

# Re-NEET 2024 Solved Paper

## PHYSICS

### SECTION-A

1. The magnetic potential energy, when a magnetic bar of magnetic moment  $\vec{m}$  is placed perpendicular to the magnetic field  $\vec{B}$  is

- (a)  $-\frac{mB}{2}$                       (b) Zero  
(c)  $-mB$                       (d)  $mB$

2. A bob is whirled in a horizontal circle by means of a string at an initial speed of 10 rpm. If the tension in the string is quadrupled while keeping the radius constant, the new speed is:

- (a) 20 rpm                      (b) 40 rpm  
(c) 5 rpm                      (d) 10 rpm

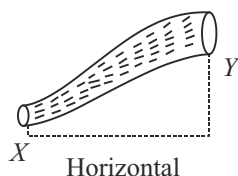
3. A metal cube of side 5 cm is charged with 6  $\mu\text{C}$ . The surface charge density on the cube is

- (a)  $0.125 \times 10^{-3} \text{ C m}^{-2}$     (b)  $0.25 \times 10^{-3} \text{ C m}^{-2}$   
(c)  $4 \times 10^{-3} \text{ C m}^{-2}$         (d)  $0.4 \times 10^{-3} \text{ C m}^{-2}$

4. The incorrect relation for a diamagnetic material (all the symbols carry their usual meaning and  $\epsilon$  is a small positive number) is

- (a)  $\mu < \mu_0$                       (b)  $0 \leq \mu_r < 1$   
(c)  $-1 \leq \chi < 0$                 (d)  $1 < \mu_r < 1 + \epsilon$

5. An ideal fluid is flowing in a non-uniform cross-sectional tube  $XY$  (as shown in the figure) from end  $X$  to end  $Y$ . If  $K_1$  and  $K_2$  are the kinetic energy per unit volume of the fluid at  $X$  and  $Y$  respectively, then the correct option is :



- (a)  $K_1 = K_2$                       (b)  $2K_1 = K_2$   
(c)  $K_1 > K_2$                       (d)  $K_1 < K_2$

6. The escape velocity for earth is  $v$ . A planet having 9 times mass that of earth and radius, 16 times that of earth, has the escape velocity of :

- (a)  $\frac{v}{3}$                                   (b)  $\frac{2v}{3}$   
(c)  $\frac{3v}{4}$                                   (d)  $\frac{9v}{4}$

7. An electron and an alpha particle are accelerated by the same potential difference. Let  $\lambda_e$  and  $\lambda_\alpha$  denote the de-Broglie wavelengths of the electron and the alpha particle, respectively, then:

- (a)  $\lambda_e > \lambda_\alpha$                       (b)  $\lambda_e = 4\lambda_\alpha$   
(c)  $\lambda_e = \lambda_\alpha$                       (d)  $\lambda_e < \lambda_\alpha$

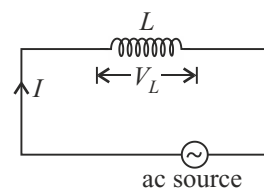
8. An object moving along horizontal  $x$ -direction with kinetic energy 10 J is displaced through  $x = (3\hat{i})$  m by the force  $\vec{F} = (-2\hat{i} + 3\hat{j})$  N. The kinetic energy of the object at the end of the displacement  $x$  is

- (a) 10 J                                (b) 16 J  
(c) 4 J                                (d) 6 J

9. An object falls from a height of 10 m above the ground. After striking the ground it loses 50% of its kinetic energy. The height upto which the object can rebound from the ground is:

- (a) 7.5 m                              (b) 10 m  
(c) 2.5 m                              (d) 5 m

10. In the circuit shown below, the inductance  $L$  is connected to an ac source. The current flowing in the circuit is  $I = I_0 \sin \omega t$ . The voltage drop ( $V_L$ ) across  $L$  is



- (a)  $\omega L I_0 \sin \omega t$                 (b)  $\frac{I_0}{\omega L} \sin \omega t$   
(c)  $\frac{I_0}{\omega L} \cos \omega t$                 (d)  $\omega L I_0 \cos \omega t$

11. A 12 pF capacitor is connected to a 50 V battery, the electrostatic energy stored in the capacitor in nJ is

- (a) 15                                  (b) 7.5  
(c) 0.3                                (d) 150

12. A uniform wire of diameter  $d$  carries a current of 100 mA when the mean drift velocity of electrons in the wire is  $v$ .

For a wire of diameter  $\frac{d}{2}$  of the same material to carry a current of 200 mA, the mean drift velocity of electrons in the wire is

- (a)  $4v$     (b)  $8v$     (c)  $v$         (d)  $2v$

13. In an electrical circuit, the voltage is measured as  $V = (200 \pm 4)$  volt and the current is measured as  $I = (20 \pm 0.2)$  A. The value of the resistance is:

(a)  $(10 \pm 4.2) \Omega$  (b)  $(10 \pm 0.3) \Omega$   
(c)  $(10 \pm 0.1) \Omega$  (d)  $(10 \pm 0.8) \Omega$

14. A step up transformer is connected to an ac mains supply of 220 V to operate at 11000 V, 88 watt. The current in the secondary circuit, ignoring the power loss in the transformer, is

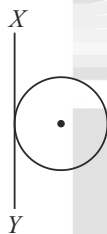
(a) 8 mA (b) 4 mA  
(c) 0.4 A (d) 4 A

15. A particle is moving along x-axis with its position ( $x$ ) varying with time ( $t$ ) as  $x = \alpha t^4 + \beta t^2 + \gamma t + \delta$ . The ratio of its initial velocity to its initial acceleration, respectively, is:

(a)  $2\alpha : \delta$  (b)  $\gamma : 2\delta$   
(c)  $4\alpha : \beta$  (d)  $\gamma : 2\beta$

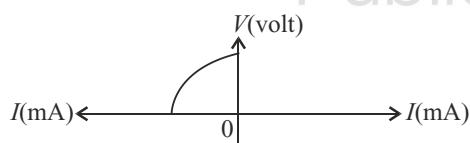
16. The radius of gyration of a solid sphere of mass 5 kg about XY is 5 m as shown in figure. The radius of the sphere is

$\frac{5x}{\sqrt{7}}$  m, then the value of  $x$  is:



(a) 5 (b)  $\sqrt{2}$   
(c)  $\sqrt{3}$  (d)  $\sqrt{5}$

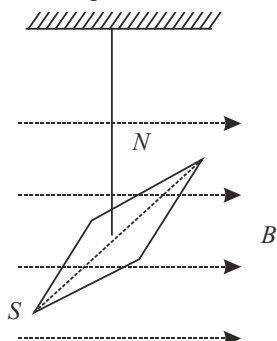
- 17.



The I-V characteristics shown above are exhibited by a

(a) Light emitting diode (b) Zener diode  
(c) Photodiode (d) Solar cell

18. The magnetic moment and moment of inertia of a magnetic needle as shown are, respectively,  $1.0 \times 10^{-2}$  A m<sup>2</sup> and  $\frac{10^{-6}}{\pi^2}$  kg m<sup>2</sup>. If it completes 10 oscillations in 10 s, the magnitude of the magnetic field is



(a) 0.4 T (b) 4 T  
(c) 0.4 mT (d) 4 mT

19. The capacitance of a capacitor with charge  $q$  and a potential difference  $V$  depends on

(a) both  $q$  and  $V$   
(b) the geometry of the capacitor  
(c)  $q$  only  
(d)  $V$  only

20. Given below are two statements:

**Statement I:** Image formation needs regular reflection and/or refraction.

**Statement II:** The variety in colour of objects we see around us is due to the constituent colours of the light incident on them.

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

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

21. A uniform metal wire of length  $l$  has  $10 \Omega$  resistance. Now this wire is stretched to a length  $2l$  and then bent to form a perfect circle. The equivalent resistance across any arbitrary diameter of that circle is

(a)  $10 \Omega$  (b)  $5 \Omega$   
(c)  $40 \Omega$  (d)  $20 \Omega$

22. The spectral series which corresponds to the electronic transition from the levels  $n_2 = 5, 6, \dots$  to the level  $n_1 = 4$  is

(a) Pfund series (b) Brackett series  
(c) Lyman series (d) Balmer series

23. Given below are two statements: One is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A:** Houses made of concrete roofs overlaid with foam keep the room hotter during summer.

**Reason R:** The layer of foam insulation prohibits heat transfer, as it contains air pockets.

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

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

24. A particle executing simple harmonic motion with amplitude  $A$  has the same potential and kinetic energies at the displacement

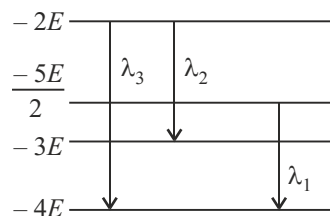
(a)  $2\sqrt{A}$  (b)  $\frac{A}{2}$   
(c)  $\frac{A}{\sqrt{2}}$  (d)  $A\sqrt{2}$

25. Two slits in Young's double slit experiment are 1.5 mm apart and the screen is placed at a distance of 1 m from the slits. If the wavelength of light used is  $600 \times 10^{-9}$  m then the fringe separation is  
 (a)  $4 \times 10^{-5}$  m (b)  $9 \times 10^{-8}$  m  
 (c)  $4 \times 10^{-7}$  m (d)  $4 \times 10^{-4}$  m
26. Water is used as a coolant in a nuclear reactor because of its  
 (a) high thermal expansion coefficient  
 (b) high specific heat capacity  
 (c) low density  
 (d) low boiling point
27. The pitch of an error free screw gauge is 1 mm and there are 100 divisions on the circular scale. While measuring the diameter of a thick wire, the pitch scale reads 1 mm and 63<sup>rd</sup> division on the circular scale coincides with the reference line. The diameter of the wire is:  
 (a) 1.63 cm (b) 0.163 cm  
 (c) 0.163 m (d) 1.63 m
28. Let us consider two solenoids  $A$  and  $B$ , made from same magnetic material of relative permeability  $\mu_r$  and equal area of cross-section. Length of  $A$  is twice that of  $B$  and the number of turns per unit length in  $A$  is half that of  $B$ . The ratio of self inductances of the two solenoids,  $L_A : L_B$  is  
 (a) 1 : 2 (b) 2 : 1  
 (c) 8 : 1 (d) 1 : 8
29. When the output of an OR gate is applied as input to a NOT gate, then the combination acts as a  
 (a) NAND gate (b) NOR gate  
 (c) AND gate (d) OR gate
30. Interference pattern can be observed due to superposition of the following waves:  
 A.  $y = a \sin \omega t$  B.  $y = a \sin 2\omega t$   
 C.  $y = a \sin (\omega t - \phi)$  D.  $y = a \sin 3\omega t$   
 Choose the **correct** answer from the options given below.  
 (a) B and C (b) B and D  
 (c) A and C (d) A and B
31. If  $\phi$  is the work function of photosensitive material in eV and light of wavelength of numerical value  $\lambda = \frac{hc}{e}$  metre, is incident on it with energy above its threshold value at an instant then the maximum kinetic energy of the photoelectron ejected by it at that instant (Take  $h$  - Planck's constant,  $c$  - velocity of light in free space) is (in SI units):  
 (a)  $e + 2\phi$  (b)  $2e - \phi$   
 (c)  $e - \phi$  (d)  $e + \phi$
32. The electromagnetic radiation which has the smallest wavelength are  
 (a) X-rays (b) Gamma rays  
 (c) Ultraviolet rays (d) Microwaves
33. The equilibrium state of a thermodynamic system is described by

- A. Pressure B. Total heat  
 C. Temperature D. Volume  
 E. Work done

Choose the **most appropriate** answer from the options given below.

- (a) A, B and E only (b) B, C and D only  
 (c) A, B and C only (d) A, C and D only
34. Some energy levels of a molecule are shown in the figure with their wavelengths of transitions. Then:

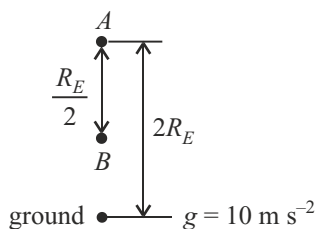


- (a)  $\lambda_3 > \lambda_2, \lambda_1 = 2\lambda_2$  (b)  $\lambda_3 > \lambda_2, \lambda_1 = 4\lambda_2$   
 (c)  $\lambda_1 > \lambda_2, \lambda_2 = 2\lambda_3$  (d)  $\lambda_2 > \lambda_1, \lambda_2 = 2\lambda_3$
35. A box of mass 5 kg is pulled by a cord, up along a frictionless plane inclined at  $30^\circ$  with the horizontal. The tension in the cord is 30 N. The acceleration of the box is (Take  $g = 10 \text{ m s}^{-2}$ )  
 (a)  $2 \text{ m s}^{-2}$  (b) Zero  
 (c)  $0.1 \text{ m s}^{-2}$  (d)  $1 \text{ m s}^{-2}$

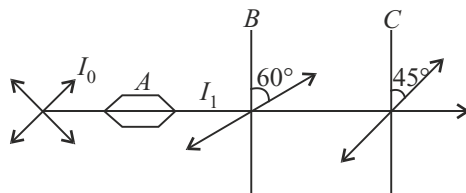
### SECTION-B

36. If the ratio of relative permeability and relative permittivity of a uniform medium is 1 : 4. The ratio of the magnitudes of electric field intensity ( $E$ ) to the magnetic field intensity ( $H$ ) of an EM wave propagating in that medium is  
 (Given that  $\sqrt{\frac{\mu_0}{\epsilon_0}} = 120\pi$ ):  
 (a)  $30\pi : 1$  (b)  $1 : 120\pi$   
 (c)  $60\pi : 1$  (d)  $120\pi : 1$
37. The value of electric potential at a distance of 9 cm from the point charge  $4 \times 10^{-7}$  C is  
 [Given  $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$ ]:  
 (a)  $4 \times 10^2$  V (b) 44.4 V  
 (c)  $4.4 \times 10^5$  V (d)  $4 \times 10^4$  V
38. The displacement of a travelling wave  $y = C \sin \frac{2\pi}{\lambda} (at - x)$  where  $t$  is time,  $x$  is distance and  $\lambda$  is the wavelength, all in S.I. units. Then the frequency of the wave is  
 (a)  $\frac{2\pi\lambda}{a}$  (b)  $\frac{2\pi a}{\lambda}$   
 (c)  $\frac{\lambda}{a}$  (d)  $\frac{a}{\lambda}$

39. An object of mass 100 kg falls from point  $A$  to  $B$  as shown in figure. The change in its weight, corrected to the nearest integer is ( $R_E$  is the radius of the earth)



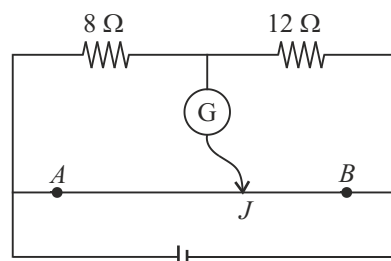
- (a) 49 N (b) 89 N  
(c) 5 N (d) 10 N
40. The potential energy of a particle moving along  $x$ -direction varies as  $V = \frac{Ax^2}{\sqrt{x+B}}$ . The dimensions of  $\frac{A^2}{B}$  are:
- (a)  $[M^{3/2} L^{1/2} T^{-3}]$  (b)  $[M^{1/2} L T^{-3}]$   
(c)  $[M^2 L^{1/2} T^{-4}]$  (d)  $[ML^2 T^{-4}]$
41. The two-dimensional motion of a particle, described by  $\vec{r} = (\hat{i} + 2\hat{j}) A \cos \omega t$  is a/an:
- A. parabolic path  
B. elliptical path  
C. periodic motion  
D. simple harmonic motion
- Choose the correct answer from the options given below:
- (a) B, C and D only (b) A, B and C only  
(c) A, C and D only (d) C and D only
42. A beam of unpolarized light of intensity  $I_0$  is passed through a polaroid  $A$ , then through another polaroid  $B$ , oriented at  $60^\circ$  and finally through another polaroid  $C$ , oriented at  $45^\circ$  relative to  $B$  as shown. The intensity of emergent light is:



- (a)  $\frac{I_0}{16}$  (b)  $\frac{I_0}{4}$   
(c)  $\frac{I_0}{2}$  (d)  $\frac{I_0}{32}$
43. Select the correct statements among the following :
- A. Slow neutrons can cause fission in  ${}_{92}^{235}\text{U}$  than fast neutrons.  
B.  $\alpha$ -rays are Helium nuclei.  
C.  $\beta$ -rays are fast moving electrons or positrons.  
D.  $\gamma$ -rays are electromagnetic radiations of wavelengths larger than X-rays.

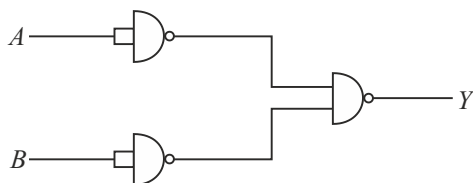
Choose the **most appropriate** answer from the options given below :

- (a) A, B and C only (b) A, B and D only  
(c) A and B only (d) C and D only
44. Let  $\omega_1$ ,  $\omega_2$  and  $\omega_3$  be the angular speed of the second hand, minute hand and hour hand of a smoothly running analog clock, respectively. If  $x_1$ ,  $x_2$  and  $x_3$  are their respective angular distances in 1 minute then the factor which remains constant ( $k$ ) is
- (a)  $\frac{\omega_1}{x_1} = \frac{\omega_2}{x_2} = \frac{\omega_3}{x_3} = k$   
(b)  $\omega_1 x_1 = \omega_2 x_2 = \omega_3 x_3 = k$   
(c)  $\omega_1 x_1^2 = \omega_2 x_2^2 = \omega_3 x_3^2 = k$   
(d)  $\omega_1^2 x_1 = \omega_2^2 x_2 = \omega_3^2 x_3 = k$
45. The magnetic moment of an iron bar is  $M$ . It is now bent in such a way that it forms an arc section of a circle subtending an angle of  $60^\circ$  at the centre. The magnetic moment of this arc section is
- (a)  $\frac{3M}{\pi}$  (b)  $\frac{4M}{\pi}$   
(c)  $\frac{M}{\pi}$  (d)  $\frac{2M}{\pi}$
46. The given circuit shows a uniform straight wire  $AB$  of 40 cm length fixed at both ends. In order to get zero reading in the galvanometer  $G$ , the free end of  $J$  is to be placed from  $B$  at:



- (a) 32 cm (b) 8 cm  
(c) 16 cm (d) 24 cm
47. According to the law of equipartition of energy, the number of vibrational modes of a polyatomic gas of constant  $\gamma = \frac{C_p}{C_v}$  is ( $C_p$  where  $C_v$  are the specific heat capacities of the gas at constant pressure and constant volume, respectively):
- (a)  $\frac{4+3\gamma}{\gamma-1}$  (b)  $\frac{3+4\gamma}{\gamma-1}$   
(c)  $\frac{4-3\gamma}{\gamma-1}$  (d)  $\frac{3-4\gamma}{\gamma-1}$

48. The output  $Y$  for the inputs  $A$  and  $B$  of the given logic circuit is :

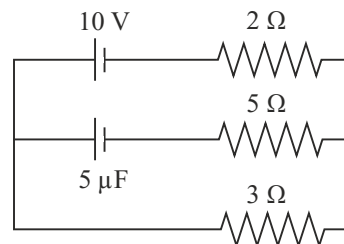


- (a)  $A \cdot B$  (b)  $\bar{A} \cdot \bar{B}$   
 (c)  $A + B$  (d)  $\bar{A} + \bar{B}$
49. The amplitude of the charge oscillating in a circuit decreases exponentially as  $Q = Q_0 e^{-Rt/2L}$ , where  $Q_0$  is the charge at  $t = 0$  s. The time at which charge amplitude decreases to  $0.50 Q_0$  is nearly:

[Given that  $R = 1.5 \Omega$ ,  $L = 12 \text{ mH}$ ,  $\ln(2) = 0.693$ ]

- (a) 19.01 ms (b) 11.09 ms  
 (c) 19.01 s (d) 11.09 s

50. The steady state current in the circuit shown below is :



- (a) 0.67 A (b) 1.5 A  
 (c) 2 A (d) 1 A

## CHEMISTRY

### SECTION-A

51. The correct decreasing order of atomic radii (pm) of Li, Be, B and C is
- (a)  $\text{Be} > \text{Li} > \text{B} > \text{C}$   
 (b)  $\text{Li} > \text{Be} > \text{B} > \text{C}$   
 (c)  $\text{C} > \text{B} > \text{Be} > \text{Li}$   
 (d)  $\text{Li} > \text{C} > \text{Be} > \text{B}$

52. Following data is for a reaction between reactants A and B :

Rate $\text{mol L}^{-1} \text{s}^{-1}$	[A]	[B]
$2 \times 10^{-3}$	0.1 M	0.1 M
$4 \times 10^{-3}$	0.2 M	0.1 M
$1.6 \times 10^{-2}$	0.2 M	0.2 M

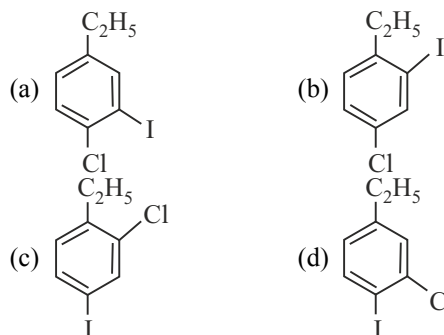
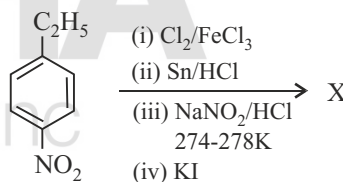
The order of the reaction with respect to A and B, respectively, are

- (a) 1, 0 (b) 0, 1  
 (c) 1, 2 (d) 2, 1
53. Given below are two statements:
- Statement I:** Propene on treatment with diborane gives an addition product with the formula  $((\text{CH}_3)_2\text{-CH})_2\text{B}$
- Statement II:** Oxidation of  $((\text{CH}_3)_2\text{-CH})_2\text{B}$  with hydrogen peroxide in presence of NaOH gives propan-2-ol.
- In the light of the above statements, choose the most appropriate answer from the options given below:
- (a) **Statement I** is correct but **Statement II** is incorrect  
 (b) **Statement I** is incorrect but **Statement II** is correct  
 (c) Both **Statement I** and **Statement II** are correct  
 (d) Both **Statement I** and **Statement II** are incorrect
54. Baeyer's reagent is :
- (a) Acidic potassium permanganate solution  
 (b) Acidic potassium dichromate solution

- (c) Cold, dilute, aqueous solution of potassium permanganate  
 (d) Hot, concentrated solution of potassium permanganate
55. Which of the following molecules has "NON ZERO" dipole moment value?

- (a)  $\text{CCl}_4$  (b) HI  
 (c)  $\text{CO}_2$  (d)  $\text{BF}_3$

56. The major product X formed in the following reaction sequence is:



57. Which indicator is used in the titration of sodium hydroxide against oxalic acid and what is the colour change at the end point?

- (a) Phenolphthalein, pink to yellow  
 (b) Alkaline  $\text{KMnO}_4$ , colourless to pink  
 (c) Phenolphthalein, colourless to pink  
 (d) Methyl orange, yellow to pinkish red colour

58. Match List-I with List-II:

List-I (Atom/Molecule)	List-II (Property)
A. Nitrogen atom	I. Paramagnetic
B. Fluorine molecule	II. Most reactive element in group 18
C. Oxygen molecule	III. Element with highest ionisation enthalpy in group 15
D. Xenon atom	IV. Strongest oxidising agent

Identify the **correct** answer from the options given below:

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

59. From the following select the one which is **not** an example of corrosion.

- (a) Rusting of iron object  
 (b) Production of hydrogen by electrolysis of water  
 (c) Tarnishing of silver  
 (d) Development of green coating on copper and bronze ornaments

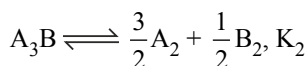
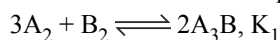
60. Which of the following pairs of ions will have same spin only magnetic moment values within the pair?

- A.  $Zn^{2+}$ ,  $Ti^{2+}$       B.  $Cr^{2+}$ ,  $Fe^{2+}$   
 C.  $Ti^{3+}$ ,  $Cu^{2+}$       D.  $V^{2+}$ ,  $Cu^{+}$

Choose the **correct** answer from the options given below:

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

61. At a given temperature and pressure, the equilibrium constant values for the equilibria are given below:



The relation between  $K_1$  and  $K_2$  is :

- (a)  $K_1^2 = 2K_2$       (b)  $K_2 = \frac{K_1}{2}$   
 (c)  $K_1 = \frac{1}{\sqrt{K_2}}$       (d)  $K_2 = \frac{1}{\sqrt{K_1}}$

62. Arrange the following compounds in increasing order of their solubilities in chloroform:

NaCl,  $CH_3OH$ , cyclohexane,  $CH_3CN$

- (a)  $NaCl < CH_3CN < CH_3OH < Cyclohexane$   
 (b)  $CH_3OH < CH_3CN < NaCl < Cyclohexane$   
 (c)  $NaCl < CH_3OH < CH_3CN < Cyclohexane$   
 (d)  $Cyclohexane < CH_3CN < CH_3OH < NaCl$

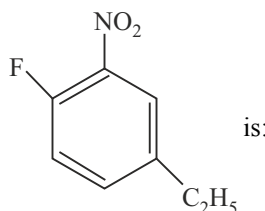
63. Identify the **incorrect** statement about  $PCl_5$ .

- (a)  $PCl_5$  possesses two different Cl – P – Cl bond angles  
 (b) All five P – Cl bonds are identical in length  
 (c)  $PCl_5$  exhibits  $sp^3d$  hybridisation  
 (d)  $PCl_5$  consists of five P – Cl (sigma) bonds

64. Choose the correct statement for the work done in the expansion and heat absorbed or released when 5 litres of an ideal gas at 10 atmospheric pressure isothermally expands into vacuum until volume is 15 litres :

- (a) Both the heat and work done will be greater than zero  
 (b) Heat absorbed will be less than zero and work done will be positive  
 (c) Work done will be zero and heat will also be zero  
 (d) Work done will be greater than zero and heat will remain zero

65. The correct IUPAC name of the compound

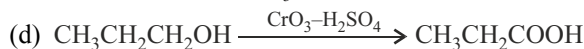
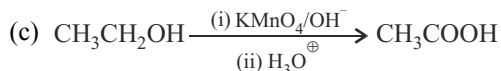
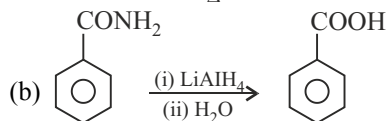
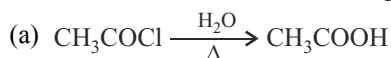


- (a) 4-ethyl-1-fluoro-2-nitrobenzene  
 (b) 4-ethyl-1-fluoro-6-nitrobenzene  
 (c) 3-ethyl-6-fluoro-1-nitrobenzene  
 (d) 1-ethyl-4-fluoro-3-nitrobenzene

66. Which of the following set of ions act as oxidising agents?

- (a)  $Ce^{4+}$  and  $Tb^{4+}$       (b)  $La^{3+}$  and  $Lu^{3+}$   
 (c)  $Eu^{2+}$  and  $Yb^{2+}$       (d)  $Eu^{2+}$  and  $Tb^{4+}$

67. Select the **incorrect** reaction among the following:



68. The UV-visible absorption bands in the spectra of lanthanoid ions are 'X', probably because of the excitation of electrons involving 'Y'. The 'X' and 'Y', respectively, are :

- (a) Broad and  $f$  orbitals  
 (b) Narrow and  $f$  orbitals  
 (c) Broad and  $d$  and  $f$  orbitals  
 (d) Narrow and  $d$  and  $f$  orbitals

69. Ethylene diaminetetraacetate ion is a/an:

- (a) hexadentate ligand      (b) ambidentate ligand  
 (c) monodentate ligand      (d) bidentate ligand

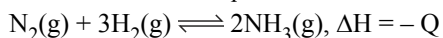
70. The amount of glucose required to prepare 250 mL of  $\frac{M}{20}$  aqueous solution is :

- (Molar mass of glucose :  $180 \text{ g mol}^{-1}$ )  
 (a) 2.25 g (b) 4.5 g  
 (c) 0.44 g (d) 1.125 g

71. Identify the **incorrect** statement from the following :

- (a) The acidic strength of HX (X = F, Cl, Br and I) follows the order :  $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$ .  
 (b) Fluorine exhibits  $-1$  oxidation state whereas other halogens exhibit  $+1$ ,  $+3$ ,  $+5$  and  $+7$  oxidation states also.  
 (c) The enthalpy of dissociation of  $\text{F}_2$  is smaller than that of  $\text{Cl}_2$ .  
 (d) Fluorine is stronger oxidising agent than chlorine.

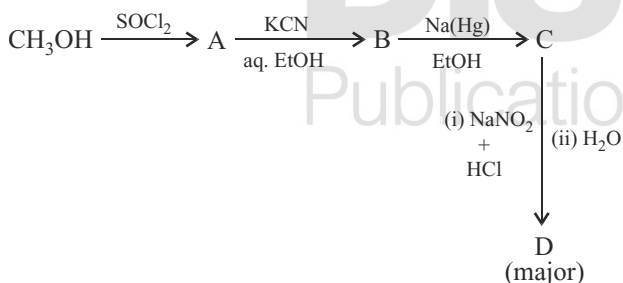
72. For the reaction in equilibrium



Reaction is favoured in forward direction by:

- (a) use of catalyst  
 (b) decreasing concentration of  $\text{N}_2$   
 (c) low pressure, high temperature and high concentration of ammonia  
 (d) high pressure, low temperature and higher concentration of  $\text{H}_2$

73. The major product D formed in the following reaction sequence is:



- (a)  $\text{CH}_3-\text{C}(=\text{O})-\text{H}$  (b)  $\text{CH}_3-\text{C}(=\text{O})-\text{NH}_2$   
 (c)  $\text{CH}_3\text{CH}_2\text{OH}$  (d)  $\text{CH}_3\text{CH}_2\text{Cl}$

74. Match List-I with List-II:

**List-I**  
(Block/group in periodic table)

- A. Lanthanoid  
 B. *d*-block element  
 C. *p*-block element  
 D. *s*-block element

**List-II**  
(Element)

- I. Ce  
 II. As  
 III. Cs  
 IV. Mn

Choose the **correct** answer from the options given below:

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

75. Which of the following is **not** an ambidentate ligand?

- (a)  $\text{C}_2\text{O}_4^{2-}$  (b)  $\text{SCN}^-$   
 (c)  $\text{NO}_2^-$  (d)  $\text{CN}^-$

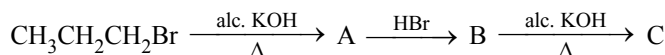
76. The quantum numbers of four electrons are given below :

- I.  $n = 4; l = 2; m_l = -2; s = -\frac{1}{2}$   
 II.  $n = 3; l = 2; m_l = 1; s = +\frac{1}{2}$   
 III.  $n = 4; l = 1; m_l = 0; s = +\frac{1}{2}$   
 IV.  $n = 3; l = 1; m_l = -1; s = +\frac{1}{2}$

The **correct** decreasing order of energy of these electrons is

- (a)  $\text{IV} > \text{II} > \text{III} > \text{I}$  (b)  $\text{I} > \text{III} > \text{II} > \text{IV}$   
 (c)  $\text{III} > \text{I} > \text{II} > \text{IV}$  (d)  $\text{I} > \text{II} > \text{III} > \text{IV}$

77. The major product C in the below mentioned reaction is:



- (a) Propan-1-ol (b) Propan-2-ol  
 (c) Propane (d) Propyne

78. The compound that does not undergo Friedel-Crafts alkylation reaction but gives a positive carbylamine test is :

- (a) Aniline (b) Pyridine  
 (c) *N*-methylaniline (d) Triethylamine

79. For an endothermic reaction:

- (A)  $q_p$  is negative. (B)  $\Delta_r H$  is positive.  
 (C)  $\Delta_r H$  is negative. (D)  $q_p$  is positive.

Choose the **correct** answer from the options given below:

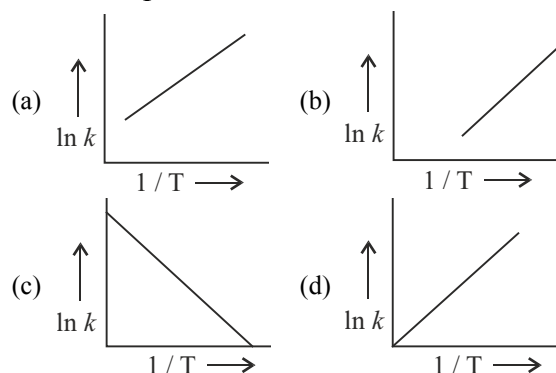
- (a) B and D (b) C and D  
 (c) A and B (d) A and C

80. 1.0 g of  $\text{H}_2$  has same number of molecules as in:

- (a) 14 g of  $\text{N}_2$  (b) 18 g of  $\text{H}_2\text{O}$   
 (c) 16 g of CO (d) 28 g of  $\text{N}_2$

81. Which of the following plot represents the variation of

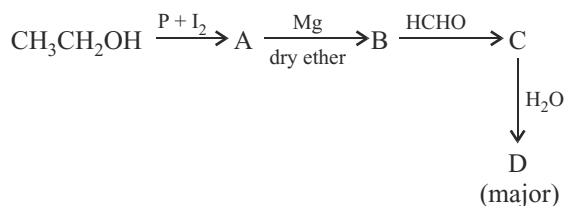
$\ln k$  versus  $\frac{1}{T}$  in accordance with Arrhenius equation?



82. A steam volatile organic compound which is immiscible with water has a boiling point of 250°C. During steam distillation, a mixture of this organic compound and water will boil :
- above 100°C but below 250°C
  - above 250°C
  - at 250°C
  - close to but below 100°C
83. Given below are two statements:  
**Statement I:** Glycogen is similar to amylose in its structure.  
**Statement II:** Glycogen is found in yeast and fungi also.  
 In the light of the above statements, choose the **correct** answer from the options given below :
- Statement I** is true but **Statement II** is false.
  - Statement I** is false but **Statement II** is true.
  - Both **Statement I** and **Statement II** are true.
  - Both **Statement I** and **Statement II** are false.
84. The oxidation states **not** shown by Mn in given reaction is :  
 $3\text{MnO}_4^{2-} + 4\text{H}^+ \rightarrow 2\text{MnO}_4^- + \text{MnO}_2 + 2\text{H}_2\text{O}$
- +6
  - +2
  - +4
  - +7
  - +3
- Choose the **most appropriate** answer from the options given below :
- D and E only
  - B and D only
  - A and B only
  - B and E only
85. Given below are two statements:  
**Statement I:** The Balmer spectral line for H atom with lowest energy is located at  $\frac{5}{36} R_H \text{ cm}^{-1}$ .  
 ( $R_H$  = Rydberg constant)  
**Statement II:** When the temperature of blackbody increases, the maxima of the curve (intensity and wavelength) shifts to shorter wavelength.  
 In the light of the above statements, choose the **correct** answer from the options given below:
- Statement I** is true but **Statement II** is false
  - Statement I** is false but **Statement II** is true
  - Both **Statement I** and **Statement II** are true
  - Both **Statement I** and **Statement II** are false

## SECTION-B

86. Identify D in the following sequence of reactions:



- n*-propyl alcohol
- isopropyl alcohol
- propanal
- propionic acid

87. Identify the **incorrect** statement.

- PEt<sub>3</sub> and AsPh<sub>3</sub> as ligands can form  $d\pi-d\pi$  bond with transition metals
- The N – N single bond is as strong as the P – P single bond
- Nitrogen has unique ability to form  $p\pi-p\pi$  multiple bonds with nitrogen, carbon and oxygen
- Nitrogen cannot form  $d\pi-p\pi$  bond as other heavier elements of its group

88. Match List-I with List-II :

List-I (Test/reagent)	List-II (Radical identified)
A. Lake Test	I. NO <sub>3</sub> <sup>-</sup>
B. Nessler's Reagent	II. Fe <sup>3+</sup>
C. Potassium sulphocyanide	III. Al <sup>3+</sup>
D. Brown Ring Test	IV. NH <sub>4</sub> <sup>+</sup>

Choose the **correct** answer from the options given below:

- A-IV, B-II, C-III, D-I
- A-II, B-IV, C-III, D-I
- A-II, B-III, C-IV, D-I
- A-III, B-IV, C-II, D-I

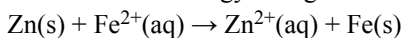
89. Match List-I with List-II:

List-I (Molecule)	List-II (Bond enthalpy (kJ mol <sup>-1</sup> ))
A. HCl	I. 435.8
B. N <sub>2</sub>	II. 498
C. H <sub>2</sub>	III. 946.0
D. O <sub>2</sub>	IV. 431.0

Choose the **correct** answer from the options given below:

- A-III, B-IV, C-I, D-II
- A-IV, B-I, C-III, D-II
- A-IV, B-III, C-II, D-I
- A-IV, B-III, C-I, D-II

90. The standard cell potential of the following cell Zn | Zn<sup>2+</sup>(aq) | Fe<sup>2+</sup>(aq) | Fe is 0.32 V. Calculate the standard Gibbs energy change for the reaction :



(Given : 1 F = 96487 C)

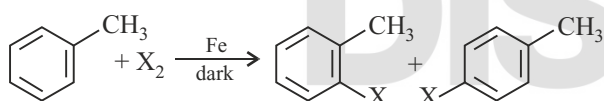
- 61.75 kJ mol<sup>-1</sup>
- + 5.006 kJ mol<sup>-1</sup>
- 5.006 kJ mol<sup>-1</sup>
- + 61.75 kJ mol<sup>-1</sup>

91. Match List-I will List-II:

List-I (Solid salt treated with dil. H <sub>2</sub> SO <sub>4</sub> )	List-II (Anion detected)
A. effervescence of colourless gas	I. NO <sub>2</sub> <sup>-</sup>
B. gas with smell of rotten egg	II. CO <sub>3</sub> <sup>2-</sup>
C. gas with pungent smell	III. S <sup>2-</sup>
D. brown fumes	IV. SO <sub>3</sub> <sup>2-</sup>

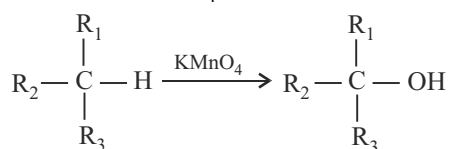
Choose the **correct** answer from the options given below:

- (a) A-II, B-III, C-IV, D-I (b) A-IV, B-III, C-II, D-I  
(c) A-I, B-II, C-III, D-IV (d) A-II, B-III, C-I, D-IV
92. The ratio of solubility of AgCl in 0.1 M KCl solution to the solubility of AgCl in water is:  
(Given : Solubility product of AgCl = 10<sup>-10</sup>)  
(a) 10<sup>-4</sup> (b) 10<sup>-6</sup>  
(c) 10<sup>-9</sup> (d) 10<sup>-5</sup>
93. On complete combustion, 0.3 g of an organic compound gave 0.2 g of CO<sub>2</sub> and 0.1 g of H<sub>2</sub>O. The percentage composition of carbon and hydrogen in the compound, respectively is:  
(a) 4.07% and 15.02% (b) 18.18% and 3.70%  
(c) 15.02% and 4.07% (d) 3.70% and 18.18%
94. The following reaction method



is **not** suitable for the preparation of the corresponding haloarene products, due to high reactivity of halogen, when X is :

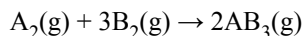
- (a) F (b) I  
(c) Cl (d) Br
95. The alkane that can be oxidized to the corresponding alcohol by KMnO<sub>4</sub> as per the equation



is, when:

- (a) R<sub>1</sub> = H; R<sub>2</sub> = H; R<sub>3</sub> = H  
(b) R<sub>1</sub> = CH<sub>3</sub>; R<sub>2</sub> = CH<sub>3</sub>; R<sub>3</sub> = CH<sub>3</sub>  
(c) R<sub>1</sub> = CH<sub>3</sub>; R<sub>2</sub> = H; R<sub>3</sub> = H  
(d) R<sub>1</sub> = CH<sub>3</sub>; R<sub>2</sub> = CH<sub>3</sub>; R<sub>3</sub> = H

96. For the following reaction at 300 K



the enthalpy change is +15 kJ, then the internal energy change is :

- (a) 19988.4 J (b) 200 J  
(c) 1999 J (d) 1.9988 kJ

97. Rate constants of a reaction at 500 K and 700 K are 0.04 s<sup>-1</sup> and 0.14 s<sup>-1</sup>, respectively; then, activation energy of the reaction is :

(Given: log 3.5 = 0.5441, R = 8.31 J K<sup>-1</sup> mol<sup>-1</sup>)

- (a) 182310 J (b) 18500 J  
(c) 18219 J (d) 18030 J

98. Mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>) required to be dissolved to prepare one litre of its solution which is isotonic with 15 g L<sup>-1</sup> solution of urea (NH<sub>2</sub>CONH<sub>2</sub>) is (Given: Molar mass in g mol<sup>-1</sup> C : 12, H : 1, O : 16, N : 14)

- (a) 55 g (b) 15 g  
(c) 30 g (d) 45 g

99. [Mn<sub>2</sub>(CO)<sub>10</sub>] and [Co<sub>2</sub>(CO)<sub>8</sub>] structures have

- A. Metal-Metal linkage  
B. Terminal CO groups  
C. Bridging CO groups  
D. Metal in zero oxidation state

Choose the **correct** answer from the options given below

- (a) Only A, B, C  
(b) Only B, C, D  
(c) Only A, C, D  
(d) Only A, B, D
100. Methyl group attached to a positively charged carbon atom stabilizes the carbocation due to
- (a) -I inductive effect  
(b) electromeric effect  
(c) hyperconjugation  
(d) mesomeric effect

## BOTANY

### SECTION-A

101. The regions with high level of species richness, high degree of endemism and a loss of 70% of the species and habitat are identified as:  
(a) Natural Reserves  
(b) Sacred Groves  
(c) Biodiversity Hotspots  
(d) Biogeographical Regions

102. Which of the following simple tissues are commonly found in the fruit walls of nuts and pulp of pear?

- (a) Sclereids  
(b) Fibres  
(c) Parenchyma  
(d) Collenchyma

103. In a chromosome, there is a specific DNA sequence, responsible for initiating replication. It is called as:
- Recognition sequence
  - Cloning site
  - Restriction site
  - ori site
104. Given below are two statements:  
**Statement I:** When many alleles of a single gene govern a character, it is called polygenic inheritance.  
**Statement II:** In Polygenic inheritance, the effect of each allele is additive.  
 In the light of the above statements, choose the **correct** answer from the options given below.
- Statement I is true but Statement II is false
  - Statement I is false but Statement II is true
  - Both Statement I and Statement II are true
  - Both Statement I and Statement II are false
105. Which of the following are required for the light reaction of Photosynthesis?
- |                     |                   |
|---------------------|-------------------|
| A. CO <sub>2</sub>  | B. O <sub>2</sub> |
| C. H <sub>2</sub> O | D. Chlorophyll    |
| E. Light            |                   |
- Choose the **correct** answer from the options given below:
- A, C, D and E only
  - C, D and E only
  - A and B only
  - A, C and E only
106. Match List-I with List-II:
- | List-I           | List-II  |
|------------------|--|
| A. Fleming       | I. Disc shaped sacs or cisternae near cell nucleus |
| B. Robert Brown  | II. Chromatin                                      |
| C. George Palade | III. Ribosomes                                     |
| D. Camillo Golgi | IV. Nucleus  |
- Choose the **correct** answer from the options given below:
- A-II, B-IV, C-III, D-I
  - A-II, B-III, C-I, D-IV
  - A-I, B-II, C-III, D-IV
  - A-IV, B-II, C-III, D-I
107. Match List-I with List-II:
- | List-I<br>(Type of Inheritance) | List-II<br>(Example)                    |
|---------------------------------|---|
| A. Incomplete dominance         | I. Blood groups in human                |
| B. Co-dominance                 | II. Flower colour in <i>Antirrhinum</i> |
| C. Pleiotropy                   | III. Skin colour in human               |
| D. Polygenic inheritance        | IV. Phenylketonuria                     |
- Choose the **correct** answer from the options given below:
- A-III, B-IV, C-II, D-I
  - A-II, B-I, C-IV, D-III
  - A-II, B-III, C-I, D-IV
  - A-IV, B-I, C-III, D-II
108. Which part of the ovule stores reserve food materials?
- Nucellus
  - Integument
  - Placenta
  - Funicle
109. Which one of the following is **not** found in Gymnosperms?
- Sieve cells
  - Albuminous cells
  - Tracheids
  - Vessels
110. Which one of the following is **not** included under in-situ conservation?
- Wild-life sanctuary
  - Botanical garden
  - Biosphere reserve
  - National park
111. Given below are two statements:  
**Statement I:** The Indian Government has set up GEAC, which will make decisions regarding the validity of GM research.  
**Statement II:** Biopiracy is the term used to refer to the use of bio-resources by native people.  
 In the light of the above statements, choose the correct answer from the options given below :
- Statement I is true but Statement II is false
  - Statement I is false but Statement II is true
  - Both Statement I and Statement II are true
  - Both Statement I and Statement II are false
112. Pollen grains remain preserved as fossils due to the presence of :
- Epidermal layer
  - Tapetum
  - Exine layer
  - Intine layer
113. Identify the **incorrect** pair :
- Sphenopsida – *Adiantum*
  - Pteropsida – *Dryopteris*
  - Psilopsida – *Psilotum*
  - Lycopsida – *Selaginella*
114. Which of the following is the **correct** match?
- Gymnosperms : *Cedrus, Pinus, Sequoia*
  - Angiosperms : *Wolffia, Eucalyptus, Sequoia*
  - Bryophytes : *Polytrichum, Polysiphonia, Sphagnum*
  - Pteridophytes : *Equisetum, Ginkgo, Adiantum*
115. Given below are two statements regarding RNA polymerase in prokaryotes.  
**Statement I:** In prokaryotes, RNA polymerase is capable of catalysing the process of elongation during transcription.  
**Statement II:** RNA polymerase associate transiently with 'Rho' factor to initiate transcription.  
 In the light of the above statements, choose the correct answer from the options given below :
- Statement I is true but Statement II is false
  - Statement I is false but Statement II is true
  - Both Statement I and Statement II are true
  - Both Statement I and Statement II are false

116. Which of the following is a nucleotide?

- (a) Uridine (b) Adenylic acid  
(c) Guanine (d) Guanosine

117. Match List-I with List-II :

- | List-I                   | List-II    |
|--------------------------|------------|
| A. Vexillary aestivation | I. Brinjal |
| B. Epipetalous stamens   | II. Peach  |
| C. Epiphylous stamens    | III. Pea   |
| D. Perigynous flower     | IV. Lily   |

Choose the **correct** answer from the options given below:

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

118. Match List-I with List-II :

- | List-I        | List-II         |
|---------------|-----------------|
| A. China rose | I. Free central |
| B. Mustard    | II. Basal       |
| C. Primrose   | III. Axile      |
| D. Marigold   | IV. Parietal    |

Choose the **correct** answer from the options given below:

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

119. Which of the following helps in maintenance of the pressure gradient in sieve tubes?

- (a) Albuminous cells (b) Sieve cells  
(c) Phloem parenchyma (d) Companion cells

120. Mesosome in a cell is a :

- (a) Membrane bound vesicular structure  
(b) Chain of many ribosomes attached to a single mRNA  
(c) Special structure formed by extension of plasma membrane  
(d) Medium sized chromosome

121. Match List-I with List-II :

- | List-I           | List-II                                    |
|------------------|--|
| A. Abscisic acid | I. Promotes female flowers in cucumber     |
| B. Ethylene      | II. Helps seeds to withstand desiccation   |
| C. Gibberellin   | III. Helps in nutrient mobilisation        |
| D. Cytokinin     | IV. Promotes bolting in beet, cabbage etc. |

Choose the **correct** answer from the options given below:

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

122. Match List-I with List-II :

- | List-I                                  | List-II                           |
|---|-----------------------------------|
| A. Genetically engineered Human Insulin | I. Gene therapy                   |
| B. GM Cotton                            | II. <i>E. coli</i>                |
| C. ADA Deficiency                       | III. Antigen-antibody interaction |
| D. ELISA                                | IV. <i>Bacillus thuringiensis</i> |

Choose the **correct** answer from the options given below:

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

123. Match List-I with List-II:

- | List-I             | List-II                     |
|--------------------|-----------------------------|
| A. ETS Complex I   | I. NADH Dehydrogenase       |
| B. ETS Complex II  | II. Cytochrome $bC_1$       |
| C. ETS Complex III | III. Cytochrome C oxidase   |
| D. ETS Complex IV  | IV. Succinate Dehydrogenase |

Choose the **correct** answer from the options given below:

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

124. Cryopreservation technique is used for :

- (a) Protection of environment  
(b) Protection of Biodiversity hotspots  
(c) Preservation of gametes in viable and fertile condition for a long period  
(d) *In-situ* conservation

125. Which of the following are **correct** about cellular respiration?

- A. Cellular respiration is the breaking of C-C bonds of complex organic molecules by oxidation.  
B. The entire cellular respiration takes place in Mitochondria.  
C. Fermentation takes place under anaerobic condition in germinating seeds.  
D. The fate of pyruvate formed during glycolysis depends on the type of organism also.  
E. Water is formed during respiration as a result of  $O_2$  accepting electrons and getting reduced.

Choose the **correct** answer from the options given below:

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

126. Given below are two statements:

**Statement I:** In eukaryotes there are three RNA polymerases in the nucleus in addition to the RNA polymerase found in the organelles.

**Statement II:** All the three RNA polymerases in eukaryotic nucleus have different roles.

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

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

127. Match List-I with List-II:

List-I	List-II
A. Histones	I. Loosely packed chromatin
B. Nucleosome	II. Densely packed Chromatin
C. Euchromatin	III. Positively charged basic proteins
D. Heterochromatin	IV. DNA wrapped around histone octamer

Choose the **correct** answer from the options given below:

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

128. Given below are two statements:

**Statement I:** Failure of segregation of chromatids during cell cycle resulting in the gain or loss of whole set of chromosome in an organism is known as aneuploidy.

**Statement II:** Failure of cytokinesis after anaphase stage of cell division results in the gain or loss of a chromosome is called polyploidy.

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

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

129. Recombination between homologous chromosomes is completed by the end of

- (a) Diakinesis
- (b) Zygotene
- (c) Diplotene
- (d) Pachytene

130. Match List-I with List-II:

List-I	List-II
A. Metacentric chromosome	I. Chromosome has a terminal centromere

- |                               |  |
|-------------------------------|--|
| B. Sub-metacentric chromosome | II. Middle centromere forming two equal arms of chromosome                                     |
| C. Acrocentric chromosome     | III. Centromere is slightly away from the middle of chromosome resulting into two unequal arms |
| D. Telocentric chromosome     | IV. Centromere is situated close to its end forming one extremely short and one very long arm  |

Choose the **correct** answer from the options given below:

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

131. Ligases is a class of enzymes responsible for catalysing the linking together of two compounds.

Which of the following bonds is not catalysed by it?

- (a) C – C
- (b) P – O
- (c) C – O
- (d) C – N

132. F. Skoog observed that callus proliferated from the internodal segments of tobacco stem when auxin was supplied with one of the following except :

- (a) Extract of Vascular tissues
- (b) Coconut milk
- (c) Abscisic acid
- (d) Yeast Extract

133. Given below are some statements about plant growth regulators.

- A. All GAs are acidic in nature.
- B. Auxins are antagonists to GAs.
- C. Zeatin was isolated from coconut milk.
- D. Ethylene induces flowering in Mango.
- E. Abscisic acid induces parthenocarpy.

Choose the **correct** set of statements from the options given below:

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

134. Identify the **incorrect** statement related to gel electrophoresis.

- (a) Separated DNA fragments can be directly seen under UV radiation
- (b) Separated DNA can be extracted from gel piece
- (c) Fragment of DNA moves toward anode
- (d) Sieving effect of agarose gel helps in separation of DNA fragments

135. Which of the following examples show monocarpellary, unilocular ovary with many ovules?

- A. *Sesbania*                      B. Brinjal  
C. *Indigofera*                    D. Tobacco  
E. *Asparagus*

Choose the **correct** answer from the options given below:

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

### SECTION-B

136. Given below are two statements :

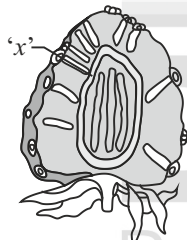
**Statement I:** In the *lac* operon, the *z* gene codes for beta-galactosidase which is primarily responsible for the hydrolysis of lactose into galactose and glucose.

**Statement II:** In addition to lactose, glucose or galactose can also induce *lac* operon.

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

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

137. The part marked as 'x' in the given figure is



- (a) Endosperm                      (b) Thalamus  
(c) Endocarp                        (d) Mesocarp

138. Given below are two statements:

**Statement I:** In a dicotyledonous leaf, the adaxial epidermis generally bears more stomata than the abaxial epidermis.

**Statement II:** In a dicotyledonous leaf, the adaxially placed palisade parenchyma is made up of elongated cells, which are arranged vertically and parallel to each other.

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

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

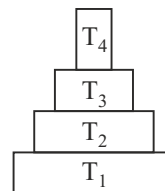
139. Which of the following are **not** fatty acids?

- A. Glutamic acid                    B. Arachidonic acid  
C. Palmitic acid                    D. Lecithin  
E. Aspartic acid

Choose the **correct** answer from the options given below:

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

140. Consider the pyramid of energy of an ecosystem given below:



If  $T_4$  is equivalent to 1000 J, what is the value at  $T_1$  ?

- (a)  $\frac{10000}{10}$  J                              (b)  $\frac{10000}{10} \times 4$  J  
(c) 10,000 J                              (d) 10,00,000 J

141. Which one of the following products diffuses out of the chloroplast during photosynthesis?

- (a) ADP                                  (b) NADPH  
(c)  $O_2$                                     (d) ATP

142. Recombinant DNA molecule can be created normally by cutting the vector DNA and source DNA respectively with:

- (a) Hind II, Hind II                    (b) Hind II, Alu I  
(c) Hind II, EcoR I                    (d) Hind II, BamHI

143. Which one of the following is not a limitation of ecological pyramids?

- (a) Saprophytes are not given any place in ecological pyramids  
(b) It assumes a simple food chain, that almost never exists in nature  
(c) It accommodates a food web  
(d) It does not take into account the same species belonging to two or more trophic levels

144. The *Bt* toxin in genetically engineered *Bt* cotton kills the pest by:

- (a) Creating pores in the midgut  
(b) Damaging the respiratory system  
(c) Degenerating the nervous system  
(d) Altering the pH of body fluids

145. Match List-I with List-II:

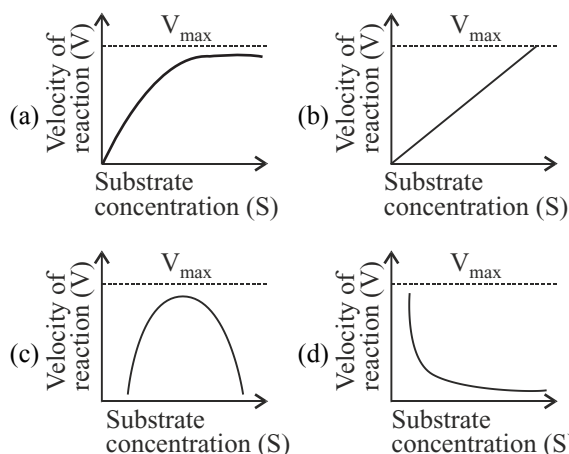
List-I (Organisms)	List-II (Mode of Nutrition)
--------------------	-----------------------------

- |                      |   |
|----------------------|---|
| A. Euglenoid         | I. Parasitic  |
| B. Dinoflagellate    | II. Saprophytic   |
| C. Slime mould       | III. Photosynthetic   |
| D. <i>Plasmodium</i> | IV. Switching between photosynthetic and heterotrophic mode |

Choose the **correct** answer from the options given below:

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

146. Which of the following graphs depicts the effect of substrate concentration on velocity of enzyme catalysed reaction?



147. When will the population density increase, under special conditions?

When the number of :

- (a) Deaths exceeds number of births and also number of emigrants equals number of immigrants.  
 (b) Births plus number of immigrants equals number of deaths plus number of emigrants.  
 (c) Births plus number of emigrants is more than the number of deaths plus number of immigrants.  
 (d) Births plus number of immigrants is more than the sum of number of deaths and number of emigrants.

148. When a tall pea plant with round seeds was selfed, it produced the progeny of :

- (a) Tall plants with round seeds and  
 (b) Tall plants with wrinkled seeds.

Identify the genotype of the parent plant.

- (a) TtRr (b) TtRR  
 (c) TTRR (d) TTRr

149. Match List-I with List-II:

**List-I**

A. Biodiversity hotspot

**List-II**

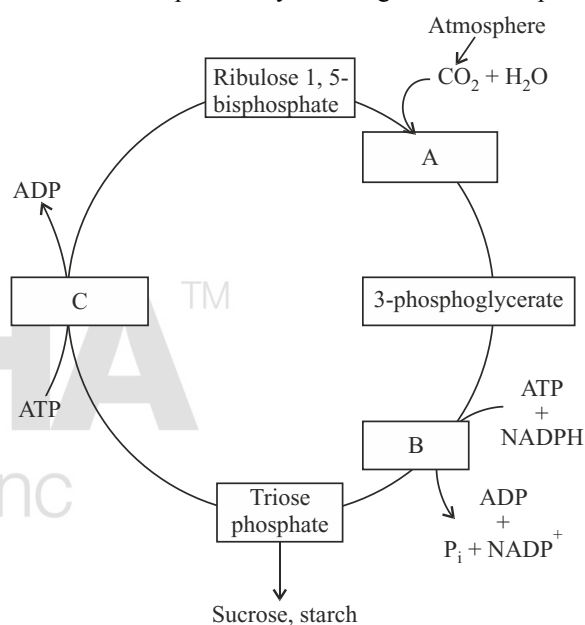
I. Khasi and Jantia hills in Meghalaya

- B. Sacred groves II. World Summit on Sustainable Development 2002  
 C. Johannesburg, South Africa III. *Parthenium*  
 D. Alien species invasion IV. Western Ghats

Choose the **correct** answer from the options given below:

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

150. Observe the given figure. Identify the different stages labelled with alphabets by selecting the **correct** option.



- (a) A-Carboxylation, B-Regeneration, C-Reduction  
 (b) A-Reduction, B-Decarboxylation, C-Regeneration  
 (c) A-Carboxylation, B-Reduction, C-Regeneration  
 (d) A-Reduction, B-Carboxylation, C-Regeneration

## ZOOLOGY

### SECTION-A

151. Match List-I with List-II:

**List-I**

- A. Predator  
 B. Mutualism  
 C. Parasitism  
 D. Sexual deceit

**List-II**

- I. *Ophrys*  
 II. *Pisaster*  
 III. Female wasp and fig  
 IV. Plasmodium

Chose the **correct** answer from the options given below:

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

152. Match List-I with List-II:

List-I (Location of Joint)	List-II (Type of Joint)
A. Joint between humerus and pectoral girdle	I. Gliding joint
B. Knee joint	II. Ball and Socket joint
C. Joint between atlas and axis	III. Hinge joint
D. Joint between carpals	IV. Pivot joint

Choose the **correct** answer from the options given below:

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

153. Following are the steps involved in action of toxin in *Bt. Cotton*

- A. The inactive toxin converted into active form due to alkaline pH of gut of insect.  
 B. *Bacillus thuringiensis* produce crystals with toxic insecticidal proteins.  
 C. The alkaline pH solubilises the crystals.  
 D. The activated toxin binds to the surface of midgut cells, creates pores and causes death of the insect.  
 E. The toxin proteins exist as inactive protoxins in bacteria.

Choose the **correct** sequence of steps from the options given below:

- (a) E → C → B → A → D  
 (b) B → C → A → E → D  
 (c) A → E → B → D → C  
 (d) B → E → C → A → D

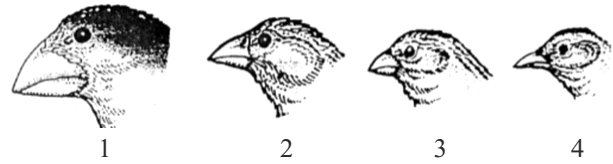
154. Match List-I with List-II:

List-I	List-II
A. Gene pool	I. Stable within a generation
B. Genetic drift	II. Change in gene frequency by chance
C. Gene flow	III. Transfer of genes into or out of population
D. Gene frequency	IV. Total number of genes and their alleles

Choose the correct answer from the options given below:

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

155. Which evolutionary phenomenon is depicted by the sketch given in figure?



- (a) Artificial selection  
 (b) Genetic drift  
 (c) Convergent evolution  
 (d) Adaptive radiation

156. A person with blood group ARh<sup>-</sup> can receive the blood transfusion from which of the following types?

- A. BRh<sup>-</sup> B. ABRh<sup>-</sup>  
 C. ORh<sup>-</sup> D. ARh<sup>-</sup>  
 E. ARh<sup>+</sup>

Choose the **correct** answer from the options given below:

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

157. Enzymes that catalyse the removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds, are known as :

- (a) Transferases (b) Oxidoreductases  
 (c) Dehydrogenases (d) Lyases

158. Match List-I with List-II.

List-I (Event)	List-II [Stage of Prophase-I (Meiosis-I)]
A. Chiasmata formation	I. Pachytene
B. Crossing over	II. Diakinesis
C. Synaptonemal complex formation	III. Diplotene
D. Terminalisation of chiasmata	IV. Zygotene

Choose the correct answer from the options given below:

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

159. Match List-I with List-II.

List-I	List-II
A. Primary structure of protein	I. Human haemoglobin
B. Secondary structure of protein	II. Disulphide bonds
C. Tertiary structure of protein	III. Polypeptide chain
D. Quaternary structure of protein	IV. Alpha helix and β sheet

Choose the **correct** answer from the options given below:

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

160. Match List-I with List-II.

List-I	List-II
A. Epinephrine	I. Hyperglycemia
B. Thyroxine	II. Smooth muscle contraction
C. Oxytocin	III. Basal metabolic rate
D. Glucagon	IV. Emergency hormone

Choose the **correct** answer from the options given below:

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

161. Which of the following statements is **correct** about the type of junction and their role in our body?

- (a) Adhering junctions facilitate the cells to communicate with each other.
- (b) Tight junctions help to stop substances from leaking across a tissue.
- (c) Tight junctions help to perform cementing to keep neighbouring cells together.
- (d) Gap junctions help to create gap between the cells and tissues.

162. Select the restriction endonuclease enzymes whose restriction sites are present for the tetracycline resistance ( $tet^R$ ) gene in the pBR322 cloning vector.

- (a) Bam HI and Sal I
- (b) Sal I and Pst I
- (c) Pst I and Pvu I
- (d) Pvu I and Bam HI

163. Match List-I with List-II.

List-I	List-II
A. Chondrichthyes	I. Clarias
B. Cyclostomata	II. Carcharodon
C. Osteichthyes	III. <i>Myxine</i>
D. Amphibia	IV. <i>Ichthyophis</i>

Choose the **correct** answer from the options given below:

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

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

**Assertion A:** During menstrual cycle, the ovulation takes place approximately on 14<sup>th</sup> day.

**Reason R:** Rapid secretion of LH in the middle of menstrual cycle induces rupture of Graafian follicle and thereby the release of ovum.

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

- (a) A is correct but R is not correct.
- (b) A is not correct but R is correct.
- (c) Both A and R are correct and R is the correct explanation of A.
- (d) Both A and R are correct but R is NOT the correct explanation of A.

165. Match List-I with List-II with respect to convergent evolution:

List-I	List-II
A. Lemur	I. Flying phalanger
B. Bobcat	II. Numbat
C. Anteater	III. Spotted cuscus
D. Flying squirrels	IV. Tasmanian tiger cat

Choose the **correct** answer from the options given below:

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

166. Match List-I with List-II.

List-I	List-II
A. Cells are metabolically active and proliferate	I. $G_2$ phase
B. DNA replication takes place	II. $G_1$ phase
C. Proteins are synthesised	III. $G_0$ phase
D. Quiescent stage with metabolically active cells	IV. S phase

Choose the **correct** answer from the options given below:

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

167. Match List-I with List-II.

List-I	List-II
A. Migratory flamingoes and resident fish in South American lakes	I. Interference competition
B. Abingdon tortoise became extinct after introduction of goats in their habitat	II. Competitive release

- C. *Chathamalus* expands its distributional range in the absence of *Balanus*
- D. Five closely related species of Warblers feeding in different locations on same tree
- III. Resource Partitioning
- IV. Interspecific competition

Choose the **correct** answer from the options given below:

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

168. Match List-I with List-II relating to microbes and their products:

List-I (Microbes)	List-II (Products)
A. <i>Streptococcus</i>	I. Citric acid
B. <i>Trichoderma polysporum</i>	II. Clot buster
C. <i>Monascus purpureus</i>	III. Cyclosporin A
D. <i>Aspergillus niger</i>	IV. Statins

Choose the **correct** answer from the options given below:

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

169. Match List-I with List-II.

List-I	List-II
A. F <sub>1</sub> Particles	I. Chromosomes
B. Histones	II. Cilia
C. Axoneme	III. Golgi apparatus
D. Cisternae	IV. Mitochondria

Choose the correct answer from the options given below:

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

170. Match List-I with List-II relating to examples of various kind of IUDs and barrier:

List-I	List-II
A. Copper releasing IUD	I. Vaults
B. Non-medicated IUD	II. Multiload 375
C. Contraceptive barrier	III. LNG-20
D. Hormone releasing IUD	IV. Lippes loop

Choose the **correct** answer from the options given below:

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

171. Given below are two statements:

**Statement I:** Antibiotics are chemicals produced by microbes that kill other microbes.

**Statement II:** Antibodies are chemicals formed in body that eliminate microbes.

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

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

172. Arrange the following parts in human Mammary gland, traversing the route of milk ejection.

- A. Mammary duct  
B. Lactiferous duct  
C. Mammary alveolus  
D. Ampulla  
E. Mammary tubule

Choose the **correct** answer from the options given below:

- (a) D → C → E → A → B  
(b) C → E → B → A → D  
(c) C → E → A → D → B  
(d) A → C → E → D → B

173. Which of the following are correct about *EcoRI*?

- A. Cut the DNA with blunt end  
B. Cut the DNA with sticky end  
C. Recognise a specific palindromic sequence  
D. Cut the DNA between the base G and A when encounters the DNA sequence 'GAATTC'  
E. Exonuclease

Choose the **correct** answer from the options given below:

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

174. Which of the following is/are present in female cockroach?

- A. Collateral gland B. Mushroom gland  
C. Spermatheca D. Anal style  
E. Phallic gland

Choose the most appropriate answer from the options given below:

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

175. Match List-I with List-II:

List-I	List-II
A. Malignant tumors	I. Destroy tumors
B. MALT	II. AIDS
C. NACO	III. Metastasis
D. α-Interferons	IV. Lymphoid tissue

Choose the correct answer from the options given below:

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

176. Open Circulatory system is present in:

- (a) *Palaemon*, *Nereis*, *Balanoglossus*  
 (b) *Hirudinaria*, *Bombyx*, *Salpa*  
 (c) *Anopheles*, *Limax*, *Limulus*  
 (d) *Pheretima*, *Musca*, *Pila*

177. In which of the following connective tissues, the cells secrete fibres of collagen or elastin?

- A. Cartilage                      B. Bone  
 C. Adipose tissue                D. Blood  
 E. Areolar tissue

Choose the **most appropriate** answer from the options given below :

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

178. Which of the following pairs is an **incorrect** match?

- (a) Annelids and arthropods-Bilateral symmetry  
 (b) Sponges-Acoelomates  
 (c) Coelenterates and Ctenophores-Radial symmetry  
 (d) Platyhelminthes-Diploblastic organisation

179. Match List-I with List-II:

List-I	List-II
A. Residual Volume	I. Maximum volume of air that can be breathed in after forced expiration
B. Vital Capacity	II. Volume of air inspired or expired during normal respiration
C. Expiratory Capacity	III. Volume of air remaining in lungs after forcible expiration
D. Tidal Volume	IV. Total volume of air expired after normal inspiration

Choose the **correct** answer from the options given below:

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

180. Match List-I with List-II:

List-I	List-II
A. Living Fossil	I. Elongated canine teeth
B. Connecting Link	II. Vermiform appendix
C. Vestigial Organ	III. <i>Echidna</i>
D. Atavism	IV. <i>Latimeria</i>

Choose the **correct** answer from the options given below:

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

181. Match List-I with List-II.

List-I	List-II
A. Schwann cells	I. Neurotransmitter
B. Synaptic knob	II. Cerebral cortex
C. Bipolar neurons	III. Myelin sheath
D. Multipolar neurons	IV. Retina

Choose the **correct** answer from the options given below:

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

182. Diuresis is prevented by:

- (a) Renin from JG cell via switching off the osmoreceptors  
 (b) ANF from atria of the heart  
 (c) Aldosterone from adrenal medulla  
 (d) Vasopressin from Neurohypophysis

183. Following is the list of STDs. Select the diseases which are not completely curable.

- A. Genital warts                B. Genital herpes  
 C. Syphilis                        D. Hepatitis-B  
 E. Trichomoniasis

Choose the **correct** answer from the options given below:

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

184. What is the correct order (old to recent) of periods in Paleozoic era?

- (a) Silurian, Devonian, Permian, Carboniferous  
 (b) Silurian, Devonian, Carboniferous, Permian  
 (c) Permian, Devonian, Silurian, Carboniferous  
 (d) Silurian, Carboniferous, Permian, Devonian

185. 'Lub' sound of Heart is caused by the \_\_\_\_\_.

- (a) closure of the semilunar valves  
 (b) opening of tricuspid and bicuspid valves  
 (c) opening of the semilunar valves  
 (d) closure of the tricuspid and bicuspid valves

### SECTION-B

186. Match List-I with List-II relating to human female external genitalia.

List-I (Structures)	List-II (Features)
A. Mons pubis	I. A fleshy fold of tissue surrounding the vaginal opening
B. Clitoris	II. Fatty cushion of cells covered by skin and hair
C. Hymen	III. Tiny finger-like structure above labia minora

- D. Labina majora      IV. A thin membrane-like structure covering vaginal opening

Choose the correct answer from the option given below :

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

187. Aneuploidy is a chromosomal disorder where chromosome number is not the exact copy of its haploid set of chromosomes, due to:

- A. Substitution  
 B. Addition  
 C. Deletion  
 D. Translocation  
 E. Inversion

Choose the **most appropriate** answer from the options given below:

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

188. Given below are two statements :

**Statement I:** RNA interference takes place in all Eukaryotic organisms as method of cellular defense.

**Statement II:** RNAi involves the silencing of a specific mRNA due to a complementary single-stranded RNA molecule that binds and prevents translation of mRNA

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

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

189. Identify the wrong statements :

- A. Erythropoietin is produced by juxtaglomerular cells of the kidney  
 B. Leydig cells produce Androgens  
 C. Atrial Natriuretic factor, a peptide hormone is secreted by the seminiferous tubules of the testes  
 D. Cholecystokinin is produced by gastrointestinal tract  
 E. Gastrin acts on intestinal wall and helps in the production of pepsinogen

Choose the **most appropriate** answer from the options given below :

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

190. Following are the steps involved in the process of PCR.

- A. Annealing  
 B. Amplification (~1 billion times)  
 C. Denaturation  
 D. Treatment with Taq polymerase and deoxynucleotides  
 E. Extension

Choose the **correct** sequence of steps of PCR from the options given below :

- (a) C → A → D → E → B  
 (b) A → B → E → D → C  
 (c) A → C → E → D → B  
 (d) D → B → E → C → A

191. Given below are two statements:

**Statements I:** Concentrated urine is formed due to counter current mechanism in nephron.

**Statement II:** Counter current mechanism helps to maintain osmotic gradient in the medullary interstitium.

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

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

192. Given below are two statements:

**Statement I:** Concentrically arranged cisternae of Golgi complex are arranged near the nucleus with distinct convex *cis* or maturing and concave *trans* or forming face.

**Statement II:** A number of proteins are modified in the cisternae of Golgi complex before they are released from *cis* face.

In the light of the above statements, choose the correct answer from the option given below.

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

193. Match List-I with List-II:

List-I	List-II
A. Parturition	I. Several antibodies for new-born babies
B. Placenta	II. Collection of ovum after ovulation
C. Colostrum	III. Foetal ejection reflex
D. Fimbriae	IV. Secretion of the hormone hCG

Choose the correct answer from the option given below:

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

194. Given below are two statements: One is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A:** Members of subphylum vertebrata possess notochord during the embryonic period. The notochord is replaced by a cartilaginous or bony vertebral column in the adult.

**Reason R:** Thus all chordates are vertebrates not all vertebrates are chordates.

In the light of the above statements choose the correct answer from the option given below.

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

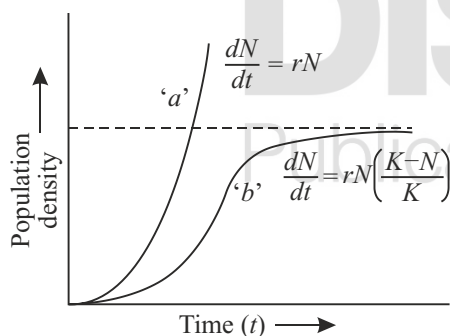
195. The mother has A<sup>+</sup> blood group the father has B<sup>+</sup> and the child is A<sup>+</sup>. What can be the possibility of genotypes of all three, respectively?

- A. I<sup>A</sup>I<sup>A</sup> | I<sup>A</sup>i | I<sup>B</sup>i  
 B. I<sup>A</sup>I<sup>A</sup> | I<sup>B</sup>i | I<sup>A</sup>i  
 C. I<sup>B</sup>i | I<sup>A</sup>I<sup>A</sup> | I<sup>A</sup>I<sup>B</sup>  
 D. I<sup>A</sup>I<sup>A</sup> | I<sup>B</sup>I<sup>B</sup> | I<sup>A</sup>i  
 E. I<sup>A</sup>i | I<sup>A</sup>i | I<sup>A</sup>i

Choose the **correct** answer from the option given below:

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

196. What do 'a' and 'b' represent in the following population growth curve?



- (a) 'a' represents exponential growth when responses are not limiting the growth; and 'b' represents logistic growth when responses are limiting the growth.  
 (b) 'a' represents logistic growth when responses are not limiting the growth; 'b' represents exponential growth when responses are limiting the growth.  
 (c) 'a' represents carrying capacity and 'b' shows logistic growth when responses are limiting the growth.  
 (d) 'a' represents exponential growth when responses are not limiting the growth and 'b' shows carrying capacity.

197. Select the correct statements regarding mechanism of muscle contraction.

- A. It is initiated by a signal sent by CNS via sensory neuron.  
 B. Neurotransmitter generates action potential in the sarcolemma.

- C. Increased Ca<sup>++</sup> level leads to the binding of calcium with troponin on action filaments.  
 D. Masking of active site for actin is activated.  
 E. Utilising the energy from ATP hydrolysis to form cross bridge.

Choose the most appropriate answer from the options given below:

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

198. Match List-I with List-II :

List-I	List-II
A. Squamous Epithelium	I. Goblet cells of alimentary canal
B. Ciliated Epithelium	II. Inner lining of pancreatic ducts
C. Glandular Epithelium	III. Walls of blood vessels
D. Compound Epithelium	IV. Inner surface of Fallopian tubes

Choose the **correct** answer from the options given below:

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

199. Match List-I with List-II :

List-I	List-II
A. B-Lymphocytes	I. Passive immunity
B. Interferons	II. Cell mediated immunity
C. T-Lymphocytes	III. Produce an army of proteins in response to pathogens
D. Colostrum	IV. Innate immunity

Choose the correct answer from the options given below:

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

200. Given below are two statements: One is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A:** During the transportation of gases, about 20-25 percent of CO<sub>2</sub> is carried by Haemoglobin as carbamino-haemoglobin.

**Reason R:** This binding is related to high pCO<sub>2</sub> and low pO<sub>2</sub> in tissues.

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

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

# Hints & Solutions

## PHYSICS

1. (b) Potential energy stored in external magnetic field is  $U = -\vec{M} \cdot \vec{B}$   
 $= -MB \cos 90^\circ = 0$   
 $\therefore$  Angle between  $\vec{M}$  and  $\vec{B}$  is  $90^\circ$   
 $\therefore U = -MB \cos 90^\circ = 0$
2. (a) In horizontal circular motion,  
Tension,  $T = m\omega^2 r$   
For constant  $m$  and  $r$ ,  $T \propto \omega^2$   
 $T' = 4T$  (Given)  
 $\Rightarrow \omega' = 2\omega = 20 \text{ rpm}$
3. (d) In metal all the charge resides on surface.  
 $Q = 6 \mu\text{C}$   
Total surface area,  $A = 6a^2$   
 $= 6 \times (5 \times 10^{-2})^2$   
 $= 150 \times 10^{-4} \text{ m}^2$   
Surface charge density,  $\sigma = \frac{Q}{A}$   
 $= \frac{6 \times 10^{-6}}{150 \times 10^{-4}}$   
 $= 0.4 \times 10^{-3} \text{ C m}^{-2}$
4. (d) For diamagnetic material,  
 $0 \leq \mu_r < 1$   
 $\chi = \mu_r - 1 \Rightarrow -1 \leq \chi < 0$   
 $\mu_r = \frac{\mu}{\mu_0} < 1 \Rightarrow \mu < \mu_0$
5. (c) By Bernoulli's principle,  
 $\frac{1}{2} \rho V^2 + \rho gh + P = \text{constant}$   
 $P + K_1 + \rho g(0) = P + K_2 + \rho g(h)$   
 $K_1 = K_2 + \rho gh$   
 $K_1 > K_2$
6. (c) Escape velocity of object from planet is  
 $(V_e)_p = \sqrt{\frac{2GM_p}{R_p}}$   
 $\therefore (V_e)_p \propto \sqrt{\frac{M_p}{R_p}}$   
Now,  $M_p = 9M_e$  and  $R_p = 16R_e$   
 $\frac{(V_e)_p}{(V_e)_e} = \sqrt{\frac{M_p}{R_p} \times \frac{R_e}{M_e}} = \sqrt{\frac{9M_e}{16R_e} \times \frac{R_e}{M_e}} = \frac{3}{4}$   
 $\Rightarrow (V_e)_p = \frac{3}{4} v$
7. (a) de-Broglie wavelength is  
 $\lambda = \frac{h}{\sqrt{2mqV}} \therefore \lambda \propto \frac{1}{\sqrt{mq}}$   
 $\frac{\lambda_\alpha}{\lambda_e} = \sqrt{\frac{m_e q_e}{m_\alpha q_\alpha}}$   
 $\therefore m_\alpha \gg m_e$   
 $\lambda_e = \lambda_\alpha$
8. (c)  $W = \Delta \text{K.E.}$   
 $\Rightarrow K_f - K_i = \vec{F} \cdot \Delta \vec{x}$   
 $\Rightarrow K_f - 10 = (-2\hat{i} + 3\hat{j}) \cdot (3\hat{i})$   
 $K_f - 10 = -6$   
 $K_f = 4 \text{ J}$
9. (d) K.E. before striking the ground is  
 $K_1 = mgh_1 = mg(10)$   
K.E. after striking the ground is  
 $= K_1 - \frac{50}{100} K_1 = \frac{50}{100} K_1 = \frac{K_1}{2} = K_2$   
Now,  $K_2 = mgh_2 \Rightarrow \frac{K_1}{2} = mgh_2$   
 $\Rightarrow \frac{mg(10)}{2} = mgh_2 \Rightarrow h_2 = 5 \text{ m}$
10. (d)  $V_L$  leads current  $I$  by phase angle  $\frac{\pi}{2}$   
 $\therefore V_L = V_0 \sin\left(\omega t + \frac{\pi}{2}\right) = V_0 \cos \omega t$  ( $\because I = I_0 \sin \omega t$ )  
 $V_0 = I_0 X_L$   
 $\Rightarrow V_L = I_0 X_L \cos(\omega t) = I_0 \omega L \cos(\omega t)$
11. (a) Electrostatic energy,  $U = \frac{1}{2} CV^2$   
 $= \frac{1}{2} \times 12 \times 10^{-12} \times (50)^2$   
 $= 15 \times 10^{-9} \text{ J}$   
 $= 15 \text{ nJ}$
12. (b) current,  $i = nAv_d e$   
 $= n \left(\frac{\pi D^2}{4}\right) v_d e \Rightarrow i \propto D^2 v_d$   
 $\frac{100}{200} = \frac{(d)^2}{\left(\frac{d}{2}\right)^2} \times \frac{v}{v'}$   
 $\Rightarrow v' = 2 \times 2^2 v = 8v$

13. (b) Resistance,  $R = \frac{V}{I} = \frac{200}{20} = 10\Omega$

$$\frac{\Delta R}{R} = \frac{\Delta V}{V} + \frac{\Delta I}{I} = \frac{4}{200} + \frac{0.2}{20} = \frac{6}{200}$$

$$\Rightarrow \Delta R = \frac{6}{200} \times R = \frac{6}{20} = 0.3\Omega$$

$$\Rightarrow \text{Resistance} = R \pm \Delta R = (10 \pm 0.3)\Omega$$

14. (a) In secondary circuit,  $P = VI$

$$\Rightarrow 88 = 11000 I$$

$$\Rightarrow I = \frac{88}{11 \times 10^3} = 8 \times 10^{-3} \text{ A}$$

$$\Rightarrow I = 8 \text{ mA}$$

15. (d) Position,  $x = \alpha t^4 + \beta t^2 + \gamma t + \delta$

$$\text{Velocity, } v = \frac{dx}{dt} = 4\alpha t^3 + 2\beta t + \gamma$$

$$\text{Initial velocity} = v_i = \gamma$$

$$\text{Acceleration, } a = \frac{dv}{dt} = 12\alpha t^2 + 2\beta$$

$$\text{Initial acceleration} = a_i = 2\beta$$

$$\therefore \frac{v_i}{a_i} = \frac{\gamma}{2\beta}$$

16. (d)  $I_{XY} = I_g + MR^2$

$$= \frac{2}{5}MR^2 + MR^2 = \frac{7}{5}MR^2 = \frac{7}{5} \times 5R^2$$

$$= 7R^2 \quad \dots(1)$$

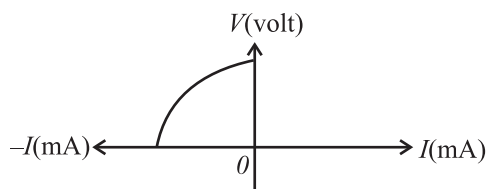
$$I_{XY} = MK^2 = 5 \times 5^2 \quad \dots(2)$$

$$\Rightarrow 5 \times 5^2 = 7 \times R^2 \quad [\text{From (1) and (2)}]$$

$$\Rightarrow R = \sqrt{\frac{5}{7}} \times 5 = \frac{5x}{\sqrt{7}} \quad (\text{Given})$$

$$\therefore x = \sqrt{5}$$

17. (d) The I-V characteristics of solar cell is given as



18. (c) Time period of oscillation of magnet inside the magnetic field is  $T = 2\pi\sqrt{\frac{I}{MB}}$

$$T = \frac{t}{n} = \frac{10}{10} = 1\text{s}$$

$$1 = 2\pi\sqrt{\frac{10^{-6}}{\pi^2 \times 1.0 \times 10^{-2} \times B}}$$

$$\Rightarrow B = 0.4 \text{ mT}$$

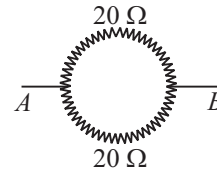
19. (b) Capacitance of capacitor is  $C = \frac{A\epsilon_0}{d}$

So capacitance of capacitor is independent of charge ( $q$ ) and potential ( $V$ ), it depends on the geometry of the capacitor and medium between plates of the capacitor.

20. (c) Regular reflection needs for image formation, that is why we can see our image in a mirror but not in wall. Different constituent colours in white light are responsible for the variety in colour of objects.

21. (a)  $R_0 = 10\Omega, l_2 = 2l_1 \Rightarrow n = 2$

$$R_1 = n^2 R_0 = 4R_0 = 40\Omega$$



$$R_{AB} = \frac{20 \times 20}{20 + 20} = 10\Omega$$

22. (b) The spectral series corresponding to the electronic transition from the levels  $n_2 = 5, 6, \dots$  to  $n_1 = 4$  is Brackett series.

23. (b) Layer of foam forms an insulation which prohibits heat transfer, and hence roofs of houses containing foam keep room cooler during summer.

24. (c) Potential energy,  $U = \frac{1}{2} kx^2$

$$\text{Kinetic energy, } K = \frac{1}{2} kA^2 - \frac{1}{2} kx^2$$

$$\therefore U = K$$

$$\frac{1}{2} kx^2 = \frac{1}{2} kA^2 - \frac{1}{2} kx^2 \Rightarrow k^2 x^2 = kA^2$$

$$x^2 = \frac{A^2}{2}$$

$$x = \frac{A}{\sqrt{2}}$$

25. (d) Fringe width ( $\beta$ ) = Fringe separation =  $\frac{\lambda D}{d}$

$$\Rightarrow \beta = \frac{600 \times 10^{-9} \times 1}{1.5 \times 10^{-3}} = \frac{6 \times 10^{-7}}{1.5 \times 10^{-3}}$$

$$= 4 \times 10^{-4} \text{ m}$$

26. (b) Water is used as a coolant in nuclear reactor due to its high specific heat capacity.

27. (b) Least count of screw gauge

$$= \frac{\text{Pitch}}{\text{No. of divisions on circular scale}}$$

$$\Rightarrow \text{Least count} = \frac{1}{100} = 0.01 \text{ mm}$$

Final reading = MSR + CSR × L.C.  
 = 1 mm + (63) (0.01) mm  
 = 1.63 mm = 0.163 cm

28. (a) Self inductance  $L = \mu_0 \mu_r \times n \times A \times N$

$$\Rightarrow L = \mu_0 \mu_r n \times A \times \frac{N}{l} \times l$$

$$\Rightarrow L = \mu_0 \mu_r \times n^2 \times A \times l \Rightarrow L \propto n^2 l$$

$$\therefore \frac{L_A}{L_B} = \frac{n_A^2}{n_B^2} \times \frac{l_A}{l_B}$$

$$\Rightarrow \frac{L_A}{L_B} = \frac{1}{4} \times 2 = \frac{1}{2}$$

29. (b) When the output of an OR gate is applied to input of a NOT gate, then the combination acts as NOR gate.

30. (c) For interference pattern to be observed the sources must be coherent.

Hence the interference will be observed due to superposition of waves  $y = a \sin(\omega t)$  and  $y = a \sin(\omega t - \phi)$

31. (c) From the Einstein's photoelectric equation

$$(\text{K.E.})_{\max} = \frac{hc}{\lambda} - \phi_0 \text{ and } \lambda = \frac{hc}{e}$$

$$\Rightarrow (\text{K.E.})_{\max} = \frac{hc}{\lambda} - \phi_0$$

$$\Rightarrow (\text{K.E.})_{\max} = e - \phi$$

32. (b)  $\gamma$ -rays has the smallest wavelength.

33. (d) Equilibrium state of a thermodynamic system is given by state variables P, V and T. Work done and total heat are path variables.

34. (d) From Einstein's photoelectric equation,

$$h \frac{c}{\lambda_1} = \frac{-5E}{2} + 4E = \frac{3}{2}E \quad \dots(1)$$

$$h \frac{c}{\lambda_2} = -2E + 3E = E \quad \dots(2)$$

$$h \frac{c}{\lambda_3} = -2E + 4E = 2E \quad \dots(3)$$

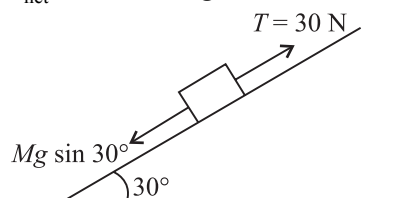
Comparing (2) and (3)

$$\frac{1}{\lambda_3} = \frac{2}{\lambda_2} \Rightarrow \lambda_2 = 2\lambda_3$$

Comparing (1) and (2)

$$3\lambda_1 = 2\lambda_2 \Rightarrow \lambda_1 < \lambda_2$$

35. (d)  $F_{\text{net}} = Ma = T - Mg \sin 30$



$$\Rightarrow 30 - 5 \times 10 \times \frac{1}{2} = 5a$$

$$\Rightarrow a = 1 \text{ m/s}^2$$

36. (c) For EM wave,  $\frac{\mu_r}{\epsilon_r} = \frac{1}{4}$

$$\frac{E}{H} = \frac{E\mu}{B} = v\mu$$

$$\therefore \frac{E}{H} = \frac{1}{\sqrt{\mu\epsilon}} \mu = \sqrt{\frac{\mu}{\epsilon}} = \sqrt{\frac{\mu_0 \mu_r}{\epsilon_0 \epsilon_r}}$$

$$= \sqrt{\frac{\mu_0}{\epsilon_0}} \sqrt{\frac{\mu_r}{\epsilon_r}} = 120\pi \left(\frac{1}{2}\right) = \frac{60\pi}{1}$$

37. (d) Electric potential,  $V = \frac{kq}{r} = 9 \times 10^9 \times \frac{4 \times 10^{-7}}{9 \times 10^{-2}}$

$$= 4 \times 10^4 \text{ V}$$

38. (d) Given,  $y = c \sin \frac{2\pi}{\lambda} (at - x)$

$$\Rightarrow y = c \sin \left( \frac{2\pi}{\lambda} at - \frac{2\pi}{\lambda} x \right)$$

Comparing with  $y = A \sin(\omega t - kx)$ , we get

$$\omega = 2\pi f = \frac{2\pi a}{\lambda}$$

$$f = \frac{a}{\lambda}$$

Acceleration due gravity at height h,  $g' = \frac{gR^2}{(R+h)^2}$

39. (a)  $\therefore$  Weight,  $Mg' = Mg \frac{R^2}{(R+h)^2}$

$$\text{At A, } Mg' = Mg \frac{R^2}{(R+2R)^2} = \frac{Mg}{9}$$

$$\text{At B, } Mg' = Mg \frac{R}{\left(R + \frac{3R}{R}\right)^2} = \frac{Mg \cdot 4}{25}$$

$$\text{Change in weight} = Mg \frac{4}{25} - \frac{Mg}{9} = 49 \text{ N}$$

40. (c) Potential energy,  $V = \frac{Ax^2}{\sqrt{x+B}}$  From homogeneous

rule of dimensions,  $B = \sqrt{L}$

$$\therefore ML^2T^{-2} = \frac{AL^2}{L^{1/2}}$$

$$\Rightarrow A = ML^{1/2}T^{-2}$$

$$\therefore \frac{A^2}{B} = \frac{M^2LT^{-4}}{L^{1/2}} = M^2L^{1/2}T^{-4}$$

41. (d) Given,  $\vec{r} = (\hat{i} + 2\hat{j}) A \cos \omega t$

$$x \text{ component} = A \cos \omega t$$

$$y \text{ component} = 2A \cos \omega t$$

$$\therefore y = 2x$$

The path is straight line.

The motion is SHM and periodic because,

$$\frac{d\vec{r}}{dt} = -(\hat{i} + 2\hat{j})\omega A \sin \omega t$$

$$\Rightarrow a = \frac{d^2\vec{r}}{dt^2} = -(\hat{i} + 2\hat{j})\omega^2 A \cos \omega t$$

$$\vec{a} = -\omega^2 \vec{r}$$

42. (a)  $\ell_1 = \frac{\ell_0}{2}$

$$\ell_B = (\ell_1) \cos^2 60^\circ$$

$$= \frac{\ell_0}{2} \left(\frac{1}{2}\right)^2 = \frac{\ell_0}{8}$$

$$\ell_C = \ell_B \cos^2 45^\circ$$

$$= \frac{\ell_0}{8} \times \left(\frac{1}{\sqrt{2}}\right)^2 = \frac{\ell_0}{16}$$

43. (a) (A) Slow neutron can cause fission in  ${}_{92}^{235}\text{U}$  fast neutrons cannot cause fission because they are too quick so they scatter of atoms instead of being captured by them  
 (B)  $\alpha$ -rays are Helium nuclei.  
 (C)  $\beta$ -rays are generated when neutron is converted into proton by releasing electron or proton is converted into neutron by releasing positron.  
 (D) Due to smaller wavelength as compared to X-rays,  $\gamma$ -rays have higher energies as compared to X-rays.

44. (a)  $\omega_1 = \frac{2\pi}{60}$ ;

$$\therefore x_1 = \frac{2\pi}{60} \times 60 = 2\pi$$

$$\omega_2 = \frac{2\pi}{3600}$$

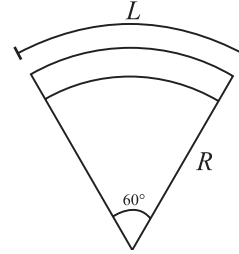
$$\therefore x_2 = \frac{2\pi}{3600} \times 60 = \frac{2\pi}{60}$$

$$\omega_3 = \frac{2\pi}{3600 \times 12}$$

$$\therefore x_3 = \frac{2\pi}{3600 \times 12} \times 60 = \frac{2\pi}{720}$$

$$\frac{\omega_1}{x_1} = \frac{\omega_2}{x_2} = \frac{\omega_3}{x_3} = \frac{1}{60} =$$

45. (a) Magnetic moment  $M = m \cdot L$



$$\text{From figure, } R\theta = L \Rightarrow \frac{R\pi}{3} = L$$

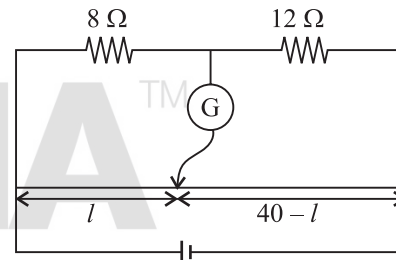
$$\Rightarrow R = \frac{3L}{\pi}$$

New magnetic moment  $M' = m (2R) \sin 30^\circ$

$$= m(2) \frac{3L}{\pi} \times \frac{1}{2} = \frac{3}{\pi} mL = \frac{3M}{\pi}$$

46. (d) From the balancing condition of meter bridge.

$$\frac{8}{\ell} = \frac{12}{40 - \ell}$$



$$\frac{2}{\ell} = \frac{3}{40 - \ell}$$

$$\Rightarrow 80 - 2\ell = 3\ell$$

$$\Rightarrow 16 = \ell$$

from B

$$= 40 - 16 = 24 \text{ cm}$$

47. (c) A polyatomic gas has 3 translational, 3 rotational and  $f$  number of vibration modes

$$\text{Total internal energy } U = \frac{3}{2} k_B T + \frac{3}{2} k_B T + f k_B T$$

$$\Rightarrow U = (3 + f) k_B T$$

$$C_V = (3 + f) R$$

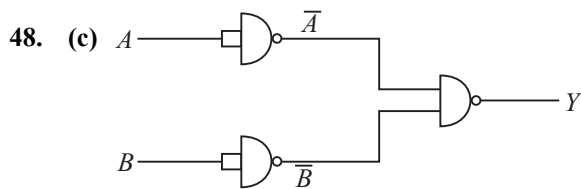
$$C_P = (4 + f) R$$

$$\therefore \frac{C_P}{C_V} = \frac{4 + f}{3 + f} = \gamma$$

$$\Rightarrow 4 + f = 3\gamma + f\gamma$$

$$\Rightarrow 4 - 3\gamma = f(\gamma - 1)$$

$$\Rightarrow f = \frac{4 - 3\gamma}{\gamma - 1}$$



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

49. (b) Using  $Q = Q_0 e^{-Rt/2L}$   
substituting necessary values,  
 $0.5Q_0 = Q_0 e^{-Rt/2L}$

$$\Rightarrow \frac{1}{2} = e^{-Rt/2L}$$

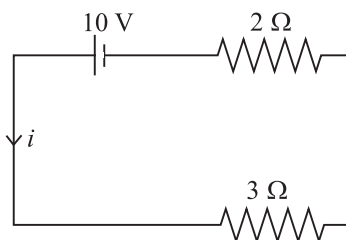
Taking log on both sides

$$\ln \left( \frac{1}{2} \right) = \ln e^{-Rt/2L}$$

$$\Rightarrow \ln 2 = \frac{Rt}{2L}$$

$$t = \frac{2L \ln 2}{R} = \frac{2 \times 12 \times 10^{-3} \times 0.693}{1.5} = 11.09 \text{ ms}$$

50. (c) In steady state current will not pass through capacitor,

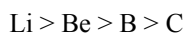


$$\text{Current is given by } i = \frac{V}{R} \Rightarrow i = \frac{10}{2+3} = 2 \text{ A}$$

## CHEMISTRY

51. (b) As the atomic number across the period increases, the effective nuclear charge also increases hence, atomic radii along the period decreases.

Correct order of atomic radii :



52. (c) Let the rate equation is

$$\text{Rate} = k[A]^x[B]^y$$

Therefore, we can write

$$2 \times 10^{-3} = k[0.1]^x[0.1]^y \quad \dots \text{(i)}$$

$$4 \times 10^{-3} = k[0.2]^x[0.1]^y \quad \dots \text{(ii)}$$

$$1.6 \times 10^{-2} = k[0.2]^x[0.2]^y \quad \dots \text{(iii)}$$

By equation (i) & (ii)

$$\frac{4 \times 10^{-3}}{2 \times 10^{-3}} = \frac{k[0.2]^x[0.1]^y}{k[0.1]^x[0.1]^y}$$

$$\Rightarrow \frac{2}{1} = \frac{(0.2)^x}{(0.1)^x} = \left( \frac{2}{1} \right)^x$$

$$\therefore x = 1$$

By equation (ii) & (iii)

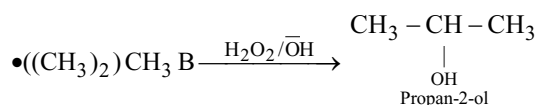
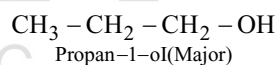
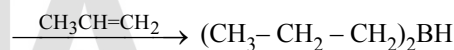
$$\frac{4 \times 10^{-3}}{1.6 \times 10^{-2}} = \frac{k[0.2]^x[0.1]^y}{k[0.2]^x[0.2]^y}$$

$$\Rightarrow \frac{1}{4} = \frac{(0.1)^y}{(0.2)^y} = \left( \frac{1}{2} \right)^y \Rightarrow y = 2$$

$$\therefore \text{Rate} = k[A]^1[B]^2$$

First order with respect to A while second order with respect to B.

53. (b)  $\text{CH}_3\text{CH}=\text{CH}_2 + (\text{H}-\text{BH}_2)_2 \rightarrow \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{BH}_2$

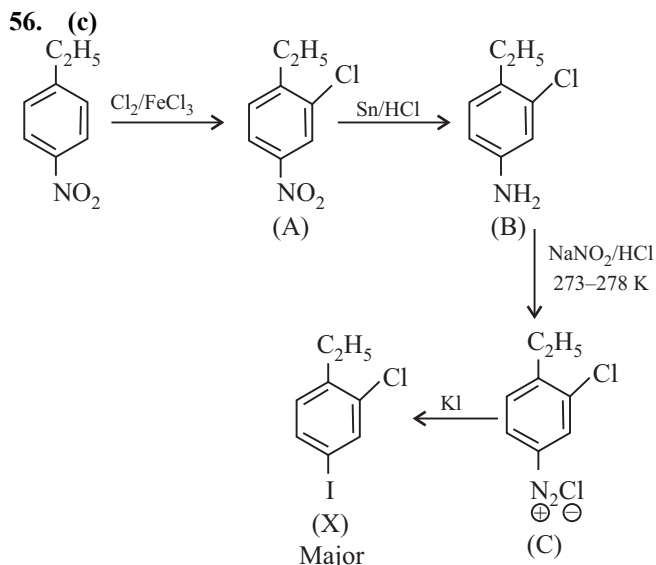


Statement I is incorrect but Statement II is correct.

54. (c) Baeyer's reagent is cold, dilute, aqueous solution of potassium permanganate.

55. (b) Dipole moment of a molecule depends both on shape and bond dipole.

Molecule	$\mu \text{ D}$
$\text{CCl}_4$	0
HI	0.38
$\text{CO}_2$	0
$\text{BF}_3$	0



57. (c) For weak acid and strong base titration, phenolphthalein is used as indicator. In acidic medium phenolphthalein is colourless while in alkaline medium it is pink in colour.

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

59. (b) The rusting of iron, tarnishing of silver, development of green coating on copper and bronze are the examples of corrosion. Production of  $\text{H}_2$  by electrolysis of water is an example of electrolytic cell.

60. (d) Magnetic moment  $\mu = \sqrt{n(n+2)}\text{BM}$   
where  $n$  is the Number of unpaired electrons

Ion	$n$	$\mu(\text{BM})$
$\text{Zn}^{2+}$	0	0
$\text{Ti}^{2+}$	2	$\sqrt{8}$
$\text{Cr}^{2+}$	4	$\sqrt{24}$
$\text{Fe}^{2+}$	4	$\sqrt{24}$
$\text{Ti}^{3+}$	1	$\sqrt{3}$
$\text{Cu}^{2+}$	1	$\sqrt{3}$
$\text{V}^{2+}$	3	$\sqrt{15}$
$\text{Cu}^+$	0	0

Hence ( $\text{Cr}^{2+}$ ,  $\text{Fe}^{2+}$ ) and ( $\text{Ti}^{3+}$ ,  $\text{Cu}^{2+}$ ) are the pair of same magnetic moment.

61. (d)  $3A_2 + B_2 \rightleftharpoons 2A_3B; K_1$

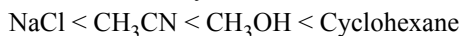
$$2A_3 \rightleftharpoons 3A_2 + B_2; K' = \frac{1}{K_1}$$

$$\frac{1}{2}A_3B \rightleftharpoons \frac{3}{2}A_2 + \frac{1}{2}B_2; K_2 = \sqrt{K'}$$

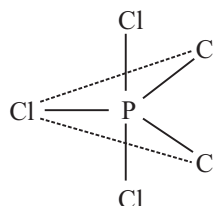
$$K_2 = \sqrt{K'} = \frac{1}{\sqrt{K_1}}$$

62. (a) Since  $\text{CHCl}_3$  is an organic solvent so covalent (non-polar) compounds will be more soluble in it. As the dipole moment of solute increases, solubility in chloroform decreases.

Order of solubility :



63. (b)



It is  $sp^3d$  hybridised with axial to equatorial angle of  $90^\circ$  and equatorial bond angles of  $120^\circ$ . It has five P - Cl sigma bonds. Axial bonds are longer than equatorial bonds.

64. (c) Since it is isothermal,  $\Delta T = 0$

$$\Delta U = nC_v\Delta T = 0$$

Since expansion is taking place against vacuum

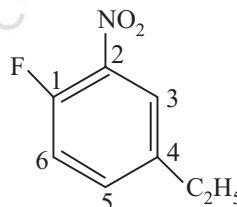
$$\therefore P_{\text{ext}} = 0$$

$$\Rightarrow W = -P_{\text{ext}}\Delta V = 0$$

From first law of thermodynamics,

$$\Delta U = q + W \Rightarrow 0 = q + 0 \Rightarrow q = 0$$

65. (a)

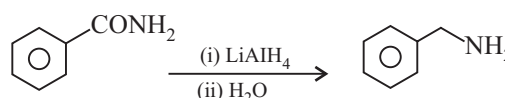


4-ethyl-1-fluoro-2-nitrobenzene

66. (a) Most stable oxidation state of lanthanoids is +3

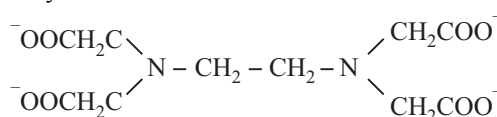
$\text{Ce}^{4+}$  and  $\text{Tb}^{4+}$  will get reduced easily therefore act as good oxidising agents.

67. (b)



68. (b) For lanthanoids, absorption bands are narrow because of excitation within f-level.

69. (a) Ethylene diaminetetraacetate



It is hexadentate as it can bind through two nitrogen and four oxygen atoms to a central metal ion.

70. (a) Molarity,  $M = \frac{w_2 \times 1000}{M_2 \times (V)}$

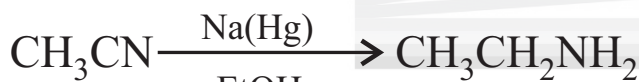
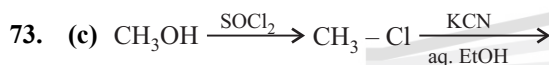
$$\frac{1}{20} = \frac{w_2 \times 1000}{180 \times 250} \Rightarrow w_2 = \frac{180 \times 250}{20 \times 1000} = 2.25 \text{ g}$$

Bond enthalpy of hydrides of group 17 decreases down the group.

71. (a)  $\therefore$  The acidic strength of HX follows the order  
 $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$

72. (d)  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}), \Delta H = -Q$   
 According to Le Chatelier's principle.

- Exothermic reactions are favoured at low temperature.
- Increase in pressure shifts the reaction in direction having lesser number of moles. Hence, the given reaction shifts forward on increasing pressure.
- Increasing the concentration of reactants shifts the reaction in forward direction. So high concentration of  $\text{H}_2$  shifts reaction in forward direction.



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

75. (a) Ambidentate ligands are those ligands which have two different donor atoms and either of two donor atom can be attached to the metal during complex formation.

$\begin{array}{c} \text{COO}^- \rightarrow \text{M} \\ | \\ \text{COO}^- \end{array}$  has only one donor site through 'O'. So, it is not an ambidentate ligand.

76. (b)

(i)  $n = 4, l = 2, m_l = -2, s = -\frac{1}{2};$

represents  $4d; (n + l = 6)$

(ii)  $n = 3, l = 2, m_l = 1, s = +\frac{1}{2};$

represents  $3d; (n + l = 5)$

(iii)  $n = 4, l = 1, m_l = 0, s = +\frac{1}{2};$

represents  $4p; (n + l = 5)$

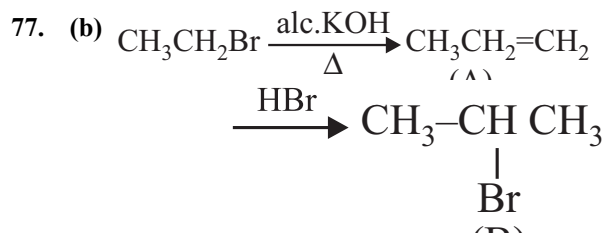
(iv)  $n = 3, l = 1, m_l = -1, s = +\frac{1}{2};$

represents  $3p; (n + l = 4)$

Order of energy depends on the  $(n + l)$ , greater is the  $(n + l)$  value greater is the energy, if  $(n + l)$  is same, then it depends on  $n$ ; if ' $n$ ' is more, energy is more.

$\therefore$  Correct order of energy :

(I) > (III) > (II) > (IV)



78. (a) For positive carbylamine test, there must be the presence of primary amine.

Aniline will not show Friedal Crafts alkylation(I) but gives positive carbylamine test.

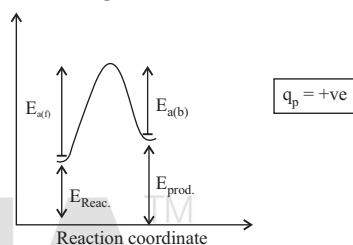
All others are not primary amines hence, do not give carbylamine test.

79. (a) For endothermic reactions,

$\Delta H_r = \text{positive}$  (Heat is absorbed)

$$\Delta H = E_{a(f)} - E_{a(b)}$$

Hence,  $q_p = +ve$



80. (a) Number of moles of  $\text{H}_2 = \frac{1}{2} = 0.5$

Number of molecules of  $\text{H}_2 = 0.5 N_A$

(a) Number of moles of  $\text{N}_2 = \frac{14}{28} = 0.5$

Number of molecules of  $\text{N}_2 = 0.5 N_A$

(b) Number of moles of  $\text{H}_2\text{O} = \frac{18}{18} = 1$

Number of molecules of  $\text{H}_2\text{O} = 1 \times N_A = N_A$

(c) Number of moles of  $\text{CO} = \frac{16}{28} = \frac{4}{7}$

Number of molecules of  $\text{CO} = \frac{4}{7} N_A$

(d) Number of moles of  $\text{N}_2 = \frac{28}{28} = 1$

Number of molecules of  $\text{N}_2 = 1 \times N_A = N_A$

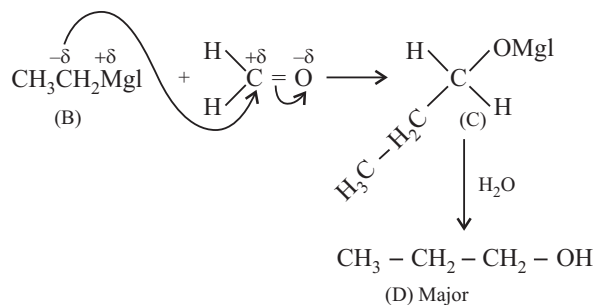
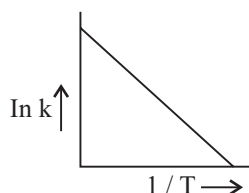
81. (c) Using Arrhenius equation,

$$k = A e^{-E_a/RT}$$

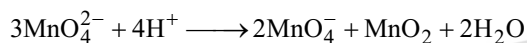
$$\ln k = \ln A - \frac{E_a}{RT}$$

$$y = mx + c, \text{ slope } (m) = -\frac{E_a}{R}$$

Intercept =  $\ln A$



82. (d) If one of the substances in the mixture is water and the other, a water insoluble substance, then the mixture will boil close to but below  $100^\circ\text{C}$ .
83. (b) Glycogen is similar to amylopectin in its structure. Glycogen is also found in yeast and fungi. So statement I is false but statement II is true.
84. (d) In the following reaction



Oxidation state of Mn	Species
+6	$\text{MnO}_4^{2-}$
+7	$\text{MnO}_4^-$
+4	$\text{MnO}_2$

So +2 and +3 oxidation state is not shown by Mn.

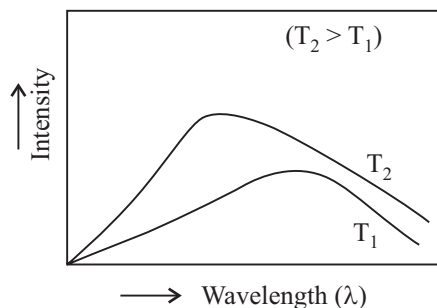
85. (c) For Balmer series  $n_1 = 2$

$$n_2 = 3$$

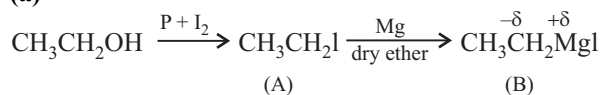
$$\bar{\nu} = \frac{1}{\lambda} R_H \left[ \frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$$

$$\bar{\nu} = R_H \left[ \frac{1}{4} - \frac{1}{9} \right]$$

$$\bar{\nu} = \frac{5R_H}{36} \text{ cm}^{-1}$$



86. (a)



87. (b) The N-N single bond is weaker than the single P-P bond because of high inter-electronic repulsion of the non-bonding electrons.

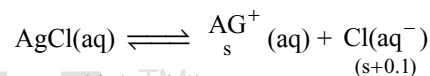
88. (d) A - III, B - IV, C - II, D - I

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

90. (a)  $\Delta_r G^\circ = -nF E^\circ_{\text{cell}}$   
For the given reaction,  $n = 2$   
 $\therefore \Delta_r G^\circ = -2 \times 96487 \times 0.32$   
 $= -61751.68 \text{ J mol}^{-1} = -61.751 \text{ kJ mol}^{-1}$

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

92. (a) Solubility of AgCl (in 0.1 M KCl)



$$K_{\text{sp}} = (s)(s + 0.1)$$

$$s \ll 0.1$$

$$\therefore (s + 0.1) \approx 0.1 \text{ M}$$

$$\therefore 10^{-10} = s \times 0.1$$

$$\therefore \frac{10^{-10}}{0.1} = 10^{-9} \text{ M}$$

Solubility of AgCl (in water)



$$K_{\text{sp}} = s^2$$

$$\therefore 10^{-10} = s^2$$

$$\therefore s = \sqrt{10^{-10}} = 10^{-5} \text{ M}$$

$$\text{Ratio} = \frac{10^{-9} \text{ M}}{10^{-5} \text{ M}} = 10^{-4}$$

93. (b) Percentage of carbon =  $\frac{12 \times m_2 \times 100}{44 \times m}$

$$m = \text{mass of organic compound} = 0.3 \text{ g}$$

$$m_2 = \text{mass of carbon dioxide} = 0.2 \text{ g}$$

$$\therefore \%C = \frac{12 \times 0.2 \times 100}{44 \times 0.3} = 18.18\%$$

$$\text{Percentage of hydrogen} = \frac{2 \times m_1 \times 100}{18 \times m}$$

$$m_1 = \text{mass of water} = 0.1 \text{ g}$$

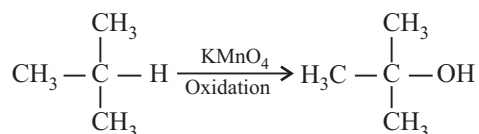
$$\therefore \%H = \frac{2 \times 0.1 \times 100}{18 \times 0.3} = 3.70\%$$

94. (a) Aryl chlorides and bromides can easily be prepared by electrophilic substitution of arenes (toluene) with  $\text{Cl}_2$  and  $\text{Br}_2$  respectively in the presence of Lewis acid catalyst (Fe in dark).

Reaction with  $\text{I}_2$  is reversible and requires the presence of oxidising agent.

Corresponding fluoroarene cannot be prepared by this method due to high reactivity of fluorine. Hence, 'X' is F.

95. (b) Generally alkanes resist oxidation but alkane with tertiary H atom(s) can be oxidised to corresponding alcohols by  $\text{KMnO}_4$ .



96. (a)  $\text{A}_2(\text{g}) + 3\text{B}_2(\text{g}) \rightarrow 2\text{AB}_3(\text{g})$

$$\Delta n_{(\text{g})} = n_{(\text{P})} - n_{(\text{R})} = 2 - 3 - 1 = -2$$

$$\Delta H = \Delta U + \Delta n_{\text{g}} RT$$

$$15 \times 1000 = \Delta U - 2 \times 8.314 \times 300$$

$$\Delta U = 15000 + 600 \times 8.314$$

$$= 15000 + 6 \times 831.4$$

$$= 15000 + 4988.4$$

$$\Delta U = 19988.4 \text{ J}$$

97. (c)  $K = A e^{-E_a/RT}$

taking  $\ln$  on both sides,

$$\ln K = \ln A - \frac{E_a}{RT}$$

$$\ln K_1 = \ln A - \frac{E_a}{RT_1} \quad \dots \text{(i)}$$

$$\ln K_2 = \ln A - \frac{E_a}{RT_2} \quad \dots \text{(ii)}$$

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

$$\ln \frac{K_2}{K_1} = \frac{E_a}{R} \left[ \frac{1}{500} - \frac{1}{700} \right]$$

$$\ln \frac{0.14}{0.04} = \frac{E_a}{R} \left[ \frac{700 - 500}{500 \times 700} \right]$$

$$\ln \frac{14}{4} = \frac{E_a}{R} \left[ \frac{200}{500 \times 700} \right]$$

$$\log 3.5 = \frac{E_a}{2.303 \times R} \left[ \frac{1}{250 \times 7} \right]$$

$$0.5441 = \frac{E_a}{2.303 \times 8.31} \left[ \frac{1}{250 \times 7} \right]$$

$$E_a = 0.5441 \times 8.31 \times 250 \times 7 \times 2.303$$

$$= 0.5441 \times 83.1 \times 25 \times 7 \times 2.303$$

$$= 18222.65 \text{ J}$$

98. (d) For isotonic solutions [osmotic pressure must be equal]

$$\therefore \pi_1 = \pi_2$$

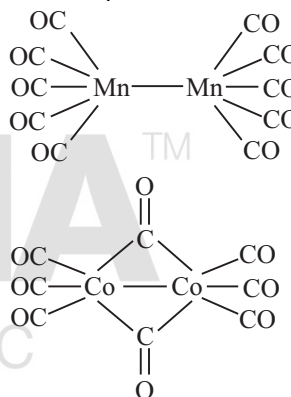
$$\Rightarrow C_1 RT = C_2 RT$$

$$\Rightarrow C_1 = C_2$$

$$\Rightarrow \frac{m}{180 \times 1} = \frac{15}{60 \times 1} \quad \text{where (m is the mass of glucose)}$$

$$\Rightarrow m = \frac{180}{4} = 45 \text{ g}$$

99. (d)



$\therefore$  Statement (A), (B) and (D) are correct.

100. (c)  $\text{CH}_3 - \overset{\oplus}{\text{C}}(\text{CH}_3) - \text{CH}_3 \leftrightarrow \text{CH}_3 - \overset{\text{H}^\oplus}{\text{C}} = \text{CH}_2$

Methyl group attached to a positively charged carbon atom stabilizes the carbocation due to hyperconjugation and +I effect.

## BOTANY

101. (c) Biodiversity hotspots are the regions with high level of species richness, high degree of endemism and a loss of most of the species and habitat are identified.

102. (a) Sclereids are commonly found in the hard parts of the plant such as fruit walls of nuts, or they occur in soft parts, i.e., pulp of the fruits, like pear.

103. (d) Origin of replication (*ori*) is a sequence from where replication starts and any piece of DNA when linked to this sequence can be made to replicate, within the host cells.

104. (b) Polygenic inheritance refers to the inheritance of a trait governed by more than one gene.

In a polygenic trait the multiple independent genes have an additive or similar effects on a single quantitative trait.

105. (b) Water, light and chlorophyll are required, for the process of light reaction.

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

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

108. (a) Nucellus is a mass of cell enclosed within the integument and it has abundant food reserves.

109. (d) Gymnosperm lack vessels in their xylem, as they have albuminous cells in place of companion cells. They lack sieve tube but have sieve cells.
110. (b) Botanical garden is an ex-situ conservation strategy of biodiversity. While, wild-life Sanctuary, Biosphere Reserve and National Parks all come under in-situ conservation.
111. (a) Indian Government has set up organisations such as GEAC (Genetic Engineering Approval Committee), which will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services and Biopiracy is used to refer to the use of bioresources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment.
112. (c) Pollen grains remain preserved as fossils due to the presence of sporopollenin, which is present in the outer layer of pollen, called exine.
113. (a) Equisetum belongs to Sphenopsida.  
Adiantum belongs to Pteropsida
114. (a) *Cedrus*, *Pinus* and *Sequoia* belongs to gymnosperms.
115. (a) The RNA polymerase is only capable of catalysing the process of elongation and it associates transiently with initiation-factor ( $\sigma$ ) and termination-factor ( $\rho$ ) to start and terminate the transcription.
116. (b) Uridine is a nucleoside, adenylic acid is a nucleotide, guanine is a nitrogenous base and guanosine is a nucleoside
117. (a) A-III, B-I, C-IV, D-II
118. (c) A-III, B-IV, C-I, D-II
119. (d) The pressure gradient in the sieve tubes is maintained by the companion cells.
120. (c) Mesosomes in a cell is a special structure formed by the extensions of plasma membrane into the cell.
121. (c) A-II, B-I, C-IV, D-III
122. (d) A-II, B-IV, C-I, D-III
123. (b) A-I, B-IV, C-II, D-III
124. (c) Cryopreservation technique is a type of ex-situ conservation which is used for preserving viable and fertile conditions for long period.
125. (a) Only statements A, C, D and E are correct as the entire cellular respiration do not take place in mitochondria.
126. (c) In eukaryotes, there are three RNA polymerases in the nucleus in addition to the RNA polymerase found in the organelles. RNA polymerase I transcribing rRNAs (28S, 18S, and 5.8S), whereas the RNA polymerase III is responsible for transcription of tRNA, 5 SrRNA and SnRNAs. The RNA polymerase II is responsible transcribing precursor of mRNA.
127. (d) A-III, B-IV, C-I, D-II
128. (d) Failure of segregation of chromatids during cell cycle results in the gain or loss of a chromosome(s), which refers to aneuploidy.  
Failure of cytokinesis after telophase of cell division causes increase in a whole set of chromosomes in an organism which is referred as polyploidy.
129. (d) Recombination between homologous chromosomes is completed by the end of pachytene.
130. (d) A-II, B-III, C-IV, D-I
131. (a) Ligases are the enzymes that catalyse the linking together of 2 compounds, e.g., enzymes which catalyse joining of C – O, C – S, C – N, P – O etc. bonds.
132. (c) F. Skoog observed that from the internodal segments of tobacco stems the callus proliferated only if in addition to auxins the nutrient medium was supplied with the extracts of vascular tissues, yeast extract, coconut milk or DNA.
133. (a) All GAs are acidic in nature. Zeatin was isolated from coconut milk. Ethylene induces flowering in Mango. Abscisic acid is antagonistic to Gibberellic acid. Auxins induce parthenocarpy in certain fruits, such as, tomatoes.
134. (a) In gel electrophoresis, Separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation. Pure DNA fragments cannot be seen in visible light without staining.
135. (d) Monocarpellary, unilocular ovary with many ovules is the characteristic feature of the members of the family Fabaceae. *Sesbania* and *Indigofera* show such characteristic features as they belong to fabaceae.
136. (a) In the lac operon the z- gene codes for  $\beta$ -galactosidase which is primarily responsible for the hydrolysis of lactose into galactose and glucose.  
Lactose or allolactose act as inducers of lac operon.
137. (b) In given figure 'x' represents the thalamus of a false fruit, strawberry.
138. (b) In a dicotyledonous leaf, adaxial epidermis generally bears very less stomata and may even lack stomata in comparison to abaxial surface.  
The adaxially placed palisade parenchyma is made up of elongated cells, arranged vertically and parallel to each other.
139. (c) Glutamic acid and aspartic acid are amino acids while lecithin is a phospholipid. Palmitic acid and arachidonic acid are fatty acids.
140. (d) Based on the given pyramid of energy, if  $T_4$  is equivalent to 1000 J, then according to the 10 percent law, which states that only 10 percent of energy is transferred to each trophic level from the lower trophic level, the value at  $T_1$  is 10,00,000 J.  

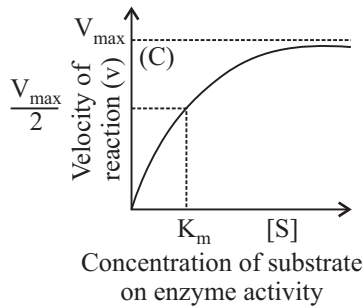
$$T_1 = 10,00,000 \text{ J}$$

$$T_2 = \frac{10}{100} \times 10,00,000 = 1,00,000 \text{ J}$$

$$T_3 = \frac{10}{100} \times 100,000 = 10,000 \text{ J}$$

$$T_4 = \frac{10}{100} \times 10,000 = 1000 \text{ J}$$
141. (c) Product of light reaction are ATP, NADPH and  $O_2$ . Of these  $O_2$  diffuses out of the chloroplast while ATP and NADPH are used to drive the processes leading to synthesis of food/sugars.
142. (a) Hind II, Hind III
143. (c) The limitation of ecological pyramid is that it does not accommodate a food web.
144. (a) The activated toxin binds to the surface of midgut epithelial cells and creates pore that cause cell swelling and lysis and eventually cause death of the insect.
145. (c) A-IV, B-III, C-II, D-I
146. (a) With increase in substrate concentration, the velocity

of enzymatic reaction rises at first. The reaction finally reaches maximum velocity ( $V_{max}$ ) which is not exceeded by any further rise in concentration of the substrate. This is because the enzyme molecules are lesser than substrate molecules and after saturation of these molecules, there are no free enzyme molecules to bind the additional substrate molecules



147. (d) ( $N$ ) is the population density at time  $t$ , then its density at time  $t + 1$  is

$$N_{t+1} = Nt + [(B + I) - (D + E)]$$

Population density will increase if the number of births plus the number of immigrants ( $B + I$ ) is more than the number of deaths plus the number of emigrants ( $D + E$ ).

148. (d) As per the type of given progeny the genotype of the parent will be  $TTRr$ .

$$\text{Selfing} = TTRr \times TTRr$$

F <sub>1</sub> generation	$\frac{\sigma}{\phi}$	TR	Tr
		TTRR	TTRr
		TTRr	Ttrr

149. (a) A-IV, B-I, C-II, D-III  
 150. (c) The labelling depicts:  
 (A) Carboxylation,  
 (B) Reduction,  
 (C) Regeneration

## ZOOLOGY

151. (d) A-II, B-III, C-IV, D-I  
 152. (a) A-II, B-III, C-IV, D-I  
 153. (d) The correct sequence of action of toxin in Bt. cotton is  
 B. *Bacillus thuringiensis* produces crystals with toxic insecticidal proteins.  
 E. The toxin proteins exist as inactive protoxins in bacteria.  
 C. The alkaline pH solubilises the crystals.  
 A. The inactive toxin converted into active form due to alkaline pH of gut of insect.  
 D. The activated toxin binds to the surface of midgut cells, creates pores and causes death of the insect.
154. (b) A-IV, B-II, C-III, D-I  
 155. (d) The evolutionary phenomenon depicted in the sketch is adaptive radiation.  
 156. (d) Recipient is A blood group with Rh(-ve) antigen, hence cannot receive blood from any blood group with Rh(+ve) antigen and as A blood group individuals have anti-B antibodies in plasma. So, donor could be O (Rh -ve) and A (Rh -ve) only.  
 157. (d) Lyases are group of enzymes that catalyse the removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.  
 158. (a) A-III, B-I, C-IV, D-II  
 159. (a) A-III, B-IV, C-II, D-I  
 160. (c) A-IV, B-III, C-II, D-I  
 161. (b) Tight junctions help to stop substances from leaking across a tissue.  
 162. (a) The restriction sites for restriction endonucleases Bam HI and Sal I are present within the tet<sup>R</sup> gene in the pBR322 cloning vector.  
 163. (c) A-II, B-III, C-I, D-IV  
 164. (c) In a 28 days menstrual cycle of a human female, rapid secretion of LH leading to its maximum level during the mid-cycle (14th day) called LH surge induces the rupture of Graafian follicle and thereby leading to ovulation.
165. (a) A-III, B-IV, C-II, D-I  
 166. (d) A-II, B-IV, C-I, D-III  
 167. (b) A-IV, B-I, C-II, D-III  
 168. (a) A-II, B-III, C-IV, D-I  
 169. (b) A-IV, B-I, C-II, D-III  
 170. (d) A-II, B-IV, C-I, D-III  
 171. (c) Antibiotics are chemicals produced by microorganisms. that have the capacity to inhibit the growth and eventually destroy bacterial and other microorganisms in low concentration.  
 They are immunoglobulins produced in the body in response to any attack from pathogens and facilitate killing of microbes by various mechanisms and provide immunity to the body.
172. (c) The correct route of milk ejection via mammary glands in human is:  
 Mammary alveolus → Mammary tubule → Mammary duct → Mammary ampulla → Lactiferous duct
173. (d) *EcoRI* cuts the DNA with sticky / cohesive / staggered ends on each strand.  
*EcoRI* is a restriction endonuclease that recognises a specific palindromic sequence and cuts at a specific site within the DNA, known as the restriction site. It is not an exonuclease as exonucleases remove nucleotides from the free ends of the DNA.  
 The recognition sequence for *EcoRI* is  
 $5' - G \downarrow - A - A - T - T - C - 3'$   
 $3' - C - T - T - A - A \uparrow - G - 5'$   
 and it cuts the DNA between bases G and A only when the sequence GAATTC is present in the DNA.
174. (d) Collateral gland is present in female cockroaches It is a pair of gland that secrete the hard egg case or ootheca Spermatheca is present in female cockroaches in the 6<sup>th</sup> abdominal segment.

175. (a) A-III, B-IV, C-II, D-I
176. (c) *Anopheles* (Arthropods), *Limax* (Mollusc) and *Limulus* (Arthropods) have an open circulatory system.
177. (b) Blood does not contain fibre secreting cells called as fibroblasts.  
Whereas, cartilage, bone, adipose tissue and areolar tissue contain cells that secrete fibres of collagen or elastin or structural protein.
178. (d) Platyhelminthes are triploblastic organisms; not diploblastic.
179. (c) A-III, B-I, C-IV, D-II
180. (a) A-IV, B-III, C-II, D-I
181. (a) A-III, B-I, C-IV, D-II
182. (d) Diuresis is prevented by vasopressin or anti-diuretic hormone from neurohypophysis or posterior pituitary. When there is excessive loss of fluid from the body the secretion of, ADH facilitates water reabsorption from latter part of renal tubules.
183. (b) Except for hepatitis - B, genital herpes and HIV infections, other sexually transmitted diseases are completely curable, if detected early and treated properly. Genital warts, syphilis and trichomoniasis are completely curable STDs upon proper detection and treatment.
184. (b) The correct order (from old to recent) of periods in Paleozoic era is Silurian, Devonian, Carboniferous, Permian
185. (d) LUB is the first heart sound and it is produced by closure of AV valves; (tricuspid valve in between right atrium and right ventricle) and (bicuspid/mitral valve in between left atrium and left ventricle), during ventricular systole.
186. (a) A-II, B-III, C-IV, D-I
187. (d) Failure of segregation of chromatids during cell division-cycle results in the gain or loss of chromosome called aneuploidy.  
Aneuploidy occurs due to addition or deletion.
188. (a) RNA interference takes place in all eukaryotic organisms as method of cellular defense RNAi involves the silencing of a specific mRNA due to a complementary dsRNA molecule that is involved in silencing of a specific mRNA.
189. (c)
- Atrial natriuretic factor, a peptide hormone is secreted from the atria of the heart.
  - Gastrin acts on the gastric glands and stimulates the secretion of hydrochloric acid and pepsinogen.
190. (a) The of steps involved in the process of PCR are :
- (C) Denaturation
  - (A) Annealing
  - (D) Treatment with Taq polymerase and deoxynucleotides
  - (E) Extension
  - (B) Amplification (~1 billion times).
191. (c) Mammals have the ability to produce a concentrated urine. The Henle's loop and vasa recta play a significant role in this. The flow of filtrate in the two limbs of Henle's loop as well as flow of blood through the two limbs of vasa recta are in a counter current pattern. The proximity between the Henle's loop and vasa recta, as well as the counter current in them help in maintaining the increasing osmolarity towards the inner medullary interstitium. So, counter current mechanism of loop of Henle of juxtamedullary nephron participates in concentration of urine.
192. (d) The Golgi cisternae are concentrically arranged near the nucleus with distinct convex cis or the forming face and concave trans or the maturing face.  
A number of proteins synthesised by ribosomes on the endoplasmic reticulum are modified in the cisternae of the Golgi apparatus before they are released from its trans face.
193. (a) A-III, B-IV, C-I, D-II
194. (a) Phylum Chordata is divided into three subphyla: Urochordata, Cephalochordata and Vertebrata. The members of subphylum Vertebrata possess notochord during the embryonic period. The notochord is replaced by a cartilaginous or bony vertebral column in the adult. Thus, all vertebrates are chordates but all chordates are not vertebrates.
195. (d) The child blood group is (A<sup>+</sup>) that means he must have received (i) allele from the father i.e. the father genotype is (I<sup>B</sup>i).  
While mother can have I<sup>A</sup>I<sup>A</sup> or I<sup>A</sup>i genotype.  
So, the possible genotypes of all three i.e. mother, father and child respectively would be either
- (B) I<sup>A</sup>I<sup>A</sup> | I<sup>B</sup>i | I<sup>A</sup>i
  - (E) I<sup>A</sup>i | I<sup>B</sup>i | I<sup>A</sup>i
196. (a) The given graph represents the population growth curve where 'a' depicts exponential growth when responses are not limiting the growth which forms a J-shaped curve and 'b' represents logistic growth when responses are limiting the growth which forms an S-shaped curve.
197. (a) Muscle contraction is initiated by a signal sent by the CNS via a motor neuron. A neural signal reaching the neuromuscular junction releases a neurotransmitter (acetylcholine) which generates an action potential in the sarcolemma. This spreads through the muscle fibre and causes the release of Ca<sup>2+</sup> into the sarcoplasm. Increase in Ca<sup>2+</sup> level leads to the binding of calcium with a subunit of troponin on actin filaments and thereby remove the masking of active sites for myosin. Using the energy from ATP hydrolysis, the myosin head now binds to the exposed active sites on actin to form a cross bridge.
198. (d) A-III, B-IV, C-I, D-II
199. (c) A-III, B-IV, C-II, D-I
200. (c) Nearly 20-25 percent of CO<sub>2</sub> is transported by RBCs whereas 70 percent of it is carried as bicarbonate. About 7 percent of CO<sub>2</sub> is carried in a dissolved state through plasma.  
**The binding** of CO<sub>2</sub> with haemoglobin is related to the partial pressure of CO<sub>2</sub>. pO<sub>2</sub> is a main factor which could affect this binding. When pCO<sub>2</sub> is high and pO<sub>2</sub> is low as in the tissues, more binding of CO<sub>2</sub> occurs. Percentage of a gas transported depends upon its partial pressure.