm and secondary phloem.
E. Phellogen is single-layered in thickness.

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

150. Given below are two statements : One labelled as **Assertion A** and the other labelled as **Reason R**:
Assertion A : In gymnosperms the pollen grains are released from the microsporangium and carried by air currents.

Reason R : Air currents carry the pollen grains to the mouth of the archegonia where the male gametes are discharged and pollen tube is not formed.

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 current explanation of A
(c) A is true but R is false
(d) A is false but R is true

ZOOLOGY

Section-A

151. Which of the following is not a cloning vector?
(a) BAC   (b) YAC
(c) pBR322   (d) Probe

152. Broad palm with single palm crease is visible in a person suffering from–
(a) Down's syndrome
(b) Turner's syndrome
(c) Klinefelter's syndrome
(d) Thalassemia

153. Which of the following are NOT considered as the part of endomembrane system?
A. Mitochondria   B. Endoplasmic reticulum
C. Chloroplasts   D. Golgi complex
E. Peroxisomes

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

154. Match List I with List II.

	List I		List II
A.	Taenia	I.	Nephridia
B.	Paramoecium	II.	Contractile vacuole
C.	Periplaneta	III.	Flame cells
D.	Pheretima	IV.	Urecose gland

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

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

Assertion A : Amniocentesis for sex determination is one of the strategies of Reproductive and Child Health Care Programme.

Reason R : Ban on amniocentesis checks increasing menace of female foeticide.

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.

156. Given below are two statements:
Statement I: Ligaments are dense irregular tissue.
Statement II: Cartilage is dense regular tissue.

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

157. Match List I with List II.

	List I		List II
A.	P–wave	I.	Beginning of systole
B.	Q–wave	II.	Repolarisation of ventricles
C.	QRS complex	III.	Depolarisation of atria
D.	T–wave	IV.	Depolarisation of ventricles

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

158. Match List I with List II

	List I (Cells)		List II (Secretion)
A.	Peptic cells	I.	Mucus
B.	Goblet cells	II.	Bile juice
C.	Oxyntic cells	III.	Proenzyme pepsinogen
D.	Hepatic cells	IV.	HCl and intrinsic factor for absorption of vitamin B_{12}

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

159. Match List I with List II.

	List I		List II
A.	Vasectomy	I.	Oral method
B.	Coitus interruptus	II.	Barrier method
C.	Cervical caps	III.	Surgical method
D.	Saheli	IV.	Natural method

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

160. Given below are two statements:
Statement I: Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.
Statement II: The cavity of the cervix is called cervical canal which along with vagina forms birth canal.
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.

161. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.
Assertion A: Nephrons are of two types: Cortical & Juxta medullary, based on their relative position in cortex and medulla.
Reason R: Juxta medullary nephrons have short loop of Henle whereas, cortical nephrons have longer loop of Henle.
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.

162. Given below are two statements:
Statement I : Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.
Statement II: When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as competitive inhibitor.
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.

163. Match List I with List II.

List I		**List II**	
A.	Gene 'a'	I.	β-galactosidase
B.	Gene 'y'	II.	Transacetylase
C.	Gene 'i'	III.	Permease
D.	Gene 'z'	IV.	Repressor protein

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

164. Match List I with List II.

List I		**List II**	
A.	Ringworm	I.	*Haemophilus influenzae*
B.	Filariasis	II.	*Trichophyton*

C. Malaria   III. *Wuchereria bancrofti*
D. Pneumonia   IV. *Plasmodium vivax*
Choose the correct answer from the options given below:
(a) A–II, B–III, C–IV, D–I
(b) A–II, B–III, C–I, D–IV
(c) A–III, B–II, C–I, D–IV
(d) A–III, B–II, C–IV, D–I

165. Which of the following functions is carried out by cytoskeleton in a cell?
(a) Nuclear division   (b) Protein synthesis
(c) Motility   (d) Transportation

166. Which of the following statements is correct?
(a) Eutrophication refers to increase in domestic sewage and waste water in lakes.
(b) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.
(c) Presence of large amount of nutrients in water restricts 'Algal Bloom'
(d) Algal Bloom decreases fish mortality

167. Match List I with List II.

List I		**List II**	
A.	Heroin	I.	Effect on cardiovascular system
B.	Marijuana	II.	Slow down body function
C.	Cocaine	III.	Painkiller
D.	Morphine	IV.	Interfere with transport of dopamine

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

168. Radial symmetry is NOT found in adults of phylum _____.
(a) Ctenophora   (b) Hemichordata
(c) Coelenterata   (d) Echinodermata

169. Given below are two statements:
Statement I: In prokaryotes, the positively charged DNA is held with some negatively charged proteins in a region called nucleoid.
Statement II: In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form nucleosome.
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.

170. Which of the following statements are correct regarding female reproductive cycle?
A. In non-primate mammals cyclical changes during reproduction are called oestrus cycle.

B. First menstrual cycle begins at puberty and is called menopause.

C. Lack of menstruation may be indicative of pregnancy.

D. Cyclic menstruation extends between menarche and menopause.

Choose the most appropriate answer from the options given below.

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

171. Select the correct group/set of Australian Marsupials exhibiting adaptive radiation.

(a) Tasmanian wolf, Bobcat, Marsupial mole
(b) Numbat, Spotted cuscus, Flying phalanger
(c) Mole, Flying squirrel, Tasmanian tiger cat
(d) Lemur, Anteater, Wolf

172. Which one of the following techniques does not serve the purpose of early diagnosis of a disease for its early treatment?

(a) Recombinant DNA Technology
(b) Serum and Urine analysis
(c) Polymerase Chain Reaction (PCR) technique
(d) Enzyme Linked Immuno-Sorbent Assay (ELISA) technique

173. Match List I with List II.

	List I (Type of Joint)		List II (Found between)
A.	Cartilaginous Joint	I.	Between flat skull bones
B.	Ball and Socket Joint	II.	Between adjacent vertebrae in vertebral column
C.	Fibrous Joint	III.	Between carpal and metacarpal of thumb
D.	Saddle Joint	IV.	Between Humerus and Pectoral girdle

Choose the correct answer from the options given below:

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

174. Match List I with List II.

	List I (Interacting species)		List II (Name of interaction)
A.	A Leopard and a Lion in a forest/ grassland	I.	Competition
B.	A Cuckoo laying egg in a Crow's nest	II.	Brood parasitism
C.	Fungi and root of a higher plant in Mycorrhizae	III.	Mutualism
D.	A cattle egret and a Cattle in a field	IV.	Commensalism

Choose the correct answer from the options given below.

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

175. Vital capacity of lung is _____.

(a) IRV + ERV
(b) IRV + ERV + TV + RV
(c) IRV + ERV + TV – RV
(d) IRV + ERV + TV

176. Match List I with List II with respect to human eye.

	List I		List II
A.	Fovea	I.	Visible coloured portion of eye that regulates diameter of pupil.
B.	Iris	II.	External layer of eye formed of dense connective tissue.
C.	Blind spot	III.	Point of greatest visual acuity or resolution.
D.	Sclera	IV.	Point where optic nerve leaves the eyeball and photoreceptor cells are absent.

Choose the correct answer from the options given below:

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

177. Once the undigested and unabsorbed substances enter the caecum, their backflow is prevented by

(a) Sphincter of Oddi
(b) Ileo-caecal valve
(c) Gastro-oesophageal sphincter
(d) Pyloric sphincter

178. Which one of the following common sexually transmitted diseases is completely curable when detected early and treated properly?

(a) Genital herpes   (b) Gonorrhoea
(c) Hepatitis–B   (d) HIV Infection

179. Given below are two statements:

Statement I: A protein is imagined as a line, the left end represented by first amino acid (C–terminal) and the right end represented by last amino acid (N–terminal).

Statement II: Adult human haemoglobin, consists of 4 subunits (two subunits of a type and two subunits of b type.)

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.

180. Given below are two statements:

Statement I: Electrostatic precipitator is most widely used in thermal power plant.

Statement II : Electrostatic precipitator in thermal power plant removes ionising radiations.

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.

181. In which blood corpuscles, the HIV undergoes replication and produces progeny viruses?

(a) TH cells (b) B–lymphocytes
(c) Basophils (d) Eosinophils

182. Given below are two statements:

Statement I: RNA mutates at a faster rate.

Statement II: Viruses having RNA genome and shorter life span mutate and evolve faster.

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.

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

Assertion A: Endometrium is necessary for implantation of blastocyst.

Reason R: In the absence of fertilization, the corpus luteum degenerates that causes disintegration of endometrium.

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.
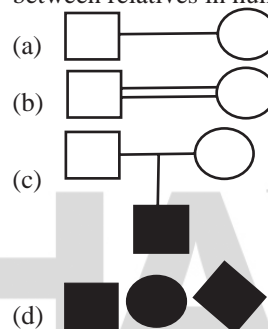
184. Match List I with List II.

List I		List II	
A.	CCK	I.	Kidney
B.	GIP	II.	Heart
C.	ANF	III.	Gastric gland
D.	ADH	IV.	Pancreas

Choose the correct answer from the options given below:

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

185. Which one of the following symbols represents mating between relatives in human pedigree analysis?

Section-B

186. The unique mammalian characteristics are:

(a) hairs, tympanic membrane and mammary glands
(b) hairs, pinna and mammary glands
(c) hairs, pinna and indirect development
(d) pinna, monocondylic skull and mammary glands

187. Which of the following statements are correct?

A. Basophils are most abundant cells of the total WBCs
B. Basophils secrete histamine, serotonin and heparin
C. Basophils are involved in inflammatory response
D. Basophils have kidney shaped nucleus

Choose the correct answer from the options given below:

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

188. Select the correct statements with reference to chordates.

A. Presence of a mid-dorsal, solid and double nerve cord.
B. Presence of closed circulatory system.
C. Presence of paired pharyngeal gill slits.
D. Presence of dorsal heart.
E. Triploblastic pseudocoelomate animals.

Choose the correct answer from the options given below:

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

189. Which of the following are NOT under the control of thyroid hormone?

A. Maintenance of water and electrolyte balance
B. Regulation of basal metabolic rate
C. Normal rhythm of sleep-wake cycle
D. Development of immune system
E. Support the process of RBCs formation

Choose the correct answer from the options given below:

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

190. In cockroach, excretion is brought about by–

A. Phallic gland B. Urecose gland
C. Nephrocytes D. Fat body
E. Collaterial glands

Choose the correct answer from the options given below:

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

191. The parts of human brain that helps in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are:

(a) Limbic system and hypothalamus
(b) Corpora quadrigemina and hippocampus
(c) Brain stem and epithalamus
(d) Corpus callosum and thalamus

192. Match List I with List II.

List I		List II
A.	Mast cells	I.	Ciliated epithelium
B.	Inner surface of bronchiole	II.	Areolar connective tissue
C.	Blood epithelium	III.	Cuboidal
D.	Tubular parts of nephron	IV.	Specialised connective tissue

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

193. Match List I with List II.

List I		List II
A.	Logistic growth availability condition	I.	Unlimited resource
B.	Exponential growth condition	II.	Limited resource availability
C.	Expanding age pyramid of pre-reproductive age is largest followed by reproductive and post reproductive age groups	III.	The percent individuals
D.	Stable age pyramid pre-reproductives and reproductive age group are same	IV.	The percent individuals of

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

194. Which of the following statements are correct?
A. An excessive loss of body fluid from the body switches off osmoreceptors.
B. ADH facilitates water reabsorption to prevent diuresis.
C. ANF causes vasodilation.
D. ADH causes increase in blood pressure.
E. ADH is responsible for decrease in GFR.
Choose the correct answer from the options given below:
(a) A and B only   (b) B, C and D only
(c) A, B and E only   (d) C, D and E only

195. Given below are two statements:
Statement I : During G0 phase of cell cycle, the cell is metabolically inactive.
Statement II : The centrosome undergoes duplication during S phase of interphase.

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.

196. Select the correct statements.
A. Tetrad formation is seen during Leptotene.
B. During Anaphase, the centromeres split and chromatids separate.
C. Terminalization takes place during Pachytene.
D. Nucleolus, Golgi complex and ER are reformed during Telophase.
E. Crossing over takes place between sister chromatids of homologous chromosome.
Choose the correct answer from the options given below:
(a) A and C only   (b) B and D only
(c) A, C and E only   (d) B and E only

197. Which one of the following is NOT an advantage of inbreeding?
(a) It decreases homozygosity.
(b) It exposes harmful recessive genes but are eliminated by selection.
(c) Elimination of less desirable genes and accumulation of superior genes takes place due to it.
(d) It decreases the productivity of inbred population, after continuous inbreeding.

198. Which of the following is characteristic feature of cockroach regarding sexual dimorphism?
(a) Dark brown body colour and anal cerci
(b) Presence of anal styles
(c) Presence of sclerites
(d) Presence of anal cerci

199. Which one of the following is the sequence on corresponding coding strand, if the sequence on mRNA formed is as follows 5'AUCGAUCGAUCGAUCGAUCGAUCG AUCG 3'?
(a) 5'GCUAGCUAGCUAGCUAGCUAGC '3'
(b) 3'GCUAGCUAGCUAGCUAGCUAGC 5'
(c) 5'ATCGATCGATCGATCGATCGATCG 3'
(d) 3'ATCGATCGATCGATCGATCGATCG 5'

200. Which of the following statements are correct regarding skeletal muscle?
A. Muscle bundles are held together by collagenous connective tissue layer called fascicle.
B. Sarcoplasmic reticulum of muscle fibre is a store house of calcium ions.
C. Striated appearance of skeletal muscle fibre is due to distribution pattern of actin and myosin proteins.
D. M line is considered as functional unit of contraction called sarcomere.
Choose the most appropriate answer from the options given below:
(a) A, B and C only   (b) B and C only
(c) A, C and D only   (d) C and D only

NEET Rank Predictor 2023

Marks Scored	All India Rank	Marks Scored	All India Rank
720 – 691	1 – 20	610 – 591	5501 – 10000
690 – 671	21 – 200	590 – 571	10,001 – 13000
670 – 651	201 – 950	570 – 551	13001 – 19000
650 – 631	951 – 2500	550 – 531	19001 – 27000
630 – 611	2501-5500	530 – 500	27001 – 40000

HINTS & SOLUTIONS

PHYSICS

1. **(b)** Since, $eV = \dfrac{hc}{\lambda_{min}} \Rightarrow \lambda_{min} = \dfrac{hc}{eV}$

$\therefore \lambda_{min} \propto \dfrac{1}{V}$

NOTES   X ray photo of maximum energy is emitted when an electron looses its whole energy during a single collision with the atom

2. **(a)** Given, efficiency $\eta = \dfrac{50}{100} = \dfrac{1}{2}$

Source temperature, $T_1 = 327 + 273 = 600$ K

Efficiency of Carnot engine $\eta = 1 - \dfrac{T_2}{T_1}$

$\Rightarrow \eta = 1 - \dfrac{T_2}{600} \Rightarrow \dfrac{1}{2} = 1 - \dfrac{T_2}{600}$

$\dfrac{T_2}{600} = \dfrac{1}{2} \Rightarrow T_2 = 300$ K

$\therefore$ Sink temperature, $T_2 = 300 - 273 = 27°C$

3. **(c)** Maximum height, $H = \dfrac{u^2 \sin^2 \theta}{2g}$

$H = \dfrac{(280)^2 \times (\sin^2 30)}{2 \times 9.8} = \dfrac{280 \times 280 \times 0.5 \times 0.5}{2 \times 9.8}$
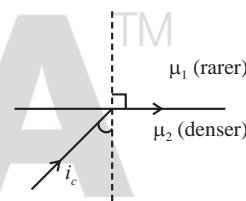
$\therefore H = 1000$ m

4. **(d)** For resonance frequency $f = \dfrac{1}{2\pi\sqrt{LC}}$

$\Rightarrow f = \dfrac{1}{2 \times \pi \times \sqrt{10 \times 10^{-3} \times 1 \times 10^{-6}}} = \dfrac{10^4}{2\pi}$

$= \dfrac{10^4}{2 \times 22/7} = 1.591 \times 10^3$

$\therefore f = 1.591$ kHz

5. **(a)** Statement I : Photovoltaic devices convert optical radiation into electricity.

II : Zener diode is designed to operate under reverse bias in breakdown region.

NOTES   Zener diodes are not damged by high reverse current.

6. **(d)** $\mu_2 \sin i_c = \mu_1 \Rightarrow \sin i_c = \dfrac{\mu_1}{\mu_2}$

μ_1 (rarer)

μ_2 (denser)

$\mu = \dfrac{c}{V}$

$\therefore \sin i_c = \dfrac{\mu_1}{\mu_2} = \dfrac{V_2}{V_1}$

$\sin i_c = \dfrac{10xt_1}{t_2 x} \quad \therefore i_c = \sin^{-1}\left(\dfrac{10t_1}{t_2}\right)$

7. **(b)** Using $\dfrac{1}{\lambda} = R\left[\dfrac{1}{n_2^2} - \dfrac{1}{n_1^2}\right]$

For Balmer series, $[n_2 = 2, n_1 = \infty]$

$\dfrac{1}{\lambda} = R\left[\dfrac{1}{4} - \dfrac{1}{\infty}\right] \Rightarrow \lambda = \dfrac{4}{R}$ ... (i)
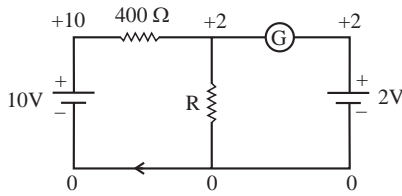
And for bracket series, $(n_2 = 4, n_1 = \infty)$

$\dfrac{1}{\lambda'} = R\left[\dfrac{1}{16} - \dfrac{1}{\infty}\right] \Rightarrow \lambda' = \dfrac{16}{R}$ ... (ii)

Dividing eq (i) by (ii)

$\dfrac{\lambda}{\lambda'} = \dfrac{4/R}{16/R} \quad\quad \therefore \lambda' = 4\lambda$

8. **(c)** Since galvanometer does not show any deflection

$\therefore i_g = 0$

From the circuit diagram,

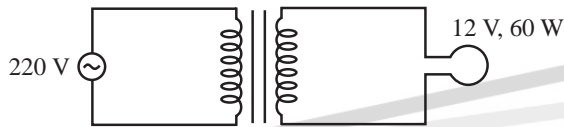$$\frac{10-2}{400}=\frac{2}{R} \quad \therefore R = \frac{2\times400}{2} = 100\ \Omega$$

9. **(c)** Amount of energy required to form a soap bubble
$$= [S \times \Delta A] \times 2$$
$$= [0.03 \times 4 \times \pi \times 4 \times 10^{-4}] \times 2 = 3.015 \times 10^{-4}\ \text{J}$$

10. **(d)** Magnetic energy stored in an inductor
$$U = \frac{1}{2}Li^2 = \frac{1}{2} \times 4 \times 10^{-6} \times (2)^2$$
$$= 8 \times 10^{-6}\ \text{J} = 8\ \mu\text{J}$$

11. **(a)**

As transfer to be ideal and for ideal transformer
$$\text{P}_{\text{input}} = \text{P}_{\text{output}}$$
$$\therefore (VI)_{\text{in}} = 60 \ \Rightarrow\ 220 \times I = 60$$
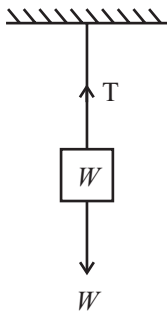$$\therefore I = 0.27\ \text{A}$$

12. **(d)** Given $E = 2 \times 10^5$ N/C, $I = 2$ cm and $\tau = 4$ Nm
$$\vec{\tau} = \vec{p} \times \vec{E} = pE\sin\theta$$
$$4 = p \times 2 \times 10^5 \times \sin 30° \Rightarrow p = 4 \times 10^{-5}\ \text{cm}$$

$\therefore$ Charge on the dipole, $q = \dfrac{p}{I} = \dfrac{4 \times 10^{-5}}{0.02} = 2\ \text{mC}$

13. **(c)** Average speed, $v_{\text{avg}} = \dfrac{2v_1 v_2}{v_1 + v_2}$
$$= \frac{2 \times v \times 2v}{v + 2v} = \frac{4v}{3}$$

14. **(b)**

Longitudinal stress
$$= \frac{\text{Internal restoring force}}{\text{Area}} = \frac{F_{ext}}{\text{Area}}$$

$\therefore$ Stress $= \dfrac{W}{A}$

15. **(a)** Since, $\phi_{\text{net}} = \displaystyle\oint_s \vec{E}\cdot \overline{dS} = 0$

i.e., Net flux through surface is zero, so number of flux lines entering the surface must be equal to the number of flux lines leaving it.

In the expresion $\displaystyle\oint \vec{E}.d\vec{S} = 0$ the electric field is the sum of electric field due to charge within the surface and due to charge outside the surface.

16. **(a)** Energy of incident radiation = 2.20 eV
Work function of Cs, ϕ_{Cs} = 2.14 eV and ϕ_{K} = 2.30 eV
ϕ_{Na} = 2.75 eV
Since the work function of caesium, $\phi_{\text{Cs}} < \phi_{\text{Incident}}$. Hence photons may be emitted from caesium.

17. **(b)** RMS speed, $v_{rms} = \sqrt{\dfrac{3RT}{m}} \Rightarrow v_{rms} \propto \sqrt{T}$

v_{rms} is increased by 3 times,
So, final rms speed = $v + 3v = 4v$

$T_1 = 273 - 50 = 223$ K and $T_2 = ?$
$$\frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}} \Rightarrow \frac{v}{4v} = \sqrt{\frac{223}{T_2}} \Rightarrow \frac{1}{16} = \frac{223}{T_2}$$

$\therefore T_2 = 3568$ K or, $T_2 = 3568 - 273 = 3295°$C

18. **(b)** Fundamental harmonic produced by open pipe,

$$f_{\text{open pipe}} = \frac{v}{2l}$$

And by closed pipe, $f_{\text{closed pipe}} = \dfrac{v}{4l}$

$$\therefore \frac{f_0}{f_c} = \frac{v}{2l} \times \frac{4l}{v} = \frac{2}{1} \quad \therefore f_0 : f_c = 2 : 1$$

19. **(c)** Resistance = $(22000 \pm 5\%)\ \Omega = (22 \times 10^3)\ \Omega \pm 5\%$
Since third band corresponds to decimal multiplier
Decimal multiplier = 10^3
Multiplier 1 = Black, 10^1 = Brown, 10^2 = Red and 10^3 = Orange.
Therefore the colour of third band must be orange.

20. **(c)** For Young's double slit experiment, angular fringe width
$$\alpha = \frac{\lambda}{d}$$
It does not depend on the distance of screen from the slit, so statement I is correct.
Angular fringe width $\propto \lambda$
So if λ increases, angular separation of fringes increases.
Therefore, statement I is true and statement II is false.

21. **(c)** Density, $\rho = \dfrac{\text{mass}}{\text{volume}} = \dfrac{M}{\pi r^2 l}$

$$\frac{\Delta\rho}{\rho} = \frac{\Delta M}{M} + \frac{2\Delta r}{r} + \frac{\Delta l}{l} = \left(\frac{0.002}{0.4} + \frac{2 \times 0.001}{0.3} + \frac{0.02}{5} \right)$$
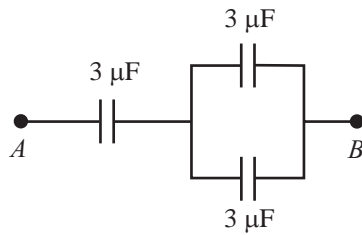
$$\frac{\Delta\rho}{\rho} = 0.0156$$

% error in density $\dfrac{\Delta\rho}{\rho}\% = 1.56\% \approx 1.6\%$

22. **(a)** For parallel grouping, $C_{\text{eq}} = C_1 + C_2 + \dots C_n$
$C_1 = 3 + 3 = 6\ \mu\text{F}$
For series grouping, $\dfrac{1}{C_{eq}} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + \dots \dfrac{1}{C_n}$
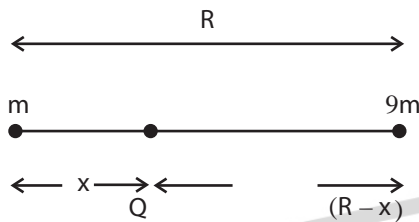
$$C_{eq} = \frac{C_1 C_2}{C_1 + C_2} = \frac{3 \times 6}{3 + 6} = \frac{18}{9} = 2\ \mu\text{F}$$

23. **(c)** Let gravitational field at point Q be zero

$$\therefore \frac{Gm}{x^2} = \frac{G(9m)}{(R-x)^2}$$

$$\frac{(R-x)^2}{x^2} = 9 \implies x = \frac{R}{4}$$

$$V_Q = \frac{-Gm}{x} - \frac{G(9m)}{R-x}$$

$$V_Q = \frac{-Gm}{\frac{R}{4}} - \frac{G(9m)}{\frac{3R}{4}} = \frac{-4Gm}{R} - \frac{12Gm}{R} = \frac{-16Gm}{R}$$

24. **(b)** Venturi-meter works on the Bernoulli's principle.

25. **(d)** $N = \frac{N_0}{2^n} \implies \frac{N}{N_0} = \frac{1}{2^n}$

$$\implies \frac{1}{16} = \frac{1}{2^n} \implies \frac{1}{2^4} = \frac{1}{2^n} \quad \therefore n = 4$$

$$n = \frac{t}{T_{\frac{1}{2}}} \quad \therefore t = 4 \times T_{\frac{1}{2}} = 4 \times 20 = 80 \text{ minutes}$$

26. **(c)** Change in momentum, $\Delta \vec{P} = \vec{P}_f - \vec{P}_i$

$$\vec{P}_f = mu\hat{i}$$

$$\vec{P}_i = mu(-\hat{j})$$

$$\Delta \vec{P} = mu\hat{i} - mu(-\hat{j})$$

$$\Delta \vec{P} = mu(\hat{i} + \hat{j})$$

$$\vec{F} = \frac{\Delta \vec{P}}{\Delta t}$$

Direction of change of momentum and direction of force acting on the player will be same i.e., along north-east.

27. **(d)**

> **NOTES**
> Random errors is also called chance error. It occurs due to parameter which are beyond the control of experimenter.

28. **(d)** Using the Right hand screw rule, angular acceleration of a body, moving along the circumference of a cirlce is along the axis of rotation.

29. **(c)** Capacitor is used to remove the ac ripple from the rectified output.

30. **(*)** Moment of inertia of solid sphere about its own axis $I_1 = \frac{2}{5}MR^2 = MK_1^2$

Here K_1 = radius of gyration of solid sphere

$$\therefore \quad K_1 = \sqrt{\frac{I_2}{M}} = \sqrt{\frac{2}{5}}R$$

Moment of inertia of thin hollow sphere,

$$I_2 = \frac{2}{3}MR^2 = MK_2^2$$

Here K_2 = radius of gyration of hollow sphere

$$\therefore \quad K_2 = \sqrt{\frac{I_2}{M}} = \sqrt{\frac{2}{3}}R$$

$$\therefore \quad \frac{K_1}{K_2} = \sqrt{\frac{2}{5}} \times \sqrt{\frac{3}{2}} = \sqrt{\frac{3}{5}}$$

*None of the option is correct (correct answer is $\sqrt{\frac{3}{5}}$)

31. **(b)** Net resistance of the circuit,
$R_{eq} = 2\,\Omega + 1\,\Omega + 7\,\Omega = 10\,\Omega$
Net Voltage, $V_{net} = 10 - 5 = 5$ V

$$i = \frac{V_{net}}{R_{eq}} = \frac{5}{10} = 0.5 \text{ A}$$

32. **(c)** Capacitive reactance $X_C = \frac{1}{\omega C} = \frac{1}{2\pi v C}$

Since v decreasing, X_C will increase

$\therefore$ Current, $I = \frac{E_0}{X_C}$ will decrease

As conduction current = displacement current
Therefore displacement current will decrease.

33. **(a)** For closed loops

Magnetic flux = $\oint \vec{B} \cdot \vec{ds}$ = zero

Magnetic monopole doesn't exist.
Hence net magnetic flux through any closed surface is zero.

34. **(c)** Given, Amplitude of oscillating electric field component, $E_0 = 48$ Vm^{-1}

Using, $c = \frac{E_0}{B_0}$

Here, B_0 = Amplitude of oscillating magnetic field

$$\therefore B_0 = \frac{48}{3 \times 10^8} = 16 \times 10^{-8} = 1.6 \times 10^{-7} \text{ T}$$

35. **(d)** Potential energy stored in spring (U) is given by

$$U = \frac{1}{2}Kx^2$$

Initially

$$U_i = \frac{1}{2}K(2)^2 \quad \text{where } x = 2 \text{ cm}$$

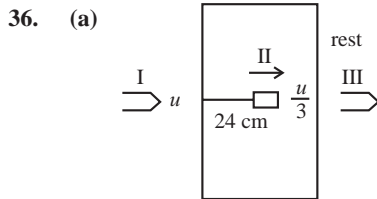$$\implies U_i = \frac{1}{2}(K) \cdot (4) = 2K \quad\quad\quad ...\text{(i)}$$

Finally

$$U_f = \frac{1}{2}K(8)^2 = \frac{1}{2}K \times 64 = 32K \quad\quad ...\text{(ii)}$$

On dividing (i) by (ii)

$$\frac{U_i}{U_f} = \frac{2K}{32K} = \frac{1}{16}$$

$\Rightarrow \quad U_f = 16\, U_i$

36. **(a)**

Using third equation of motion between I and II
$$v^2 - u^2 = 2as$$

$\Rightarrow \quad \left(\frac{u}{3}\right)^2 = u^2 - 2a \times 24$

$\Rightarrow \quad 2a(24) = \frac{8u^2}{9}$ ... (i)

Using third equation of motion again between II and III

$$0 = \left(\frac{u}{3}\right)^2 - 2as$$

$\Rightarrow \quad \frac{u^2}{9} = 2as$ ... (ii)

From equation (i) and (ii)
$2a\,24 = 8(2as)$
$\Rightarrow \quad s = 3$ cm

Length of wooden block = 24 + 3 = 27 cm

37. **(b)** Time period of satellite just above earth surface (T) is given by

$$T = 2\pi \sqrt{\frac{R}{g}}$$

But $g = \dfrac{GM}{R^2} = \dfrac{G}{R^2}\left(\dfrac{4}{3}\pi R^3 d\right) = Gd\dfrac{4}{3}\pi R$

$\therefore T = 2\pi \sqrt{\dfrac{R}{G\dfrac{4}{3}\pi Rd}} = 2\pi \sqrt{\dfrac{3}{4\pi Gd}} \Rightarrow T^2 = \dfrac{3\pi}{Gd}$

Note : The time period of satellite,

$$T = \frac{\text{Circumferance of the orbite of satellite}}{\text{Orbital velocity of Satellite}}$$

$\Rightarrow T = \dfrac{2\pi r}{v_{\text{Orbital}}} = \dfrac{2\pi r}{\sqrt{\dfrac{GM}{r}}} \quad \left(\because v_{\text{Orbital}} = \sqrt{\dfrac{GM}{r}}\right)$

$\Rightarrow T = 2\pi \sqrt{\dfrac{r^3}{GM}} = 2\pi \sqrt{\dfrac{r^3}{gR^2}} \left(\because GM = gR^2\right)$

$\Rightarrow T = 2\pi \sqrt{\dfrac{(R+h)^3}{gR^2}}$

Here, r = R + h
When satellite lies close to the earth R + h ≈ R

$\Rightarrow T = 2\pi \sqrt{\dfrac{R^3}{gR^2}} = 2\pi \sqrt{\dfrac{R}{g}}$

38. **(d)** Given,
Radius of inner most orbit of hydrogen atom,
$r_1 = 5.3 \times 10^{-11}$ m

Radius of nth orbit $r_n = \dfrac{n^2}{Z} \Rightarrow r_n \propto n^2$

$\therefore \quad \dfrac{r_1}{r_2} = \left(\dfrac{n_1}{n_2}\right)^2$

$\Rightarrow \quad \dfrac{r_1}{r_2} = \left(\dfrac{1}{3}\right)^2$

$\Rightarrow \quad r_2 = 9 r_1 = 5.3 \times 10^{-11} \times 9$
$= 47.7 \times 10^{-11} = 4.77$ Å

39. **(c)** Inductance, $L = \dfrac{50}{\pi}$ mH

Resistance, $R = 10\ \Omega$

Capacitance, $C = \dfrac{10^3}{\pi} \times 10^{-6}$

Inductive reactance, $X_L = \omega L = 2\pi f L$

$\qquad = 2\pi \times 50 \times \dfrac{50}{\pi} \times 10^{-3} = 5\ \Omega$

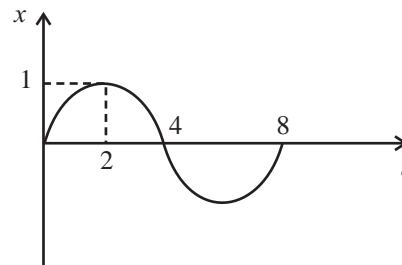Capacitive reactance, $X_C = \dfrac{1}{\omega C} = \dfrac{1}{2\pi f C}$

$= \dfrac{1 \times \pi}{2\pi \times 50 \times 10^3 \times 10^{-6}} = \dfrac{10^3}{100} = 10\ \Omega$

Impedance $Z = \sqrt{(X_C - X_L)^2 + R^2}$

$= \sqrt{(10 - 5)^2 + 10^2}$

$\Rightarrow \quad Z = \sqrt{125} = 5\sqrt{5}\ \Omega$

40. **(d)** Position of particle as function of time
$x = A \sin \omega t$

From figure, at $t = 2$ s
$x = 1$
Time period, $T = 8$ s

$\omega = \dfrac{2\pi}{T} = \dfrac{2\pi}{8} = \dfrac{\pi}{4}$

$a = -\omega^2 x = -\left(\dfrac{\pi}{4}\right)^2 \times 1$

$\Rightarrow \quad a = -\dfrac{\pi^2}{16}$ m/ s^{-2}

NOTES   In SHM, we cannot apply equation of translatory motion as acceleration ($a = \omega^2 x$) is not constant

41. **(c)** From the lens maker's formula

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\therefore \frac{1}{f_1} = (1.6 - 1)\left(\frac{1}{\infty} - \frac{1}{20}\right) = \frac{-0.6}{20} = \frac{-3}{100}$$

$$\therefore \frac{1}{f_2} = (1.5 - 1)\left(\frac{1}{20} - \frac{1}{-20}\right) = \frac{0.5}{10} = \frac{1}{20}$$

$$\therefore \frac{1}{f_3} = (1.6 - 1)\left(\frac{1}{-20} - \frac{1}{\infty}\right) = \frac{-0.6}{10} = \frac{-3}{100}$$

Effective focal length (f_{eff}) is

$$\frac{1}{f_{eff}} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$$

$$\Rightarrow \frac{1}{f_{eff}} = \frac{-3}{100} + \frac{1}{20} - \frac{3}{100} \Rightarrow \frac{1}{f_{eff}} = \frac{-1}{100}$$

$$\Rightarrow f_{eff} = -100 \text{ cm}$$

42. **(a)** Electrostatic potential due to a point charge is given by $V = \frac{Kq}{r}$

$$\therefore V_{net} = \frac{Kq}{2 \times 10^{-2}} - \frac{Kq}{8 \times 10^{-2}}$$

$$\Rightarrow V_{net} = \frac{Kq \times 10^2}{2}\left(1 - \frac{1}{4}\right) = \left(\frac{3}{8}Kq\right) \times 10^2 \ V = \frac{3}{8}qK$$

43. **(c)** Given,
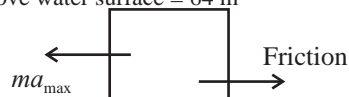Initial velocity of ball, $u = 4 \text{ ms}^{-1}$
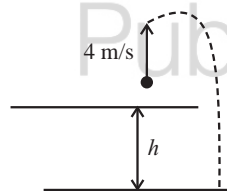
$$s = ut - \frac{1}{2}gt^2$$

$$= 4 \times 4 - \frac{1}{2} \times 10 \times (4)^2 = -64 \text{ m}$$

Height of bridge above water surface = 64 m

44. **(c)**

As the body remains stationary,
$$\therefore ma_{max} = \mu_s mg$$
$$\Rightarrow a_{max} = \mu_s g = 0.15 \times 10 = 1.5 \text{ m/s}^2$$

45. **(b)** For series combination,
Equivalent resistance, $R_{eq} = 10R$

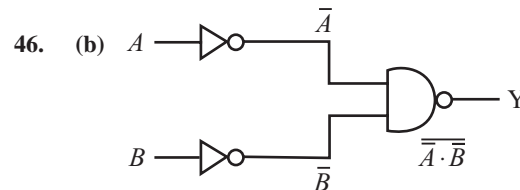Current $i_1 = \frac{E}{10R}$

For parallel combination,

Equivalent resistance, $R_{eq} = \frac{R}{10}$

$$\therefore i_2 = \frac{E}{\frac{R}{10}} = \frac{10E}{R}$$

$$\therefore \frac{i_2}{i_1} = \frac{10E}{R} \times \frac{10R}{E} = 100 \Rightarrow i_2 = 100i$$

According to question
$$i_2 = ni_1$$
$$\therefore n = 100$$

46. **(b)**

$$Y = \overline{\overline{A} \cdot \overline{B}} = \overline{\overline{A + B}} = A + B$$

It is OR gate.

A	B	Y = A + B
0	0	0
0	1	1
1	0	1
1	1	1

47. **(c)**

Magnetic field due to wire I = $\frac{\mu_0 i}{4\pi R}$.

Magnetic field due to wire III = $\frac{\mu_0 i}{4\pi R}$.

Magnetic field due to semiconductor arc II = $\frac{\mu_0 i}{4R}$.

Magnetic field due to wire I and III

$$= \frac{\mu_0 i}{4\pi R} \otimes + \frac{\mu_0 i}{4\pi R} = \frac{\mu_0 i}{2\pi R} \otimes$$

$$B_{total} = B_{arc} - B_{wires} = \frac{\mu_0 i}{4R} - \frac{\mu_0 i}{2\pi R}$$

$$= \frac{\mu_0 i}{4R}\left[1 - \frac{2}{\pi}\right]$$

Pointed away from page.

48. **(c)** Given,
Resistance at 0°C, $R_0 = 2 \ \Omega$
Resistance at 80°C, $R = 6.8 \ \Omega$
Using $R = R_0(1 + \alpha \Delta T)$
where α is the temperature coefficient of resistance
$$\therefore 6.8 = 2\{1 + \alpha(80 - 0)\}$$

$$\Rightarrow \frac{6.8}{2} - 1 = \alpha \times 80$$

$$\Rightarrow \alpha = \frac{3.4 - 1}{80} = \frac{2.4}{80} = 0.03$$

$$\therefore \alpha = 3 \times 10^{-2} \ °C^{-1}$$

49. **(c)** Given,
Magnetic Field, B = $(2\hat{i} + 3\hat{j} - 4\hat{k})T$

Magnetic force acting on a current carrying wire is

$\vec{F} = I\vec{l} \times \vec{B}$

$= IL\hat{i} \times (2\hat{i} + 3\hat{j} - 4\hat{k}) = 3IL\hat{k} + 4IL\hat{j}$

Magnitude of force, $|\vec{F}| = \sqrt{(3IL)^2 + (4IL)^2}$

$= 5IL$

50. **(d)** We know that
For convex lens $f_1 > 0$,
concave lens $f_2 < 0$

$\dfrac{1}{f_{net}} = \dfrac{1}{f_1} + \dfrac{1}{f_2} = \dfrac{1}{f} - \dfrac{1}{f} = 0$

$\Rightarrow f_{net} = \infty$

> **NOTES** If two thin lenses of same focal length but having opposite nature are placed in contact then combination will behave like a plane glass plate.

CHEMISTRY

51. **(d)** **(A)** Atoms consist of three fundamental particles : Electrons, protons and neutrons
(D) Protons and neutrons present in the nucleus are collectively called as nucleons.
So, the correct statements are B, C, E only.

52. **(b)** Activation energy is defined as the minimum amount of extra energy absorbed by reactant molecules to achieve threshold energy.
Zero activation energy means the reactant molecules have the sufficient energy to form product.
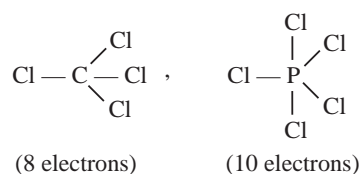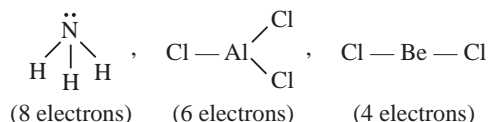
> **NOTES** According to Arrhenius equation
> $k = Ae^{-E_a/RT}$
>
> Zero activation energy means $E_a = 0$
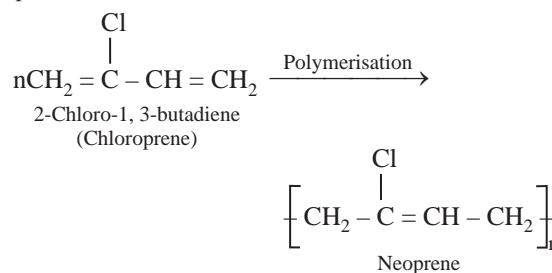> $\Rightarrow k = Ae^0 \Rightarrow k = A$, where A is the frequency factor.
> It simply implies that all collisions lead to successful collisions and should results in the formation of product which is practically not possible.

53. **(a)** Let the number of atoms of element B = N

So, the number of atoms of element A $= \dfrac{1}{3} \times 2\,N$

$\therefore$ The formula of the compound is $A_{\frac{2}{3}N} B_N$
$= A_2 B_3$
So, x = 2, y = 3, x + y = 5

54. **(c)** On dissolving alkali metal (sodium) in liquid ammonia, a deep blue solution is developed due to ammoniated electron which absorbs energy in visible region of light and imparts blue colour. Due to the presence of unpaired electrons, solution is paramagnetic.
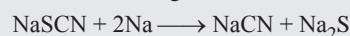$M + (x + y)NH_3 \longrightarrow [M(NH_3)_x]^+ + [e(NH_3)_y]^-$

55. **(a)**

$\overset{..}{N}$ with H, H, H (8 electrons), Cl—Al with Cl, Cl (6 electrons), Cl—Be—Cl (4 electrons)

Cl—C with Cl, Cl, Cl (8 electrons), Cl—P with Cl, Cl, Cl, Cl (10 electrons)

56. **(b)** Neoprene is formed by free radical polymerisation of chloroprene.

$$nCH_2 = \underset{\underset{Cl}{|}}{C} - CH = CH_2 \xrightarrow{Polymerisation}$$

2-Chloro-1, 3-butadiene
(Chloroprene)

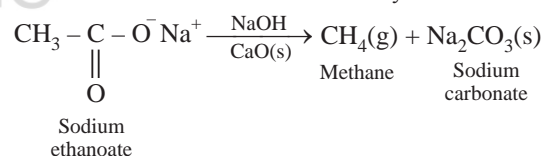$$\left[CH_2 - \underset{\underset{Cl}{|}}{C} = CH - CH_2 \right]_n$$

Neoprene

57. **(d)** In case, nitrogen and sulphur both are present in organic compound, sodium thiocyanate is formed. It gives blood red colour and no Prussian blue since there are no free cyanide ions.
$Na + C + N + S \longrightarrow NaSCN$
$Fe^{3+} + SCN^- \longrightarrow [Fe(SCN)]^{2+}$
Blood red

> **NOTES** If sodium fusion is carried out with excess of sodium, the thiocyanate decomposes to yield cyanide and sulphide. These ions now give their usual tests.
> $NaSCN + 2Na \longrightarrow NaCN + Na_2S$

58. **(b)** This reaction is called soda lime decarboxylation

$$CH_3 - \underset{\underset{O}{\parallel}}{C} - \overset{-}{O}\,Na^+ \xrightarrow[CaO(s)]{NaOH} CH_4(g) + Na_2CO_3(s)$$

Sodium ethanoate · Methane · Sodium carbonate

Molar mass of CH_4 = 16 g/mol
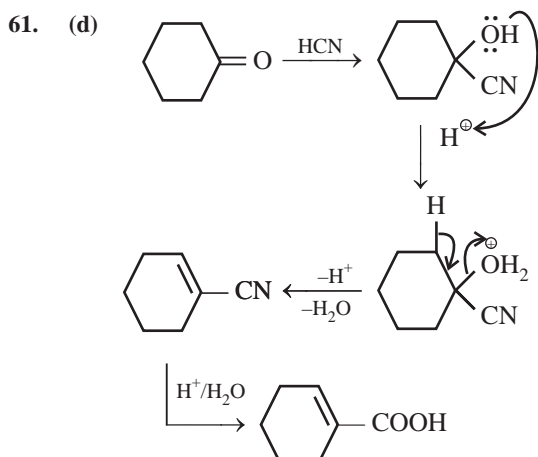Weight of 2 moles of CH_4 = 16 × 2 = 32 g

> **NOTES** Decarboxylation with soda lime produces alkane containing one carbon less than the carboxylic acid.

59. **(d)** Veronal is the derivative of Barbituric acid and considered as barbiturate.

60. **(c)** Conductivity = conductance × cell constant

$k = \dfrac{1}{R} \times \dfrac{l}{A}$

$\dfrac{l}{A} = k \times R = 0.0210 \times 60 = 1.26 \text{ cm}^{-1}$

61. (d)

62. (a) complexes in which a metal is bound to only one kind of donor groups are called as homoleptic complexes.
Potassium trioxalatoaluminate (III). It is a homoleptic complex.

63. (a) $n_m = 2l + 1 \Rightarrow l = \dfrac{n_m - 1}{2}$

64. (c) The stability of Cu^{2+} (aq) is more than Cu^+ (aq) is due to the much more negative $\Delta_{hyd}H^o$ of Cu^{2+} (aq) than Cu^+ (aq), which more than compensates for second ionisation enthalphy of Cu.
$\Delta_{hyd}H^o$ of Cu^{2+} (aq) = -2121 kJ mol^{-1},
$\Delta_i H_1^o$ of Cu = $+745$ kJ mol^{-1},
$\Delta_i H_2^o$ of Cu = $+1960$ kJ mol^{-1}

65. (d) As we move down the group, due to poor shielding effect of intervening d and f orbitals, the increased effective nuclear charge holds ns electrons tightly and therefore restricting their participation in bonding. This effect is known as inert pair effect.
So, the relative stability of +1 O.S increases for heavier elements.
Hence, TlI is more stable than TlI$_3$.

> **NOTES**
> Boron and Aluminium do not show the inert pair effect. The inert pair effect is only shown by the elements which have d and f orbitals influencing their outermost s-orbital electrons by having poor shielding.

66. (d) Combination of N_2 and H_2 to form NH_3 in presence of finely divided Fe is an example of heterogeneous catalysis.
N_2 (g) + 3H$_2$ (g) $\xrightarrow{\text{Fe(s)}}$ 2NH$_3$ (g)

67. (c)

Pyridine
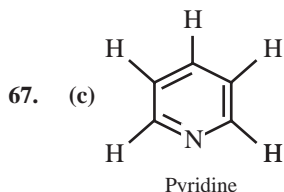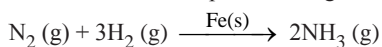
No. of σ bonds = 11, No. of π bonds = 3, No. of lone pair of e$^-$ = 1

68. (a) For molecules like B_2, C_2, N_2 etc. the increasing order of energies of various molecular orbitals is
$\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < (\pi 2p_x = \pi 2p_y) < \sigma 2p_z < (\pi^* 2p_x = \pi^* 2p_y) < \pi^* 2p_z$

69. (b) Helium is used as diluent for oxygen in modern diving apparatus because of its very low solubility in blood.
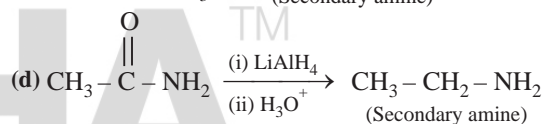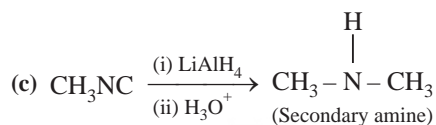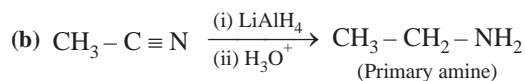
> **NOTES**
> The solubility of he is less than that of nitrogen and it diffuses more rapidly, the elimination of inert gas from blood and tissues would be more rapid if Helium was substituted for nitrogen.

70. (c) Rate = k[A]^2[B]
When concentration of A is tripled, [A'] = [3A]
New rate, r' = k[A']^2 [B] = k[3A]^2 [B] = 9k[A]^2 [B]
$\Rightarrow$ r' = 9r, increases by factor of nine.

**71. (a)** This reaction is Clemmensen reduction
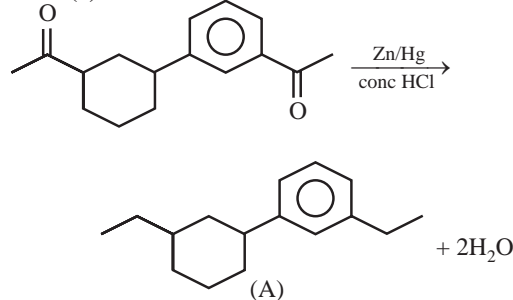
72. (c) (a) $CH_3 - \overset{O}{\overset{||}{C}} - NH_2 \xrightarrow[\substack{\text{Hoffmann bromamide} \\ \text{degradation reaction}}]{\text{Br}_2/\text{KOH}} CH_3 - NH_2$
(Primary amine)

(b) $CH_3 - C \equiv N \xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) LiAlH}_4} CH_3 - CH_2 - NH_2$
(Primary amine)

(c) $CH_3NC \xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) LiAlH}_4} CH_3 - \overset{H}{\overset{|}{N}} - CH_3$
(Secondary amine)

(d) $CH_3 - \overset{O}{\overset{||}{C}} - NH_2 \xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) LiAlH}_4} CH_3 - CH_2 - NH_2$
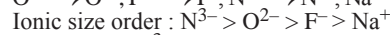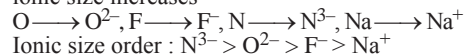(Secondary amine)

73. (b) According to Boyle's law, $P \propto \dfrac{1}{V}$, option (b) is the correct representation.

74. (c) Lewis acids are the one which accepts lone pair of electron due to presence of vacant orbital in outermost shell.
$\overset{..}{N}H_3, \overset{..}{O}H^-, H_2\overset{..}{\overset{..}{O}}: \longrightarrow$ Lewis base
$BF_3 \longrightarrow$ Lewis acid
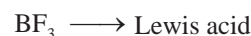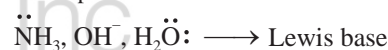
75. (c) For isoelectronic species, as the charge on anion increases, ionic size increases
$O \longrightarrow O^{2-}, F \longrightarrow F^-, N \longrightarrow N^{3-}, Na \longrightarrow Na^+$
Ionic size order : $N^{3-} > O^{2-} > F^- > Na^+$
So, N forms N^{3-} anion with largest ionic size.

76. (c) Allylic halides are the compound where halogen atom attached to sp^3 hybridised carbon atom next to double bond.

77. (a) A unit formed by the attachment of a base to 1' position of sugar is known as nucleoside. In nucleosides, the sugar carbons are numbered as 1', 2', 3', etc. in order to distinguish these from the bases (Fig. (a)). When nucleoside is linked to phosphoric acid at 5'-position of sugar moiety, we get a nucleotide (Fig. (b)).
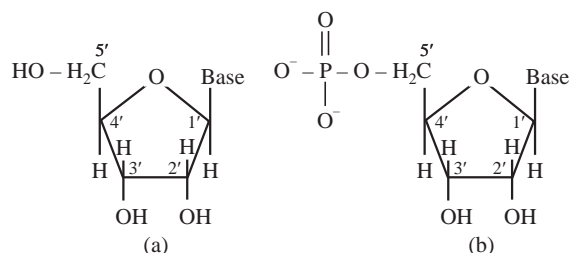

Fig. Structure of (a) a nucleoside and (b) a nucleotide

78. **(c)** Intermolecular forces are the forces of attraction and repulsion between interacting molecules. This term does not include covalent bonds as covalent bond holds atoms of a molecule together.
Hence, dipole - dipole forces, dipole - induced dipole forces, hydrogen bonding and dispersion forces are intermolecular forces.

79. **(c)** Statement A, B, C are correct.
(D) H – H bond dissociation energy is maximum as compared to single bond between two atom of any element.
(E) Hydrogen reduces oxides of metal that are less active than iron.

80. **(a)** **(b)** All enzymes that utilize ATP in phosphate transfer require Mg as the co-factor.
(c) Bone in human body is not an inert and unchanging substance but is continuously being solubilised and redeposited.
(d) Ca plays important role in neuromuscular function, interneuronal transmission, cell membrance integrity and blood coagulation.

81. **(c)** A – III, B – I, C – IV, D – II

82. **(b)** $CaCO_3 \xrightarrow{1200\ K} CaO + CO_2$
    1 mol   1 mol
    100 g   44 g
As $CaCO_3$ is 20% pure, So, mass of pure $CaCO_3$

$= 20 \times \dfrac{20}{100} = 4$ g

So, 100 g $CaCO_3$ produces 44 g CO_2

$\therefore$ 4 g $CaCO_3$ produces $\dfrac{44}{100} \times 4$ g CO_2

$= 1.76$ g CO_2

83. **(b)**
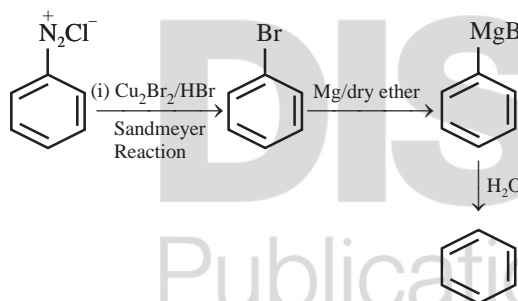
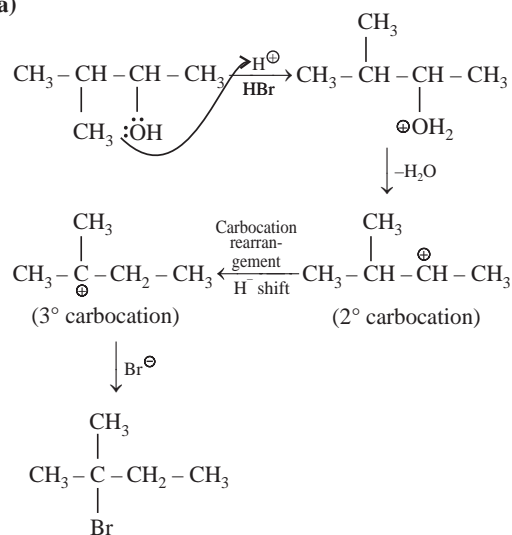**84.** **(b)** The value of $\Delta_r G$ depends on n value as per the equation
$\Delta_r G = -nFE_{cell}$
So, assertion statement is correct
E_{cell} is an intensive property while $\Delta_r G$ is an extensive thermodynamic property
So, reason is correct but not explaining the assertion.

85. **(a)**

86. **(a)** Criteria for Huckel's rule:
- Planarity
- Complete delocalisation of π electrons
- Presence of $(4n + 2)\pi$ electrons in ring where n is an integer (n = 0, 1, 2, ...)

The compounds which follow Huckel's rule are option (i), (ii), (iv), (vii).

87. **(c)** Ammoniacal silver nitrate solution is Tollens' reagent. Aldehyde upon warming with Tollens' reagent produces a silver mirror due to formation of silver metal in alkaline medium. Aldehyde is oxidised to corresponding carboxylate anion.
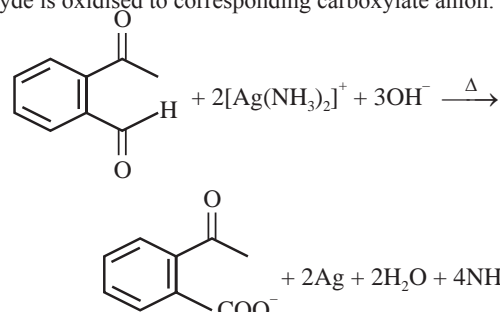
88. **(c)** **(C)** Basic character decreases from V_2O_3 to V_2O_4 to V_2O_5.
(D) V_2O_4 dissolves in acids to give VO^{2+}.

89. **(b)**
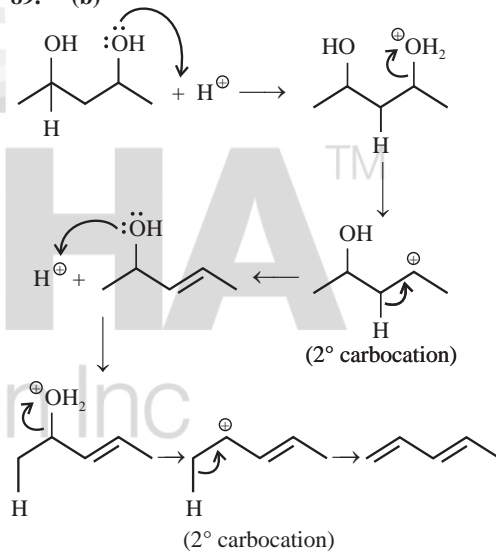
(2° carbocation)

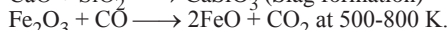**NOTES**   In other options carbocation formed destabilised by –I effect of $-NO_2$ group.
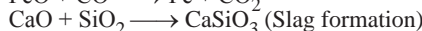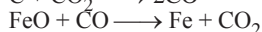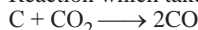
90. **(c)**
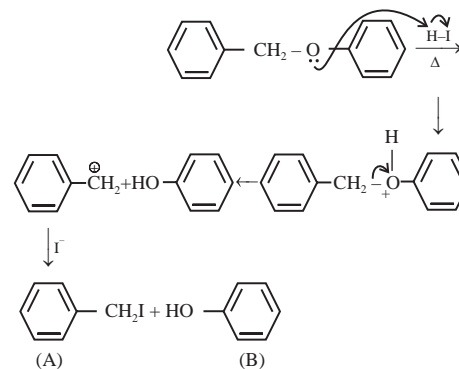
NOTES

The bond between $O - CH_2 -$ is weaker than the bond between $O - C_6H_5$ because the carbon of phenyl group is sp^2 hybridised and there is a partial double bond character.

Therefore I^- ion breaks $O - CH_2 -$ bond.

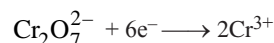**91. (a)** At 900-1500 K (higher temperature range in the blast furnace)
Reaction which take place are:
$C + CO_2 \longrightarrow 2CO$
$FeO + CO \longrightarrow Fe + CO_2$
$CaO + SiO_2 \longrightarrow CaSiO_3$ (Slag formation)
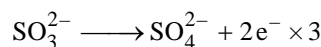$Fe_2O_3 + CO \longrightarrow 2FeO + CO_2$ at 500-800 K.

92. (b) Correct relation between change in enthalpy and change in internal energy is $\Delta H = \Delta U + \Delta n_g RT$

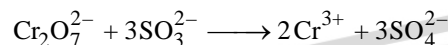**93. (a)** Using Ion electron method :
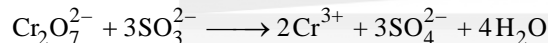Reduction Half reaction :

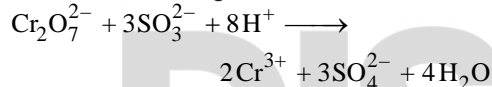$$Cr_2O_7^{2-} + 6e^- \longrightarrow 2Cr^{3+}$$

Oxidation Half reaction :

$$SO_3^{2-} \longrightarrow SO_4^{2-} + 2e^- \times 3$$

Overall reaction :

$$Cr_2O_7^{2-} + 3SO_3^{2-} \longrightarrow 2Cr^{3+} + 3SO_4^{2-}$$

• To balance 'O' atoms, adding H_2O on LHS

$$Cr_2O_7^{2-} + 3SO_3^{2-} \longrightarrow 2Cr^{3+} + 3SO_4^{2-} + 4H_2O$$

• To balance 'H' atoms, adding H^+ on RHS

$$Cr_2O_7^{2-} + 3SO_3^{2-} + 8H^+ \longrightarrow$$

$$2Cr^{3+} + 3SO_4^{2-} + 4H_2O$$

$\therefore$ a = 1, b = 3, c = 8

94. (c) The total number of octahedral voids in FCC are four
Octahedral voids in FCC = Edge centres + Body centre

The contribution of edge centre = $\dfrac{1}{4}$

$\therefore$ Fraction of one edge centred octahedral void in one unit cell
of FCC = $\dfrac{1}{4}$

95. (d) Nutrient enriched water bodies support a dense plant population, which kills animal life by depriving it of oxygen and results in subsequent loss of biodiversity. This process is called as eutrophication.
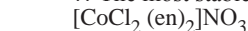$\therefore$ Statement I is incorrect and Statement II is correct.

96. (c) $A + B \rightleftharpoons C + D$
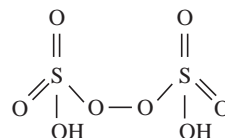$k_{eq} = [C] [D] / [A] [B]$

$$k_{eq} = \frac{10 \times 6}{2 \times 3} = 10$$

$\Delta G^o = -RT \ln k_{eq}$
$= -2.303 \, RT \log k_{eq}$
$= -2.303 \times 2 \times 300 \times \log 10$
$= -1381.8 \, cal$

97. (c) Chelating ligands in general form more stable complexes
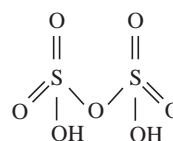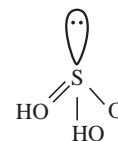$\therefore$ The most stable complex is
$[CoCl_2 \, (en)_2]NO_3$

98. (b)

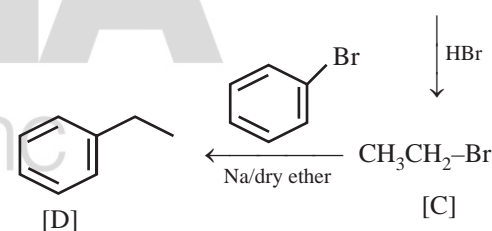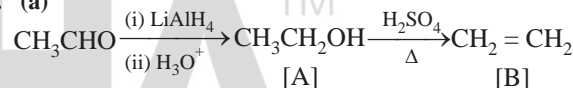Peroxodisulphuric acid $(H_2S_2O_8)$ Sulphuric acid (H_2SO_4)
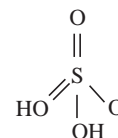
Pyrosulphuric acid $(H_2S_2O_7)$ Sulphurous acid (H_2SO_3)

99. (c) Pumice stone is a solid sol.
Disperesed phase : Gas, Dispersed medium : Solid.

100. (a)

$$CH_3CHO \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } LiAlH_4} CH_3CH_2OH \xrightarrow[\Delta]{H_2SO_4} CH_2 = CH_2$$
$$\qquad\qquad\qquad\qquad [A] \qquad\qquad\qquad [B]$$

BOTANY

101. (a) Both the statements are correct because transpiration cools leaf surfaces, sometimes 10 to 15 degrees, by evaporative cooling and forces generated by transpiration can create pressures sufficient to lift a xylem sized column of water up to 130 meters high.

102. (c) In this method of making competent cells, suitable for plants, cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA in a method known as biolistics or gene gun.

103. (a) Both the assertion and reason is correct and reason is the correct explanation of assertion. The predominant stage of life cycle of moss is gametophyte which consist of 2 stages. The first stage is protonema that directly develops from spore.

104. (b) The unequivocal proof that DNA is the genetic material came from the experiments of Alfred Hershey and Martha Chase

(1952). They worked with viruses that infect bacteria called bacteriophages. The bacteriophages attaches to the bacteria and its genetic material then enter the bacterial cell.

NOTES

While DNA had been known to biologists since 1869, many scientists still assumed at the time that proteins carried the information for inheritance because DNA appeared to be an inert molecule, and, since it is located in the nucleus, its role was considered to be phosphorus storage. In their experiments, Hershey and Chase showed that when bacteriophages, which are composed of DNA and protein, infect bacteria, their DNA enters the host bacterial cell, but most of their protein does not. Hershey and Chase and subsequent discoveries all served to prove that DNA is the hereditary material.

105. (a) Decibel (dB) is the unit to measure the intensity of sound. Dobson unit (DU) is used to measure the thickness of earth's atmosphere.
E. Kilobase is a unit of measurement used to help designate the length of DNA or RNA.
Hence, thickness of ozone in column of air from ground to top of atmosphere is measured in terms of Dobson units.
So, the correct answer is 'Dobson units'.

106. (b) Dedifferentiation is a phenomenon by which the living differentiated plant cells, that by now have lost the capacity to divide can regain the capacity of division under certain conditions. In tissue culture experiments, leaf mesophyll cells are put in a culture medium to form callus. This phenomenon may be called as dedifferentiation.

107. (a) Majority of insect pollinated *flowers* are *large*-sized. These *flowers* are *colorful* and possess *fragrance* to attract the insects.

108. (c) The frequency of recombination is the number of crossovers formed between any two genes. Alfred Sturtevant explained that the recombination frequency between gene pairs is the measure of distance between the genes.

> **NOTES**
> Alfred Sturtevant said that the recombination frequency is inversely proportional to the distance between the genes.

109. (c) The division of the centromeres occurs during anaphase. This allows for the separation of each sister chromatid into its respective daughter cell.

110. (b) In eukaryotes there are three major types of RNA polymerases are found that are RNA polymerase I, RNA polymerase II and RNA polymerase III. RNA polymerase III transcribes : tRNAs, ScRNA, 5S rRNA and snRNA.

> **NOTES**
> RNA polymerase I transcribes : 5.8S, 18S, 28S rRNAs
> RNA polymerase II transcribes : hnRNAs (precurssor of mRNA)

111. (a) Habitat loss and fragmentation is the most important cause driving animals and plants to extinction.

112. (d) Statement I is incorrect because endarch and exarch are the terms often used for describing the position of primary xylem in the plant body. Exarch condition is the most common feature of the root system. Hence, statement I is incorrect and II is correct.

113. (d) Axile placentation occurs in syncarpous pistils. The ovary is partitioned into two or more chambers. Axile placentation is observed in China rose, Petunia and Lemon.

114. (a) Expressed Sequence Tags or ESTs are genes that are expressed as RNA in the body. ESTs represent portions of expressed genes. They may be represented as either cDNA/mRNA sequence or as the reverse complement of the mRNA, the template strand.

115. (b) Tassels in the com cob represents stigma and style which wave in the wind to trap pollen grains.

116. (b) Spraying juvenile conifers with gibberellins hastens their maturity period, thus leading to early seed production.

117. (c) The given equation represent Net primary productivity which is gross primary productivity minus respiration loss. In the given equation, R represent "Respiratory loss".

118. (a) The the characteristics specific to family Fabaceae but not found in Solanaceae or Liliaceae is Diadelphous and ditheceous anther.

119. (c) Primary endosperm nucleus is formed by the fusion of diploid secondary nucleus with a male gamete. Therefore, it is triploid. Zygote is formed by fusion of two gametes and thus it is diploid. Synergids are the cells of gametophyte and hence these are haploid.

120. (c) Ethylene promotes rapid internode/petiole elongation in deep water rice plants.

121. (a) Late wood is also known as autumn wood. It is a wood in a tree's growth ring which is produced later in the growing season when the growth is not rapid.

122. (a) Both assertion and reason are correct and reason is the correct explanation of assertion because
ATP in glycolysis is used at two steps of conversion that are
Glucose → Glucose-6-phosphate
Fructose-6-phosphate → Fructose-1, 6-bisphosphate

123. (a) The detritus food chain begins with detritus that is dead organic matter. The saprotrophic bacteria and fungi breakdown detritus into simpler inorganic substances by a process called catabolism.

124. (b) The Pachytene stage of meiosis is characterized by the appearance of recombination nodules. It is the site at which crossing over occurs between non-sister chromatids of homologous chromosomes.

125. (b) For every CO_2 molecule entering the Calvin cycle, 3 molecules of ATP and 2 of $NADPH_2$ are required. To make one molecule of glucose, 6 turns of the cycle are required. Thus, ATP and NADPH2 molecules required for synthesis of one molecule of glucose during Calvin cycle will be:
6*3=18 ATP
6*2=12 $NADPH_2$

126. (c) The phenomenon of pleiotropism refers to phenomenon where a single gene affecting multiple phenotypic expression.

> **NOTES**
> One of the most widely cited examples of pleiotropy in humans is phenylketonuria (PKU). This disorder is caused by a deficiency of the enzyme phenylalanine hydroxylase, which is necessary to convert the essential amino acid phenylalanine to tyrosine.

127. (d) One can see bright orange coloured bands of DNA in an ethidium bromide stained gel exposed to U.V. light.

128. (a) The reaction centre in PS II has an absorption maxima at 680 nm.

129. (b) During isolation of the genetic material, purified DNA ultimately precipitates out after the addition of chilled ethanol

130. (a) Manganese (Mn) is an essential micronutrient that while needed in small amounts, plays a key role in photosynthesis. Mn sparks the photosynthesis process by splitting water after Photosytem II (PSII) fixes light to initiate the conversion of CO2 and water into carbohydrates.

131. (d) Active Transport is defined as a process that involves the movement of molecules from a region of lower concentration to a region of higher concentration against a gradient or an obstacle with the use of external energy

132. (b) DNA replication in most eukaryotic cells occurs, only during a specific part of the cell division cycle called the DNA synthesis phase or S phase. In a mammalian cell, the S phase typically lasts for about 8 hours

133. (c) Cellulose does not form blue colour with Iodine because cellulose does not have a helical structure, it does not bind to iodine to form a colored product.

134. (b) The historic convention on Biological Diversity, "The Earth Summit" was held in Rio de Janeiro in the year 1992. It called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits.

135. (b) Pteridophytes that produce two types of spores are known as heterosporous. Selaginella and Salvinia are heterosporous pteridophytes.

136. (c) The correct matching is:
M phase or Mitosis is also called equational division.
During G_2 phase DNA synthesis stops but cell synthesis RNA, proteins, etc. for next phase.

Quiescent stage is inactive phase in which non-dividing cells enters.

G1 phase is the interval between mitosis and initiation of DNA replication.

137. (c) The correct matching is:

Iron activates catalase enzyme.

Zinc is needed in the synthesis of auxin.

Boron is required for cell elongation and cell differentiation.

Molybdenum is component of nitrogenase and nitrate reductase enzyme.

138. (a) The correct matching is:

Cohesion represents mutual attraction between water molecules.

Adhesion represents attraction of water molecules to polar surfaces

Surface tension represents water molecules are attracted to each other in the liquid phase more than to water in the gas phase.

Guttation represent loss of water in liquid phase.

139. (a) The ribosome consists of about 80 different proteins.

140. (d) The correct matching is:

Pyruvate, which is formed by the glycolytic catabolism of carbohydrates in the cytosol, after it enters mitochondrial matrix undergoes oxidative decarboxylation by a complex set of reactions catalyzed by pyruvate dehydrogenase.

The scheme of glycolysis was given by Gustav Embden, Otto Meyrhof and J. Parnas, and is often referred to as the EMP pathway.

In electron transport system, the energy of oxidation-reduction is utilized for the production of proton gradient required for phosphorylation, thus, this process is also called oxidative phosphorylation.

The TCA (tricarboxylic acid cycle) starts with the condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid. The reaction is catalysed by the enzyme citrate synthase.

141. (b) The correct matching is:

(+, +) Mutualism : In this interaction, both the interacting species are benefitted.

(+, 0) Commensalism : Only one species is benefitted and the other species remains unharmed.

(−, 0) Amensalism : Neither species is benefitted. One remains unharmed and the other is harmed.

(+, −) Parasitism : One species is benefitted and other negatively effected.

142. (a) The correct sequence of formation of recombinant DNA is:
i. Cutting of DNA at specific location by restriction enzyme
ii. Isolation of desired DNA fragment
iii. Amplification of gene of interest using PCR
iv. Insertion of recombinant DNA into the host cell

NOTES

Recombinant DNA technology is the joining together of DNA molecules from two different species. The recombined DNA molecule is inserted into a host organism to produce new genetic combinations that are of value to science, medicine, agriculture, and industry.

143. (c) Statement II is incorrect as in general, herbivores and plants appear to be more adversely affected by competition than carnivores. Statement I is correct.

144. (a) A *flower* is *defined* as the *modification* of *shoot apical meristem* into *floral meristem.* Internodes do not elongate and the axis gets condensed. The apex produces different kinds of floral appendages laterally at the successive nodes instead of leaves.

145. (c) Statement A, C and D are incorrect w.r.t. Klinefelter's syndrome as they are associated with Down's syndrome.

146. (a) Melonate inhibits the growth of pathogenic bacteria by inhibiting the activity of Succinic dehydrogenase because malonate is a competitive inhibitor of enzyme succinate dehydrogenase.

147. (b) Statement b is incorrect because algal bloom causes deterioration of the water quantity and fish mortality.

148. (a) The required components for chemiosmosis are proton gradient, proton pump, plasma membrane and ATP synthase.

149. (b) Statement B,C and E are incorrect because:

Bark that is formed early in the season is called early or soft bark. Towards the end of the season late or hard bark is formed.

Bark is non-technical term that refer to all tissues exterior to vascular cambium.

Phellogen is couple of layers thick

150. (c) Assertion is correct but reason is false as in gymnosperms the pollen grains are released from the microsporangium and they are carried in air currents. They come in contact with the opening of the ovules borne on megasporophylls. The pollen tube carrying the male gametes grows towards archegonia in the ovules and discharge their contents near the mouth of the archegonia.

ZOOLOGY

151. (d) Probe is not a cloning vector because *probe* is a single-stranded sequence of DNA or RNA used to search for its complementary sequence in a sample genome.

NOTES

A gene probe (also known as DNA probe or nucleic acid probe) is a single-stranded DNA or RNA fragment of known structure or function and is used to detect a target sequence of DNA in a sample. For example, it can be used for the rapid and specific identification of microorganisms.

152. (a) Broad palm with single palm crease is visible in a person suffering from Down syndrome.

153. (b) The endomembrane system includes the nuclear envelope, lysosomes, vesicles, the ER, and Golgi apparatus, as well as the plasma membrane

154. (c) The correct matching will be:

• Protonephridia or flame cells are the excretory structures in platyhelminthes.

• Nephridia are the tubular excretory structures of earthworms (Pheretima) and other annelids.

• Single celled organisms like Paramoecium have contractile vacuoles for excretion.

• Urecose glands are present in cockroach.

155. (d) Amniocentesis can lead to female foeticide as it detects the sex of the foetus which decreases the gender ratio. So, it *has a statutory ban to avoid female* .

156. (b) Both the statement are false because ligaments is an example of dense regular connective tissue. Cartilage is an example of specialized connective tissue.

157. (a) The correct matching is:

P-wave represents the electrical excitation (or depolarisation) of the atria which leads to the contraction of both the atria.

QRS complex represents the depolarisation of ventricles which initiates the ventricular contraction.

T-wave represents the return of the ventricles from excited to normal state.

NOTES

P-wave represents the electrical excitation (or depolarisation) of the atria which leads to the contraction of both the atria.

QRS complex represents the depolarisation of ventricles which initiates the ventricular contraction.

T-wave represents the return of the ventricles from excited to normal

158. (c) The correct matching will be:
Mucus neck cells which secrete mucus
Peptic or chief cells which secrete the proenzyme pepsinogen
Parietal or oxyntic cells which secrete HCl and intrinsic factor for absorption of vitamin B12.

159. (b) the correct matching is:
Vasectomy is a surgical method of contraception
Coitus interruptus is a natural method of contraception
Cervical cap is a barrier method of contraception
Saheli is an oral method of contraception which is a non-steroidal pill

160. (a) Both the statements are correct. Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct. The cavity of the cervix is called cervical canal which along with vagina forms birth canal.

161. (c) Assertion is true as there are two types of nephrons, i.e., cortical nephrons and juxtamedullary nephrons based on their relative position in the cortex and medulla. Reason is not correct as loop of Henle in juxtamedullary nephrons is very long and runs deep into the medulla.

162. (a) Both Statement I and Statement II are true. This is because low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.
Competitive inhibitor due to its close structural similarity with the substrate, competes with the substrate for the substrate-binding site of the enzyme.

163. (b) The correct matching is following:
Gene a codes for enzyme transacetylase.
Gene y codes for enzyme permease.
Gene i codes for repressor protein
Gene z codes for enzyme -galactosidase.

NOTES The lac operon consists of 3 structural genes, and a promoter, a terminator, regulator, and an operator. The three structural genes are: lacZ, lacY, and lacA. lacZ encodes β-galactosidase (LacZ), an intracellular enzyme that cleaves the disaccharide lactose into glucose and galactose.

164. (a) The correct matching will be:
Ringworm is caused by Trichophyton.
Filariasis is caused by Wuchereria bancrofti.
Malaria is caused by Plasmodium species.
Pneumonia is caused by Haemophilus influenzae.

165. (c) Cytoskeleton in a cell involved in many functions such as mechanical support, motility, maintenance of the shape of the cell.

166. (b) The correct statement is option b because:
Large amount of nutrients in water promotes growth of algal bloom. Algal bloom increases fish mortality.
Eutrophication result due to natural ageing of lakes.

167. (a) The correct matching will be:
Heroin belongs to the category of opioids and it is a depressant that slows down body functions.
Marijuana is known for its effect on the cardiovascular system of the body.
Cocaine interferes with the transport of the neurotransmitter dopamine.
Morphine is used is a sedative and painkiller.

168. (b) Radial symmetry is found in adults of phylum of ctenophore, coelenterate and Echinodermata.

169. (d) In prokaryotes, the negatively charged DNA is held with some positively charged proteins in a region termed as nucleoid. In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.

170. (d) The incorrect answer is option (d) as incorrect statement is: First menstrual cycle that begins at puberty is called menarche. Rest other statements are incorrect.

171. (b)
Mole and flying squirrel are placental mammals.
Lemur and wolf are placental mammals.
Bobcat is a placental mammal
Therefore only option b is correct.

172. (b) The correct answer is option (b) because using conventional methods of diagnosis like serum and urine analysis, etc, do not help in early diagnosis. Recombinant DNA technology, Polymerase Chain Reaction and Enzyme Linked Immuno-Sorbent Assay (ELISA) are some of the techniques that serve the purpose of early diagnosis.

NOTES Recombinant DNA technology is the joining together of DNA molecules from two different species. The recombined DNA molecule is inserted into a host organism to produce new genetic combinations that are of value to science, medicine, agriculture, and industry.

173. (b) The correct matching will be:
Cartilaginous joint is present between the adjacent vertebrae in the vertebral column.
Ball and socket joint is present between between Humerus and Pectoral girdle
Fibrous Joint is present between between flat skull bones
Saddle Joint is present between between carpal and metacarpal of thumb

174. (a) The correct matching is:
A leopard and a lion in a forest/grassland exemplify competition where both the species are competing for the same resources.
Fungi and root of a higher plant in mycorrhizae exemplify mutualism where both the species are benefitted. The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy yielding carbohydrates
A cattle egret and a cattle in a field exemplify commensalism where one species benefits and the other remains unaffected..
The egrets always forage close to where cattle are grazing because the cattle, as they move, stir up and flush out insects from the vegetation that otherwise might be difficult for the egrets to find and catch.

175. (d) Vital capacity is the maximum volume of air a person can breathe in after forced expiration. Vital capacity includes ERV, TV and IRV.

176. (a) The correct matching is:
(i)   Fovea is the point of greatest visual acuity or resolution.
(ii)   Iris is the visible coloured portion of the eye that regulates diameter of pupil.
(iii) Blind spot is the point where optic nerve leaves the eye-ball and photoreceptor cells are absent.
(iv)   Sclera is the external layer of eye formed of dense connective tissue.

177. (b) Once the undigested and unabsorbed substances enter the caecum, their backflow is prevented by Ileo-caecal valve

178. (b) Gonorrhoea is a bacterial disease which can be treated with the help of antibiotics and cured completely. Rest other diseases are not completely cured as other mentioned options are viral diseases.

179. (d) Statement I is incorrect because left –hand represented by first amino acid is N terminal and right –hand by C terminal

180. (c) Statement II is incorrect because It can particulate matter present in the exhaust from a thermal power plant.

181. (a) HIV enters into helper T-lymphocytes (TH), replicates and produces progeny viruses. The progeny viruses released into blood attack other helper lymphocytes.

NOTES HIV enters its genetic information into helper T cells to make copies of itself. When this happens, the helper T cells die. This severely disrupts the immune response.

182. (a) Both the statements are correct. RNA mutate at much higher rate as compare to DNA because RNA has higher mutation rate that DNA because DNA has deoxyribose pentose sugar in it's configuration whereas RNA has extra oxygen in its ribose sugar which makes it more reactive. As oxygen has got lone pair it will have tendency to react.

183. (b) Both assertion and reason are correct but reason is not the correct explanation of assertion. Corpus luteum secretes large amount of progesterone which is essential for maintenance of endometrium of uterus. In absence of fertilisation, the corpus luteum degenerates hence the decrease in the level of progesterone hormone will cause disintegration of endometrium leading to menstruation.

184. (a)
The correct matching is:
Cholecystokinin (CCK) acts on both gall bladder and pancreas and stimulates the secretion of bile juice and pancreatic enzymes respectively.
GIP inhibits gastric secretion and motility.
Atrial Natriuretic Factor (ANF) is released from the atrial wall of our heart.
Anti-diuretic hormone (ADH) acts mainly on the kidney and stimulates resorption of water and electrolytes by the distal tubules.

185. (b) Consanguineous marriage is matrimony between individuals who are closely related. In a clinical sense, marriage between two family members who are second cousins or closer qualify as having a consanguineous marriage.
So the correct option is '□=○ = mating between relatives'.

186. (b) The unique mammalian characteristics are presence of hairs, pinna and mammary gland. Presence of tympanic membrane is present in amphibians too and monocondylic skull is present in reptiles and aves.

187. (c) Basophils are one of three granulocytes, along with neutrophils and eosinophils. Basophils are the smallest in number of granulocytes but the largest in cell size. Neutrophils are most abundant. Monocytes have kidney shape nucleus.

188. (b) The correct statement regarding chordates are b and c.
The chordate characters are presence of closed circulatory system and presence of pharyngeal gill slits. Nerve cord is dorsal, hollow and single. Heart is ventral. They are triploblastic and coelomate.

189. (c) Thyroid hormone is involved in maintaining water and electrolytes balance, help in the process of RBC production and maintaining basal metabolic rate.

190. (c) The chordate characters are presence of closed circulatory system and presence of pharyngeal gill slits. Nerve cord is dorsal, hollow and single. Heart is ventral. They are triploblastic and coelomate.

191. (a) The parts of human brain that helps in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are Limbic system and hypothalamus.

192. (c) The correct matching will be:
Areolar connective tissue contains fibroblasts (cells that produce and secrete fibres), macrophages and mast cells.
Inner surface of bronchioles is lined by ciliated epithelium.
Blood is a specialised connective tissue.
Tubular parts of nephron are lined by cuboidal epithelium.

193. (a) The correct matching will be:
Exponential growth occurs when there is unlimited resource availability condition.
Expanding age pyramid reflects growing population where the percent individuals of pre-reproductive age is largest followed by reproductive and post-reproductive age groups.
Stable age pyramid shows stable population where the percent individuals of pre-reproductive and reproductive age group are same.

194. (b) Statement A and E are incorrect because excessive loss of body fluid from the body switches on osmoreceptors and ADH is responsible for increasing in GFR.

195. (d) Statement I is not correct because During G0 phase of cell cycle, the cell is metabolically active but do not divide.

196. (b) Tetrad formation is seen during zygotene stage.
Terminalisation of chiasmata takes place during diakinesis.
Crossing over takes place between non-sister chromatids of homologus chromosomes.

197. (d) Inbreeding decreases the productivity of inbred population, after continuous inbreeding is not an advantage of inbreeding

198. (b) Anal style is present only in male cockroach, so it show sexual dimorphism.

NOTES The anal styles act as sensory organs for cockroaches. Anal styles can easily detect the environmental conditions and presence of chemicals around the environment such that cockroaches can protect themselves. This is a male copulatory structure which helps in mating.

199. (c) The template strand serves in mRNA synthesis while the other strand is called coding strand as its base sequence is same as that of newly synthesized mRNA. So, the sequence of mRNA will be identical to the given sequence of coding strand except for the presence of uracil in place of thymine in mRNA

200. (b) Muscle bundles are held together by collagenous connective tissue layer called fascia. Muscle bundles are called fascicles. The portion of the myofibril between two functional unit of contraction called sarcomere.

The candidate should ensure that Roll No. and Test Booklet No. have been filled and marked correctly and Test Booklet Code printed in this sheet and Test Booket is the same.

Candidate MUST NOT carry ORIGINAL or OFFICE Copy

ROLL No.

TEST BOOKLET No.

TEST BOOKLET Code

A

Answer Sheet No.

1234567

DECLARATION BY THE CANDIDATE

I declare that particulars and signature on this OMR Answer Sheet are mine and are same as in Attendance Sheet. I further declare that particulars filled-in and Signature as well as the circles darkened on this ORIGINALCOPY is same as in OFFICE Copy.

Signature with time (in running handwriting)

CANDIDATE's NAME (in running handwriting)

SECTION-A — Attempt all 35 questions in each subject

SECTION-B — Attempt any 10 questions in each subject

Q No.	Physics Response	Q No.	Chemistry Response	Q No.	Botany Response	Q No.	Zoology Response
001	①②③④	051	①②③④	101	①②③④	151	①②③④
002	①②③④	052	①②③④	102	①②③④	152	①②③④
003	①②③④	053	①②③④	103	①②③④	153	①②③④
004	①②③④	054	①②③④	104	①②③④	154	①②③④
005	①②③④	055	①②③④	105	①②③④	155	①②③④
006	①②③④	056	①②③④	106	①②③④	156	①②③④
007	①②③④	057	①②③④	107	①②③④	157	①②③④
008	①②③④	058	①②③④	108	①②③④	158	①②③④
009	①②③④	059	①②③④	109	①②③④	159	①②③④
010	①②③④	060	①②③④	110	①②③④	160	①②③④
011	①②③④	061	①②③④	111	①②③④	161	①②③④
012	①②③④	062	①②③④	112	①②③④	162	①②③④
013	①②③④	063	①②③④	113	①②③④	163	①②③④
014	①②③④	064	①②③④	114	①②③④	164	①②③④
015	①②③④	065	①②③④	115	①②③④	165	①②③④
016	①②③④	066	①②③④	116	①②③④	166	①②③④
017	①②③④	067	①②③④	117	①②③④	167	①②③④
018	①②③④	068	①②③④	118	①②③④	168	①②③④
019	①②③④	069	①②③④	119	①②③④	169	①②③④
020	①②③④	070	①②③④	120	①②③④	170	①②③④
021	①②③④	071	①②③④	121	①②③④	171	①②③④
022	①②③④	072	①②③④	122	①②③④	172	①②③④
023	①②③④	073	①②③④	123	①②③④	173	①②③④
024	①②③④	074	①②③④	124	①②③④	174	①②③④
025	①②③④	075	①②③④	125	①②③④	175	①②③④
026	①②③④	076	①②③④	126	①②③④	176	①②③④
027	①②③④	077	①②③④	127	①②③④	177	①②③④
028	①②③④	078	①②③④	128	①②③④	178	①②③④
029	①②③④	079	①②③④	129	①②③④	179	①②③④
030	①②③④	080	①②③④	130	①②③④	180	①②③④
031	①②③④	081	①②③④	131	①②③④	181	①②③④
032	①②③④	082	①②③④	132	①②③④	182	①②③④
033	①②③④	083	①②③④	133	①②③④	183	①②③④
034	①②③④	084	①②③④	134	①②③④	184	①②③④
035	①②③④	085	①②③④	135	①②③④	185	①②③④
036	①②③④	086	①②③④	136	①②③④	186	①②③④
037	①②③④	087	①②③④	137	①②③④	187	①②③④
038	①②③④	088	①②③④	138	①②③④	188	①②③④
039	①②③④	089	①②③④	139	①②③④	189	①②③④
040	①②③④	090	①②③④	140	①②③④	190	①②③④
041	①②③④	091	①②③④	141	①②③④	191	①②③④
042	①②③④	092	①②③④	142	①②③④	192	①②③④
043	①②③④	093	①②③④	143	①②③④	193	①②③④
044	①②③④	094	①②③④	144	①②③④	194	①②③④
045	①②③④	095	①②③④	145	①②③④	195	①②③④
046	①②③④	096	①②③④	146	①②③④	196	①②③④
047	①②③④	097	①②③④	147	①②③④	197	①②③④
048	①②③④	098	①②③④	148	①②③④	198	①②③④
049	①②③④	099	①②③④	149	①②③④	199	①②③④
050	①②③④	100	①②③④	150	①②③④	200	①②③④

MOTHER's NAME (in running handwriting)

FATHER's NAME (in running handwriting)

CANDIDATE'S LEFT HAND THUMB IMPRESSION

SIGNATURE OF INVILIGATOR'S WITH TIME

1

2

*Copy the same for rest of the papers.

The candidate should ensure that Roll No. and Test Booklet No. have been filled and marked correctly and Test Booklet Code printed in this sheet and Test Booklet is the same.

Candidate MUST NOT carry ORIGINAL or OFFICE Copy

ROLL No.

TEST BOOKLET No.

TEST BOOKLET Code

A

Answer Sheet No.

1234567

Q No.	Physics Response	Q No.	Chemistry Response	Q No.	Botany Response	Q No.	Zoology Response

SECTION-A — Attempt all 35 questions in each subject

Questions 001–035, 051–085, 101–135, 151–185 with response options ① ② ③ ④

SECTION-B — Attempt any 10 questions in each subject

Questions 036–050, 086–100, 136–150, 186–200 with response options ① ② ③ ④

DECLARATION BY THE CANDIDATE

I declare that particulars and signature on this OMR Answer Sheet are mine and are same as in Attendance Sheet. I further declare that particulars filled-in and Signature as well as the circles darkened on this ORIGINALCOPY is same as in OFFICE Copy.

Signature with time (in running handwriting)

CANDIDATE's NAME (in running handwriting)

MOTHER's NAME (in running handwriting)

FATHER's NAME (in running handwriting)

CANDIDATE'S LEFT HAND THUMB IMPRESSION

SIGNATURE OF INVILIGATOR'S WITH TIME

1

2

*Copy the same for rest of the papers.