

## All India Aakash Test Series for NEET - 2026

**TEST - 5 (Code-C)**[Click here for Code-D Sol.](#)

Test Date : 23/02/2025

**ANSWERS**

1. (2)	37. (2)	73. (2)	109. (4)	145. (4)
2. (3)	38. (2)	74. (2)	110. (1)	146. (4)
3. (2)	39. (3)	75. (1)	111. (3)	147. (3)
4. (3)	40. (2)	76. (1)	112. (2)	148. (4)
5. (4)	41. (3)	77. (3)	113. (4)	149. (3)
6. (2)	42. (4)	78. (2)	114. (3)	150. (4)
7. (1)	43. (1)	79. (4)	115. (3)	151. (2)
8. (4)	44. (4)	80. (4)	116. (1)	152. (3)
9. (2)	45. (1)	81. (4)	117. (3)	153. (2)
10. (2)	46. (3)	82. (3)	118. (3)	154. (4)
11. (2)	47. (2)	83. (2)	119. (3)	155. (1)
12. (3)	48. (2)	84. (1)	120. (2)	156. (2)
13. (4)	49. (4)	85. (4)	121. (2)	157. (1)
14. (2)	50. (1)	86. (1)	122. (4)	158. (3)
15. (4)	51. (4)	87. (2)	123. (3)	159. (3)
16. (3)	52. (1)	88. (3)	124. (2)	160. (4)
17. (1)	53. (3)	89. (3)	125. (3)	161. (4)
18. (1)	54. (3)	90. (2)	126. (4)	162. (3)
19. (4)	55. (2)	91. (4)	127. (4)	163. (2)
20. (3)	56. (3)	92. (4)	128. (4)	164. (2)
21. (2)	57. (1)	93. (1)	129. (3)	165. (3)
22. (2)	58. (1)	94. (4)	130. (3)	166. (4)
23. (3)	59. (4)	95. (1)	131. (4)	167. (3)
24. (1)	60. (1)	96. (3)	132. (2)	168. (4)
25. (2)	61. (3)	97. (4)	133. (2)	169. (2)
26. (4)	62. (3)	98. (1)	134. (3)	170. (1)
27. (3)	63. (2)	99. (3)	135. (4)	171. (3)
28. (1)	64. (1)	100. (2)	136. (3)	172. (4)
29. (3)	65. (3)	101. (1)	137. (3)	173. (4)
30. (2)	66. (3)	102. (3)	138. (4)	174. (4)
31. (4)	67. (1)	103. (3)	139. (2)	175. (3)
32. (3)	68. (4)	104. (3)	140. (4)	176. (3)
33. (1)	69. (3)	105. (2)	141. (1)	177. (3)
34. (1)	70. (2)	106. (4)	142. (2)	178. (4)
35. (1)	71. (1)	107. (3)	143. (3)	179. (2)
36. (1)	72. (3)	108. (2)	144. (3)	180. (3)

**HINTS & SOLUTIONS****[PHYSICS]**

1. Answer (2)

**Hint:** Excess pressure inside water drop =  $\frac{2T}{R}$

$$\text{Sol.: } \frac{P_1}{P_2} = \frac{R_2}{R_1} \Rightarrow 2 = \frac{R_2}{R_1}$$

$$R_2 = 2R_1$$

$$\frac{M_1}{M_2} = \left(\frac{R_1}{R_2}\right)^3 = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$$

2. Answer (3)

**Hint:** Stress =  $Y \times$  Strain

$$\text{Sol.: } \text{Stress} = 7 \times 10^{10} \times \frac{0.14}{100} = 0.98 \times 10^8 \\ = 9.8 \times 10^7 \text{ N/m}^2$$

3. Answer (2)

**Hint:** Shear Modulus =  $\frac{\text{Tangential stress}}{\text{Shear strain}}$

$$\text{Sol.: } \text{Shear Modulus} = \frac{F}{\frac{A}{\infty}} = 0$$

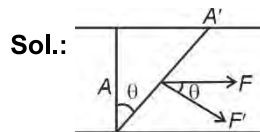
4. Answer (3)

**Hint:** Slope of stress-strain graph gives Young's modulus.

$$\text{Sol.: } \frac{Y_A}{Y_B} = \frac{\tan 30^\circ}{\tan 60^\circ} = \frac{1}{\sqrt{3} \sqrt{3}} = \frac{1}{3}$$

5. Answer (4)

**Hint:** Longitudinal stress =  $\frac{\text{Normal Force}}{\text{Area}}$



$$A' \cos \theta = A$$

$$A' = \frac{A}{\cos \theta} \text{ and } F' = F \cos \theta$$

Longitudinal stress =

$$\frac{F'}{A'} = \frac{F \cos^2 \theta}{A} = \left(\frac{F}{A}\right) (\cos 30^\circ)^2 = \frac{3F}{4A}$$

6. Answer (2)

**Hint & Sol.:** When a body floats, its weight is balanced by net upward thrust provided by displaced volume of liquid.

7. Answer (1)

**Hint & Sol.:** As air continuously moves out of the balloon, it gradually deflates, causing the number of air molecules inside the balloon to decrease. Consequently, the pressure inside the balloon also decreases. Although the internal pressure remains higher than the external atmospheric pressure, it progressively reduces as more air escapes from the balloon.

8. Answer (4)

**Hint:** Viscous force =  $\eta A \frac{dv}{dx}$

$$\text{Sol.: } [\text{MLT}^{-2}] = [\eta] \left[ L^2 \cdot \frac{\text{LT}^{-1}}{L} \right]$$

$$[\text{MLT}^{-2}] = [\eta] [L^2 \cdot \text{T}^{-1}]$$

$$[\text{ML}^{-1}\text{T}^{-1}] = [\eta]$$

9. Answer (2)

**Hint:** The pressure is greater in concave side.

$$\text{Sol.: } P_A - P_0 = \frac{2S}{r} \Rightarrow P_A = P_0 + \frac{2S}{r}$$

10. Answer (2)

**Hint:** Surface energy =

Surface tension  $\times$  Change in area

$$\text{Sol.: } \frac{4}{3} \pi R^3 = 8 \times \frac{4}{3} \pi r^3$$

$$\frac{R}{2} = r$$

$$\Delta U = S \Delta A$$

$$= 0.5 [8 \times 4\pi r^2 - 4\pi R^2]$$

$$= 0.5 \times 4\pi \left[ 8 \frac{R^2}{4} - R^2 \right]$$

$$= \frac{1}{2} \times 4\pi R^2 = 2\pi R^2 = 2 \times \frac{22}{7} \times 7 \times 7 \times 10^{-6}$$

$$\Delta U = 14 \times 22 \times 10^{-6} \text{ J}$$

$$= 308 \times 10^{-6} \text{ J} = 3.08 \times 10^{-4} \text{ J} = 0.31 \text{ mJ}$$

11. Answer (2)

**Hint:** The difference of pressure for a horizontal accelerated tube is

$$P_2 - P_1 = \rho aL$$

where  $a$  is the horizontal acceleration

**Sol.:**  $P_2 - P_1 = \rho gh = \rho aL$

$$gh = \frac{g}{2}L \Rightarrow h = \frac{L}{2}$$

12. Answer (3)

**Hint:** Weight of block is balanced by net upward thrust due to the liquids.

**Sol.:**  $\rho L^3 g = \rho_1 \frac{L}{3} L^2 g + \rho_2 \left(\frac{2L}{3}\right) L^2 g$

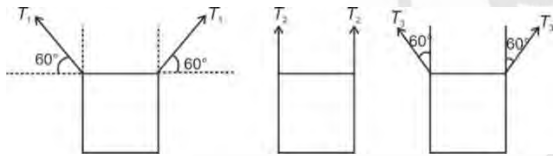
$$\rho = \frac{\rho_1}{3} + \frac{2\rho_2}{3}$$

$$\rho = \frac{\rho_1 + 2\rho_2}{3}$$

13. Answer (4)

**Hint:** Tension in wires balances the weight of frame.

**Sol.:**



$$2T \sin \theta = mg$$

$$T_1 = \frac{mg}{\sqrt{3}}, T_2 = \frac{mg}{2} \text{ and } T_3 = mg$$

Hence tension is maximum in figure (iii)

$$\text{Stress} = \frac{\text{Force}}{\text{Area}}$$

Extension  $\propto$  Force

14. Answer (2)

**Hint:** Young's modulus of steel is more than of copper wire.

**Sol.:**  $\Delta l_s = \frac{Fl}{AY_s}, \Delta l_c = \frac{Fl}{AY_c}$

$$\Delta l_s < \Delta l_c$$

15. Answer (4)

**Hint:**  $T(K) = T(^{\circ}C) + 273$

**Sol.:**  $\frac{T - 273}{100} = \frac{T - 32}{180}$

$$T - 273 = \frac{5}{9}T - \frac{5}{9} \times 32$$

$$9T - 9 \times 273 = 5T - 5 \times 32$$

$$T = 574.25 \text{ K} = 574.25^{\circ}F$$

16. Answer (3)

**Hint & Sol.:** When heated uniformly, all dimensions increases as in photographic enlargement.

17. Answer (1)

**Hint:** The heat will be lost by hot water to cold water.

**Sol.:**  $1(100^{\circ}C - T) = 2(T - 60^{\circ}C)$

$$100^{\circ}C - T = 2T - 120^{\circ}C$$

$$3T = 220^{\circ}C$$

$$T = \frac{220}{3}^{\circ}C = 73.3^{\circ}C$$

18. Answer (1)

**Hint:** Treat the rod as if it is fixed at one end and pulled at the other end.

**Sol.:**  $\Delta y = \frac{(F_1 + F_2)L}{2AY} = \frac{2FL}{2AY} = \frac{FL}{AY}$

19. Answer (4)

**Hint:**  $I_0 = \frac{2}{5}MR^2$

**Sol.:**  $\frac{\Delta I_0}{I_0} = \frac{2\Delta R}{R}$

$$\frac{\Delta V}{V} = \frac{3\Delta R}{R} = \gamma \Delta T$$

$$\frac{\Delta R}{R} = \frac{\gamma}{3} \Delta T$$

$$\frac{\Delta I_0}{I_0} = 2 \left( \frac{\gamma}{3} \right) \Delta T$$

$$\Delta I_0 = \frac{2}{3} \gamma I_0 \Delta T$$

20. Answer (3)

**Hint:** Thermal capacities

**Sol.:**  $\frac{S_1}{S_2} = \frac{m_1}{m_2} = \left(\frac{L_1}{L_2}\right)^3 = \left(\frac{2}{3}\right)^3$

$$\frac{S_1}{S_2} = \frac{8}{27}$$

21. Answer (2)

**Hint:**  $\Delta Q = mL$ , where  $L$  is latent heat of fusion

**Sol.:**  $m_w s_w \Delta T = m_{ice} \times 80$

$$\frac{4000}{80} = m_{ice}$$

$$50 \text{ g} = m_{ice}$$

22. Answer (2)

**Hint:** Heat flow rate  $H = \frac{kA(T_2 - T_1)}{L}$

**Sol.:**  $\frac{kA}{L}(T_2 - T_1) = \frac{kA}{l}(T_2 - T)$

$$\frac{l}{L}(T_2 - T_1) = T_2 - T$$

$$T = T_2 - \frac{l}{L}(T_2 - T_1)$$

Straight line  $T-l$  graph with negative slope

23. Answer (3)

**Hint:** The temperature of water remains constant

**Sol.:**  $\Delta Q = ms\Delta T$

$$s = \frac{\Delta Q}{m\Delta T} = \frac{\Delta Q_L}{0} \rightarrow \infty$$

24. Answer (1)

**Hint:**  $Q = ms\Delta T$

**Sol.:**  $Q = \frac{50}{1000} \times 4200 \times 20 \text{ J} = 4200 \text{ J}$

25. Answer (2)

**Hint & Sol:** The specific heat capacity of a substance depends upon the temperature and nature of substance.

26. Answer (4)

**Hint:**  $H = \frac{kA}{L}(T_2 - T_1) = \frac{T_2 - T_1}{R_T}$

**Sol.:**  $\frac{T_A - T_C}{2R} = \frac{T_C - T_D}{R} \Rightarrow \frac{120 - T_C}{2} = \frac{T_C - 20^\circ}{1}$

$$160^\circ = 3T_C$$

$$T_C = \frac{160^\circ}{3} \text{ C}$$

27. Answer (3)

**Hint:** Pressure on the bottom =  $\frac{\text{Force}}{\text{Area}}$

**Sol.:** The height of water is maximum in vessel C, so pressure at the bottom will be maximum in C. As all the vessel have same base area, so force will be maximum in C.

28. Answer (1)

**Hint:** Use Bernoulli's theorem

**Sol.:**  $\Delta P = \frac{1}{2}\rho v_2^2 - \frac{1}{2}\rho v_1^2$

$$5 \times 10^{-2} \times 10 \times 13600 = \frac{1}{2} \times 1000 [v_2^2 - v_1^2]$$

$$\frac{5 \times 1360}{500} = v_2^2 - v_1^2$$

$$13.6 + v_1^2 = v_2^2$$

$$13.6 \gg v_1^2$$

Therefore  $v_2 = \sqrt{13.6} \text{ m s}^{-1}$

29. Answer (3)

**Hint:** Use  $v = \sqrt{2gh}$

**Sol.:**  $v = \sqrt{2 \times 10 \times 80 \times 10^{-2}} = \sqrt{16} = 4 \text{ m s}^{-1}$

30. Answer (2)

**Hint:** Use equation of continuity

**Sol.:**  $A_1v_1 = A_2v_2 + A_3v_3$

$$4A = 0.8A \times 3 + 1.2A \times v$$

$$4 - 2.4 = 1.2v$$

$$1.6 = 1.2v$$

$$v = \frac{1.6}{1.2} = \frac{4}{3} \text{ m s}^{-1}$$

31. Answer (4)

**Hint & Sol.:**

(1) Point A is proportional limit. Till A, the stress is directly proportional to strain.

(2) Point B is yield point. After point B, if stress is increased there will be permanent extension even after removal of force.

(3) Point C is ultimate tensile strength. This is the maximum stress developed in given wire.

(4) Point D is fracture point.

32. Answer (3)

**Hint:**  $H = \frac{(T_2 - T_1)}{R}$ , where  $R$  is thermal resistance

and  $R_T = \frac{L}{kA}$  for one rod

**Sol.:**  $H = \frac{T_2 - T_1}{2R_T}$

$$H' = \frac{T_2 - T_1}{\frac{R_T}{2}}$$

$$H' = 4H$$

33. Answer (1)

**Hint:** To cook the rice easily, more heat should be absorbed before boiling.

**Sol.:** High pressure increases the boiling point of water. It allows water to absorb sufficient heat before it boils.

34. Answer (1)

**Hint:**  $\frac{E}{t} = P = \sigma \epsilon AT^4$

**Sol.:**  $\frac{E_2}{E_1} = \left(\frac{A_2}{A_1}\right) \left(\frac{T_2}{T_1}\right)^4$

$$\frac{E_2}{E_1} = \left(\frac{1}{4}\right) \left(\frac{600}{300}\right)^4 = \frac{1}{4} \times 16$$

$$P_2 = 4P_1$$

35. Answer (1)

**Hint:** Increasing the temperature will decrease the density of water.

**Sol.:**  $N = mg - B = mg - \rho Vg$

As  $T \uparrow$ ,  $\rho \downarrow$ ,  $B \downarrow$  and so  $N \uparrow$ .

36. Answer (1)

**Hint & Sol:** The castor oil is highly viscous. The friction force of layers quickly absorb kinetic energy of oil particles.

37. Answer (2)

**Hint:** The acceleration of the ball will decrease with increase in velocity.

**Sol.:**  $a = g - \frac{k}{m}v$

$$\frac{da}{dt} = -\frac{k}{m} \frac{dv}{dt}$$

$$\frac{da}{dt} + \frac{k}{m}a = 0$$

$$a = ge^{-\frac{k}{m}t}$$

38. Answer (2)

**Hint:**  $h = \frac{2S \cos \theta}{\rho gr}$

**Sol.:**  $h' = \frac{2S \cos \theta}{\rho g_{\text{eff}} r}$

$$h' = \frac{2S \cos \theta}{\rho \frac{g}{2} r}$$

$$h' = \frac{4S \cos \theta}{\rho gr} = 2 \times 8 = 16 \text{ cm}$$

39. Answer (3)

**Hint:** The surface energy of bigger drop is smaller than total surface energy of smaller drops.

**Sol.:** When a bigger drop is formed, the surface energy decreases. The decrease in surface energy gives rise to the temperature of bigger drop because energy has been liberated in this process.

40. Answer (2)

**Hint:** Tension in the wire does not change.

**Sol.:**  $\Delta l = \frac{Tl}{AY}$  ... (i)

$$\Delta l' = \Delta l_1 + \Delta l_2$$

$$= \frac{Tl}{2YA} + \frac{Tl}{2YA}$$

$$\Rightarrow \Delta l' = \frac{Tl}{YA}$$
 ... (ii)

From (i) and (ii)

$$\Delta l' = \Delta l$$

41. Answer (3)

**Hint:** The vertical rise of liquid in capillary tube remains constant.

**Sol.:**  $\frac{2S \cos \theta}{r} = \rho gh = \rho gl \sin \phi$

$$l = \frac{h}{\sin \phi} = \frac{h}{1/2} = 2h = 2 \times 10 = 20 \text{ cm}$$

42. Answer (4)

**Hint & Sol:**

Weight  $\propto$  Stress  $\propto$  Strain  $\propto$  Change in length

43. Answer (1)

**Hint:** The pressure will create the lift force.

**Sol.:**  $(\Delta P) A = mg$

$$\Delta P = \frac{mg}{A}$$

44. Answer (4)

**Hint & Sol:** Adding detergent decreases the surface tension of water.

45. Answer (1)

**Hint:** If strain is equal in both wires, then

$$\frac{F_1}{A_1 Y_1} = \frac{F_2}{A_2 Y_2}$$

**Sol.:**  $T_P \times \frac{L}{3} = T_Q \frac{2L}{3}$

$$T_P = 2T_Q$$

$$\Delta l_P = \Delta l_Q$$

$$\frac{T_P l_P}{Y_P A} = \frac{T_Q l_Q}{Y_Q (2A)}$$

$$l_P = l_Q$$

$$\frac{T_P}{Y_P} = \frac{T_Q}{Y_Q (2)}$$

$$\frac{Y_P}{Y_Q} = \frac{2T_P}{T_Q} = 2(2) = 4$$

## [CHEMISTRY]

46. Answer (3)

**Hint:** Group 13 and group 14 belong to p-block.**Sol.:** The group oxidation state of group 13 is +3 and group 14 is +4.The general outer electronic configuration of group 13 and 14 are  $ns^2 np^1$  and  $ns^2 np^2$  respectively.

47. Answer (2)

**Hint:** Generally down the group, ionization enthalpy decreases but for group-13 elements order is random.**Sol.:**

Element	First Ionization enthalpy (kJ mol <sup>-1</sup> )
B	801
Al	577
Ga	579
In	558
Tl	589

48. Answer (2)

**Hint:**  $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ}$ **Sol.:**  $E_{\text{cell}}^{\circ} = -0.76 - (-2.36) = +1.6 \text{ V}$ 

49. Answer (4)

**Hint:** Due to very strong crystalline lattice, boron has unusually high melting point.**Sol.:**

Elements	(Melting point/K)
B	2453
Al	933
Ga	303
In	430
Tl	576

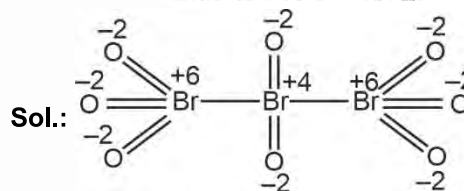
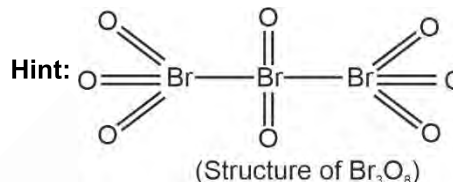
50. Answer (1)

**Hint:** Due to inert pair effect, the relative stability of +1 oxidation state progressively increases for heavier elements in group 13.**Sol.:** The correct order of stability of +1 oxidation state is  $\text{Tl} > \text{In} > \text{Ga} > \text{Al}$ . In thallium +1 oxidation state is predominant, so  $\text{Tl}^{+3}$  is a good oxidising agent.

51. Answer (4)

**Hint:** Due to strong  $p\pi-p\pi$  back bonding, Lewis acidity decreases from  $\text{BI}_3$  to  $\text{BF}_3$ .**Sol.:** Lewis acidity order:  $\text{BI}_3 > \text{BBr}_3 > \text{BCl}_3 > \text{BF}_3$ 

52. Answer (1)



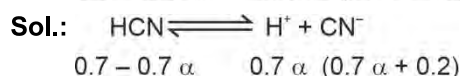
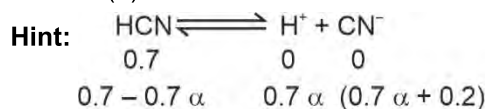
53. Answer (3)

**Hint:** Boron is unreactive in crystalline form.**Sol.:**  $2\text{B}(\text{s}) + 3\text{O}_2(\text{g}) \xrightarrow{\Delta} 2\text{B}_2\text{O}_3(\text{s})$  $2\text{B}(\text{s}) + \text{N}_2(\text{g}) \xrightarrow{\Delta} 2\text{BN}(\text{s})$ 

54. Answer (3)

**Hint:** For disproportionation reaction the element in the form of reacting substance is in the intermediate oxidation state.**Sol.:** The oxidation state of Cl is  $\text{ClO}^-$ ,  $\text{ClO}_2^-$ ,  $\text{ClO}_3^-$  are +1, +3 and +5 respectively but in  $\text{ClO}_4^-$  the oxidation state of Cl is +7, which is highest oxidation state of Cl.

55. Answer (2)



$$K_a = \frac{[\text{H}^+][\text{CN}^-]}{[\text{HCN}]}$$

$$K_a = \frac{0.7\alpha [0.7\alpha + 0.2]}{0.7 [1 - \alpha]}$$

$$= \frac{0.7\alpha^2 + 0.2\alpha}{1 - \alpha} \quad \alpha \ll 1$$

$$\text{So } 1 - \alpha \approx 1$$

$$K_a = 0.2\alpha$$

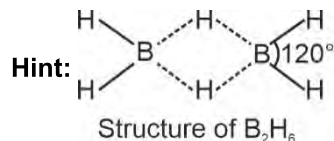
$$\alpha = \frac{4.9 \times 10^{-9}}{0.2}$$

$$[H^+] = C\alpha$$

$$= \frac{0.7 \times 4.9 \times 10^{-9}}{0.2}$$

$$= 1.715 \times 10^{-9}$$

56. Answer (3)



**Sol.:** In B<sub>2</sub>H<sub>6</sub>, there are two 3c – 2e<sup>-</sup> bonds and four 2c – 2e<sup>-</sup> bonds.

57. Answer (1)

**Hint & Sol.:** Boron fibres are used in making bullet proof vest, borax is used as a flux for soldering metals, graphite is used for electrodes in batteries and silicones are used for water proofing of fabrics.

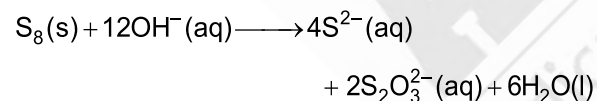
58. Answer (1)

**Hint:** In a disproportionation reaction an element in one oxidation state is simultaneously oxidised and reduced.

**Sol.:** CH<sub>4</sub>(g) + 2O<sub>2</sub>(g)  $\xrightarrow{\Delta}$  CO<sub>2</sub>(g) + 2H<sub>2</sub>O(l) is combination reaction.

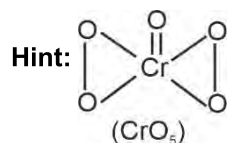
2KClO<sub>3</sub>(s)  $\xrightarrow{\Delta}$  2KCl(s) + 3O<sub>2</sub>(g) is decomposition reaction.

Cl<sub>2</sub>(g) + 2KBr(aq)  $\longrightarrow$  2KCl(aq) + Br<sub>2</sub>(l) is non-metal displacement reaction



is disproportionation reaction

59. Answer (4)



**Sol.:** In CrO<sub>5</sub> molecule, two peroxy linkages are present and oxidation number of Cr is + 6.

60. Answer (1)

**Hint & Sol:** CO<sub>2</sub>, SiO<sub>2</sub>, GeO<sub>2</sub> are acidic, CO is neutral while SnO and PbO<sub>2</sub> are amphoteric in nature.

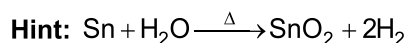
61. Answer (3)

**Hint:** Carbon exhibits many allotropic forms; diamond and graphite are crystalline form of carbon.

**Sol.:** In graphite, carbon atom is sp<sup>2</sup> hybridised but in diamond carbon atom is sp<sup>3</sup> hybridised.

Carbon black, coke and charcoal are all impure forms of graphite or fullerenes.

62. Answer (3)



**Sol.:** PbF<sub>4</sub> and SnF<sub>4</sub> are ionic in nature and catenation power of silicon is greater than tin.

Catenation power C  $\gg$  Si > Ge  $\approx$  Sn

63. Answer (2)

**Hint:** pH =  $\frac{1}{2}$  [pK<sub>w</sub> + pK<sub>a</sub> + log C]

**Sol.:** For WASB

$$pH = \frac{1}{2} [pK_w + pK_a + \log C]$$

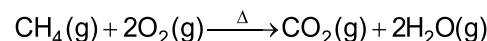
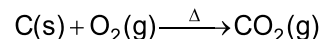
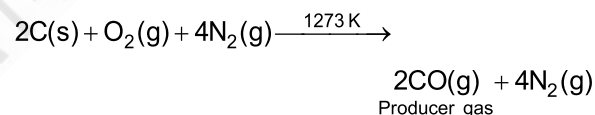
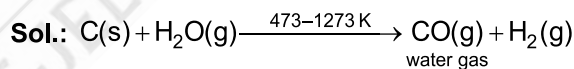
$$pH = \frac{1}{2} [14 + 4.76 + \log 0.1]$$

$$= \frac{1}{2} [18.76 - 1]$$

$$= \frac{17.76}{2} = 8.88 \approx 8.9$$

64. Answer (1)

**Hint:** CO(g) + H<sub>2</sub>(g) is known as water gas.



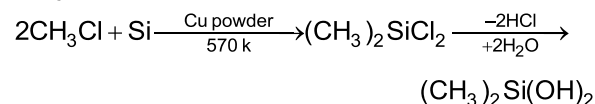
65. Answer (3)

**Hint:** The element in the form of reacting substance is in the intermediate oxidation state, to show disproportionation reaction.

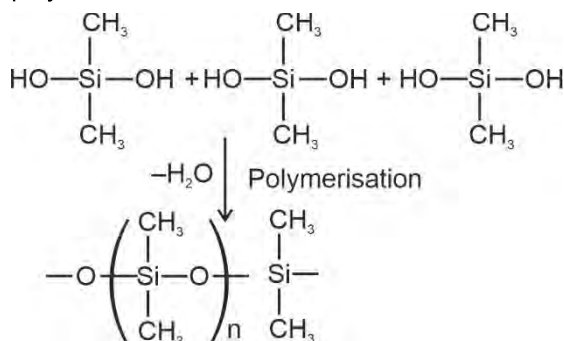
**Sol.:** In O<sub>2</sub>F<sub>2</sub> molecule, fluorine has –1 oxidation state.

66. Answer (3)

**Hint:**



**Sol.:** Hydrolysis of  $(\text{CH}_3)_2\text{SiCl}_2$  followed by condensation polymerisation yields straight chain polymer.



67. Answer (1)

**Hint & Sol.:** Oxidation state of metal in alloy is zero hence oxidation state of Na in sodium amalgam will be zero.

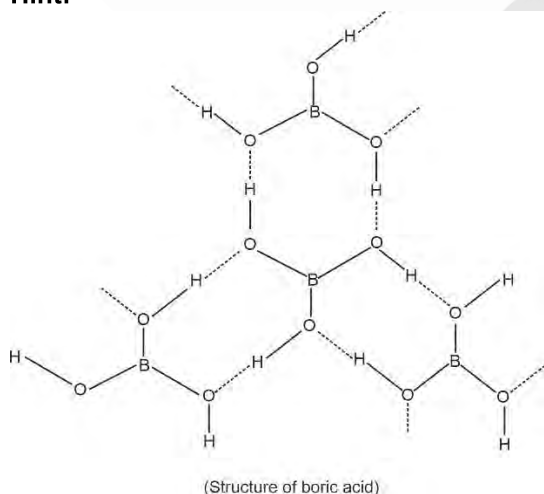
68. Answer (4)

**Hint:** Le Chatelier's principle states that a change in any of the factors that determine the equilibrium conditions of a system will cause the system to change in such a manner so as to reduce or to counteract the effect of the change.

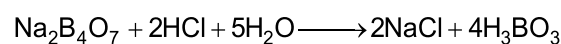
**Sol.:** By decreasing the volume of reaction vessel, number of moles in per unit volume increases and reaction shift in that direction which have lesser number of gaseous molecules.

69. Answer (3)

**Hint:**



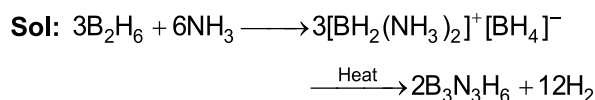
**Sol.:**



Boric acid is a weak monobasic Lewis acid.

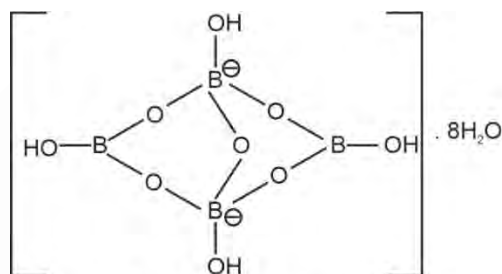
70. Answer (2)

**Hint:** Reaction of ammonia with  $\text{B}_2\text{H}_6$  gives initially  $\text{B}_2\text{H}_6 \cdot 2\text{NH}_3$  which is formulated as  $[\text{BH}_2(\text{NH}_3)_2]^+ [\text{BH}_4]^-$



71. Answer (1)

**Hint:**

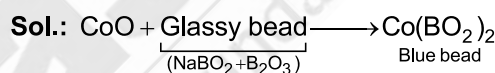


Structure of borax

**Sol.:** Total number of B–O–B bonds in borax are 5.

72. Answer (3)

**Hint:** Metaborates of many transition metals have characteristic colours and, therefore, borax bead test can be used to identify them.



73. Answer (2)

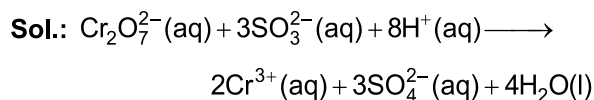
**Hint:** Down the group the size increases so bond enthalpy decreases.

**Sol.:**

Bond	Bond enthalpy/kJ mol <sup>-1</sup>
C–C	348
Si–Si	297
Ge–Ge	260
Sn–Sn	240

74. Answer (2)

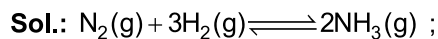
**Hint:** Balance the atoms as well as charge.



75. Answer (1)

**Hint:**  $K_p = K_c(\text{RT})^{\Delta n_g}$

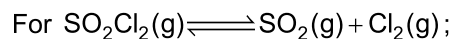
$\Delta n_g$  = number of moles of gaseous product molecules – number of moles of gaseous reactant molecules.



$$\Delta n_g = 2 - 4 = -2$$

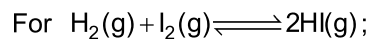
$$K_p = K_c(\text{RT})^{-2}$$

$$K_p = \frac{K_c}{(\text{RT})^2}$$



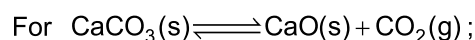
$$\Delta n_g = 2 - 1 = 1$$

$$K_p = K_c(\text{RT})$$



$$\Delta n_g = 2 - 2 = 0$$

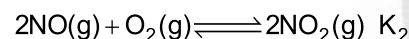
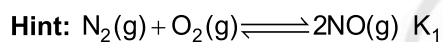
$$K_p = K_c$$



$$\Delta n_g = 1$$

$$K_p = K_c(\text{RT})$$

76. Answer (1)



$$K_3 = K_1 \times K_2$$

**Sol.:**  $K_3 = K_1 \times K_2$

$$K_3 = 10 \times 5 = 50$$

77. Answer (3)

**Hint:** A catalyst increases the rate of the chemical reaction by making available of a new lower energy pathway for the conversion of reactants to products.

**Sol.:** The value of equilibrium constant is independent of initial concentration of the reactants and products. Catalyst does not affect the equilibrium composition of a reaction mixture.

78. Answer (2)

**Hint:**  $K_p = \frac{P_{\text{CO}_2}}{P_{\text{CO}}}$

P = equilibrium partial pressure

**Sol.:**

	$\text{FeO}(\text{s}) + \text{CO}(\text{g}) \rightleftharpoons \text{Fe}(\text{s}) + \text{CO}_2(\text{g})$	
initial pressure	4	0
At equilibrium	4 - x	x

$$K_p = \frac{P_{\text{CO}_2}}{P_{\text{CO}}}$$

$$K_p = \frac{x}{4-x}$$

$$1.5 = \frac{x}{4-x}$$

$$x = 6 - 1.5x$$

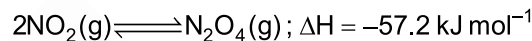
$$x = \frac{6}{2.5} = 2.4$$

Equilibrium partial pressure of  $\text{CO}(\text{g})$

$$= 4 - 2.4 = 1.6 \text{ atm}$$

79. Answer (4)

**Hint:**



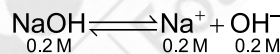
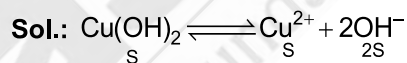
According to Le Chatelier's principle for exothermic reaction, temperature increases then reaction shift in backward direction.

**Sol.:** For exothermic reaction, reaction shift in forward direction with decreases in temperature.

Pressure increases, reaction shift in those direction which have lesser number of gaseous molecules.

80. Answer (4)

**Hint:** In the presence of common ion, the solubility of sparingly soluble salts decrease.



$$K_{sp} = [\text{Cu}^{2+}][\text{OH}^-]^2$$

$$K_{sp} = [\text{S}][2\text{S} + 0.2]^2$$

As  $K_{sp}$  is small,  $2\text{S} \ll 0.2$

Thus  $(0.2 + 2\text{S}) \approx 0.2$

Hence  $2.2 \times 10^{-20} = \text{S}(0.2)^2$

$$\text{S} = \frac{2.2 \times 10^{-20}}{0.2 \times 0.2} = 5.5 \times 10^{-19} \text{ M}$$

81. Answer (4)

**Hint:** Maximum covalence of boron is 4.

**Sol.:** Due to non-availability of  $d$  orbitals boron is unstable to form  $\text{BF}_6^{3-}$  ion.

Except Tl, all group 13 elements react with halogens to form trihalides.

82. Answer (3)

**Hint:** For basic buffer solution

$$\text{pOH} = \text{p}K_b + \log \frac{[\text{Salt}]}{[\text{Base}]}$$

$$\text{Sol.: } \text{pOH} = 3.27 + \log \frac{0.2}{0.01}$$

$$= 3.27 + 1 + 0.3010 = 4.571$$

$$\text{pH} = \text{pOH} + \text{p}K_w$$

$$\text{pH} = 14 - 4.571$$

$$\text{pH} = 9.429$$

83. Answer (2)

**Hint:** Stability of dihalides increases down the group in group -14

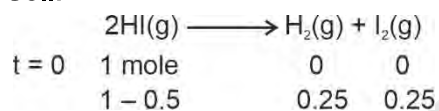
**Sol.:**  $\text{GeI}_4$  is thermally more stable than  $\text{GeI}_2$  and  $\text{PbI}_2$  is thermally more stable than  $\text{PbI}_4$

84. Answer (1)

**Hint:** At equilibrium  $\Delta G = 0$

$$\Delta G = \Delta G^\circ + RT \ln K_{\text{eq}}$$

**Sol.:**

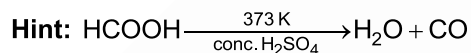


$$K_c = \frac{0.25 \times 0.25}{0.5 \times 0.5} = \frac{1}{4}$$

$$\Delta G^\circ = -2.303 RT \log \left( \frac{1}{4} \right)$$

$$= 1.386 RT$$

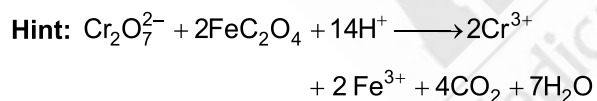
85. Answer (4)



**Sol.:** In CO molecule  $\text{:C} \equiv \text{O:}$ , one sigma and two  $\pi$  bonds are present.

CO is a colourless, odourless and almost water insoluble gas.

86. Answer (1)



**Sol.:** Oxidation of two moles of ferrous oxalate = 1 mole  $\text{K}_2\text{Cr}_2\text{O}_7$  required

Oxidation of 5 moles of ferrous oxalate

$$= \frac{1}{2} \times 5 \text{ moles } \text{K}_2\text{Cr}_2\text{O}_7 \text{ required}$$

87. Answer (2)

**Hint & Sol.:**

Atomic radius order :  $\text{Tl} > \text{In} > \text{Al} > \text{Ga} > \text{B}$

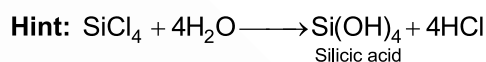
• Electronegativity :

Al Ga

1.5 1.6

• Ionic radius order :-  $\text{Tl}^{3+} > \text{In}^{3+}, \text{Ga}^{3+} > \text{Al}^{3+}$

88. Answer (3)



**Sol.:**  $[\text{SiF}_6]^{2-}$  is known whereas  $[\text{SiCl}_6]^{2-}$  not due to two main reasons.

(i) Six large chloride ions cannot be accommodated around  $\text{Si}^{4+}$  due to limitation of its size.

(ii) Interaction between lone pair of chloride ion and  $\text{Si}^{4+}$  is not very strong.

• Due to unavailability of *d* orbitals in carbon atom of  $\text{CCl}_4$ , does not undergo hydrolysis.

89. Answer (3)

**Hint:**  $\text{AlCl}_3$  in acidified aqueous solution forms octahedral  $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$  ion.

**Sol.:** In  $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$  ion, the 3*d* orbitals of Al are involved and the hybridisation state of Al is  $sp^3d^2$ .

90. Answer (2)

**Hint:** Sum of oxidation states of all the elements in a compound will be zero.

**Sol.:**  $x_2(\text{yz})_4$

$$+4 \times 2 + 4(+1 - 3)$$

$$+8 - 8 = 0$$

So correct formula of compound is  $x_2(\text{yz})_4$

## [BOTANY]

91. Answer (4)

**Hint:** In natural system of classification, features like ultrastructure, anatomy, embryology and phytochemistry were considered.

**Sol.:** Phylogenetic system of classification are based on evolutionary relationships between the various organisms, assuming that organisms belonging to the same taxa have common ancestor.

92. Answer (4)

**Hint:** *Volvox* and *Eudorina* are colonial forms of algae.

**Sol.:** The marine forms such as kelps form massive plant bodies.

93. Answer (1)

**Hint:** Phenetics is also known as numerical taxonomy.

**Sol.:** Cytotaxonomy is based on cytological information like chromosome number, structure and behaviour.

94. Answer (4)

**Hint:** In oogamous type of sexual reproduction small, motile or non-motile male gamete fuses with a large non-motile female gamete.

**Sol.:** In *Spirogyra*, isogamous type of sexual reproduction is present while in *Volvox*, *Polysiphonia* and *Fucus*, oogamous type of sexual reproduction is present.

95. Answer (1)

**Hint:** Floridean starch is the stored food in the members of Rhodophyceae.

**Sol.:** *Gracilaria* is an example of red algae and its stored food is floridean starch. Stored food in *Laminaria*, *Dictyota* and *Fucus* is laminarin or mannitol.

96. Answer (3)

**Hint:** Types of chlorophyll present in green algae are chlorophyll *a* and *b*.

**Sol.:** In brown algae, chlorophyll *a* and chlorophyll *c* are present, e.g., *Ectocarpus*

In red algae chlorophyll *a* and *d* are present, e.g.-*Porphyra*.

97. Answer (4)

**Hint:** Pollen grains are formed in seed producing plants.

**Sol.:** In algae, transfer of gametes occurs through water.

98. Answer (1)

**Hint:** Artificial system of classification was given by Linnaeus.

**Sol.:** Classification system given by Linnaeus was based on the androecium structure.

99. Answer (3)

**Hint:** Bryophytes are non-vascular terrestrial plants of moist habitats.

**Sol.:** Bryophytes are also called amphibians of the plant kingdom because these plants can live in soil but are dependent on water for sexual reproduction.

100. Answer (2)

**Hint:** *Selaginella* is an example of class Lycopsidea.

**Sol.:**

Class	Example
Psilopsida	– <i>Psilotum</i>
Sphenopsida	– <i>Equisetum</i>
Pteropsida	– <i>Adiantum</i>

101. Answer (1)

**Hint:** Priestley in 1770 performed a series of experiments that revealed essential role of air in growth of green plants.

**Sol.:** Joseph Priestley concluded that the plants restore to the air whatever the breathing animals and the burning candle remove.

102. Answer (3)

**Sol.:** A chromatographic separation of the leaf pigments shows that the colour of leaves is due to four pigments.

- (1) Chlorophyll *a* – Bright or blue green
- (2) Chlorophyll *b* – Yellow green
- (3) Xanthophyll – Yellow
- (4) Carotenoids – Yellow to yellow-orange

103. Answer (3)

**Hint:** Dark reaction depends upon the product of light reaction (that occurs in thylakoid).

**Sol.:** Dark reactions of photosynthesis occurs in the fluid compartment surrounding the thylakoid called stroma.

104. Answer (3)

**Hint :** Photosystem I is involved in both cyclic and non-cyclic photophosphorylation.

**Sol :** PS I is found in both grana and stroma lamellae.

105. Answer (2)

**Hint:** Green algae have storage bodies called pyrenoids located in the chloroplasts.

**Sol.:** Green algae usually have a rigid cell wall made up of an inner layer of cellulose and an outer layer of pectose.

106. Answer (4)

**Hint:** Algin is a hydrocolloid which has good water holding capacity. Cell wall of brown algae is usually covered with coating of algin.

**Sol.:** Agar is obtained from *Gelidium* and *Gracilaria*.

107. Answer (3)

**Hint:** Gametes are non-motile in red algae. Blue-green algae do not have flagella.

**Sol.:** In brown algae, motile cells have two unequal laterally placed flagella. In these algae, fucoxanthin is present.

108. Answer (2)

**Hint:** Bryophytes are homosporous, *i.e.*, they produce only one type of spores.

**Sol.:** During sexual reproduction, the sex organs antheridia and archegonia are produced either on the same thallus (*Riccia*) or on the different thalli (*Marchantia*).

109. Answer (4)

**Hint:** Bryophytes are also called amphibians of plant kingdom and they have motile male gametes.

**Sol.:** In bryophytes, zygotes do not undergo reduction division immediately instead they undergo mitotic division to form the embryo which develop further into diploid multicellular sporophyte.

110. Answer (1)

**Sol.:** *Sequoia* is the tallest gymnosperm.

111. Answer (3)

**Hint:** Assimilatory power are the major products of light reaction.

**Sol.:** Arnon used the term assimilatory powers to refer ATP and NADPH.

112. Answer (2)

**Hint:** Protons which are produced during photolysis of water get accumulated within the lumen of the thylakoid.

**Sol.:** Chemiosmotic hypothesis explain how ATP are synthesised in chloroplasts.

113. Answer (4)

**Hint:** Photorespiration is a process which involves loss of fixed carbon as CO<sub>2</sub> in plants in the presence of light.

**Sol.:** In photorespiration, there is neither synthesis of sugar nor of ATP. Rather results in the release of CO<sub>2</sub> with utilisation of ATP.

114. Answer (3)

**Hint:** Energy is required to pump protons across the membrane to create proton gradient.

**Sol.:** Chemiosmosis process requires a membrane, a proton pump, a proton gradient and ATP synthase.

115. Answer (3)

**Hint :** CF<sub>0</sub> of ATP synthase is embedded in the membrane of thylakoid.

**Sol. :** NADP reductase reaction occurs towards stroma side of the thylakoid membrane.

116. Answer (1)

**Hint:** Ruben, Kamen *et al.* used heavy but non-radioactive stable isotopes of oxygen <sup>18</sup>O to prove that O<sub>2</sub> evolve during light reaction comes from H<sub>2</sub>O and not from CO<sub>2</sub>.

**Sol.:**

- T.W Engelmann experimented on *Cladophora*.
- Jan Ingenhousz experimented with an aquatic plant (*Hydrilla*) and he showed that in bright sunlight, small bubbles were formed around the green parts of the plant.
- Julius von Sachs found that the green parts in plant is where glucose is made and glucose is usually stored as starch.

117. Answer (3)

**Hint:** Carotenoids protect plant from excessive heat and prevent photooxidation of chlorophyll.

**Sol.:** In C<sub>4</sub> plants, PEPcase is a strong CO<sub>2</sub> fixing enzyme.

118. Answer (3)

**Hint:** Hill and Bendall proposed Z-scheme of light reaction, *i.e.*, photophosphorylation.

**Sol.:** Oxygen evolving complex is associated with the PS II, which itself is physically located on the inner side of the membrane of the thylakoid.

119. Answer (3)

**Hint:** In C<sub>4</sub> plants, decarboxylation process occurs in bundle sheath cells.

**Sol.:** Bundle sheath cells of the leaves of C<sub>4</sub> plants are characterised by having large number of chloroplasts in which, grana are absent.

120. Answer (2)

**Sol.:** Most of the plants that are adapted to dry tropical regions have the C<sub>4</sub> – pathway, *e.g.* sugarcane, maize, etc.

Wheat, tomato and bell pepper are the examples of C<sub>3</sub> plants.

121. Answer (2)

**Hint:** C<sub>4</sub> plants have special type of leaf anatomy and they tolerate higher temperatures.

**Sol.:** The temperature optimum for photosynthesis of different plants also depends on the habitat that they are adapted to.

122. Answer (4)

**Hint:** Photorespiration involves three organelles viz. chloroplast, peroxisomes and mitochondria.

**Sol.:** In C<sub>4</sub> plants, photorespiration does not occur. This is because these plants have a special mechanism that increases the concentration of CO<sub>2</sub> at the enzyme site.

123. Answer (3)

**Hint:** Double fixation occurs in  $C_4$  plants like maize.

**Sol.:** RuBP is a primary  $CO_2$  acceptor in  $C_3$  plants.

124. Answer (2)

**Hint:** In bundle sheath cells of  $C_4$  plants,  $C_4$  acids are broken down to release  $CO_2$  and 3 carbon molecules.

**Sol.:** The primary  $CO_2$  acceptor is a three carbon molecule phosphoenol pyruvate and it is present in mesophyll cell of  $C_4$  plants. So, the  $CO_2$  fixation in Hatch and Slack pathway occurs in mesophyll cell.

125. Answer (3)

**Hint:**  $C_4$  plants respond to higher temperatures and they show higher rate of photosynthesis, while  $C_3$  plants have much lower temperature optimum.

**Sol.:**  $C_4$  plants are less efficient at low temperature due to cold sensitivity of PEP synthetase enzyme.

126. Answer (4)

**Hint:** Pteridophytes are the first terrestrial plants to possess vascular tissues.

**Sol.:** Bryophytes are non-vascular terrestrial plants of moist habitats.

127. Answer (4)

**Hint:** Dominant phase of gymnosperms is a sporophyte.

**Sol.:** Dominant phase of gymnosperms and pteridophytes is a sporophyte. Dominant phase of bryophytes is a gametophyte. e.g. *Marchantia*.

128. Answer (4)

**Hint:** It is a pteridophyte.

**Sol.:** It is *Salvinia* and it is heterosporous.

129. Answer (3)

**Hint:** Lax is present in gymnosperms.

**Sol.:** Lax is spirally arranged sporophylls present in plants, like *Cycas*.

130. Answer (3)

**Hint:** Chlorophyll *a* is an universal pigment and it is present in all green plants.

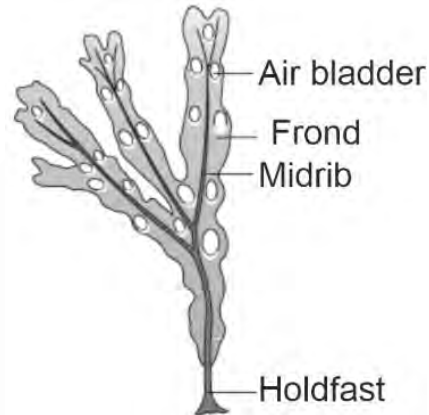
**Sol.:** Red algae can be distinguished from green algae as the former lack flagella and have complex post fertilization developments.

131. Answer (4)

**Hint:** *Sphagnum* is a peat moss.

**Sol.:** In *Cedrus*, stems are branched.

132. Answer (2)



133. Answer (2)

**Hint:** The sporophyte in mosses is not free-living but attached to the photosynthetic gametophyte and derives nourishment.

**Sol.:** The plant body of moss is a leafy gametophyte which has multicellular and branched rhizoids. It consists of upright, slender axis bearing spirally arranged leaves. This stage bear sex organs.

134. Answer (3)

**Hint:** Coralloid roots are associated with nitrogen fixing cyanobacteria in *Cycas*.

**Sol.:** The gymnosperms are plants in which the seeds are not enclosed within fruit wall.

135. Answer (4)

**Hint:** Calvin cycle occurs in the bundle sheath cells of  $C_4$  plants.

**Sol.:** In  $C_3$  pathway, the first stable product is 3-phosphoglycerate while in  $C_4$  pathway the first stable product is OAA.

## [ZOOLOGY]

136. Answer (3)

**Hint:** *Ascaris* shows internal fertilization

**Sol.:** Animals like annelids, arthropods, etc, where the body can be divided into identical left and right halves in only one plane, exhibit bilateral symmetry.

Those animals in which the developing embryo also has a third germinal layer, i.e., mesoderm, in between the ectoderm and endoderm are called triploblastic animals.

### Platyhelminthes

- Bilaterally symmetrical
- Do not show any segmentation
- Show internal fertilization

**Aschelminthes**

- Bilaterally symmetrical
- Sexes are separate
- Unsegmented
- Exhibit internal fertilization

All bilateral animals are triploblastic. (e.g., Platyhelminthes to Chordates).

137. Answer (3)

**Hint:** Their lifetime include a free swimming flagellated larva.

**Sol.:**

- *Spongilla* is a fresh water sponge.
- Although most sponges are asymmetrical, some species of sponges belonging to the class Demospongiae exhibit radial symmetry.
- They are hermaphrodite. The larval stages of sponges are motile.
- Sponges show indirect development.

138. Answer (4)

**Hint:** These cells also line the water canal system.

**Sol.:** Choanocytes or collar cells are specialized flagellated cells that line the spongocoel and the canals in porifers.

Coelenterates like *Adamsia* possess cnidoblasts or cnidocytes which are used for anchorage, defense and for the capture of prey.

*Sepia* is a mollusc and *Ctenoplana* is a ctenophore.

139. Answer (2)

**Hint:** Also called comb jellies.

**Sol.:** *Echinus* (Sea urchin), *Cucumaria* (Sea cucumber) and *Antedon* (Sea lily) are echinoderms. Sexes are separate in echinoderms.

Ctenophores, commonly known as sea walnuts or comb jellies, are monoecious, i.e. sexes are not separate in them.

140. Answer (4)

**Hint:** Digestive system has two openings in segmented worms.

**Sol.:** When the digestive system has only a single opening to the outside of the body that serves as both mouth and anus, it is called an incomplete digestive system.

Coelenterates (*Gorgonia*), ctenophores (*Pleurobrachia*) and platyhelminths (*Fasciola*) does not possess complete digestive system.

Complete digestive system is present in annelids (*Pheretima*).

141. Answer (1)

**Hint:** Platyhelminthes are triploblastic acoelomates.

**Sol.:** Organisms belonging to the phylum Platyhelminthes are triploblastic and acoelomate animals with organ-level of organisation.

*Planaria*, *Taenia* and *Fasciola* are platyhelminths.

*Ancylostoma* (Aschelminth) is a pseudocoelomate.

*Nereis* (Annelid) is a coelomate.

142. Answer (2)

**Hint:** Exclude the feature of vertebrates.

**Sol.:**

- Organ-system level of organisation is exhibited by aschelminths to chordates.
- *Hirudinaria* (Annelid) and *Bombyx* (Arthropod) show true metamerism.
- Molluscs (*Dentalium*) are unsegmented.
- Non-chordates possess a dorsal heart (if present).

143. Answer (3)

**Hint:** Parasitic adaptations.

**Sol.:**

- *Aplysia* (Mollusc): Possesses a file-like rasping organ in mouth that helps in feeding.
- *Nereis* is an aquatic annelid which possesses lateral appendages called parapodia, for swimming.
- *Taenia* possesses both hooks and suckers.
- *Saccoglossus* (Hemichordate) possesses a rudimentary structure in the collar region called stomochord.

144. Answer (3)

**Hint:** In some arthropods, tracheal tubes act as the respiratory structure.

**Sol.:** *Loligo* is a mollusc.

*Limulus* is known as the living fossil. It belongs to the phylum Arthropoda.

Its body is divided into cephalothorax and abdomen. It respire via book gills.

145. Answer (4)

**Hint:** Sponges have cells arranged as loose cell aggregates.

**Sol.:** Porifers are primitive multicellular animals and have cellular level of body organisation. Some division of labour occur among the cells. The body is supported by a skeleton made up of spicules or spongin fibres.

146. Answer (4)

**Hint:** Arthropods exhibit open type of circulatory system.

**Sol.:** In an open type of circulatory system, the blood is pumped out of the heart and the cells and tissues are directly bathed in it.

Arthropods (*Periplaneta*), non-cephalopod molluscs (*Pila*; *Pinctada*) and hemichordates possess an open circulatory system.

*Pheretima* (Annelid) has a closed circulatory system.

147. Answer (3)

**Hint:** Chitin is composed of repeated units of N-acetylglucosamine.

**Sol.:** The body of arthropods is covered by chitinous exoskeleton.

They have jointed appendages.

They are mostly oviparous. Development may be direct or indirect.

148. Answer (4)

**Hint:** Feature of coelenterates.

**Sol.:** 'X' belongs to the phylum Mollusca. Molluscs are terrestrial or aquatic organisms having an organ-system level of organisation. They possess feather-like gills. They have respiratory and excretory functions. Their anterior head region has sensory tentacles. Their mouth contains a file-like rasping organ for feeding called radula. Their body is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.

149. Answer (3)

**Hint:** Molluscs.

**Sol.:**

- The body of arthropods (*Apis*; *Laccifer*) is divided into head, thorax and abdomen.
- The body of molluscs (*Pila*, *Sepia*; *Chaetopleura*, *Loligo*, *Octopus*) is divided into distinct head, muscular foot and visceral hump.
- The body of hemichordates (*Saccoglossus*) is composed of an anterior proboscis, a collar and a long trunk.

150. Answer (4)

**Hint:** Sea lily and sea urchin have spiny body.

**Sol.:**

*Aplysia* – Sea hare

*Echinus* – Sea urchin

*Pennatula* – Sea pen

*Antedon* – Sea lily

151. Answer (2)

**Hint:** The symmetry possessed by the larvae of echinoderms is also possessed by arthropods.

**Sol.:** The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

When any plane passing through the central axis of the body divides the organisms into two identical halves, it is called radial symmetry.

When the body of an organism can be divided into identical left and right halves in only one plane, it exhibits bilateral symmetry.

152. Answer (3)

**Hint:** The comb plates bear cilia.

**Sol.:** Ctenophores are commonly called sea walnuts or comb jellies. They are radially symmetrical, diploblastic organisms (two germ layers only) with tissue level of organisation.

The external surface of their body bears eight ciliated comb plates that help in locomotion.

153. Answer (2)

**Hint:** Organisms with dorso-ventrally flattened body.

**Sol.:** Members of the phylum Platyhelminthes showed bilateral symmetry for the first time.

154. Answer (4)

**Hint:** Identify a roundworm

**Sol.:** Hookworms belong to the phylum Aschelminthes. They possess an excretory tube that removes body wastes from the body cavity through the excretory pore.

155. Answer (1)

**Hint:** These organisms are exclusively marine.

**Sol.:** *Echinus* and *Asterias* are echinoderms. These animals have an endoskeleton of calcareous ossicles and hence the name Echinodermata (spiny bodied). They show external fertilisation.

*Aplysia* and *Pila* are molluscs and their body is covered by a calcareous shell.

156. Answer (2)

**Hint:** Earthworms are known as farmer's friends.

**Sol.:**

- Mosquitoes act as vector and spread various diseases.
- Earthworms (Annelids) and hemichordates, both exhibit bilateral symmetry.
- Arthropods show organ-system level of body organisation.
- Both earthworms and mosquitoes possess a solid ventral nerve cord.

157. Answer (1)

**Hint:** Members of the 2<sup>nd</sup> largest phylum in animal kingdom.

**Sol.:**

- *Pila* (Apple snail), *Pinctada* (Pearl oyster), *Octopus* (Devil fish) are molluscs.
- Sea urchin and sea cucumber are echinoderms. Sea-pen is a cnidarian.
- Roundworms and hookworms are aschelminths.

158. Answer (3)

**Hint:** Include the members that have water vascular system

**Sol.:** Ctenophores, hemichordates and echinoderms are exclusively marine organisms and show indirect development.

159. Answer (3)

**Hint:** Different levels of body organisation.

**Sol.:** Though all members of animalia are multicellular, all of them do not exhibit the same pattern of organisation of cells.

Exoskeleton of arthropods is one of the characteristics that is mainly responsible for the diversification of insects on land.

160. Answer (4)

**Hint:** Some fundamental features are common to various organisms.

**Sol.:** The features used as the basis of animal classification are :

- (1) Level of organisation
- (2) Patterns of digestive, circulatory or reproductive system
- (3) Body symmetry
- (4) Number of germ layers during embryonic development
- (5) Nature of coelom or body cavity
- (6) Presence or absence of segmentation in the body
- (7) Presence or absence of notochord

161. Answer (4)

**Hint:** Shown by chordates also

**Sol.:**

**Molluscs :** Triploblastic, coelomate and bilaterally symmetrical organisms.

Possess feather-like gills for respiration and excretion.

**Coelenterates:** Diploblastic, acoelomate and radially symmetrical organisms.

Respire by simple diffusion over their entire body surface.

162. Answer (3)

**Hint:** Structure similar to notochord.

**Sol.:**

- In porifers, water enters through minute pores (ostia) in the body wall into a central cavity, spongocoel, from where it goes out through the osculum.
- Porifers show indirect development having a larval stage which is morphologically distinct from the adult.
- Echinoderms are organisms with calcareous ossicles present in the body hence, they are also called spiny bodied.
- Hemichordates have a rudimentary structure in the collar region called stomochord.

163. Answer (2)

**Hint:** Porifers are sessile.

**Sol.:** The most distinctive feature of echinoderms is the presence of water vascular system which helps in locomotion, capture and transport of food and respiration.

- Sponges have a water transport or canal system. It helps in food gathering, respiratory exchange and removal of waste. Adult porifers are sessile.

164. Answer (2)

**Hint:** Gemmule formation is often called internal budding.

**Sol.:** Sponges reproduce asexually by fragmentation and sexually by formation of gametes.

165. Answer (3)

**Hint:** Coelenterates possesses nematocysts.

**Sol.:** The name cnidaria is derived from the cnidoblasts or cnidocytes (which contain the stinging capsules or nematocysts) present on the tentacles and the body. Cnidoblasts are used for anchorage, defense and for the capture of prey.

166. Answer (4)

**Hint:** Digestion of food takes place in the cavity as well as inside the food vacuole.

**Sol.:** *Physalia* is a coelenterate and *Pleurobrachia* is a ctenophore.

Both are radially symmetrical and acoelomates with tissue level of body organisation.

Both show extracellular and intracellular digestion.

167. Answer (3)

**Hint:** Spiny body**Sol.:***Aplysia* – Sea hare*Anopheles* – Mosquito*Adamsia* – Sea anemone*Asterias* – Star fish

168. Answer (4)

**Hint:** Cnidarians that exist in both body forms, sessile and free swimming, show this phenomenon.**Sol.:** Cnidarians which exist in both body forms exhibit alternation of generation (Metagenesis), *i.e.*, polyps produce medusae asexually and medusae form the polyps sexually.In *Hydra*, *Gorgonia* and *Adamsia*, only polyp form is observed

169. Answer (2)

**Hint:** Aquatic flatworm.**Sol.:**

- Coelenterata – They have a central gastrovascular cavity with a single opening, mouth on hypostome.
- *Sepia* (Mollusca) – Dioecious
- *Antedon* is an echinoderm.

170. Answer (1)

**Hint:** Belongs to the phylum that exhibits metagenesis.**Sol.:** *Physalia* – Portuguese-man-of-war*Pinctada* – Pearl oyster*Pila* – Apple snail

171. Answer (3)

**Hint:** *Adamsia* is sessile.**Sol.:** *Adamsia* exists only in polyp form.

172. Answer (4)

**Hint:** Loose cellular aggregates present in sponges.**Sol.:** In porifers, the digestion is intracellular.

Food is trapped by the collar cells or choanocytes and is digested within the cells.

Digestive system is absent in porifers.

173. Answer (4)

**Hint:** A notochord is a primitive beginning of the backbone.**Sol.:** Notochord is a mesodermally derived rod-like structure formed on the dorsal side during the embryonic development in some animals. Animals with notochord are called chordates and those animals which do not form this structure are called non-chordates, *e.g.*, porifers to echinoderms.

174. Answer (4)

**Hint:** Molluscs are eucoelomates.**Sol.:** True body cavity is lined by mesoderm. On both sides, *i.e.*, towards body wall as well as towards gut wall, this space is enclosed by the layers of mesoderm.

175. Answer (3)

**Hint:** Identify an aschelminth**Sol.:**

- *Ctenoplana* → External fertilization with indirect development
- *Planaria* → Internal fertilization but direct development
- *Ctenoplana* and *Pleurobrachia* → Undergo external fertilization

176. Answer (3)

**Hint:** They are found in the liver of sheep.**Sol.:***Fasciola* is a flatworm having head lobe, oral and ventral sucker but hooks are absent.*Planaria* is aquatic and free living. *Ascaris* is an aschelminth.

177. Answer (3)

**Hint:** Aschelminth**Sol.:** The body of the aschelminths is circular in cross section, hence, the name roundworms. Sexes are separate. Often females are longer than males. Liver fluke and tapeworm are dorso-ventrally flattened.

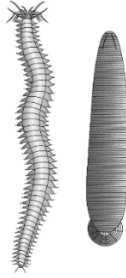
178. Answer (4)

**Hint:** Feature of flatworms**Sol.:** *Ancylostoma* belongs to the phylum Aschelminthes.Their alimentary canal is complete with a well developed muscular pharynx. An excretory tube removes body wastes from the body cavity through the excretory pore. Sexes are separate (dioecious), *i.e.*, males and females are distinct. Often females are longer than males.

179. Answer (2)

**Hint:** Separate sexes are seen in an aquatic annelid

**Sol.:**



**Nereis**

Present ← Parapodia → Absent

External ← Fertilization → Internal

Aquatic ← Habitat → Various habitats

**Hirudinaria**

180. Answer (3)

**Hint:** Roundworm.

**Sol.:** *Ascaris* is dioecious. *Taenia*, *Hirudinaria* and earthworm are hermaphrodites.



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## All India Aakash Test Series for NEET - 2026

**TEST - 5 (Code-D)**[Click here for Code-C Sol.](#)

Test Date : 23/02/2025

**ANSWERS**

1. (2)	37. (3)	73. (2)	109. (3)	145. (3)
2. (3)	38. (1)	74. (3)	110. (1)	146. (1)
3. (2)	39. (3)	75. (3)	111. (3)	147. (2)
4. (3)	40. (4)	76. (1)	112. (3)	148. (4)
5. (4)	41. (2)	77. (4)	113. (4)	149. (3)
6. (2)	42. (1)	78. (1)	114. (2)	150. (4)
7. (1)	43. (3)	79. (1)	115. (3)	151. (3)
8. (4)	44. (2)	80. (3)	116. (1)	152. (2)
9. (2)	45. (2)	81. (2)	117. (4)	153. (2)
10. (2)	46. (2)	82. (3)	118. (2)	154. (3)
11. (2)	47. (3)	83. (3)	119. (3)	155. (4)
12. (3)	48. (3)	84. (1)	120. (4)	156. (4)
13. (4)	49. (2)	85. (4)	121. (2)	157. (3)
14. (2)	50. (1)	86. (1)	122. (3)	158. (3)
15. (4)	51. (4)	87. (4)	123. (3)	159. (1)
16. (3)	52. (1)	88. (2)	124. (3)	160. (2)
17. (1)	53. (2)	89. (2)	125. (1)	161. (1)
18. (1)	54. (3)	90. (3)	126. (2)	162. (4)
19. (4)	55. (4)	91. (4)	127. (3)	163. (2)
20. (3)	56. (4)	92. (3)	128. (1)	164. (3)
21. (1)	57. (4)	93. (2)	129. (4)	165. (2)
22. (4)	58. (2)	94. (2)	130. (3)	166. (4)
23. (1)	59. (3)	95. (4)	131. (1)	167. (3)
24. (4)	60. (1)	96. (3)	132. (4)	168. (4)
25. (3)	61. (1)	97. (3)	133. (1)	169. (3)
26. (2)	62. (2)	98. (4)	134. (4)	170. (4)
27. (3)	63. (2)	99. (4)	135. (4)	171. (4)
28. (2)	64. (3)	100. (4)	136. (3)	172. (3)
29. (2)	65. (1)	101. (3)	137. (2)	173. (3)
30. (1)	66. (2)	102. (2)	138. (4)	174. (2)
31. (1)	67. (3)	103. (3)	139. (3)	175. (1)
32. (1)	68. (4)	104. (4)	140. (3)	176. (4)
33. (1)	69. (1)	105. (2)	141. (3)	177. (2)
34. (3)	70. (3)	106. (2)	142. (4)	178. (4)
35. (4)	71. (3)	107. (3)	143. (4)	179. (3)
36. (2)	72. (1)	108. (3)	144. (4)	180. (3)

# HINTS & SOLUTIONS

## [PHYSICS]

1. Answer (2)

**Hint:** Excess pressure inside water drop =  $\frac{2T}{R}$

$$\text{Sol.: } \frac{P_1}{P_2} = \frac{R_2}{R_1} \Rightarrow 2 = \frac{R_2}{R_1}$$

$$R_2 = 2R_1$$

$$\frac{M_1}{M_2} = \left(\frac{R_1}{R_2}\right)^3 = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$$

2. Answer (3)

**Hint:** Stress =  $Y \times$  Strain

$$\text{Sol.: } \text{Stress} = 7 \times 10^{10} \times \frac{0.14}{100} = 0.98 \times 10^8 \\ = 9.8 \times 10^7 \text{ N/m}^2$$

3. Answer (2)

**Hint:** Shear Modulus =  $\frac{\text{Tangential stress}}{\text{Shear strain}}$

$$\text{Sol.: } \text{Shear Modulus} = \frac{F}{\infty} = 0$$

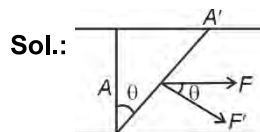
4. Answer (3)

**Hint:** Slope of stress-strain graph gives Young's modulus.

$$\text{Sol.: } \frac{Y_A}{Y_B} = \frac{\tan 30^\circ}{\tan 60^\circ} = \frac{1}{\sqrt{3} \cdot \sqrt{3}} = \frac{1}{3}$$

5. Answer (4)

**Hint:** Longitudinal stress =  $\frac{\text{Normal Force}}{\text{Area}}$



$$A' \cos \theta = A$$

$$A' = \frac{A}{\cos \theta} \text{ and } F' = F \cos \theta$$

Longitudinal stress =

$$\frac{F'}{A'} = \frac{F \cos^2 \theta}{A} = \left(\frac{F}{A}\right) (\cos 30^\circ)^2 = \frac{3}{4} \frac{F}{A}$$

6. Answer (2)

**Hint & Sol.:** When a body floats, its weight is balanced by net upward thrust provided by displaced volume of liquid.

7. Answer (1)

**Hint & Sol.:** As air continuously moves out of the balloon, it gradually deflates, causing the number of air molecules inside the balloon to decrease. Consequently, the pressure inside the balloon also decreases. Although the internal pressure remains higher than the external atmospheric pressure, it progressively reduces as more air escapes from the balloon.

8. Answer (4)

**Hint:** Viscous force =  $\eta A \frac{dv}{dx}$

$$\text{Sol.: } [\text{MLT}^{-2}] = [\eta] \left[ \text{L}^2 \cdot \frac{\text{LT}^{-1}}{\text{L}} \right]$$

$$[\text{MLT}^{-2}] = [\eta] [\text{L}^2 \cdot \text{T}^{-1}]$$

$$[\text{ML}^{-1}\text{T}^{-1}] = [\eta]$$

9. Answer (2)

**Hint:** The pressure is greater in concave side.

$$\text{Sol.: } P_A - P_0 = \frac{2S}{r} \Rightarrow P_A = P_0 + \frac{2S}{r}$$

10. Answer (2)

**Hint:** Surface energy =

Surface tension  $\times$  Change in area

$$\text{Sol.: } \frac{4}{3} \pi R^3 = 8 \times \frac{4}{3} \pi r^3$$

$$\frac{R}{2} = r$$

$$\Delta U = S \Delta A$$

$$= 0.5 [8 \times 4\pi r^2 - 4\pi R^2]$$

$$= 0.5 \times 4\pi \left[ 8 \frac{R^2}{4} - R^2 \right]$$

$$= \frac{1}{2} \times 4\pi R^2 = 2\pi R^2 = 2 \times \frac{22}{7} \times 7 \times 7 \times 10^{-6}$$

$$\Delta U = 14 \times 22 \times 10^{-6} \text{ J}$$

$$= 308 \times 10^{-6} \text{ J} = 3.08 \times 10^{-4} \text{ J} = 0.31 \text{ mJ}$$

11. Answer (2)

**Hint:** The difference of pressure for a horizontal accelerated tube is

$$P_2 - P_1 = \rho aL$$

where  $a$  is the horizontal acceleration

**Sol.:**  $P_2 - P_1 = \rho gh = \rho aL$

$$gh = \frac{g}{2}L \Rightarrow h = \frac{L}{2}$$

12. Answer (3)

**Hint:** Weight of block is balanced by net upward thrust due to the liquids.

**Sol.:**  $\rho L^3 g = \rho_1 \frac{L}{3} L^2 g + \rho_2 \left(\frac{2L}{3}\right) L^2 g$

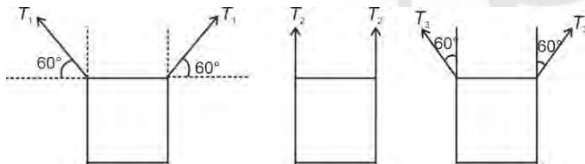
$$\rho = \frac{\rho_1}{3} + \frac{2\rho_2}{3}$$

$$\rho = \frac{\rho_1 + 2\rho_2}{3}$$

13. Answer (4)

**Hint:** Tension in wires balances the weight of frame.

**Sol.:**



$$2T \sin \theta = mg$$

$$T_1 = \frac{mg}{\sqrt{3}}, T_2 = \frac{mg}{2} \text{ and } T_3 = mg$$

Hence tension is maximum in figure (iii)

$$\text{Stress} = \frac{\text{Force}}{\text{Area}}$$

Extension  $\propto$  Force

14. Answer (2)

**Hint:** Young's modulus of steel is more than of copper wire.

**Sol.:**  $\Delta l_s = \frac{Fl}{AY_s}, \Delta l_c = \frac{Fl}{AY_c}$

$$\Delta l_s < \Delta l_c$$

15. Answer (4)

**Hint:**  $T(K) = T(^{\circ}C) + 273$

**Sol.:**  $\frac{T - 273}{100} = \frac{T - 32}{180}$

$$T - 273 = \frac{5}{9}T - \frac{5}{9} \times 32$$

$$9T - 9 \times 273 = 5T - 5 \times 32$$

$$T = 574.25 \text{ K} = 574.25^{\circ}F$$

16. Answer (3)

**Hint & Sol.:** When heated uniformly, all dimensions increases as in photographic enlargement.

17. Answer (1)

**Hint:** The heat will be lost by hot water to cold water.

**Sol.:**  $1(100^{\circ}C - T) = 2(T - 60^{\circ}C)$

$$100^{\circ}C - T = 2T - 120^{\circ}C$$

$$3T = 220^{\circ}C$$

$$T = \frac{220}{3}^{\circ}C = 73.3^{\circ}C$$

18. Answer (1)

**Hint:** Treat the rod as if it is fixed at one end and pulled at the other end.

**Sol.:**  $\Delta y = \frac{(F_1 + F_2)L}{2AY} = \frac{2FL}{2AY} = \frac{FL}{AY}$

19. Answer (4)

**Hint:**  $I_0 = \frac{2}{5}MR^2$

**Sol.:**  $\frac{\Delta I_0}{I_0} = \frac{2\Delta R}{R}$

$$\frac{\Delta V}{V} = \frac{3\Delta R}{R} = \gamma \Delta T$$

$$\frac{\Delta R}{R} = \frac{\gamma}{3} \Delta T$$

$$\frac{\Delta I_0}{I_0} = 2 \left( \frac{\gamma}{3} \right) \Delta T$$

$$\Delta I_0 = \frac{2}{3} \gamma I_0 \Delta T$$

20. Answer (3)

**Hint:** Thermal capacities

**Sol.:**  $\frac{S_1}{S_2} = \frac{m_1}{m_2} = \left(\frac{L_1}{L_2}\right)^3 = \left(\frac{2}{3}\right)^3$

$$\frac{S_1}{S_2} = \frac{8}{27}$$

21. Answer (1)

**Hint:** If strain is equal in both wires, then

$$\frac{F_1}{A_1 Y_1} = \frac{F_2}{A_2 Y_2}$$

**Sol.:**  $T_P \times \frac{L}{3} = T_Q \frac{2L}{3}$

$$T_P = 2T_Q$$

$$\Delta l_P = \Delta l_Q$$

$$\frac{T_P l_P}{Y_P A} = \frac{T_Q l_Q}{Y_Q (2A)}$$

$$l_P = l_Q$$

$$\frac{T_P}{Y_P} = \frac{T_Q}{Y_Q (2)}$$

$$\frac{Y_P}{Y_Q} = \frac{2T_P}{T_Q} = 2(2) = 4$$

22. Answer (4)

**Hint & Sol:** Adding detergent decreases the surface tension of water.

23. Answer (1)

**Hint:** The pressure will create the lift force.

$$\text{Sol.: } (\Delta P) A = mg$$

$$\Delta P = \frac{mg}{A}$$

24. Answer (4)

**Hint & Sol:**

Weight  $\propto$  Stress  $\propto$  Strain  $\propto$  Change in length

25. Answer (3)

**Hint:** The vertical rise of liquid in capillary tube remains constant.

$$\text{Sol.: } \frac{2S \cos \theta}{r} = \rho gh = \rho gl \sin \phi$$

$$l = \frac{h}{\sin \phi} = \frac{h}{1/2} = 2h = 2 \times h = 20 \text{ cm}$$

26. Answer (2)

**Hint:** Tension in the wire does not change.

$$\text{Sol.: } \Delta l = \frac{Tl}{AY} \quad \dots(i)$$

$$\Delta l' = \Delta l_1 + \Delta l_2$$

$$= \frac{Tl}{2YA} + \frac{Tl}{2YA}$$

$$\Rightarrow \Delta l' = \frac{Tl}{YA} \quad \dots(ii)$$

From (i) and (ii)

$$\Delta l' = \Delta l$$

27. Answer (3)

**Hint:** The surface energy of bigger drop is smaller than total surface energy of smaller drops.

**Sol.:** When a bigger drop is formed, the surface energy decreases. The decrease in surface energy gives rise to the temperature of bigger drop because energy has been liberated in this process.

28. Answer (2)

$$\text{Hint: } h = \frac{2S \cos \theta}{\rho gr}$$

$$\text{Sol.: } h' = \frac{2S \cos \theta}{\rho g_{\text{eff}} r}$$

$$h' = \frac{2S \cos \theta}{\rho \frac{g}{2} r}$$

$$h' = \frac{4S \cos \theta}{\rho gr} = 2 \times 8 = 16 \text{ cm}$$

29. Answer (2)

**Hint:** The acceleration of the ball will decrease with increase in velocity.

$$\text{Sol.: } a = g - \frac{k}{m} v$$

$$\frac{da}{dt} = -\frac{k}{m} \frac{dv}{dt}$$

$$\frac{da}{dt} + \frac{k}{m} a = 0$$

$$a = ge^{-\frac{k}{m} t}$$

30. Answer (1)

**Hint & Sol:** The castor oil is highly viscous. The friction force of layers quickly absorb kinetic energy of oil particles.

31. Answer (1)

**Hint:** Increasing the temperature will decrease the density of water.

$$\text{Sol.: } N = mg - B = mg - \rho Vg$$

As  $T \uparrow$ ,  $\rho \downarrow$ ,  $B \downarrow$  and so  $N \uparrow$ .

32. Answer (1)

$$\text{Hint: } \frac{E}{t} = P = \sigma eAT^4$$

$$\text{Sol.: } \frac{E_2}{E_1} = \left( \frac{A_2}{A_1} \right) \left( \frac{T_2}{T_1} \right)^4$$

$$\frac{E_2}{E_1} = \left( \frac{1}{4} \right) \left( \frac{600}{300} \right)^4 = \frac{1}{4} \times 16$$

$$P_2 = 4P_1$$

33. Answer (1)

**Hint:** To cook the rice easily, more heat should be absorbed before boiling.

**Sol.:** High pressure increases the boiling point of water. It allows water to absorb sufficient heat before it boils.

34. Answer (3)

**Hint:**  $H = \frac{(T_2 - T_1)}{R}$ , where  $R$  is thermal resistance

and  $R_T = \frac{L}{kA}$  for one rod

**Sol.:**  $H = \frac{T_2 - T_1}{2R_T}$

$$H' = \frac{T_2 - T_1}{\frac{R_T}{2}}$$

$$H' = 4H$$

35. Answer (4)

**Hint & Sol.:**

(1) Point  $A$  is proportional limit. Till  $A$ , the stress is directly proportional to strain.

(2) Point  $B$  is yield point. After point  $B$ , if stress is increased there will be permanent extension even after removal of force.

(3) Point  $C$  is ultimate tensile strength. This is the maximum stress developed in given wire.

(4) Point  $D$  is fracture point.

36. Answer (2)

**Hint:** Use equation of continuity

**Sol.:**  $A_1v_1 = A_2v_2 + A_3v_3$

$$4A = 0.8A \times 3 + 1.2A \times v$$

$$4 - 2.4 = 1.2v$$

$$1.6 = 1.2v$$

$$v = \frac{1.6}{1.2} = \frac{4}{3} \text{ m s}^{-1}$$

37. Answer (3)

**Hint:** Use  $v = \sqrt{2gh}$

**Sol.:**  $v = \sqrt{2 \times 10 \times 80 \times 10^{-2}} = \sqrt{16} = 4 \text{ m s}^{-1}$

38. Answer (1)

**Hint:** Use Bernoulli's theorem

**Sol.:**  $\Delta P = \frac{1}{2}\rho v_2^2 - \frac{1}{2}\rho v_1^2$

$$5 \times 10^{-2} \times 10 \times 13600 = \frac{1}{2} \times 1000 [v_2^2 - v_1^2]$$

$$\frac{5 \times 1360}{500} = v_2^2 - v_1^2$$

$$13.6 + v_1^2 = v_2^2$$

$$13.6 \gg v_1^2$$

$$\text{Therefore } v_2 = \sqrt{13.6} \text{ m s}^{-1}$$

39. Answer (3)

**Hint:** Pressure on the bottom =  $\frac{\text{Force}}{\text{Area}}$

**Sol.:** The height of water is maximum in vessel  $C$ , so pressure at the bottom will be maximum in  $C$ . As all the vessel have same base area, so force will be maximum in  $C$ .

40. Answer (4)

**Hint:**  $H = \frac{kA}{L}(T_2 - T_1) = \frac{T_2 - T_1}{R_T}$

**Sol.:**  $\frac{T_A - T_C}{2R} = \frac{T_C - T_D}{R} \Rightarrow \frac{120 - T_C}{2} = \frac{T_C - 20^\circ}{1}$

$$160^\circ = 3T_C$$

$$T_C = \frac{160^\circ}{3} \text{ C}$$

41. Answer (2)

**Hint & Sol:** The specific heat capacity of a substance depends upon the temperature and nature of substance.

42. Answer (1)

**Hint:**  $Q = ms\Delta T$

**Sol.:**  $Q = \frac{50}{1000} \times 4200 \times 20 \text{ J} = 4200 \text{ J}$

43. Answer (3)

**Hint:** The temperature of water remains constant

**Sol.:**  $\Delta Q = ms\Delta T$

$$s = \frac{\Delta Q}{m\Delta T} = \frac{\Delta Q_L}{0} \rightarrow \infty$$

44. Answer (2)

**Hint:** Heat flow rate  $H = \frac{kA(T_2 - T_1)}{L}$

**Sol.:**  $\frac{kA}{L}(T_2 - T_1) = \frac{kA}{l}(T_2 - T)$

$$\frac{l}{L}(T_2 - T_1) = T_2 - T$$

$$T = T_2 - \frac{l}{L}(T_2 - T_1)$$

Straight line  $T-l$  graph with negative slope

45. Answer (2)

**Hint:**  $\Delta Q = mL$ , where  $L$  is latent heat of fusion

**Sol.:**  $m_w s_w \Delta T = m_{ice} \times 80$

$$\frac{4000}{80} = m_{ice}$$

$$50 \text{ g} = m_{ice}$$

## [CHEMISTRY]

46. Answer (2)

**Hint:** Sum of oxidation states of all the elements in a compound will be zero.

**Sol.:**  $x_2(yz)_4$

$$+4 \times 2 + 4(+1 - 3)$$

$$+8 - 8 = 0$$

So correct formula of compound is  $x_2(yz)_4$

47. Answer (3)

**Hint:**  $AlCl_3$  in acidified aqueous solution forms octahedral  $[Al(H_2O)_6]^{3+}$  ion.

**Sol.:** In  $[Al(H_2O)_6]^{3+}$  ion, the 3d orbitals of Al are involved and the hybridisation state of Al is  $sp^3d^2$ .

48. Answer (3)

**Hint:**  $SiCl_4 + 4H_2O \longrightarrow Si(OH)_4 + 4HCl$   
Silicic acid

**Sol.:**  $[SiF_6]^{2-}$  is known whereas  $[SiCl_6]^{2-}$  not due to two main reasons.

(i) Six large chloride ions cannot be accommodated around  $Si^{4+}$  due to limitation of its size.

(ii) Interaction between lone pair of chloride ion and  $Si^{4+}$  is not very strong.

• Due to unavailability of d orbitals in carbon atom of  $CCl_4$ , does not undergo hydrolysis.

49. Answer (2)

**Hint & Sol.:**

Atomic radius order :  $Tl > In > Al > Ga > B$

• Electronegativity :

Al Ga

1.5 1.6

• Ionic radius order :-  $Tl^{3+} > In^{3+}, Ga^{3+} > Al^{3+}$

50. Answer (1)

**Hint:**  $Cr_2O_7^{2-} + 2FeC_2O_4 + 14H^+ \longrightarrow 2Cr^{3+} + 2Fe^{3+} + 4CO_2 + 7H_2O$

**Sol.:** Oxidation of two moles of ferrous oxalate = 1 mole  $K_2Cr_2O_7$  required

Oxidation of 5 moles of ferrous oxalate

$$= \frac{1}{2} \times 5 \text{ moles } K_2Cr_2O_7 \text{ required}$$

51. Answer (4)

**Hint:**  $HCOOH \xrightarrow[\text{conc. } H_2SO_4]{373 K} H_2O + CO$

**Sol.:** In CO molecule  $\text{:C} \equiv \text{O:}$ , one sigma and two  $\pi$  bonds are present.

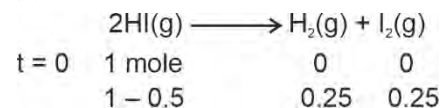
CO is a colourless, odourless and almost water insoluble gas.

52. Answer (1)

**Hint:** At equilibrium  $\Delta G = 0$

$$\Delta G = \Delta G^\circ + RT \ln K_{eq}$$

**Sol.:**



$$K_c = \frac{0.25 \times 0.25}{0.5 \times 0.5} = \frac{1}{4}$$

$$\Delta G^\circ = -2.303 RT \log \left( \frac{1}{4} \right)$$

$$= 1.386 RT$$

53. Answer (2)

**Hint:** Stability of dihalides increases down the group in group -14

**Sol.:**  $GeI_4$  is thermally more stable than  $GeI_2$  and  $PbI_2$  is thermally more stable than  $PbI_4$

54. Answer (3)

**Hint:** For basic buffer solution

$$pOH = pK_b + \log \frac{[\text{Salt}]}{[\text{Base}]}$$

$$\text{Sol.} \quad pOH = 3.27 + \log \frac{0.2}{0.01}$$

$$= 3.27 + 1 + 0.3010 = 4.571$$

$$pH = pOH + pK_w$$

$$pH = 14 - 4.571$$

$$pH = 9.429$$

55. Answer (4)

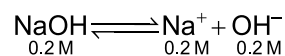
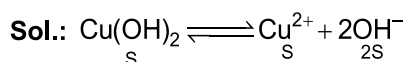
**Hint:** Maximum covalence of boron is 4.

**Sol.:** Due to non-availability of d orbitals boron is unstable to form  $BF_6^{3-}$  ion.

Except Tl, all group 13 elements react with halogens to form trihalides.

56. Answer (4)

**Hint:** In the presence of common ion, the solubility of sparingly soluble salts decrease.



$$K_{sp} = [Cu^{2+}][OH^-]^2$$

$$K_{sp} = [S][2S+0.2]^2$$

As  $K_{sp}$  is small,  $2S \ll 0.2$

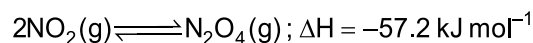
Thus  $(0.2 + 2S) \approx 0.2$

Hence  $2.2 \times 10^{-20} = S(0.2)^2$

$$S = \frac{2.2 \times 10^{-20}}{0.2 \times 0.2} = 5.5 \times 10^{-19} \text{ M}$$

57. Answer (4)

**Hint:**



According to Le Chatelier's principle for exothermic reaction, temperature increases then reaction shift in backward direction.

**Sol.:** For exothermic reaction, reaction shift in forward direction with decreases in temperature.

Pressure increases, reaction shift in those direction which have lesser number of gaseous molecules.

58. Answer (2)

$$\text{Hint: } K_p = \frac{P_{\text{CO}_2}}{P_{\text{CO}}}$$

$P$  = equilibrium partial pressure

**Sol.:**

	$\text{FeO}(\text{s}) + \text{CO}(\text{g}) \rightleftharpoons \text{Fe}(\text{s}) + \text{CO}_2(\text{g})$
initial pressure	4                      0
At equilibrium	$4 - x$ $x$

$$K_p = \frac{P_{\text{CO}_2}}{P_{\text{CO}}}$$

$$K_p = \frac{x}{4 - x}$$

$$1.5 = \frac{x}{4 - x}$$

$$x = 6 - 1.5x$$

$$x = \frac{6}{2.5} = 2.4$$

Equilibrium partial pressure of  $\text{CO}(\text{g})$

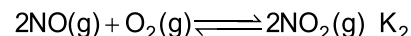
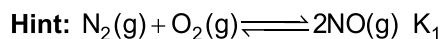
$$= 4 - 2.4 = 1.6 \text{ atm}$$

59. Answer (3)

**Hint:** A catalyst increases the rate of the chemical reaction by making available of a new lower energy pathway for the conversion of reactants to products.

**Sol.:** The value of equilibrium constant is independent of initial concentration of the reactants and products. Catalyst does not affect the equilibrium composition of a reaction mixture.

60. Answer (1)



$$K_3 = K_1 \times K_2$$

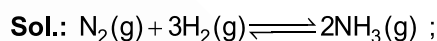
$$\text{Sol.} \quad K_3 = K_1 \times K_2$$

$$K_3 = 10 \times 5 = 50$$

61. Answer (1)

$$\text{Hint: } K_p = K_c(\text{RT})^{\Delta n_g}$$

$\Delta n_g$  = number of moles of gaseous product molecules – number of moles of gaseous reactant molecules.



$$\Delta n_g = 2 - 4 = -2$$

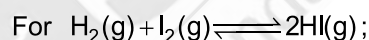
$$K_p = K_c(\text{RT})^{-2}$$

$$K_p = \frac{K_c}{(\text{RT})^2}$$



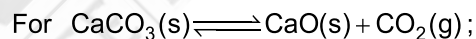
$$\Delta n_g = 2 - 1 = 1$$

$$K_p = K_c(\text{RT})$$



$$\Delta n_g = 2 - 2 = 0$$

$$K_p = K_c$$

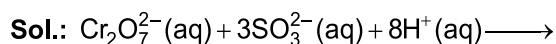


$$\Delta n_g = 1$$

$$K_p = K_c(\text{RT})$$

62. Answer (2)

**Hint:** Balance the atoms as well as charge.



63. Answer (2)

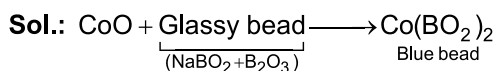
**Hint:** Down the group the size increases so bond enthalpy decreases.

**Sol.:**

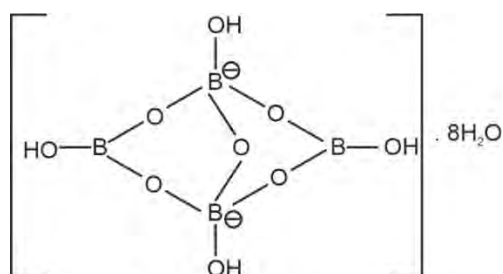
Bond	Bond enthalpy/kJ mol <sup>-1</sup>
C–C	348
Si–Si	297
Ge–Ge	260
Sn–Sn	240

64. Answer (3)

**Hint:** Metaborates of many transition metals have characteristic colours and, therefore, borax bead test can be used to identify them.



65. Answer (1)

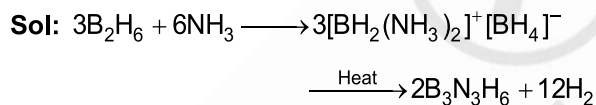
**Hint:**

Structure of borax

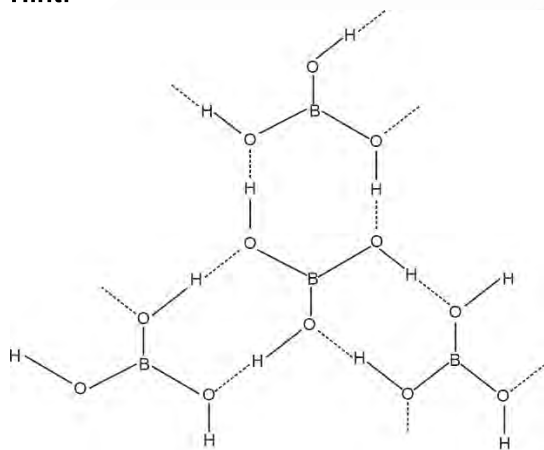
**Sol.:** Total number of B–O–B bonds in borax are 5.

66. Answer (2)

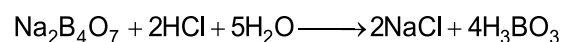
**Hint:** Reaction of ammonia with  $\text{B}_2\text{H}_6$  gives initially  $\text{B}_2\text{H}_6 \cdot 2\text{NH}_3$  which is formulated as  $[\text{BH}_2(\text{NH}_3)_2]^+ [\text{BH}_4]^-$



67. Answer (3)

**Hint:**

(Structure of boric acid)

**Sol.:**

Boric acid is a weak monobasic Lewis acid.

68. Answer (4)

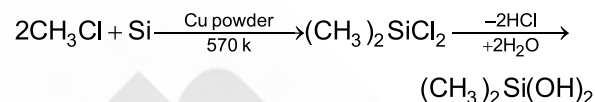
**Hint:** Le Chatelier's principle states that a change in any of the factors that determine the equilibrium conditions of a system will cause the system to change in such a manner so as to reduce or to counteract the effect of the change.

**Sol.:** By decreasing the volume of reaction vessel, number of moles in per unit volume increases and reaction shift in that direction which have lesser number of gaseous molecules.

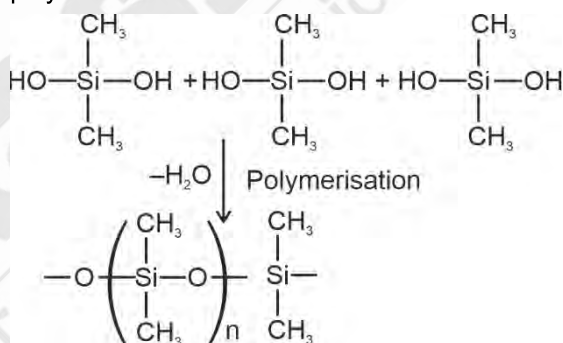
69. Answer (1)

**Hint & Sol.:** Oxidation state of metal in alloy is zero hence oxidation state of Na in sodium amalgam will be zero.

70. Answer (3)

**Hint:**

**Sol.:** Hydrolysis of  $(\text{CH}_3)_2\text{SiCl}_2$  followed by condensation polymerisation yields straight chain polymer.



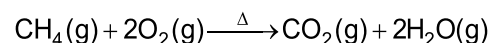
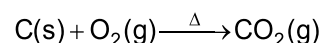
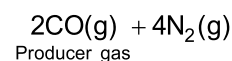
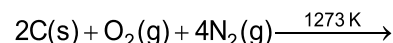
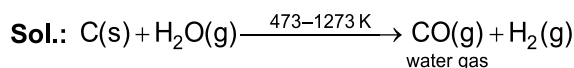
71. Answer (3)

**Hint:** The element in the form of reacting substance is in the intermediate oxidation state, to show disproportionation reaction.

**Sol.:** In  $\text{O}_2\text{F}_2$  molecule, fluorine has  $-1$  oxidation state.

72. Answer (1)

**Hint:**  $\text{CO}(\text{g}) + \text{H}_2(\text{g})$  is known as water gas.



73. Answer (2)

$$\text{Hint: } \text{pH} = \frac{1}{2}[\text{pK}_w + \text{pK}_a + \log C]$$

Sol.: For WASB

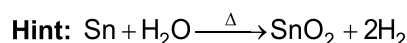
$$\text{pH} = \frac{1}{2}[\text{pK}_w + \text{pK}_a + \log C]$$

$$\text{pH} = \frac{1}{2}[14 + 4.76 + \log 0.1]$$

$$= \frac{1}{2}[18.76 - 1]$$

$$= \frac{17.76}{2} = 8.88 \approx 8.9$$

74. Answer (3)

Sol.:  $\text{PbF}_4$  and  $\text{SnF}_4$  are ionic in nature and catenation power of silicon is greater than tin.Catenation power  $\text{C} \gg \text{Si} > \text{Ge} \approx \text{Sn}$ 

75. Answer (3)

Hint: Carbon exhibits many allotropic forms; diamond and graphite are crystalline form of carbon.

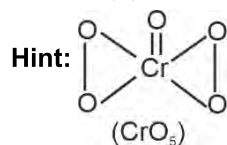
Sol.: In graphite, carbon atom is  $sp^2$  hybridised but in diamond carbon atom is  $sp^3$  hybridised.

Carbon black, coke and charcoal are all impure forms of graphite or fullerenes.

76. Answer (1)

Hint & Sol:  $\text{CO}_2$ ,  $\text{SiO}_2$ ,  $\text{GeO}_2$  are acidic,  $\text{CO}$  is neutral while  $\text{SnO}$  and  $\text{PbO}_2$  are amphoteric in nature.

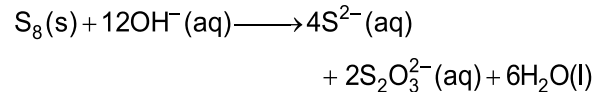
77. Answer (4)

Sol.: In  $\text{CrO}_5$  molecule, two peroxy linkages are present and oxidation number of Cr is + 6.

78. Answer (1)

Hint: In a disproportionation reaction an element in one oxidation state is simultaneously oxidised and reduced.

Sol.:  $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \xrightarrow{\Delta} \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$  is combination reaction.
$$2\text{KClO}_3(\text{s}) \xrightarrow{\Delta} 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$$
 is decomposition reaction.

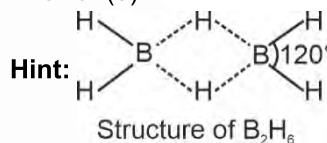
$$\text{Cl}_2(\text{g}) + 2\text{KBr}(\text{aq}) \longrightarrow 2\text{KCl}(\text{aq}) + \text{Br}_2(\text{l})$$
 is non-metal displacement reaction


is disproportionation reaction

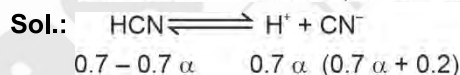
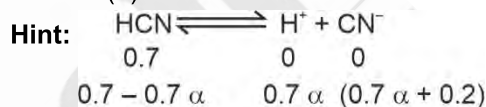
79. Answer (1)

Hint &amp; Sol.: Boron fibres are used in making bullet proof vest, borax is used as a flux for soldering metals, graphite is used for electrodes in batteries and silicones are used for water proofing of fabrics.

80. Answer (3)

Sol.: In  $\text{B}_2\text{H}_6$ , there are two  $3c - 2e^-$  bonds and four  $2c - 2e^-$  bonds.

81. Answer (2)



$$K_a = \frac{[\text{H}^+][\text{CN}^-]}{[\text{HCN}]}$$

$$K_a = \frac{0.7\alpha [0.7\alpha + 0.2]}{0.7 [1 - \alpha]}$$

$$= \frac{0.7\alpha^2 + 0.2\alpha}{1 - \alpha} \quad \alpha \ll 1$$

$$\text{So } 1 - \alpha \approx 1$$

$$K_a = 0.2\alpha$$

$$\alpha = \frac{4.9 \times 10^{-9}}{0.2}$$

$$[\text{H}^+] = C\alpha$$

$$= \frac{0.7 \times 4.9 \times 10^{-9}}{0.2} = 1.715 \times 10^{-9}$$

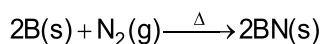
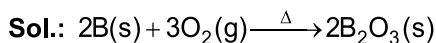
82. Answer (3)

Hint: For disproportionation reaction the element in the form of reacting substance is in the intermediate oxidation state.

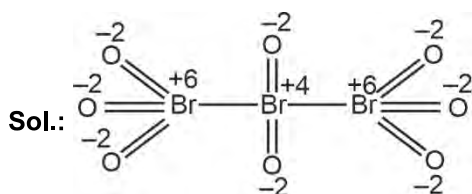
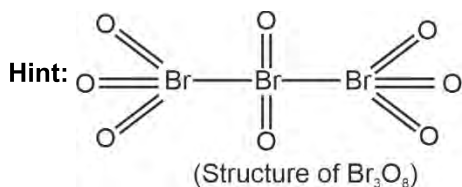
Sol.: The oxidation state of Cl is  $\text{ClO}^-$ ,  $\text{ClO}_2^-$ ,  $\text{ClO}_3^-$  are +1, +3 and +5 respectively but in  $\text{ClO}_4^-$  the oxidation state of Cl is +7, which is highest oxidation state of Cl

83. Answer (3)

**Hint:** Boron is unreactive in crystalline form.



84. Answer (1)



85. Answer (4)

**Hint:** Due to strong  $p\pi-p\pi$  back bonding, Lewis acidity decreases from  $\text{BI}_3$  to  $\text{BF}_3$ .

**Sol.:** Lewis acidity order:  $\text{BI}_3 > \text{BBr}_3 > \text{BCl}_3 > \text{BF}_3$

86. Answer (1)

**Hint:** Due to inert pair effect, the relative stability of +1 oxidation state progressively increases for heavier elements in group 13.

**Sol.:** The correct order of stability of +1 oxidation state is  $\text{Tl} > \text{In} > \text{Ga} > \text{Al}$ . In thallium +1 oxidation state is predominant, so  $\text{Tl}^{+3}$  is a good oxidising agent.

87. Answer (4)

**Hint:** Due to very strong crystalline lattice, boron has unusually high melting point.

**Sol.:**

Elements	(Melting point/K)
B	2453
Al	933
Ga	303
In	430
Tl	576

88. Answer (2)

$$\text{Hint: } E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ}$$

$$\text{Sol.: } E_{\text{cell}}^{\circ} = -0.76 - (-2.36) = +1.6 \text{ V}$$

89. Answer (2)

**Hint:** Generally down the group, ionization enthalpy decreases but for group-13 elements order is random.

**Sol.:**

Element	First Ionization enthalpy ( $\text{kJ mol}^{-1}$ )
B	801
Al	577
Ga	579
In	558
Tl	589

90. Answer (3)

**Hint:** Group 13 and group 14 belong to p-block.

**Sol.:** The group oxidation state of group 13 is +3 and group 14 is +4.

The general outer electronic configuration of group 13 and 14 are  $ns^2 np^1$  and  $ns^2 np^2$  respectively.

## [BOTANY]

91. Answer (4)

**Hint:** Calvin cycle occurs in the bundle sheath cells of  $\text{C}_4$  plants.

**Sol.:** In  $\text{C}_3$  pathway, the first stable product is 3-phosphoglycerate while in  $\text{C}_4$  pathway the first stable product is OAA.

92. Answer (3)

**Hint:** Coralloid roots are associated with nitrogen fixing cyanobacteria in *Cycas*.

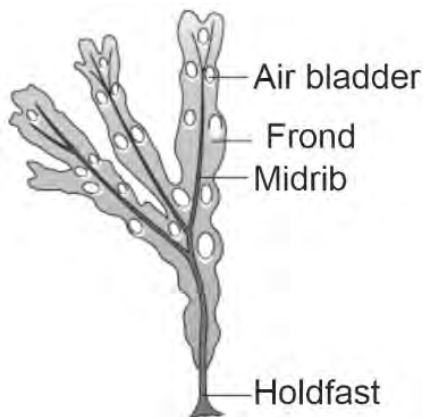
**Sol.:** The gymnosperms are plants in which the seeds are not enclosed within fruit wall.

93. Answer (2)

**Hint:** The sporophyte in mosses is not free-living but attached to the photosynthetic gametophyte and derives nourishment.

**Sol.:** The plant body of moss is a leafy gametophyte which has multicellular and branched rhizoids. It consists of upright, slender axis bearing spirally arranged leaves. This stage bears sex organs.

94. Answer (2)



95. Answer (4)

**Hint:** *Sphagnum* is a peat moss.**Sol.:** In *Cedrus*, stems are branched.

96. Answer (3)

**Hint:** Chlorophyll *a* is an universal pigment and it is present in all green plants.**Sol.:** Red algae can be distinguished from green algae as the former lack flagella and have complex post fertilization developments.

97. Answer (3)

**Hint:** Lax is present in gymnosperms.**Sol.:** Lax is spirally arranged sporophylls present in plants, like *Cycas*.

98. Answer (4)

**Hint:** It is a pteridophyte.**Sol.:** It is *Salvinia* and it is heterosporous.

99. Answer (4)

**Hint:** Dominant phase of gymnosperms is a sporophyte.**Sol.:** Dominant phase of gymnosperms and pteridophytes is a sporophyte. Dominant phase of bryophytes is a gametophyte. *e.g. Marchantia*.

100. Answer (4)

**Hint:** Pteridophytes are the first terrestrial plants to possess vascular tissues.**Sol.:** Bryophytes are non-vascular terrestrial plants of moist habitats.

101. Answer (3)

**Hint:**  $C_4$  plants respond to higher temperatures and they show higher rate of photosynthesis, while  $C_3$  plants have much lower temperature optimum.**Sol.:**  $C_4$  plants are less efficient at low temperature due to cold sensitivity of PEP synthetase enzyme.

102. Answer (2)

**Hint:** In bundle sheath cells of  $C_4$  plants,  $C_4$  acids are broken down to release  $CO_2$  and 3 carbon molecules.**Sol.:** The primary  $CO_2$  acceptor is a three carbon molecule phosphoenol pyruvate and it is present in mesophyll cell of  $C_4$  plants. So, the  $CO_2$  fixation in Hatch and Slack pathway occurs in mesophyll cell.

103. Answer (3)

**Hint:** Double fixation occurs in  $C_4$  plants like maize.**Sol.:** RuBP is a primary  $CO_2$  acceptor in  $C_3$  plants.

104. Answer (4)

**Hint:** Photorespiration involves three organelles viz. chloroplast, peroxisomes and mitochondria.**Sol.:** In  $C_4$  plants, photorespiration does not occur. This is because these plants have a special mechanism that increases the concentration of  $CO_2$  at the enzyme site.

105. Answer (2)

**Hint:**  $C_4$  plants have special type of leaf anatomy and they tolerate higher temperatures.**Sol.:** The temperature optimum for photosynthesis of different plants also depends on the habitat that they are adapted to.

106. Answer (2)

**Sol.:** Most of the plants that are adapted to dry tropical regions have the  $C_4$  – pathway, *e.g.* sugarcane, maize, etc.Wheat, tomato and bell pepper are the examples of  $C_3$  plants.

107. Answer (3)

**Hint:** In  $C_4$  plants, decarboxylation process occurs in bundle sheath cells.**Sol.:** Bundle sheath cells of the leaves of  $C_4$  plants are characterised by having large number of chloroplasts in which, grana are absent.

108. Answer (3)

**Hint:** Hill and Bendall proposed Z-scheme of light reaction, *i.e.*, photophosphorylation.**Sol.:** Oxygen evolving complex is associated with the PS II, which itself is physically located on the inner side of the membrane of the thylakoid.

109. Answer (3)

**Hint:** Carotenoids protect plant from excessive heat and prevent photooxidation of chlorophyll.

**Sol.:** In  $C_4$  plants, PEPcase is a strong  $CO_2$  fixing enzyme.

110. Answer (1)

**Hint:** Ruben, Kamen *et al.* used heavy but non-radioactive stable isotopes of oxygen  $^{18}O$  to prove that  $O_2$  evolve during light reaction comes from  $H_2O$  and not from  $CO_2$ .

**Sol.:**

- T.W Engelmann experimented on *Cladophora*.
- Jan Ingenhousz experimented with an aquatic plant (*Hydrilla*) and he showed that in bright sunlight, small bubbles were formed around the green parts of the plant.
- Julius von Sachs found that the green parts in plant is where glucose is made and glucose is usually stored as starch.

111. Answer (3)

**Hint :**  $CF_0$  of ATP synthase is embedded in the membrane of thylakoid.

**Sol. :** NADP reductase reaction occurs towards stroma side of the thylakoid membrane.

112. Answer (3)

**Hint:** Energy is required to pump protons across the membrane to create proton gradient.

**Sol.:** Chemiosmosis process requires a membrane, a proton pump, a proton gradient and ATP synthase.

113. Answer (4)

**Hint:** Photorespiration is a process which involves loss of fixed carbon as  $CO_2$  in plants in the presence of light.

**Sol.:** In photorespiration, there is neither synthesis of sugar nor of ATP. Rather results in the release of  $CO_2$  with utilisation of ATP.

114. Answer (2)

**Hint:** Protons which are produced during photolysis of water get accumulated within the lumen of the thylakoid.

**Sol.:** Chemiosmotic hypothesis explain how ATP are synthesised in chloroplasts.

115. Answer (3)

**Hint:** Assimilatory power are the major products of light reaction.

**Sol.:** Arnon used the term assimilatory powers to refer ATP and NADPH.

116. Answer (1)

**Sol.:** *Sequoia* is the tallest gymnosperm.

117. Answer (4)

**Hint:** Bryophytes are also called amphibians of plant kingdom and they have motile male gametes.

**Sol.:** In bryophytes, zygotes do not undergo reduction division immediately instead they undergo mitotic division to form the embryo which develop further into diploid multicellular sporophyte.

118. Answer (2)

**Hint:** Bryophytes are homosporous, *i.e.*, they produce only one type of spores.

**Sol.:** During sexual reproduction, the sex organs antheridia and archegonia are produced either on the same thallus (*Riccia*) or on the different thalli (*Marchantia*).

119. Answer (3)

**Hint:** Gametes are non-motile in red algae. Blue-green algae do not have flagella.

**Sol.:** In brown algae, motile cells have two unequal laterally placed flagella. In these algae, fucoxanthin is present.

120. Answer (4)

**Hint:** Algin is a hydrocolloid which has good water holding capacity. Cell wall of brown algae is usually covered with coating of algin.

**Sol.:** Agar is obtained from *Gelidium* and *Gracilaria*.

121. Answer (2)

**Hint:** Green algae have storage bodies called pyrenoids located in the chloroplasts.

**Sol.:** Green algae usually have a rigid cell wall made up of an inner layer of cellulose and an outer layer of pectose.

122. Answer (3)

**Hint :** Photosystem I is involved in both cyclic and non-cyclic photophosphorylation.

**Sol :** PS I is found in both grana and stroma lamellae.

123. Answer (3)

**Hint:** Dark reaction depends upon the product of light reaction (that occurs in thylakoid).

**Sol.:** Dark reactions of photosynthesis occurs in the fluid compartment surrounding the thylakoid called stroma.

124. Answer (3)

**Sol.:** A chromatographic separation of the leaf pigments shows that the colour of leaves is due to four pigments.

- (1) Chlorophyll *a* – Bright or blue green
- (2) Chlorophyll *b* – Yellow green
- (3) Xanthophyll – Yellow
- (4) Carotenoids – Yellow to yellow-orange

125. Answer (1)

**Hint:** Priestley in 1770 performed a series of experiments that revealed essential role of air in growth of green plants.

**Sol.:** Joseph Priestley concluded that the plants restore to the air whatever the breathing animals and the burning candle remove.

126. Answer (2)

**Hint:** *Selaginella* is an example of class Lycopsidea.

**Sol.:**

Class	Example
Psilopsida	– <i>Psilotum</i>
Sphenopsida	– <i>Equisetum</i>
Pteropsida	– <i>Adiantum</i>

127. Answer (3)

**Hint:** Bryophytes are non-vascular terrestrial plants of moist habitats.

**Sol.:** Bryophytes are also called amphibians of the plant kingdom because these plants can live in soil but are dependent on water for sexual reproduction.

128. Answer (1)

**Hint:** Artificial system of classification was given by Linnaeus.

**Sol.:** Classification system given by Linnaeus was based on the androecium structure.

129. Answer (4)

**Hint:** Pollen grains are formed in seed producing plants.

**Sol.:** In algae, transfer of gametes occurs through water.

130. Answer (3)

**Hint:** Types of chlorophyll present in green algae are chlorophyll *a* and *b*.

**Sol.:** In brown algae, chlorophyll *a* and chlorophyll *c* are present, e.g., *Ectocarpus*

In red algae chlorophyll *a* and *d* are present, e.g.-*Porphyra*.

131. Answer (1)

**Hint:** Floridean starch is the stored food in the members of Rhodophyceae.

**Sol.:** *Gracilaria* is an example of red algae and its stored food is floridean starch. Stored food in *Laminaria*, *Dictyota* and *Fucus* is laminarin or mannitol.

132. Answer (4)

**Hint:** In oogamous type of sexual reproduction small, motile or non-motile male gamete fuses with a large non-motile female gamete.

**Sol.:** In *Spirogyra*, isogamous type of sexual reproduction is present while in *Volvox*, *Polysiphonia* and *Fucus*, oogamous type of sexual reproduction is present.

133. Answer (1)

**Hint:** Phenetics is also known as numerical taxonomy.

**Sol.:** Cytotaxonomy is based on cytological information like chromosome number, structure and behaviour.

134. Answer (4)

**Hint:** *Volvox* and *Eudorina* are colonial forms of algae.

**Sol.:** The marine forms such as kelps form massive plant bodies.

135. Answer (4)

**Hint:** In natural system of classification, features like ultrastructure, anatomy, embryology and phytochemistry were considered.

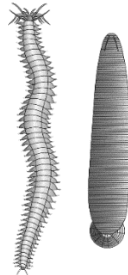
**Sol.:** Phylogenetic system of classification are based on evolutionary relationships between the various organisms, assuming that organisms belonging to the same taxa have common ancestor.

## [ZOOLOGY]

136. Answer (3)

**Hint:** Roundworm.**Sol.:** *Ascaris* is dioecious. *Taenia*, *Hirudinaria* and earthworm are hermaphrodites.

137. Answer (2)

**Hint:** Separate sexes are seen in an aquatic annelid**Sol.:****Nereis****Hirudinaria**

Present ← Parapodia → Absent

External ← Fertilization → Internal

Aquatic ← Habitat → Various habitats

138. Answer (4)

**Hint:** Feature of flatworms**Sol.:** *Ancylostoma* belongs to the phylum Aschelminthes.

Their alimentary canal is complete with a well developed muscular pharynx. An excretory tube removes body wastes from the body cavity through the excretory pore. Sexes are separate (dioecious), *i.e.*, males and females are distinct. Often females are longer than males.

139. Answer (3)

**Hint:** Aschelminth**Sol.:** The body of the aschelminths is circular in cross section, hence, the name roundworms. Sexes are separate. Often females are longer than males. Liver fluke and tapeworm are dorso-ventrally flattened.

140. Answer (3)

**Hint:** They are found in the liver of sheep.**Sol.:***Fasciola* is a flatworm having head lobe, oral and ventral sucker but hooks are absent.*Planaria* is aquatic and free living. *Ascaris* is an aschelminth

141. Answer (3)

**Hint:** Identify an aschelminth**Sol.:**

- *Ctenoplana* → External fertilization with indirect development
- *Planaria* → Internal fertilization but direct development
- *Ctenoplana* and *Pleurobrachia* → Undergo external fertilization

142. Answer (4)

**Hint:** Molluscs are eucoelomates.**Sol.:** True body cavity is lined by mesoderm. On both sides, *i.e.*, towards body wall as well as towards gut wall, this space is enclosed by the layers of mesoderm.

143. Answer (4)

**Hint:** A notochord is a primitive beginning of the backbone.**Sol.:** Notochord is a mesodermally derived rod-like structure formed on the dorsal side during the embryonic development in some animals. Animals with notochord are called chordates and those animals which do not form this structure are called non-chordates, *e.g.*, porifers to echinoderms.

144. Answer (4)

**Hint:** Loose cellular aggregates present in sponges.**Sol.:** In porifers, the digestion is intracellular.

Food is trapped by the collar cells or choanocytes and is digested within the cells.

Digestive system is absent in porifers.

145. Answer (3)

**Hint:** *Adamsia* is sessile.**Sol.:** *Adamsia* exists only in polyp form.

146. Answer (1)

**Hint:** Belongs to the phylum that exhibits metagenesis.

**Sol.:** *Physalia* – Portuguese-man of-war

*Pinctada* – Pearl oyster

*Pila* – Apple snail

147. Answer (2)

**Hint:** Aquatic flatworm.

**Sol.:**

- Coelenterata – They have a central gastrovascular cavity with a single opening, mouth on hypostome.
- *Sepia* (Mollusca) – Dioecious
- *Antedon* is an echinoderm.

148. Answer (4)

**Hint:** Cnidarians that exist in both body forms, sessile and free swimming, show this phenomenon.

**Sol.:** Cnidarians which exist in both body forms exhibit alternation of generation (Metagenesis), i.e., polyps produce medusae asexually and medusae form the polyps sexually.

In *Hydra*, *Gorgonia* and *Adamsia*, only polyp form is observed

149. Answer (3)

**Hint:** Spiny body

**Sol.:**

*Aplysia* – Sea hare

*Anopheles* – Mosquito

*Adamsia* – Sea anemone

*Asterias* – Star fish

150. Answer (4)

**Hint:** Digestion of food takes place in the cavity as well as inside the food vacuole.

**Sol.:** *Physalia* is a coelenterate and *Pleurobrachia* is a ctenophore.

Both are radially symmetrical and acoelomates with tissue level of body organisation.

Both show extracellular and intracellular digestion.

151. Answer (3)

**Hint:** Coelenterates possess nematocysts.

**Sol.:** The name cnidaria is derived from the cnidoblasts or cnidocytes (which contain the stinging capsules or nematocysts) present on the tentacles and the body. Cnidoblasts are used for anchorage, defense and for the capture of prey.

152. Answer (2)

**Hint:** Gemmule formation is often called internal budding.

**Sol.:** Sponges reproduce asexually by fragmentation and sexually by formation of gametes.

153. Answer (2)

**Hint:** Porifers are sessile.

**Sol.:** The most distinctive feature of echinoderms is the presence of water vascular system which helps in locomotion, capture and transport of food and respiration.

- Sponges have a water transport or canal system. It helps in food gathering, respiratory exchange and removal of waste. Adult porifers are sessile.

154. Answer (3)

**Hint:** Structure similar to notochord.

**Sol.:**

- In porifers, water enters through minute pores (ostia) in the body wall into a central cavity, spongocoel, from where it goes out through the osculum.
- Porifers show indirect development having a larval stage which is morphologically distinct from the adult.
- Echinoderms are organisms with calcareous ossicles present in the body hence, they are also called spiny bodied.
- Hemichordates have a rudimentary structure in the collar region called stomochord.

155. Answer (4)

**Hint:** Shown by chordates also

**Sol.:**

**Molluscs** : Triploblastic, coelomate and bilaterally symmetrical organisms.

Possess feather-like gills for respiration and excretion.

**Coelenterates:** Diploblastic, acoelomate and radially symmetrical organisms.

Respire by simple diffusion over their entire body surface.

156. Answer (4)

**Hint:** Some fundamental features are common to various organisms.

**Sol.:** The features used as the basis of animal classification are :

- (1) Level of organisation
- (2) Patterns of digestive, circulatory or reproductive system
- (3) Body symmetry
- (4) Number of germ layers during embryonic development
- (5) Nature of coelom or body cavity
- (6) Presence or absence of segmentation in the body
- (7) Presence or absence of notochord

157. Answer (3)

**Hint:** Different levels of body organisation.

**Sol.:** Though all members of animalia are multicellular, all of them do not exhibit the same pattern of organisation of cells.

Exoskeleton of arthropods is one of the characteristics that is mainly responsible for the diversification of insects on land.

158. Answer (3)

**Hint:** Include the members that have water vascular system

**Sol.:** Ctenophores, hemichordates and echinoderms are exclusively marine organisms and show indirect development.

159. Answer (1)

**Hint:** Members of the 2<sup>nd</sup> largest phylum in animal kingdom.

**Sol.:**

- *Pila* (Apple snail), *Pinctada* (Pearl oyster), *Octopus* (Devil fish) are molluscs.
- Sea urchin and sea cucumber are echinoderms. Sea-pen is a cnidarian.
- Roundworms and hookworms are aschelminths.

160. Answer (2)

**Hint:** Earthworms are known as farmer's friends.

**Sol.:**

- Mosquitoes act as vector and spread various diseases.
- Earthworms (Annelids) and hemichordates, both exhibit bilateral symmetry.
- Arthropods show organ-system level of body organisation.
- Both earthworms and mosquitoes possess a solid ventral nerve cord.

161. Answer (1)

**Hint:** These organisms are exclusively marine.

**Sol.:** *Echinus* and *Asterias* are echinoderms. These animals have an endoskeleton of calcareous ossicles and hence the name Echinodermata (spiny bodied). They show external fertilisation.

*Aplysia* and *Pila* are molluscs and their body is covered by a calcareous shell.

162. Answer (4)

**Hint:** Identify a roundworm

**Sol.:** Hookworms belong to the phylum Aschelminthes. They possess an excretory tube that removes body wastes from the body cavity through the excretory pore.

163. Answer (2)

**Hint:** Organisms with dorso-ventrally flattened body.

**Sol.:** Members of the phylum Platyhelminthes showed bilateral symmetry for the first time.

164. Answer (3)

**Hint:** The comb plates bear cilia.

**Sol.:** Ctenophores are commonly called sea walnuts or comb jellies. They are radially symmetrical, diploblastic organisms (two germ layers only) with tissue level of organisation.

The external surface of their body bears eight ciliated comb plates that help in locomotion.

165. Answer (2)

**Hint:** The symmetry possessed by the larvae of echinoderms is also possessed by arthropods.

**Sol.:** The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical. When any plane passing through the central axis of the body divides the organisms into two identical halves, it is called radial symmetry.

When the body of an organism can be divided into identical left and right halves in only one plane, it exhibits bilateral symmetry.

166. Answer (4)

**Hint:** Sea lily and sea urchin have spiny body.

**Sol.:**

*Aplysia* – Sea hare

*Echinus* – Sea urchin

*Pennatula* – Sea pen

*Antedon* – Sea lily

167. Answer (3)

**Hint:** Molluscs.

**Sol.:**

- The body of arthropods (*Apis*; *Laccifer*) is divided into head, thorax and abdomen.

- The body of molluscs (*Pila*, *Sepia*; *Chaetopleura*, *Loligo*, *Octopus*) is divided into distinct head, muscular foot and visceral hump.
- The body of hemichordates (*Saccoglossus*) is composed of an anterior proboscis, a collar and a long trunk.

168. Answer (4)

**Hint:** Feature of coelenterates.

**Sol.:** 'X' belongs to the phylum Mollusca. Molluscs are terrestrial or aquatic organisms having an organ-system level of organisation. They possess feather-like gills. They have respiratory and excretory functions. Their anterior head region has sensory tentacles. Their mouth contains a file-like rasping organ for feeding called radula. Their body is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.

169. Answer (3)

**Hint:** Chitin is composed of repeated units of N-acetylglucosamine.

**Sol.:** The body of arthropods is covered by chitinous exoskeleton.

They have jointed appendages.

They are mostly oviparous. Development may be direct or indirect.

170. Answer (4)

**Hint:** Arthropods exhibit open type of circulatory system.

**Sol.:** In an open type of circulatory system, the blood is pumped out of the heart and the cells and tissues are directly bathed in it.

Arthropods (*Periplaneta*), non-cephalopod molluscs (*Pila*; *Pinctada*) and hemichordates possess an open circulatory system.

*Pheretima* (Annelid) has a closed circulatory system.

171. Answer (4)

**Hint:** Sponges have cells arranged as loose cell aggregates.

**Sol.:** Porifers are primitive multicellular animals and have cellular level of body organisation. Some division of labour occur among the cells. The body is supported by a skeleton made up of spicules or spongin fibres.

172. Answer (3)

**Hint:** In some arthropods, tracheal tubes act as the respiratory structure.

**Sol.:** *Loligo* is a mollusc.

*Limulus* is known as the living fossil. It belongs to the phylum Arthropoda.

Its body is divided into cephalothorax and abdomen. It respire *via* book gills.

173. Answer (3)

**Hint:** Parasitic adaptations.

**Sol.:**

- *Aplysia* (Mollusc): Possesses a file-like rasping organ in mouth that helps in feeding.
- *Nereis* is an aquatic annelid which possesses lateral appendages called parapodia, for swimming.
- *Taenia* possesses both hooks and suckers.
- *Saccoglossus* (Hemichordate) possesses a rudimentary structure in the collar region called stomochord.

174. Answer (2)

**Hint:** Exclude the feature of vertebrates.

**Sol.:**

- Organ-system level of organisation is exhibited by aschelminths to chordates.
- *Hirudinaria* (Annelid) and *Bombyx* (Arthropod) show true metamerism.
- Molluscs (*Dentalium*) are unsegmented.
- Non-chordates possess a dorsal heart (if present).

175. Answer (1)

**Hint:** Platyhelminths are triploblastic acoelomates.

**Sol.:** Organisms belonging to the phylum Platyhelminthes are triploblastic and acoelomate animals with organ-level of organisation.

*Planaria*, *Taenia* and *Fasciola* are platyhelminths.

*Ancylostoma* (Aschelminth) is a pseudocoelomate.

*Nereis* (Annelid) is a coelomate.

176. Answer (4)

**Hint:** Digestive system has two openings in segmented worms.

**Sol.:** When the digestive system has only a single opening to the outside of the body that serves as both mouth and anus, it is called an incomplete digestive system.

Coelenterates (*Gorgonia*), ctenophores (*Pleurobrachia*) and platyhelminths (*Fasciola*) does not possess complete digestive system.

Complete digestive system is present in annelids (*Pheretima*)

177. Answer (2)

**Hint:** Also called comb jellies.

**Sol.:** *Echinus* (Sea urchin), *Cucumaria* (Sea cucumber) and *Antedon* (Sea lily) are echinoderms. Sexes are separate in echinoderms.

Ctenophores, commonly known as sea walnuts or comb jellies, are monoecious, *i.e.* sexes are not separate in them.

178. Answer (4)

**Hint:** These cells also line the water canal system.

**Sol.:** Choanocytes or collar cells are specialized flagellated cells that line the spongocoel and the canals in porifers.

Coelenterates like *Adamsia* possess cnidoblasts or cnidocytes which are used for anchorage, defense and for the capture of prey.

*Sepia* is a mollusc and *Ctenoplana* is a ctenophore.

179. Answer (3)

**Hint:** Their lifetime include a free swimming flagellated larva.

**Sol.:**

- *Spongilla* is a fresh water sponge.
- Although most sponges are asymmetrical, some species of sponges belonging to the class Demospongiae exhibit radial symmetry.

- They are hermaphrodite. The larval stages of sponges are motile.
- Sponges show indirect development.

180. Answer (3)

**Hint:** *Ascaris* shows internal fertilization

**Sol.:** Animals like annelids, arthropods, *etc.*, where the body can be divided into identical left and right halves in only one plane, exhibit bilateral symmetry.

Those animals in which the developing embryo also has a third germinal layer, *i.e.*, mesoderm, in between the ectoderm and endoderm are called triploblastic animals.

**Platyhelminthes**

- Bilaterally symmetrical
- Do not show any segmentation
- Show internal fertilization

**Aschelminthes**

- Bilaterally symmetrical
- Sexes are separate
- Unsegmented
- Exhibit internal fertilization

All bilateral animals are triploblastic. (*e.g.*, Platyhelminthes to Chordates).

