All India Aakash Test Series for NEET - 2027

TEST - 5 (Code - C)

Click here for Code-D Sol.

Test Date : 15/02/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint: $\rho_{mixture} = \frac{M_1 + M_2}{V_1 + V_2}$

Sol.: $\rho_{mixture} = \frac{V\rho_1 + V\rho_2}{2V} = \frac{\rho_1 + \rho_2}{2}$

$= \frac{1.4 + 1.2}{2} = \frac{2.6}{2} = 1.3 \text{ g cm}^{-3}$

2. Answer (4)

Hint: Average pressure on the walls of the container is $\frac{1}{2} h\rho g$

Sol.: Pressure on the bottom surface = $h\rho g$

Average pressure on the walls of the container is $\frac{1}{2} h\rho g$

Ratio $= \frac{2}{1}$

3. Answer (3)

Hint: Reading scale

$$= \frac{T_A - \text{ Freezing point}}{\text{Boiling point} - \text{Freezing point}}$$

Sol.: $\frac{C - 0}{100 - 0} = \frac{T_A - 10}{110 - 10}$

$\frac{60}{100} = \frac{T_A - 10}{100}$

$T_A = 70°A$

4. Answer (4)

Hint: $Q = mL_{fusion} + ms_{water}\,\Delta T + mL_{vap}$

Sol.: Heat required to melt ice at 0°C is

$Q_1 = mL = 5 \text{ g} \times 80 \text{ cal/g} = 400 \text{ cal}$

$Q_2 = ms\Delta T = 5 \times 1 \times 100°C = 500 \text{ cal}$

Heat required to convert water at 100°C to steam at 100°C is

$Q_3 = mL = 5 \text{ g} \times 540 \text{ cal/g} = 2700 \text{ cal}$

Total heat required is $Q_1 + Q_2 + Q_3 = 3600$ cal

5. Answer (2)

Hint: Higher value of Young's modulus of elasticity means more elasticity.

Sol.: $\frac{\text{Stress}}{\text{Strain}} = Y$

$\frac{\text{Strain}}{\text{Stress}} = \frac{1}{Y}$

Slope of B > slope of A

$Y_B < Y_A$

$\therefore$ A is more elastic than B

6. Answer (3)

Hint: $\boxed{F = Kx}$, where K is force constant

Sol.: $F = \frac{(\text{Area}) \times (\text{Young's modulus}) \times (\text{Extension})}{\text{Length}}$

$F = \frac{BYC}{A}$

Using $F = K \times$ (extension)

$\therefore$ $K = \frac{BY}{A}$

7. Answer (1)

Hint & Sol.: Cohesive forces between the molecules of liquid decreases due to increase in the kinetic energy with the rise in temperature hence viscosity of liquid decreases.

8. Answer (3)

Hint: The surface tension force has to support a heavier liquid column in accelerating lift.

Sol.: Capillary rise is given by

$H = \frac{2s\cos\theta}{\rho g_{eff} r}$

In case I:

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

In case II:

$h' = \frac{2s\cos\theta}{\rho(g + a)r}$, $g_{eff} = a + g$

$\therefore$ $\frac{h'}{h} = \frac{\rho g r}{\rho(g + a)r}$

$h' = \frac{h \times g}{(g + a)}$

9. Answer (1)

Hint: Pressure exerted by a liquid column $P = h\rho g$

Sol.: $P_{water} = P_{liquid}$

$h_{water} \times \rho_{water}\, g = h_{liquid} \times \rho_{liquid}\, g$

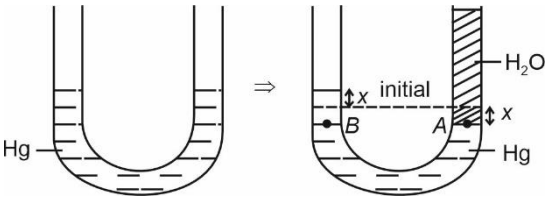
40 cm × 10^3 kg/m^3 = 20 cm × ρ_{liquid}

2 × 10^3 kg/m^3 = ρ_{liquid}

10. Answer (2)

Hint: $P = h\rho g$ and use Pascal law

Sol.:



As per Pascal law

$P_A = P_B$

$h_w \rho_w g = h_{Hg} \rho_{Hg} g$

13.6 cm × 10^3 kg/m^3 = 2x × 13.6 × 10^3 kg/m^3

x = 0.5 cm

11. Answer (2)

Hint: Elastic potential energy = energy density × volume

Sol.: Energy density of stretched wire

$= \frac{1}{2}$ × stress × strain $= \frac{1}{2} \times Y \times (\text{strain})^2$

$$= \frac{1}{2} \times 2 \times 10^{11} \times \left(\frac{2 \times 10^{-3}}{4} \right)^2 = 2.5 \times 10^4 \text{ J/m}^3$$

E.P.E = 2.5 × 10^4 × (2.0 × 10^{-6}) × 4 = 0.20 J

12. Answer (3)

Hint: Shear modulus $G = \frac{FL}{A\Delta L}$

Sol.: $G = \frac{FL}{A\Delta L} = \frac{10 \times 10^3 \times 5 \times 10^{-2}}{25 \times 10^{-4} \times 1 \times 10^{-4}}$

G = 2 × 10^9 N/m^2

13. Answer (1)

Hint & Sol.: Temperature remains constant during change in the physical state of a material. Any thermometric property can be used to establish a temperature scale.

14. Answer (4)

Hint: On increasing temperature, mass remains constant, volume increases, density decreases

Sol.: $m_2 = m_1$

$v_2 = v_1[1 + \gamma(t_2 - t_1)]$

$\rho_2 = \rho_1[1 - \gamma(t_2 - t_1)]$

15. Answer (2)

Hint & Sol.: Convection heat flow is possible in liquids and gases only.

16. Answer (2)

Hint: Net incoming heat current equals net outgoing heat current.

Sol.: $\frac{KA(\theta_0 - 0)}{L} = \frac{KA(50 - \theta_0)}{L} + \frac{KA(70 - \theta_0)}{L}$

$\theta_0 = 50 - \theta_0 + 70 - \theta_0$

$3\theta_0 = 120°$

$\theta_0 = 40°C$

17. Answer (4)

Hint & Sol.: Angle of contact depend on soluble impurity, temperature and cohesive force. Increasing temperature decreases angle of contact.

18. Answer (3)

Hint: Excess pressure inside soap bubble $= \frac{4T}{r}$

Sol.: $\Delta P = \frac{4T}{r}$

$\Rightarrow \Delta P \propto \frac{1}{r}$

$\Rightarrow \frac{\Delta P_1}{\Delta P_2} = \frac{2}{1}$

19. Answer (1)

Hint: Use equations :

$\left(\frac{dQ}{dt}\right) = eA\sigma T^4$ and $\frac{dQ}{dt} = mC\frac{dT}{dt}$

Sol.: Here the surrounding is maintained at absolute zero, hence

$\left(\frac{dQ}{dt}\right)_{\text{heat loss}} = \left(\frac{dQ}{dt}\right)_{\text{radiation}}$

$\left(\frac{dQ}{dt}\right)_{\text{heat loss}} = eA\sigma T^4$

e = 1, $A = 4\pi R^2$

$\left(\frac{dQ}{dt}\right)_{\text{heat loss}} = 4\pi R^2 \sigma T^4$ ...(i)

This heat loss is responsible for the decrease in temperature of the sphere.

$\therefore \frac{dQ}{dt} = -\frac{mCdT}{dt}$ ...(ii)

$-\frac{mcdT}{dt} = 4\pi R^2 \sigma T^4$

$$-\rho\times\frac{4}{3}\pi R^3C\frac{dT}{dt}=4\pi R^2\sigma T^4$$

$$-\frac{\rho RC}{3}\int_{T_0}^{\frac{T_0}{2}}\frac{dT}{T^4}=\sigma\int_0^t dt$$

$$-\frac{\rho RC}{3}\left(\frac{T^{-3}}{-3}\right)_{T_0}^{\frac{T_0}{2}}=\sigma t$$

$$\frac{\rho RC}{9}\left(\frac{8}{T_0^3}-\frac{1}{T_0^3}\right)=\sigma t$$

$$\frac{7\rho RC}{9\sigma T_0^3}=t$$

20. Answer (2)

Hint: Work done = Surface tension × Change in surface area

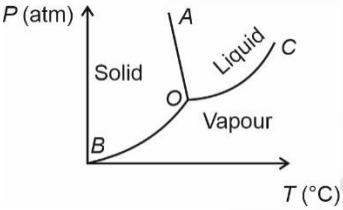
Sol.: $W=T\times 2\left[4\pi\left(\frac{3r}{2}\right)^2-4\pi r^2\right]$

$$=T\times 4\pi\times\frac{5r^2}{4}\times 2$$

$= 10\pi r^2T$

21. Answer (3)

Hint & Sol.:



OA represents fusion curve

OB represents sublimation curve

OC represents vaporisation curve

22. Answer (2)

Hint : The rate of emission must be equal to rate of energy production

Sol.: $Q=\sigma\times 4\pi R^2\times T^4$

$$\Rightarrow T^4=\frac{Q}{\sigma 4\pi R^2}$$

$$\Rightarrow T=\left(\frac{Q}{\sigma 4\pi R^2}\right)^{\frac{1}{4}}$$

23. Answer (4)

Hint & Sol.: A perfect blackbody is one which absorbs radiation of all wavelengths incident on it. Its absorptance is unity as it neither reflects nor transmits any radiation. Emissivity(e) for blackbody is also unity. The transmittance coefficient of perfect blackbody is zero.

24. Answer (3)

Hint: Elongation $\Delta l=\frac{FL}{AY}$

Sol.: $\Delta l=\frac{FL}{AY}$

$$=\frac{10\times 10^3\times 2}{\pi(20\times 10^{-3})^2\times 2\times 10^{11}}$$

$$=\frac{2\times 10^4}{\pi\times 4\times 10^{-4}\times 2\times 10^{11}}=0.796\times 10^{-4}\text{ m}$$

= 0.08 mm

25. Answer (4)

Hint: Rate of emission from black body = σAT^4

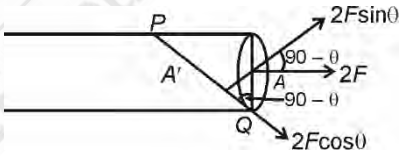
Sol.: $\frac{x}{x'}=\frac{\sigma T^4}{\sigma\left(\frac{T}{2}\right)^4}$

$$x'=\frac{x}{16}$$

26. Answer (3)

Hint : Normal stress $=\frac{F_\perp}{\text{Area}}$

Sol.:



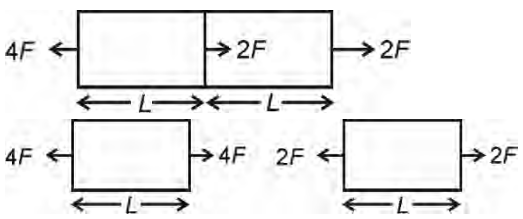
Normal stress $=\frac{2F\sin\theta}{A'}$, $A'=\frac{A}{\sin\theta}$

Normal stress $=\frac{2F\sin^2\theta}{A}$

27. Answer (3)

Hint: $\Delta L=\frac{FL}{AY}$

Sol.:

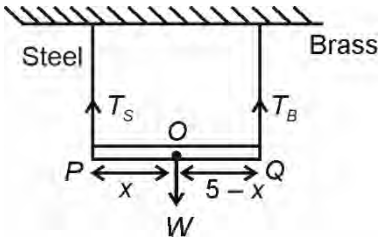


$\Delta l=\Delta l_1+\Delta l_2$

$$=\frac{4FL}{AY}+\frac{2FL}{AY}=\frac{6FL}{AY}$$

28. Answer (2)

Hint: Stress in steel = 2 × stress in brass



Sol.: Stress in steel = 2 × stress in brass

$$\frac{T_{\text{Steel}}}{A_{\text{Steel}}} = 2\frac{T_{\text{Brass}}}{A_{\text{Brass}}}$$

$$\frac{T_S}{T_B} = 2\times\frac{A_S}{A_B} = \frac{2\times10^{-3}}{3\times10^{-3}} = \frac{2}{3}$$

As system is in equilibrium, take moments about O.

$T_S x = T_B (5 - x)$

$$\frac{T_S}{T_B} = \frac{5-x}{x}$$

$$\frac{2}{3} = \frac{5-x}{x}$$

$\Rightarrow 15 - 3x = 2x$

$$x = \frac{15}{5} = 3.00 \text{ m}$$

29. Answer (2)

Hint: Use Newton's law of cooling

Sol.: $$\frac{T_1 - T_2}{t} = k\left(\frac{T_1 + T_2}{2} - T_0\right)$$

$$\frac{60-50}{10} = k\left[\frac{60+50}{2} - T_0\right]$$

$$\frac{10}{10} = k[55 - T_0] \quad \ldots(1)$$

$$\frac{50-46}{10} = k\left[\frac{50+46}{2} - T_0\right]$$

$$\frac{4}{10} = k[48 - T_0] \quad \ldots(2)$$

Dividing (1) by (2)

$$\frac{\frac{10}{10}}{\frac{4}{10}} = \frac{k[55-T_0]}{k[48-T_0]}$$

$$T_0 = \frac{130^\circ\text{C}}{3} \approx 43^\circ\text{C}$$

30. Answer (3)

Hint: $\Delta l = L\alpha\Delta t$

Sol.: $\Delta l = 100 \times 11 \times 10^{-6} \times (-1^\circ\text{C})$

$= -11 \times 10^{-4}$ cm

31. Answer (3)

Hint: Use $L_{eq} = L_1 + L_2$ and $L = L_0(1 + \alpha\Delta T)$

Sol.: $5L[1 + \alpha_{eq}\Delta T] = 2L[1 + \alpha\Delta T] + 3L(1 + 2\alpha\Delta T)$

$5L + 5L\alpha_{eq}\Delta T = 2L + 2L\alpha\Delta T + 3L + 6L\alpha\Delta T$

$5L\alpha_{eq}\Delta T = 8\alpha L\Delta T$

$$\alpha_{eq} = \frac{8\alpha}{5}$$

32. Answer (3)

Hint: $P_{\text{gauge}} = h\rho g$

$P_{\text{absolute}} = P_{\text{atm}} + h\rho g$

$$P_{\text{av on walls}} = \frac{1}{2}h\rho g$$

Sol.: $P_{\text{gauge}} = 10 \times 10^3 \times 10 = 10^5$ N/m^2

$P_{\text{absolute}} = 1.013 \times 10^5 + 10^5 = 2.013 \times 10^5$ N/m^2

$$P_{\text{avg on walls}} = \frac{h\rho g}{2} = \frac{10^5}{2} = 0.5\times10^5 \text{ N/m}^2$$

Force = P_{gauge} × Area of base

$= 10^5 \times \pi(1)^2 = \pi \times 10^5$ N

33. Answer (3)

Hint: $v_T \propto r^2$; $m \propto r^3$

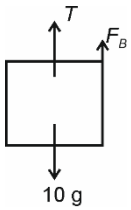
Sol.: $$\frac{m_1 v_1}{m_2 v_2} = \frac{r_1^3}{r_2^3}\frac{r_1^2}{r_2^2} = \left(\frac{r_1}{r_2}\right)^5$$

$$\frac{m_1 v_1}{m_2 v_2} = \left(\frac{2}{3}\right)^5 = \frac{32}{243}$$

34. Answer (1)

Hint: Upthrust = $V\rho_L g$

Sol.:



$T + F_B = 10g$

$T = 100 - V\rho g$

$\rho_0 V_0 g = 10g \quad \ldots(1)$

$V_0\rho_w g = F_B \quad \ldots(2)$

$\rho_0 = 1.5\ \rho_w$

$$\frac{\rho_0 V_0 g}{V_0\rho_w g} = \frac{10g}{F_B}$$

$1.5 = \frac{100}{F_B}$

$F_B = \frac{100}{1.5} = 66.67$ N

$\therefore$ $T = 100 - 66.67$ N $= 33.33$ N

35. Answer (3)

Hint: Angular momentum remains conserved.

Sol.: $I_1\omega_1 = I_2\omega_2$

$\frac{ML^2\omega}{3} = \frac{ML^2}{3}(1+\alpha\Delta T)^2\omega'$

$\omega' = \omega(1+\alpha\Delta T)^{-2} = \omega(1-2\alpha\Delta T)$

$\omega' = \omega[1-2\alpha\Delta T]$

% decrease in $\omega = \frac{\Delta\omega}{\omega}\times 100 = \frac{\omega'-\omega}{\omega}\times 100$

$\frac{\omega'-\omega}{\omega}\times 100 = -2\alpha\Delta T\times 100$

$= -2\times 3\times 10^{-4}\times 100\times 100$

$= -6\%$ *i.e.*, 6% decrease

36. Answer (4)

Hint: $Mg = F_A + F_B$

Sol.: $Mg = F_A + F_B$

$Mg = V_A\rho_A g + V_B\rho_B g$

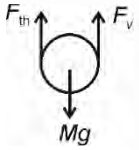
$M = V_A\rho_A + V_B\rho_B$

$= (10\times 10\times 6\times 0.3) + (10\times 10\times 4\times 0.2)$

$= 180 + 80 = 260$ g

37. Answer (4)

Hint & Sol.: For a body falling through a viscous medium



It experiences upward viscous force, upward buoyant force and downward weight of the ball.

38. Answer (2)

Hint: Use Pascal law $\frac{F_1}{A_1} = \frac{F_2}{A_2}$

Sol.: $\frac{F_1}{A_1} = \frac{F_2}{A_2}$

$\frac{10\text{N}}{\pi r_1^2} = \frac{F}{\pi r_2^2}$

$\frac{10}{(2)^2} = \frac{F}{(5)^2}$

$F = \frac{25\times 10}{4} = 62.5$ N

39. Answer (2)

Hint & Sol.: Equation of continuity is based on conservation of mass in flow of incompressible fluids.

40. Answer (2)

Hint: Use Bernoulli's theorem at points *A* and *B*

Sol.: $P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$

$\frac{1}{2}\rho\left(v_2^2 - v_1^2\right) = P_1 - P_2$

$\frac{1}{2}\rho\left(v_2^2 - v_1^2\right) = \rho gh$

$v_2 = 32$ cm/s

41. Answer (2)

Hint: Velocity of efflux $v = \sqrt{2gh}$

Sol.: $v = \sqrt{2\times g\times h}$

$= \sqrt{2\times 10\times 10} = 10\sqrt{2}$ m/s

42. Answer (2)

Hint: Use equation of continuity

$AV = A_1V_1 + A_2V_2 + A_3V_3$

Sol.: $4A = 0.6A + 0.2A + 0.4AV$

$4 - 0.8 = 0.4V$

$\frac{3.2}{0.4} = V = 8$ m/s

43. Answer (2)

Hint & Sol.: In conduction, heat transfer occurs due to molecular collisions and vibrations within a material without any bulk movement of matter.

44. Answer (3)

Hint: Use principle of calorimetry

Sol.: Heat loss by water = Heat gain by ice

$m_w s_w \Delta T = m_{ice} L_{ice}$

$100\times 1\times 40 = m_{ice}\times 80$

$m_{ice} = 50$ g

45. Answer (4)

Hint: Apply concept of thermal expansion

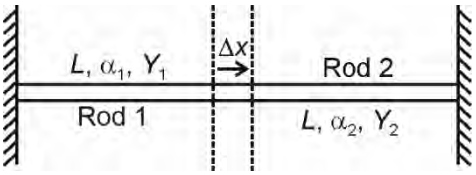
Sol.: Let the free thermal expansion of rod 1 is x_1, then

$x_1 = L\alpha_1\Delta T$ ...(i)

Similarly, for rod 2:

$x_2 = L\alpha_2\Delta T$ ...(ii)

Both the rods are connected in series and are not free to move. Let's assume that the midpoint is displaced by Δx as shown in figure.



Compression in rod 1 = $x_1 - \Delta x$

Compression in rod 2 = $x_2 + \Delta x$

Compressive force is same in both the rods and since area of cross-section is also equal, hence $\sigma_1 = \sigma_2$

$$\sigma_1 = Y_1(x_1 - \Delta x),\ \sigma_2 = Y_2(x_2 + \Delta x)$$

$$Y_1x_1 - Y_1\Delta x = Y_2x_2 + Y_2\Delta x$$

$$Y_1(L\alpha_1\Delta T) - Y_2(L\alpha_2\Delta T) = (Y_1 + Y_2)\Delta x$$

$$\Delta x = \frac{(Y_1\alpha_1 - Y_2\alpha_2)L\Delta T}{Y_1 + Y_2}$$

[CHEMISTRY]

46. Answer (2)

Hint: $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

Sol.: On addition of inert gas at constant pressure, volume will increase and equilibrium will shift in the direction where moles are increasing. Hence equilibrium will shift in backward direction and dissociation of SO_3 at equilibrium will increases.

47. Answer (1)

Hint: One reversing equation $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$ and multiplying by $\frac{1}{2}$, we get equation $NO(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO_2(g)$

Sol.: K_C for equation,

$2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$; $K_C = 9.0 \times 10^{-6}$

For new equation, $NO(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO_2(g)$

$$K_C' = \left(\frac{1}{K_C}\right)^{\frac{1}{2}} = \sqrt{\frac{1}{9.0\times10^{-6}}} = 3.3\times10^2$$

48. Answer (2)

Hint:

	$AB_2(g)$	$\rightleftharpoons$	$AB(g)$	+	$B(g)$
At $t = 0$	600 mmHg		0		0
At $t = t_{eq}$	$(600 - p)$ mmHg		p mmHg		p mmHg

Sol.: Total pressure = 600 – p + p + p

= 600 + p = 800

$\therefore$ p = 200 mm Hg

Hence, p_{AB_2} at equilibrium = 600 – 200 = 400 mm Hg

$p_{AB} = p_B$ = 200 mmHg

So, $K_p = \frac{(p_{AB})(p_B)}{(p_{AB_2})} = \frac{(200)^2}{400} = 100$

49. Answer (4)

Hint: According to Le-Chatelier's principle, any change in equilibrium conditions will shift equilibrium in a direction in which the effect of the change gets counteracted.

Sol.:

- For exothermic reaction (given) equilibrium will shift in backward direction on increasing temperature.
- Increasing concentration of NH_3 will shift the equilibrium in backward direction.
- Decreasing pressure shifts the equilibrium in backward direction, where the number of moles are increasing.

50. Answer (3)

Hint: Equation (a) + equation (c) × 3 – equation (b) to get given equation:

$$2NH_3(g) + \frac{5}{2}O_2(g) \rightleftharpoons 2NO(g) + 3H_2O(g)$$

Sol.: $K = \frac{K_1K_3^3}{K_2}$

51. Answer (4)

Hint: As per Bronsted-Lowry concept of acid base, an acid donates proton (H^+) to form its conjugate base.

Sol.:

Species	Conjugate acid	Conjugate base
H_2CO_3	–	HCO_3^-
H_3O^+	–	H_2O

H_2O	H_3O^+	OH^-
NH_3	NH_4^+	NH_2^-

52. Answer (1)

Hint: If ionic product > solubility product, then precipitate will be obtained

Sol.:

For AB_2, $K_{ip} = [A^{2+}][B^-]^2$

(1) $K_{ip} = \frac{10^{-2}}{2} \times \left(\frac{10^{-2}}{2}\right)^2 = \frac{1}{8} \times 10^{-6} = 1.25 \times 10^{-7}$

As $K_{ip} > K_{sp}$ in case I, so it will precipitate

53. Answer (3)

Hint: A mixture of a weak base and the salt of this weak base with a strong acid will make basic buffer.

Sol.:

1. $HCl + NaOH \longrightarrow NaCl + H_2O$

	5 mmol	5 mmol	0	0
After reaction	0	0	5 mmol	

2. $CH_3COOH + NaOH \rightleftharpoons CH_3COONa + H_2O$

	10 mmol	10 mmol	0	0
After reaction	0	0	10 mmol	

3. $HCl + NH_4OH \rightleftharpoons NH_4Cl + H_2O$

	10 mmol	15 mmol	0	0
After reaction	0	5 mmol	10 mmol	

Basic buffer

4. $HCl + NH_4OH \rightleftharpoons NH_4Cl + H_2O$

	5 mmol	5 mmol	0	
After reaction	0	0	5 mmol	

54. Answer (4)

Hint: $pH = -\log[H^+]$

Sol.:

$NaOH + HCl \longrightarrow NaCl + H_2O$

t = 0	0.1 M	0.08 M		
After reaction	0.02	0		

$(0.1\ V) - (0.08 \times V) = M(V + V)$

$\frac{0.02V}{2V} = M$

$[OH^-] = 10^{-2}$ M

$\therefore$ $pOH = -\log[10^{-2}] \Rightarrow 2$

$pH = 14 - 2 = 12$

55. Answer (3)

Hint: Calcium bromide will produce common ion in solution.

Sol.: $AgBr(s) \rightleftharpoons \underset{s}{Ag^+(aq)} + \underset{(s + 0.1)}{Br^-(aq)}$

$K_{sp} = [Ag^+]\ [Br^-]$

$\Rightarrow 5 \times 10^{-13} = s\ (s + 0.1)$ $(s << 0.1)$

$\therefore$ $s = \frac{5 \times 10^{-13}}{0.1} = 5 \times 10^{-12}$ M

56. Answer (1)

Hint: An aqueous solution of ammonium acetate will act as buffer.

Sol.: Electron deficient species like $AlCl_3$ and Co^{3+} can act as Lewis acids

57. Answer (4)

Hint: Salt of weak acid or weak base will undergo hydrolysis

Sol.: Ammonium chloride (NH_4Cl) – Cationic hydrolysis

Sodium acetate (CH_3COONa) – Anionic hydrolysis

Ammonium acetate (CH_3COONH_4) – Both cationic and anionic hydrolysis

Sodium chloride (NaCl) – No hydrolysis, as it is a salt of strong acid and strong base

58. Answer (2)

Hint: pH of an acidic buffer $= pK_a + \log\frac{[Salt]}{[Acid]}$

Sol.:

$CH_3COOH + NaOH \rightleftharpoons CH_3COONa + H_2O$

t = 0	100 × 0.05 = 5 mmol	100 × 0.01 1 mmol	0	0
At $t = t_{find}$	4 mmol	0	1 mmol	0

$pH = 4.74 + \log\frac{[1]}{[4]}$

$= 4.74 - 0.6 = 4.14$

59. Answer (2)

Hint:

$MnO_4^- + SO_3^{2-} + H^+ \longrightarrow SO_4^{2-} + Mn^{2+} + H_2O$

Sol.: On balancing the given equation

$2MnO_4 + 5SO_3^{2-} + 6H^+ \longrightarrow 5SO_4^{2-} + 2Mn^{2+} + 3H_2O$

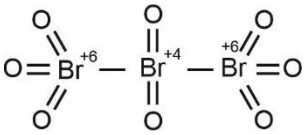
For 5 mol of SO_3^{2-} ions, MnO_4^- needed = 2 mol

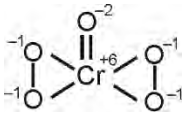
Hence, for 0.1 mol of SO_3^{2-} ions, MnO_4^- needed = 0.04 mol

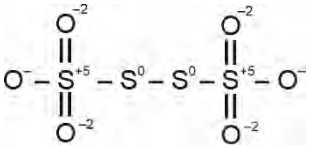
60. Answer (3)

Hint: $\overset{-2}{O}=\overset{+2}{C}=\overset{0}{C}=\overset{+2}{C}=\overset{-2}{O}$

Sol.:

1. 

2. 

3. 

61. Answer (4)

Hint: KO_2 is a superoxide

Sol.:

Underlined element in given compound	Oxidation state of underlined element
$\underline{N}_2O$	+1
$\underline{N}H_3$	–3
$H\underline{N}O_3$	+5
$H\underline{Cl}O_3$	+5
$H\underline{Cl}O_4$	+7
$\underline{Fe}_3O_4$	+2 and +3
$K\underline{O}_2$	$-\frac{1}{2}$

62. Answer (2)

Hint: $Fe^{2+} \longrightarrow Fe^{3+}$

$C_2O_4^{2-} \longrightarrow 2CO_2$

Sol.: On balancing charges

$Fe^{2+} \longrightarrow Fe^{3+} + e^-$

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-$

$\therefore$ Total electrons involved (lost) = 3

63. Answer (3)

Hint: Sulphide ion – S^{2-}

Phosphate ion – PO_4^{3-}

Dichromate – $Cr_2O_7^{2-}$

Sol.: $S^{2-} \Rightarrow -2$

$\underline{P}O_4^{3-} \Rightarrow +5$

$Cr_2O_7^{2-} \Rightarrow +6$

64. Answer (1)

Hint: Standard reduction potentials of the given electrodes are

$Zn^{2+} + 2e^- \longrightarrow Zn \quad E^\circ = -0.76\ V$

$Fe^{2+} + 2e^- \longrightarrow Fe \quad E^\circ = -0.44\ V$

Sol.: $E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$

$= -0.44 - (-0.76)$

$= -0.44 + 0.76 = 0.32\ V$

65. Answer (2)

Hint: $\overset{+1}{Na}\overset{-2}{O}\overset{+1}{H} + \overset{+1}{H}\overset{-1}{Cl} \longrightarrow \overset{+1}{Na}\overset{-1}{Cl} + \overset{+1}{H_2}\overset{-2}{O}$

As there is no change in oxidation states of any element in the reaction therefore, it is a non-redox reaction.

Sol.:

(i) $V_2O_5(s) + 2Ca(s) \xrightarrow{\Delta} 5CaO(s) + 2V(s)$

Metal displacement

(ii) $Ca(s) + 2H_2O(\ell) \longrightarrow Ca(OH)_2(aq) + H_2(g)$

Non-metal displacement

(iii) $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$ Combination

66. Answer (3)

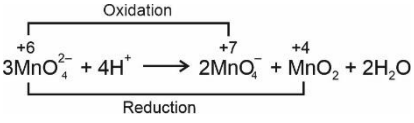
Hint: More negative value of standard reduction potential, more would be the reducing power of metal.

Sol.: The correct order of reducing power is Ca > Mg > Fe > Cu

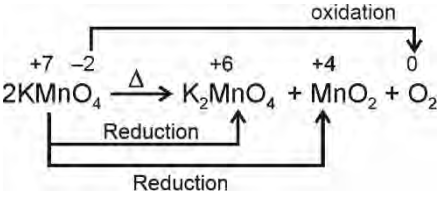
67. Answer (3)

Hint: The reaction in which same element gets oxidised as well as reduced simultaneously is called disproportionation reaction.

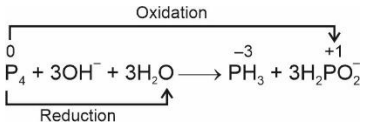
Sol.:

(i) 

Disproportionation reaction

(ii) 

Not a disproportionation reaction

(iii) 

Disproportionation reaction

68. Answer (1)

Hint: Sum of the total negative and positive charge in a compound is zero

Sol.: $X_3(YZ_2)_2 \Rightarrow (+2)3 + [+1 + (-2)2] \times 2 = 0$

$= 6 + 2 - 8 = 0$

69. Answer (4)

Hint & Sol.: By convention, the standard electrode potential of standard hydrogen electrode is 0.00 volts

70. Answer (2)

Hint: Equivalent weight = $\frac{\text{Molecular weight}}{\text{n factor}}$

Sol.: $\overset{0}{Cl_2} \longrightarrow \overset{-1}{Cl^-}$ (Reduction half)

$(n_f)_{reduction} = 2$

$\overset{0}{Cl_2} \longrightarrow \overset{+5}{Cl}O_3^-$ (oxidation half)

$(n_f)_{oxidation} = 10$

$$n_f = \frac{(n_f)_{oxidation} \times (n_f)_{reduction}}{(n_f)_{oxidation} + (n_f)_{reduction}} = \frac{2 \times 10}{2 + 10} = \frac{20}{12} = \frac{5}{3}$$

Hence equivalent weight $= \frac{M}{5/3} = \frac{3M}{5}$

71. Answer (1)

Hint: $XY \rightleftharpoons X^+ + Y^-$

$K_{sp} = s^2$

$AB_3 \rightleftharpoons \underset{s'}{A^{3+}} + \underset{3s'}{3B^-}$

$K_{sp} = s'(3s')^3 \Rightarrow 27(s')^4$

Sol.: As per question, K_{sp} is same for both the salts.

Hence, $K_{SP} = S^2 = 27\,(S')^4$

$$s' = \sqrt[4]{\frac{s^2}{27}}$$

72. Answer (2)

Hint:

$CH_3NH_2 + H_2O(\ell) \rightleftharpoons CH_3NH_3^+(aq) + OH^+(aq)$

Initially	0.1	0	0
At Eq.	$(0.1-0.1\alpha)$	0.1α	0.1α

Sol.: $[OH^-] = 0.1\alpha$

and $K_b = \frac{(0.1\alpha)^2}{0.1(1-\alpha)} = 0.1\alpha^2$

$\therefore \quad \alpha = \sqrt{\frac{5 \times 10^{-5}}{0.1}} = 2.23 \times 10^{-2}$

Percentage of $CH_3\overset{\oplus}{N}H_3$ $= 2.23 \times 10^{-2} \times 100$

$= 2.23$

pH of aqueous solution of methanamine is dependant of its concentration.

73. Answer (3)

Hint: $K_P = p_Q \times (p_R)^2$

Sol.: $P(s) \rightleftharpoons Q(g) + 2R(g)$

$K_P = (p_Q)\,(p_R)^2$ ...(1)

After tripling the partial pressure of R

$K_p = \left(p'_Q\right)(3p_R)^2$

$K_p = p'_Q 9p_R^2$ ...(2)

Comparing equation (1) and (2)

$(p_R)^2 p_Q = p'_Q 9p_R^2$

$\frac{p_Q}{9} = p'_Q$

74. Answer (2)

Hint: Atomic radius of gallium is lesser than that of aluminium

Sol.: For group 13 elements

Order of atomic radii: B < Ga < Al < In < Tl

75. Answer (4)

Hint & Sol.: $p\pi - p\pi$ back bonding is stronger in BF_3 because of involvement of 2p orbitals of both boron and fluorine in back bonding while in BI_3 back bonding between B and I is not that compatible and hence, BF_3 is not a better Lewis acid than BI_3.

76. Answer (1)

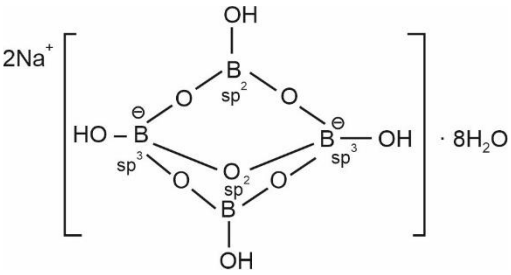
Hint: Maximum covalency of boron is 4

Sol.: Due to absence of d orbitals, boron trihalide does not hydrolyse to form $[M(H_2O)_6]^{3+}$ in aqueous solution.

77. Answer (3)

Hint: $Na_2B_4O_7 \cdot 10H_2O$ is borax

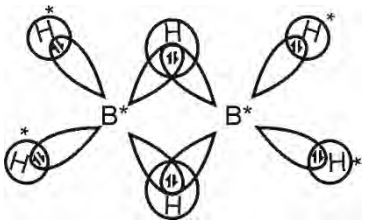
Sol.:



78. Answer (4)

Hint: Diborane has two 3-centre-2-electron bonds called banana bonds.

Sol.:



Number of atoms present in a plane (marked*) = 6

79. Answer (3)

Hint: Diborane is prepared by treating BF_3 with $LiAlH_4$ in diethyl ether

Sol.:

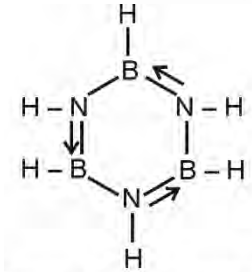
I: $3LiAlH_4 + 4BF_3 \rightarrow \underset{(X)}{2B_2H_6} + \underset{(Y)}{3AlF_3} + 3LiF$

II: $2NaBH_4 + I_2 \rightarrow \underset{(X)}{B_2H_6} + 2NaI + \underset{(Z)}{H_2}$

80. Answer (1)

Hint: Borazine is also known as inorganic benzene

Sol.:



Borazine (Inorganic benzene)

81. Answer (3)

Hint: Moving down the group 14, electronegativity decreases till Si then becomes constant till Sn and slightly increases for Pb.

Sol.:

Element	Electronegativity (on Pauling scale)
C	2.5
Si	1.8
Ge	1.8
Sn	1.8
Pb	1.9

82. Answer (4)

Hint: Germanium is a metalloid among group 14 elements.

Sol.: Order of covalent radius

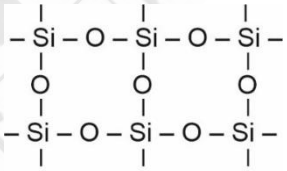
C << Si < Ge < Sn < Pb

Element	First Ionization enthalpy (kJ/mol)
C	1086
Si	786
Ge	760
Sn	707
Pb	715

83. Answer (3)

Hint: CO_2 has a linear structure

Sol.: O = C = O linear monomeric structure of CO_2 gas



SiO_2(solid)3D network

84. Answer (4)

Hint: In $[SiCl_6]^{2-}$, the interaction between lone pair of chloride ion and Si^{4+} is not very strong.

Sol.: Six chloride ions cannot be accommodated around Si^{4+} ion due to limitation of its size hence, $[SiCl_6]^{2-}$ does not exist.

85. Answer (2)

Hint: C_{60} is molecule has a shape like soccer ball and called Buckminsterfullerene

Sol.: Buckminsterfullerene has 20 six membered rings and 12 five membered rings.

86. Answer (2)

Hint: In group 14, down the group the size increases and electronegativity decreases, and thereby, tendency to show catenation decreases.

Sol.: Lead does not show catenation.

87. Answer (2)

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

Hint: At $t = 0$; 1 0 0

At $t = t_{eq}$; $(1-x)$ $\frac{x}{2}$ $\frac{x}{2}$

Sol.: Total moles = $1 - x + \frac{x}{2} + \frac{x}{2} = 1$

$$K_p = \frac{[H_2][I_2]}{[HI]^2} = \frac{x^2}{4(1-x)^2}$$

88. Answer (3)

Hint: H – A bond strength determines the acidic nature.

Sol.: As the size of A increases, H – A bond strength decreases and hence acid strength increases as follows:

HF << HCl << HBr << HI

89. Answer (4)

Hint: $pH = \frac{1}{2}(pK_a - \log C)$

Sol.: $pH = \frac{1}{2}\left[-\log(2\times10^{-5}) - \log 0.1\right]$

$= \frac{1}{2}[(5-0.3)+1]$

$= 2.85$

90. Answer (3)

Hint: pH of salt of weak acid and strong base

$pH = 7 + \frac{1}{2}(pK_a + \log C)$

Sol.: $pH = 7 + \frac{1}{2}(pK_a + \log C)$

$= 7 + \frac{1}{2}[4.74 + \log 0.04]$

$= 7 + \frac{1}{2}(4.74 - 1.398) = 8.7$

[BOTANY]

91. Answer (1)

Hint: Protons are removed from the stroma with the help of NADP reductase enzyme.

Sol.: The gradient is broken down due to the movement of proton across the membrane to the stroma, through the transmembrane channel of the CF_0 of ATP synthase. Breakdown of the gradient provides enough energy to cause a conformational change in the CF_1 particle of ATP synthase.

92. Answer (4)

Hint: Spores on liberation germinate into creeping, green, branched and frequently filamentous stage called protonema.

Sol.: In the life cycle of mosses, the correct sequence of stages would be as follows:

A → Reduction division in spore mother cell

B → Protonema stage

C → Leafy stage

E → Syngamy

D → Formation of oospore

So, the correct sequence is A → B → C → E → D

93. Answer (1)

Hint: Rice is a C_3 plant.

Sol.: Maize is adapted to dry tropical region and has the C_4 pathway.

94. Answer (1)

Hint: Seta in *Funaria* is a part of sporophytic plant body.

Sol.: Gametophytic plant body (n) → leaves(n) ⇒ 8 chromosomes

(2n) Sporophytic plant body → Seta (2n) ⇒ 16 chromosomes

95. Answer (4)

Hint: Bryophytes are known as first embryophytes.

Sol.:

	Dominant phase	Nature of spores	Archegonia	Embryo
Algae	Gametophyte	Homosporous	Absent	Absent
Bryophyta	Gametophyte	Homosporous	Present	Present
Pteridophyta	Sporophyte	Homosporous/ Heterosporous	Present	Present
Gymnosperm	Sporophyte	Heterosporous	Present	Present

96. Answer (2)

Hint: Cyclic photophosphorylation occurs in stroma lamellae which lacks NADP reductase enzyme.

Sol.: Absorption of sunlight by chlorophyll and cyclic photophosphorylation do not require NADP reductase enzyme.

97. Answer (1)

Hint: Algae → *Polysiphonia*

Sol.: Bryophytes → *Polytrichum*

Pteridophyte → *Marsilea*

Angiosperm → *Eucalyptus*

98. Answer (3)

Hint: Calvin cycle is common in both C_3 and C_4 plants

Sol.: The CO_2 fixation during C_3 pathway occurs in the chloroplast of bundle sheath cell, guard cell and mesophyll cell.

99. Answer (2)

Hint: Carboxylase activity of RuBisCO forms 2 molecules of a C_3 acid.

Sol.: C_4 plants have Kranz anatomy, where in mesophyll cell CO_2 is fixed into a 4C compound. A C_4 acid is then transported to bundle sheath cells. In the bundle sheath cells, CO_2 is released, increasing its concentration around RuBisCO, enhancing photosynthesis efficiency.

100. Answer (2)

Hint: Red algae are present in both well lighted regions and also at great depths in the ocean.

Sol.: Brown algae usually are attached to the substratum by a holdfast, and have a stalk (stipe) and leaf-like photosynthetic organ called frond.

- *Polysiphonia* reproduces asexually by non-motile spores.
- Pyrenoids contain protein besides starch.

101. Answer (2)

Hint: *Riccia* is a monoecious plant.

Sol.: In *Riccia*, antheridia and archegonia are produced on same thalli.

102. Answer (2)

Hint: Members of Chlorophyceae have oil droplets as a reserve food material.

Sol.: Most of the members of Chlorophyceae have one or more storage bodies called pyrenoids located in the chloroplast.

103. Answer (1)

Hint: Dark reaction used to drive the process that results in the synthesis of food.

Sol.: Immediately after light becomes unavailable, the biosynthetic process continues for some time and then stops. It proves that dark rection does not directly depend on the presence of light but is dependent on the products of light reaction.

104. Answer (4)

Hint: Water splitting complex is associated with PS-II.

Sol.: Splitting of water produces protons or hydrogen ions within the lumen of the thylakoid that develop the proton gradient across the membrane.

105. Answer (3)

Hint: Large cells around the vascular bundles of C_4 plants are called bundle sheath cells.

Sol.: Bundle sheath cells are characterised by having large number of chloroplast, grana are absent, thick walls impervious to gas exchange and no intercellular spaces.

106. Answer (1)

Hint: Light saturation occurs at 10 percent of the full sunlight.

Sol.: Blackman gave the law of limiting factors that states, if a chemical process is affected by more than one factor, then its rate will be determined by the factor which is nearest to its minimum value.

107. Answer (3)

Hint: The graphic curve showing the relative rate of photosynthesis at different wavelengths of light represents the action spectrum.

Sol.: The graphic curve showing the amount of energy of different wavelengths of light absorbed by a pigment, represents the absorption spectrum.

108. Answer (1)

Hint: Cytotaxonomy is based on chromosome number

Sol.: Artificial classification – Vegetative character or on the androecium structure

Chemotaxonomy– Chemical constituents

109. Answer (1)

Hint: *Selaginella* and *Sphagnum* belongs to division Pteridophyta and Bryophyta respectively.

Sol.: In *Selaginella*, sporophylls may form strobili or cone. In *Selaginella*, spore germinates to give rise to either a male or a female gametophyte.

110. Answer (3)

Hint: For one turn of Calvin cycle to occur, 3 ATP and 2 NADPH + H^+ are required.

Sol.: 2 ATP and 2 NADPH + H^+ is required for the formation of two triose phosphate from two molecules of 3-PGA. 10 ATP and 10 NADPH + H^+ are required for the formation of 10 molecules of triose phosphate from 10 molecules of 3-PGA.

111. Answer (1)

Hint: This statement holds true for pteridophytes.

Sol.: *Adiantum* is a member of pteridophytes.

112. Answer (4)

Hint: A – Linear relationship between incident light and CO_2 fixation rate.

Sol.: B – Some factor other than light becomes the limiting factor.

C – At this region, light intensity is no longer the limiting factor.

D – Saturation point for light intensity

E – Maximum rate of photosynthesis

113. Answer (3)

Hint: Given diagram is of plant *Fucus* that is a member of Phaeophyceae.

Sol.: In Brown algae, vegetative cells have a cellulosic cell wall usually covered on the outside by a gelatinous coating of algin. In red algae, food is stored in the form of floridean starch. Structurally it is very similar to amylopectin and glycogen.

114. Answer (3)

Hint: Protonema is a part of the haploid gametophytic stage in the life cycle of bryophytes.

Sol.: Both protonema of mosses and prothallus of ferns are haploid structures.

115. Answer (4)

Hint: This group is characterised by the presence of naked seed.

Sol.: In gymnosperm, pollen tube carrying the male gamete grows towards the archegonia and discharge their content near the mouth of the archegonia.

116. Answer (1)

Hint: When the two photosystems work in a series, first PS-II and then the PS-I, a process called non-cyclic photophosphorylation occurs.

Sol.: All 6 components listed are associated with non-cyclic photophosphorylation.

117. Answer (4)

Hint: In *Cycas*, pinnate leaves persist for a few years.

Sol.: Stomata are present in gymnosperms. Spores are produced within sporangia that are borne on sporophyll which are arranged spirally along an axis to form cones.

118. Answer (1)

Hint: In algae, gametophytic generation is dominant.

Sol.: During evolution, gametophyte became reduced and sporophyte became well developed.

119. Answer (4)

Hint: Gymnosperms have archegonia.

Sol.: Antheridia is absent in gymnosperms. In these plants, male gametophyte is represented by pollen grain and these are developed on macrosporophylls.

120. Answer (4)

Hint: External factors affecting photosynthesis – sunlight, temperature, CO_2 concentration in air.

Sol.: Internal factors which affect photosynthesis include internal CO_2 concentration.

121. Answer (4)

Hint: *Chlorella* is unicellular green alga, and green algae is found primarily in fresh water.

Sol.: Many species of *Porphyra*, *Laminaria* and *Sargassum* are among the 70 species of marine algae used as food.

122. Answer (4)

Hint: Maize is a C_4 plant.

Sol.: C_4 plants show saturation at about 360 $\mu l L^{-1}$ concentration of CO_2. Most of the photosynthesis takes place in the blue and red region of visible spectrum. C_4 plants respond to higher temperature.

123. Answer (4)

Hint: RuBisCO is the most abundant enzyme in the world.

Sol.:

C. Four carbon molecule is formed in mesophyll cell.

E. Four carbon compound is transported to the bundle sheath cells.

A. Release of CO_2 molecule to bind with the most abundant enzyme in the world.

B. Three carbon molecule transported back from bundle sheath cell to mesophyll cell.

D. Regeneration of primary CO_2 acceptor molecule.

124. Answer (1)

Hint: Chlorophyll *a*, Chlorophyll *b* and xanthophyll appear bright or blue green, yellow-green and yellow respectively.

Sol.: Carotenoids appear yellow to yellow-orange in chromatogram.

125. Answer (3)

Hint & Sol. : For chemiosmosis, high concentration of protons is created within the thylakoid lumen. This creates a proton gradient across thylakoid membrane.

126. Answer (4)

Hint: Beyond 0.05 per cent, CO_2 concentration becomes damaging over longer periods.

Sol.: Increase in concentration upto 0.05 per cent can cause an increase in CO_2 fixation rate.

127. Answer (3)

Hint: Calvin cycle or C_3 cycle is named after Melvin Calvin who discovered it.

Sol.: Melvin Calvin received the Nobel prize in 1961 for mapping the carbon fixation pathway.

128. Answer (3)

Hint: O_2 is utilised in chloroplast.

Sol.: During photorespiration, CO_2 is released in mitochondria.

129. Answer (3)

Hint: Duration of light affects the overall photosynthesis.

Sol.: Light duration does not affect the rate of photosynthesis.

130. Answer (4)

Hint: Cyclic photophosphorylation occurs when only light of wavelength beyond 680 nm are available for excitation.

Sol.: As PS-II is not functional, water splitting will not take place. No oxygen and electrons will be released from water molecule.

131. Answer (3)

Hint: Movement of electron is downhill in terms of redox potential scale.

Sol.: In terms of redox potential scale, transfer of electron, starting from PS-II, uphill to the acceptor, down the electron transport chain to PS-I, excitation of electron, transfer to another acceptor and finally downhill to $NADP^+$ is called the Z-scheme.

132. Answer (2)

Hint: T.W. Engelmann's experiments described first action spectrum of photosynthesis.

Sol.: Melvin Calvin – Used radioactive^{14}C in algal photosynthesis.

Joseph Priestley– Revealed the essential role of air in the growth of green plant.

Julius von Sachs – Provided evidence for production of glucose when plant grows.

133. Answer (2)

Hint: Melvin Calvin identified that the first product of C_3 cycle was 3-PGA

Sol.: Under low light intensity, chloroplasts align themselves perpendicular to the incident light.

134. Answer (2)

Hint: Major photosynthetic pigments found in Chlorophyceae members are chlorophyll *a*, *b*

Sol.: Major photosynthetic pigments found in phaeophyceae members are chlorophyll *a*, *c*

135. Answer (4)

Hint: Angiosperms and gymnosperms are seed producing plants.

Sol.: Pollen grains are formed only in angiosperms and gymnosperms.

[ZOOLOGY]

136. Answer (1)

Hint: Animals with more than one cells

Sol.: Though all members of kingdom Animalia are multicellular, all of them do not exhibit the same pattern of organisation of cells. Inspite of differences in structure and form of different

animals, there are fundamental features common to various individuals in relation to the arrangement of cells, body symmetry, nature of coelom, patterns of digestive, circulatory or reproductive systems. These features are used as the basis of animal classification.

137. Answer (4)

Hint: Identify an arthropod

Sol.: The circulatory system may be of two types:

(i) Open type in which the blood is pumped out of the heart and the cells and tissues are directly bathed in it, present in arthropods, non-cephalopod molluscs, hemichordates and tunicates.

(ii) Closed type in which the blood is circulated through a series of vessels of varying diameters (arteries, veins and capillaries), present in annelids (*Nereis*).

Spongilla and *Pleurobrachia* are diploblastic animals.

138. Answer (3)

Hint: Common feature between ctenophores and cnidarians

Sol.: *Physalia* belongs to the phylum Coelenterata and *Pleurobrachia* belongs to the phylum Ctenophora. The body of ctenophores bears eight external rows of ciliated comb plates, which help in locomotion. Digestion is extracellular and intracellular in both ctenophores and coelenterates. Some of the cnidarians, *e.g.*, corals have a skeleton composed of calcium carbonate.

139. Answer (2)

Hint: True for annelids

Sol.: *Hirudinaria* (Blood sucking leech) belongs to the phylum Annelida. They exhibit organ-system level of body organisation and bilateral symmetry. They are triploblastic, metamerically segmented and coelomate animals.

Platyhelminths have dorso-ventrally flattened body, hence are called flatworms.

Cnidarians and ctenophores exhibit tissue level of body organisation and are diploblastic.

140. Answer (1)

Hint: Feature of sea walnuts

Sol.: *Ctenoplana* belongs to the phylum Ctenophora and in ctenophores, reproduction takes place only by sexual means. Only suckers are present in liver fluke. Both hooks and suckers are present in tapeworm. In sponges, sexes are not separate.

141. Answer (2)

Hint: Identify a mollusc

Sol.: *Sycon* and *Spongilla* belong to the phylum Porifera. In porifers, fertilisation is internal and development is indirect having a larval stage which is morphologically distinct from the adults.

Sepia is a mollusc and body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.

Saccoglossus belongs to the phylum Hemichordata.

142. Answer (3)

Hint: *Laccifer* is lac insect

Sol.: Economically important insects – *Apis* (Honey bee), *Bombyx* (Silkworm), *Laccifer* (Lac insect)

Living fossil – *Limulus* (King crab)

143. Answer (3)

Hint: Possess calcareous ossicles

Sol.: Body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump. In certain molluscs, this calcareous shell is reduced or absent.

In hemichordates, respiration takes place by gills.

Insects respire through tracheal tubes.

144. Answer (2)

Hint: Feature of flatworms

Sol.: *Planaria* as well as *Hydra* possess high regeneration capacity. *Hydra* flourishes well in cool, clean and stagnant water while *Adamsia* is marine.

Ancylostoma belongs to the phylum Aschelminthes.

In *Adamsia* and *Hydra*, metagenesis is absent.

145. Answer (1)

Hint: Echinoderms have tube within tube body plan

Sol.: Digestive system is complete in echinoderms with mouth on the lower (ventral) side and anus on the upper (dorsal) side. The most distinctive feature of echinoderms is the presence of water

vascular system which helps in locomotion, capture and transport of food and respiration.

Some cnidarians exist in two basic body forms and exhibit alternation of generation (Metagenesis), *i.e.*, polyps produce medusae asexually and medusae form the polyps sexually (*e.g.*, *Obelia*).

146. Answer (2)

Hint: *Asterias* is an echinoderm

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

147. Answer (4)

Hint: Belong to the phylum Mollusca

Sol.: Sea fan and Sea pen – Coelenterates

Apple snail, Tusk shell, Devil fish, Cuttle fish and Pearl oyster – Molluscs

Sea cucumber and Starfish – Echinoderms

148. Answer (3)

Hint: Malpighian tubules are the excretory structures in insects

Sol.: *Taenia* - Flame cells

Balanoglossus – Proboscis gland

Nereis – Nephridia

Locusta - Malpighian tubules

149. Answer (1)

Hint: Identify an echinoderm

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. An excretory system is absent. Sexes are separate. Reproduction is sexual. Fertilisation is usually external. Development is indirect with free-swimming larva.

Sea fan and sea anemone are coelenterates while sea hare is a mollusc.

150. Answer (2)

Hint: Devil fish is a mollusc and star fish is an echinoderm

Sol.: Devil fish belongs to the phylum Mollusca and starfish belongs to the phylum Echinodermata.

Molluscs are bilaterally symmetrical, triploblastic and coelomate animals. Their body is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.

Echinoderms have an endoskeleton of calcareous ossicles. All are marine with organ-system level of body organisation. The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

151. Answer (3)

Hint: (a) is *Spongilla* and (b) is *Pila*

Sol.: *Spongilla* belongs to the phylum Porifera and porifers are primitive multicellular animals and have cellular level of body organisation. Digestion is intracellular in them.

Pila belongs to the phylum Mollusca and they are bilaterally symmetrical, triploblastic and coelomate animals. *Pila* undergoes torsion during their development so they become asymmetrical.

152. Answer (2)

Hint: *Taenia* does not have a digestive tract

Sol.: Hooks and suckers are present in the parasitic forms of members belonging to the phylum Platyhelminthes. Some of them absorb nutrients from the host directly through their body surface *e.g.*, tapeworms.

Over two-third of all named species are arthropods. Hemichordates have a rudimentary structure in their collar region called stomochord, a structure similar to notochord.

153. Answer (3)

Hint: Free-swimming

Sol.: Cnidarians exhibit two basic body forms called polyp and medusa. The former is a sessile and cylindrical form like *Hydra*, *Adamsia*, *etc.*, whereas, the latter is umbrella-shaped and free-swimming like *Aurelia* or jelly fish. Those cnidarians which exist in both forms exhibit alternation of generation (Metagenesis), *i.e.*, polyps produce medusae asexually and medusae form the polyps sexually.

154. Answer (3)

Hint: Mesoglea is an acellular layer

Sol.: Animals in which the cells are arranged in two embryonic layers, an external ectoderm and an internal endoderm, are called diploblastic animals, *e.g.*, coelenterates and ctenophores. An undifferentiated layer, mesoglea, is present in between the ectoderm and the endoderm.

155. Answer (1)

Hint: Feature of echinoderms

Sol.: *Euspongia* (Bath sponge) belongs to the phylum Porifera and sponges have a water transport or canal system. Water enters through

minute pores (ostia) in the body wall into a central cavity, spongocoel, from where it goes out through the osculum. This pathway of water transport is helpful in food gathering, respiratory exchange and removal of waste.

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

156. Answer (2)

Hint: Feature of insects

Sol.: Ventral heart is the feature of chordates. Butterfly, belong to the phylum Arthropoda. The body of arthropods is covered by chitinous exoskeleton. Terrestrial arthropods exhibit internal fertilization.

157. Answer (4)

Hint: True for sea walnuts

Sol.: The body of arthropods can be divided into cephalothorax and abdomen.

Blood leeches have open type of circulatory system. Flatworms are mostly endoparasites found in animals including human beings. *Planaria* is a free-swimming flatworm. Bioluminescence (the property of a living organism to emit light) is well-marked in ctenophores.

158. Answer (1)

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

Sol.: Sponges reproduce asexually by fragmentation and sexually by formation of gametes. Reproduction takes place only by sexual means in ctenophores. *Pleurobrachia* and *Ctenoplana* are ctenophores.

Echinoderms also reproduce by sexual means. *Antedon* and *Ophiura* are echinoderms.

159. Answer (1)

Hint: One of them is an arthropod and another one is a mollusc

Sol.: *Limulus* is an arthropod while *Loligo* is a mollusc. Molluscs are terrestrial or aquatic (marine or fresh water) having an organ-system level of body organisation. They are bilaterally symmetrical, triploblastic and coelomate animals. Arthropods have organ-system level of body organisation. They are bilaterally symmetrical, triploblastic, segmented and coelomate animals.

160. Answer (1)

Hint: Less than five

Sol.: Various types of respiratory structures are present in different groups of arthropods.

Gills: Present in aquatic arthropods like prawns, crabs, *etc*.

Book gills : Present in king crabs

Book lungs: Present in scorpions, spiders, *etc*.,

Tracheal system: Present in butterfly, cockroach, mosquito and other insects

161. Answer (2)

Hint: Exclude the cnidarians

Sol.:

Molluscs	Dioecious and exhibit direct development
Coelenterates	Digestion is both extracellular and intracellular
Porifers	Most primitive multicellular organism

162. Answer (4)

Hint: Also known as coelenterata

Sol.: Cnidarians exhibit tissue level of body organisation and are diploblastic. They have a central gastro-vascular cavity with a single opening, mouth on hypostome.

Cnidoblasts or cnidocytes (which contain the stinging capsules or nematocysts) are present on the tentacles and the body. Cnidoblasts are used for anchorage, defense and for the capture of prey.

Cnidarians exhibit two basic body forms called polyp and medusa. Those cnidarians which exist in both forms exhibit alternation of generation (Metagenesis), *i.e*., polyps produce medusae asexually and medusae form the polyps sexually.

163. Answer (3)

Hint: *Nereis* is an aquatic annelid

Sol.: *Nereis*, an aquatic form, is dioecious, but earthworms and leeches are monoecious. *Nereis* possesses lateral appendages parapodia, which help in swimming.

Body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump. A soft and spongy layer of skin forms a mantle over the visceral hump. The

space between the hump and the mantle is called the mantle cavity in which feather-like gills are present. They have respiratory and excretory functions.

164. Answer (3)

Hint: Possesses tube within tube body plan

Sol.: *Wuchereria* is the causative agent of elephantiasis. Roundworms have organ-system level of body organisation. They are bilaterally symmetrical, triploblastic and pseudocoelomate animals. Alimentary canal is complete with a well-developed muscular pharynx.

165. Answer (1)

Hint: Hermaphrodite organisms

Sol.: Sexes are not separate in sponges, platyhelminths and some annelids *i.e.*, eggs and sperms are produced by the same individual. In porifers, fertilisation is internal and development is indirect having a larval stage which is morphologically distinct from the adult.

166. Answer (2)

Hint: Identify an echinoderm and a mollusc

Sol.: When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry. Coelenterates, ctenophores and adult echinoderms have this kind of symmetry. Animals like annelids, arthropods, *etc*., where the body can be divided into identical left and right halves in only one plane, exhibit bilateral symmetry.

167. Answer (3)

Hint: Number of ear ossicles in one ear

Sol.: The body of hemichordates is cylindrical and is composed of an anterior proboscis, a collar and a long trunk. Circulatory system is of open type. Respiration takes place through gills.

168. Answer (3)

Hint: Identify echinoderms

Sol.: Hemichordates, ctenophores and echinoderms are exclusively marine. *Planaria* is a free living flatworm.

Pleurobrachia and *Ctenoplana* are ctenophores. *Fasciola* is a parasitic flatworm. *Ascaris* is roundworm.

169. Answer (4)

Hint: Also exhibit true metamerism

Sol.: When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry (radiata). Coelenterates, ctenophores and adult echinoderms have this kind of body plan. Larvae of echinoderms are bilaterally symmetrical (bilateria).

Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ-level of body organisation.

170. Answer (1)

Hint: Tapeworm is a flatworm

Sol.: Tapeworm belongs to the phylum Platyhelminthes and hookworm belongs to the phylum Aschelminthes.

Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ level of body organisation. The body of the aschelminth is circular in cross-section, hence, the name roundworms. They are bilaterally symmetrical, triploblastic and pseudocoelomate animals.

Aschelminths are sexually dimorphic (females are longer) while tapeworm is monoecious.

171. Answer (4)

Hint: Known as radula

Sol.: Dorsal heart is a non-chordate feature.

Open circulatory system is present in arthropods, non-cephalopod molluscs and hemichordates.

Echinoderms have an endoskeleton of calcareous ossicles.

The mouth of molluscs contains a file-like rasping organ for feeding, called radula.

172. Answer (1)

Hint: Identify an aquatic arthropod.

Sol.: The statocyst is a sensory balancing organ present in some aquatic invertebrates, including bivalves, cnidarians, ctenophores, echinoderms, cephalopods, crustaceans and gastropods.

173. Answer (3)

Hint: Liver fluke is a platyhelminth.

Sol.: *Fasciola* (Liver fluke) – Have dorso-ventrally flattened body and are endoparasites.

Cucumaria (Sea cucumber) – Characterised by absence of excretory system.

Dentalium (Tusk shell) – Body covered by a calcareous shell.

Ancylostoma (Hookworm) – Pseudocoelomate with a well- developed muscular pharynx.

174. Answer (1)

Hint: The common name of *Pinctada* is pearl oyster

Sol.: Some molluscs are famous for pearl body formation, *e.g.*, *Pinctada.* Pearls are among the most beautiful and valuable of our jewels. An oyster naturally forms the pearl when any external particle like sand gets entangled in its skin which causes irritation to it.

The irritation stimulates the mantle to secrete thin concentric layers of nacre around this foreign particle. At the end of several years, a pearl is formed. Chemically, pearl is made up of calcium carbonate.

175. Answer (4)

Hint: Both molluscs and arthropods possess exoskeleton.

Sol.: Both molluscs and arthropods are triploblastic and coelomate animals. Echinoderms have an endoskeleton of calcareous ossicles.

176. Answer (1)

Hint: Housefly possesses jointed appendages.

Sol.: Hemichordata was earlier considered as a sub-phylum under the phylum Chordata. But now, it is placed as a separate phylum under non-chordates. This phylum consists of a small group of worm-like marine animals with organ-system level of body organisation. The body of hemichordates is differentiated into proboscis, collar and trunk.

177. Answer (3)

Hint: Identify an echinoderm

Sol.: *Locusta* (Locust) is a gregarious and polyphagous (feeds on economically important agricultural and horticultural crops) insect. In *Echinus*, excretory system is absent, not circulatory system. *Hydra* is a fresh water polyp.

Sepia (Cuttlefish) is a mollusc.

178. Answer (4)

Hint: Common feature of arthropods, aschelminths and molluscs

Sol.: *Ancylostoma* and *Ascaris* are aschelminths while *Anopheles* is an arthropod and *Aplysia* is a mollusc.

Aschelminths, arthropods and molluscs are bilaterally symmetrical and triploblastic animals.

Aschelminths are pseudocoelomates while arthropods and molluscs are eucoelomates. They all are dioecious animals.

179. Answer (2)

Hint: Exclude coelenterates

Sol.: Sea lily – *Antedon*

Sea hare – *Aplysia*

Sea pen – *Pennatula*

Sea fan – *Gorgonia*

180. Answer (4)

Hint: Gregarious pest

Sol.: Vectors – *Anopheles*, *Culex* and *Aedes*

Gregarious pest – *Locusta* (Locust)

❑ ❑ ❑

All India Aakash Test Series for NEET - 2027

TEST - 5 (Code - D)

Click here for Code-C Sol.

Test Date : 15/02/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (4)

Hint: Apply concept of thermal expansion

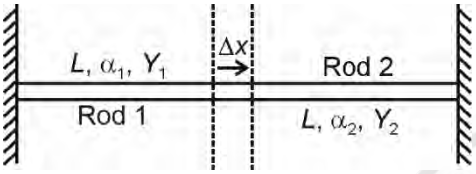
Sol.: Let the free thermal expansion of rod 1 is x_1, then

$x_1 = L\alpha_1\Delta T$ ...(i)

Similarly, for rod 2:

$x_2 = L\alpha_2\Delta T$ ...(ii)

Both the rods are connected in series and are not free to move. Let's assume that the midpoint is displaced by Δx as shown in figure.



Compression in rod 1 = $x_1 - \Delta x$

Compression in rod 2 = $x_2 + \Delta x$

Compressive force is same in both the rods and since area of cross-section is also equal, hence $\sigma_1 = \sigma_2$

$$\sigma_1 = Y_1(x_1 - \Delta x),\ \sigma_2 = Y_2(x_2 + \Delta x)$$

$$Y_1x_1 - Y_1\Delta x = Y_2x_2 + Y_2\Delta x$$

$$Y_1(L\alpha_1\Delta T) - Y_2(L\alpha_2\Delta T) = (Y_1 + Y_2)\Delta x$$

$$\Delta x = \frac{(Y_1\alpha_1 - Y_2\alpha_2)L\Delta T}{Y_1 + Y_2}$$

2. Answer (3)

Hint: Use principle of calorimetry

Sol.: Heat loss by water = Heat gain by ice

$m_w s_w \Delta T = m_{ice} L_{ice}$

$100 \times 1 \times 40 = m_{ice} \times 80$

$m_{ice} = 50$ g

3. Answer (2)

Hint & Sol.: In conduction, heat transfer occurs due to molecular collisions and vibrations within a material without any bulk movement of matter.

4. Answer (2)

Hint: Use equation of continuity

$AV = A_1V_1 + A_2V_2 + A_3V_3$

Sol.: $4A = 0.6A + 0.2A + 0.4AV$

$4 - 0.8 = 0.4V$

$$\frac{3.2}{0.4} = V = 8 \text{ m/s}$$

5. Answer (2)

Hint: Velocity of efflux $v = \sqrt{2gh}$

Sol.: $v = \sqrt{2 \times g \times h}$

$= \sqrt{2 \times 10 \times 10} = 10\sqrt{2}$ m/s

6. Answer (2)

Hint: Use Bernoulli's theorem at points A and B

Sol.: $$P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$$

$$\frac{1}{2}\rho\left(v_2^2 - v_1^2\right) = P_1 - P_2$$

$$\frac{1}{2}\rho\left(v_2^2 - v_1^2\right) = \rho gh$$

$v_2 = 32$ cm/s

7. Answer (2)

Hint & Sol.: Equation of continuity is based on conservation of mass in flow of incompressible fluids.

8. Answer (2)

Hint: Use Pascal law $\frac{F_1}{A_1} = \frac{F_2}{A_2}$

Sol.: $$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

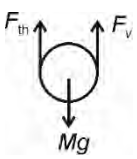
$$\frac{10\text{N}}{\pi r_1^2} = \frac{F}{\pi r_2^2}$$

$$\frac{10}{(2)^2} = \frac{F}{(5)^2}$$

$$F = \frac{25 \times 10}{4} = 62.5 \text{ N}$$

9. Answer (4)

Hint & Sol.: For a body falling through a viscous medium



It experiences upward viscous force, upward buoyant force and downward weight of the ball.

10. Answer (4)

Hint: $Mg = F_A + F_B$

Sol.: $Mg = F_A + F_B$

$Mg = V_A\rho_A g + V_B\rho_B g$

$M = V_A\rho_A + V_B\rho_B$

$= (10 \times 10 \times 6 \times 0.3) + (10 \times 10 \times 4 \times 0.2)$

$= 180 + 80 = 260$ g

11. Answer (3)

Hint: Angular momentum remains conserved.

Sol.: $I_1\omega_1 = I_2\omega_2$

$$\frac{ML^2\omega}{3} = \frac{ML^2}{3}(1+\alpha\Delta T)^2\omega'$$

$\omega' = \omega(1 + \alpha\Delta T)^{-2} = \omega(1 - 2\alpha\Delta T)$

$\omega' = \omega[1 - 2\alpha\Delta T]$

$$\% \text{ decrease in } \omega = \frac{\Delta\omega}{\omega}\times 100 = \frac{\omega'-\omega}{\omega}\times 100$$

$$\frac{\omega'-\omega}{\omega}\times 100 = -2\alpha\Delta T\times 100$$

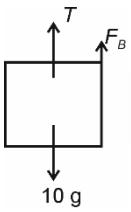
$= -2 \times 3 \times 10^{-4} \times 100 \times 100$

$= -6\%$ *i.e.*, 6% decrease

12. Answer (1)

Hint: Upthrust = $V\rho_L g$

Sol.:



$T + F_B = 10g$

$T = 100 - V\rho g$

$\rho_0 V_0 g = 10g$ …(1)

$V_0\rho_w g = F_B$ …(2)

$\rho_0 = 1.5\ \rho_w$

$$\frac{\rho_0 V_0 g}{V_0\rho_w g} = \frac{10g}{F_B}$$

$$1.5 = \frac{100}{F_B}$$

$$F_B = \frac{100}{1.5} = 66.67 \text{ N}$$

$\therefore\ T = 100 - 66.67$ N $= 33.33$ N

13. Answer (3)

Hint: $v_T \propto r^2$; $m \propto r^3$

Sol.: $$\frac{m_1v_1}{m_2v_2} = \frac{r_1^3}{r_2^3}\frac{r_1^2}{r_2^2} = \left(\frac{r_1}{r_2}\right)^5$$

$$\frac{m_1v_1}{m_2v_2} = \left(\frac{2}{3}\right)^5 = \frac{32}{243}$$

14. Answer (3)

Hint: $P_{gauge} = h\rho g$

$P_{absolute} = P_{atm} + h\rho g$

P_{av} on walls $= \frac{1}{2}h\rho g$

Sol.: $P_{gauge} = 10 \times 10^3 \times 10 = 10^5$ N/m^2

$P_{absolute} = 1.013 \times 10^5 + 10^5 = 2.013 \times 10^5$ N/m^2

$$P_{avg} \text{ on walls } = \frac{h\rho g}{2} = \frac{10^5}{2} = 0.5\times 10^5 \text{ N/m}^2$$

Force = P_{gauge} × Area of base

$= 10^5 \times \pi(1)^2 = \pi \times 10^5$ N

15. Answer (3)

Hint: Use $L_{eq} = L_1 + L_2$ and $L = L_0(1 + \alpha\Delta T)$

Sol.: $5L[1 + \alpha_{eq}\Delta T] = 2L[1 + \alpha\Delta T] + 3L(1 + 2\alpha\Delta T)$

$5L + 5L\alpha_{eq}\Delta T = 2L + 2L\alpha\Delta T + 3L + 6L\alpha\Delta T$

$5L\alpha_{eq}\Delta T = 8\alpha L\Delta T$

$$\alpha_{eq} = \frac{8\alpha}{5}$$

16. Answer (3)

Hint: $\Delta l = L\alpha\Delta t$

Sol.: $\Delta l = 100 \times 11 \times 10^{-6} \times (-1°C)$

$= -11 \times 10^{-4}$ cm

17. Answer (2)

Hint: Use Newton's law of cooling

Sol.: $$\frac{T_1 - T_2}{t} = k\left(\frac{T_1 + T_2}{2} - T_0\right)$$

$$\frac{60-50}{10} = k\left[\frac{60+50}{2} - T_0\right]$$

$$\frac{10}{10} = k[55 - T_0] \quad \ldots(1)$$

$$\frac{50-46}{10} = k\left[\frac{50+46}{2} - T_0\right]$$

$$\frac{4}{10} = k[48 - T_0] \quad \ldots(2)$$

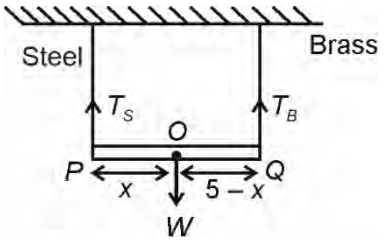
Dividing (1) by (2)

$$\frac{\frac{10}{10}}{\frac{4}{10}} = \frac{k[55-T_0]}{k[48-T_0]}$$

$$T_0 = \frac{130°C}{3} \approx 43°C$$

18. Answer (2)

Hint: Stress in steel = 2 × stress in brass



Sol.: Stress in steel = 2 × stress in brass

$$\frac{T_{Steel}}{A_{Steel}} = 2\frac{T_{Brass}}{A_{Brass}}$$

$$\frac{T_S}{T_B} = 2\times\frac{A_S}{A_B} = \frac{2\times10^{-3}}{3\times10^{-3}} = \frac{2}{3}$$

As system is in equilibrium, take moments about O.

$T_S x = T_B (5 - x)$

$$\frac{T_S}{T_B} = \frac{5-x}{x}$$

$$\frac{2}{3} = \frac{5-x}{x}$$

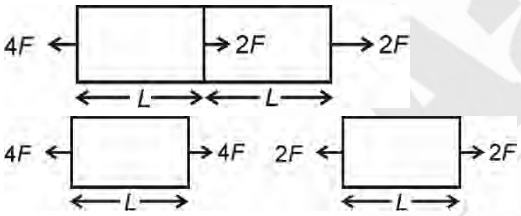
$\Rightarrow 15 - 3x = 2x$

$$x = \frac{15}{5} = 3.00 \text{ m}$$

19. Answer (3)

Hint: $\Delta L = \frac{FL}{AY}$

Sol.:



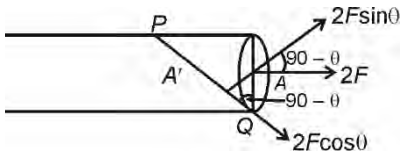
$\Delta l = \Delta l_1 + \Delta l_2$

$$= \frac{4FL}{AY} + \frac{2FL}{AY} = \frac{6FL}{AY}$$

20. Answer (3)

Hint : Normal stress $= \frac{F_\perp}{\text{Area}}$

Sol.:



Normal stress $= \frac{2F\sin\theta}{A'}$, $A' = \frac{A}{\sin\theta}$

Normal stress $= \frac{2F\sin^2\theta}{A}$

21. Answer (4)

Hint: Rate of emission from black body = σAT^4

Sol.: $\frac{x}{x'} = \frac{\sigma T^4}{\sigma\left(\frac{T}{2}\right)^4}$

$$x' = \frac{x}{16}$$

22. Answer (3)

Hint: Elongation $\Delta l = \frac{FL}{AY}$

Sol.: $\Delta l = \frac{FL}{AY}$

$$= \frac{10\times10^3\times2}{\pi(20\times10^{-3})^2\times2\times10^{11}}$$

$$= \frac{2\times10^4}{\pi\times4\times10^{-4}\times2\times10^{11}} = 0.796\times10^{-4} \text{ m}$$

= 0.08 mm

23. Answer (4)

Hint & Sol.: A perfect blackbody is one which absorbs radiation of all wavelengths incident on it. Its absorptance is unity as it neither reflects nor transmits any radiation. Emissivity(e) for blackbody is also unity. The transmittance coefficient of perfect blackbody is zero.

24. Answer (2)

Hint : The rate of emission must be equal to rate of energy production

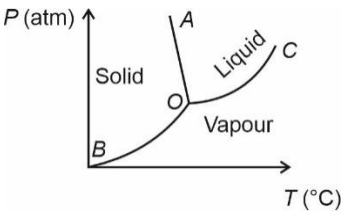
Sol.: $Q = \sigma \times 4\pi R^2 \times T^4$

$$\Rightarrow T^4 = \frac{Q}{\sigma 4\pi R^2}$$

$$\Rightarrow T = \left(\frac{Q}{\sigma 4\pi R^2}\right)^{\frac{1}{4}}$$

25. Answer (3)

Hint & Sol.:



OA represents fusion curve
OB represents sublimation curve
OC represents vaporisation curve

26. Answer (2)

Hint: Work done = Surface tension × Change in surface area

Sol.: $W = T \times 2\left[4\pi\left(\frac{3r}{2}\right)^2 - 4\pi r^2\right]$

$= T \times 4\pi \times \frac{5r^2}{4} \times 2$

$= 10\pi r^2 T$

27. Answer (1)

Hint: Use equations :

$\left(\frac{dQ}{dt}\right) = eA\sigma T^4$ and $\frac{dQ}{dt} = mC\frac{dT}{dt}$

Sol.: Here the surrounding is maintained at absolute zero, hence

$\left(\frac{dQ}{dt}\right)_{\text{heat loss}} = \left(\frac{dQ}{dt}\right)_{\text{radiation}}$

$\left(\frac{dQ}{dt}\right)_{\text{heat loss}} = eA\sigma T^4$

$e = 1$, $A = 4\pi R^2$

$\left(\frac{dQ}{dt}\right)_{\text{heat loss}} = 4\pi R^2\sigma T^4$ ...(i)

This heat loss is responsible for the decrease in temperature of the sphere.

$\therefore \frac{dQ}{dt} = -\frac{mCdT}{dt}$ ...(ii)

$-\frac{mcdT}{dt} = 4\pi R^2\sigma T^4$

$-\rho \times \frac{4}{3}\pi R^3 C\frac{dT}{dt} = 4\pi R^2\sigma T^4$

$-\frac{\rho RC}{3}\int_{T_0}^{\frac{T_0}{2}} \frac{dT}{T^4} = \sigma\int_0^t dt$

$-\frac{\rho RC}{3}\left(\frac{T^{-3}}{-3}\right)_{T_0}^{\frac{T_0}{2}} = \sigma t$

$\frac{\rho RC}{9}\left(\frac{8}{T_0^3} - \frac{1}{T_0^3}\right) = \sigma t$

$\frac{7\rho RC}{9\sigma T_0^3} = t$

28. Answer (3)

Hint: Excess pressure inside soap bubble $= \frac{4T}{r}$

Sol.: $\Delta P = \frac{4T}{r}$

$\Rightarrow \Delta P \propto \frac{1}{r}$

$\Rightarrow \frac{\Delta P_1}{\Delta P_2} = \frac{2}{1}$

29. Answer (4)

Hint & Sol.: Angle of contact depend on soluble impurity, temperature and cohesive force. Increasing temperature decreases angle of contact.

30. Answer (2)

Hint: Net incoming heat current equals net outgoing heat current.

Sol.: $\frac{KA(\theta_0 - 0)}{L} = \frac{KA(50 - \theta_0)}{L} + \frac{KA(70 - \theta_0)}{L}$

$\theta_0 = 50 - \theta_0 + 70 - \theta_0$

$3\theta_0 = 120°$

$\theta_0 = 40°C$

31. Answer (2)

Hint & Sol.: Convection heat flow is possible in liquids and gases only.

32. Answer (4)

Hint: On increasing temperature, mass remains constant, volume increases, density decreases

Sol.: $m_2 = m_1$

$v_2 = v_1[1 + \gamma(t_2 - t_1)]$

$\rho_2 = \rho_1[1 - \gamma(t_2 - t_1)]$

33. Answer (1)

Hint & Sol.: Temperature remains constant during change in the physical state of a material. Any thermometric property can be used to establish a temperature scale.

34. Answer (3)

Hint: Shear modulus $G = \frac{FL}{A\Delta L}$

Sol.: $G = \frac{FL}{A\Delta L} = \frac{10 \times 10^3 \times 5 \times 10^{-2}}{25 \times 10^{-4} \times 1 \times 10^{-4}}$

$G = 2 \times 10^9$ N/m^2

35. Answer (2)

Hint: Elastic potential energy = energy density × volume

Sol.: Energy density of stretched wire

$$= \frac{1}{2} \times \text{stress} \times \text{strain} = \frac{1}{2} \times Y \times (\text{strain})^2$$

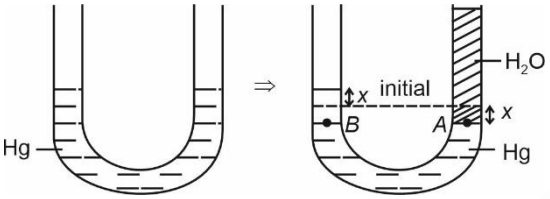
$$= \frac{1}{2} \times 2 \times 10^{11} \times \left(\frac{2 \times 10^{-3}}{4}\right)^2 = 2.5 \times 10^4 \text{ J/m}^3$$

E.P.E = $2.5 \times 10^4 \times (2.0 \times 10^{-6}) \times 4 = 0.20$ J

36. Answer (2)

Hint: $P = h\rho g$ and use Pascal law

Sol.:



As per Pascal law

$P_A = P_B$

$h_w \rho_w g = h_{Hg} \rho_{Hg} g$

13.6 cm × 10^3 kg/m^3 = $2x$ × 13.6 × 10^3 kg/m^3

x = 0.5 cm

37. Answer (1)

Hint: Pressure exerted by a liquid column $P = h\rho g$

Sol.: $P_{water} = P_{liquid}$

$h_{water} \times \rho_{water}\, g = h_{liquid} \times \rho_{liquid}\, g$

40 cm × 10^3 kg/m^3 = 20 cm × ρ_{liquid}

2 × 10^3 kg/m^3 = ρ_{liquid}

38. Answer (3)

Hint: The surface tension force has to support a heavier liquid column in accelerating lift.

Sol.: Capillary rise is given by

$$H = \frac{2s\cos\theta}{\rho g_{eff} r}$$

In case I:

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

In case II:

$$h' = \frac{2s\cos\theta}{\rho(g+a)r},\ g_{eff} = a + g$$

$$\therefore \frac{h'}{h} = \frac{\rho g r}{\rho(g+a)r}$$

$$h' = \frac{h \times g}{(g+a)}$$

39. Answer (1)

Hint & Sol.: Cohesive forces between the molecules of liquid decreases due to increase in the kinetic energy with the rise in temperature hence viscosity of liquid decreases.

40. Answer (3)

Hint: $\boxed{F = Kx}$, where K is force constant

Sol.: $F = \dfrac{(\text{Area}) \times (\text{Young's modulus}) \times (\text{Extension})}{\text{Length}}$

$$F = \frac{BYC}{A}$$

Using $F = K \times$ (extension)

$$\therefore\ K = \frac{BY}{A}$$

41. Answer (2)

Hint: Higher value of Young's modulus of elasticity means more elasticity.

Sol.: $\dfrac{\text{Stress}}{\text{Strain}} = Y$

$$\frac{\text{Strain}}{\text{Stress}} = \frac{1}{Y}$$

Slope of B > slope of A

$Y_B < Y_A$

$\therefore$ A is more elastic than B

42. Answer (4)

Hint: $Q = mL_{fusion} + ms_{water}\,\Delta T + mL_{vap}$

Sol.: Heat required to melt ice at 0°C is

$Q_1 = mL$ = 5 g × 80 cal/g = 400 cal

$Q_2 = ms\Delta T$ = 5 × 1 × 100°C = 500 cal

Heat required to convert water at 100°C to steam at 100°C is

$Q_3 = mL$ = 5 g × 540 cal/g = 2700 cal

Total heat required is $Q_1 + Q_2 + Q_3$ = 3600 cal

43. Answer (3)

Hint: Reading scale

$$= \frac{T_A - \text{ Freezing point}}{\text{Boiling point} - \text{Freezing point}}$$

Sol.: $\dfrac{C - 0}{100 - 0} = \dfrac{T_A - 10}{110 - 10}$

$$\frac{60}{100} = \frac{T_A - 10}{100}$$

T_A = 70°A

44. Answer (4)

Hint: Average pressure on the walls of the container is $\frac{1}{2}h\rho g$

Sol.: Pressure on the bottom surface = $h\rho g$

Average pressure on the walls of the container is $\frac{1}{2}h\rho g$

Ratio $= \frac{2}{1}$

45. Answer (2)

Hint: $\rho_{mixture} = \frac{M_1 + M_2}{V_1 + V_2}$

Sol.: $\rho_{mixture} = \frac{V\rho_1 + V\rho_2}{2V} = \frac{\rho_1 + \rho_2}{2}$

$= \frac{1.4 + 1.2}{2} = \frac{2.6}{2} = 1.3 \text{ g cm}^{-3}$

[CHEMISTRY]

46. Answer (3)

Hint: pH of salt of weak acid and strong base

$pH = 7 + \frac{1}{2}(pK_a + \log C)$

Sol.: $pH = 7 + \frac{1}{2}(pK_a + \log C)$

$= 7 + \frac{1}{2}[4.74 + \log 0.04]$

$= 7 + \frac{1}{2}(4.74 - 1.398) = 8.7$

47. Answer (4)

Hint: $pH = \frac{1}{2}(pK_a - \log C)$

Sol.: $pH = \frac{1}{2}\left[-\log(2\times10^{-5}) - \log 0.1\right]$

$= \frac{1}{2}[(5 - 0.3) + 1]$

= 2.85

48. Answer (3)

Hint: H – A bond strength determines the acidic nature.

Sol.: As the size of A increases, H – A bond strength decreases and hence acid strength increases as follows:

HF << HCl << HBr << HI

49. Answer (2)

Hint:

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

At $t = 0$; 1 0 0

At $t = t_{eq}$; $(1-x)$ $\frac{x}{2}$ $\frac{x}{2}$

Sol.: Total moles = $1 - x + \frac{x}{2} + \frac{x}{2} = 1$

$K_p = \frac{[H_2][I_2]}{[HI]^2} = \frac{x^2}{4(1-x)^2}$

50. Answer (2)

Hint: In group 14, down the group the size increases and electronegativity decreases, and thereby, tendency to show catenation decreases.

Sol.: Lead does not show catenation.

51. Answer (2)

Hint: C_{60} is molecule has a shape like soccer ball and called Buckminsterfullerene

Sol.: Buckminsterfullerene has 20 six membered rings and 12 five membered rings.

52. Answer (4)

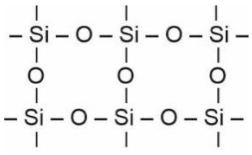
Hint: In $[SiCl_6]^{2-}$, the interaction between lone pair of chloride ion and Si^{4+} is not very strong.

Sol.: Six chloride ions cannot be accommodated around Si^{4+} ion due to limitation of its size hence, $[SiCl_6]^{2-}$ does not exist.

53. Answer (3)

Hint: CO_2 has a linear structure

Sol.: O = C = O linear monomeric structure of CO_2 gas



SiO_2(solid)3D network

54. Answer (4)

Hint: Germanium is a metalloid among group 14 elements.

Sol.: Order of covalent radius

C << Si < Ge < Sn < Pb

Element	First Ionization enthalpy (kJ/mol)
C	1086
Si	786
Ge	760
Sn	707
Pb	715

55. Answer (3)

Hint: Moving down the group 14, electronegativity decreases till Si then becomes constant till Sn and slightly increases for Pb.

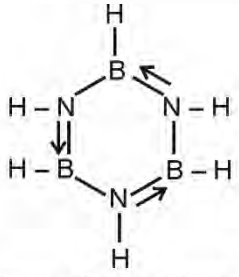
Sol.:

Element	Electronegativity (on Pauling scale)
C	2.5
Si	1.8
Ge	1.8
Sn	1.8
Pb	1.9

56. Answer (1)

Hint: Borazine is also known as inorganic benzene

Sol.:



Borazine (Inorganic benzene)

57. Answer (3)

Hint: Diborane is prepared by treating BF_3 with $LiAlH_4$ in diethyl ether

Sol.:

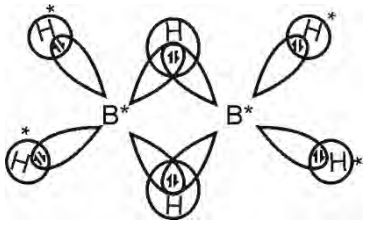
$$\text{I: } 3LiAlH_4 + 4BF_3 \rightarrow \underset{(X)}{2B_2H_6} + \underset{(Y)}{3AlF_3} + 3LiF$$

$$\text{II: } 2NaBH_4 + I_2 \rightarrow \underset{(X)}{B_2H_6} + 2NaI + \underset{(Z)}{H_2}$$

58. Answer (4)

Hint: Diborane has two 3-centre-2-electron bonds called banana bonds.

Sol.:

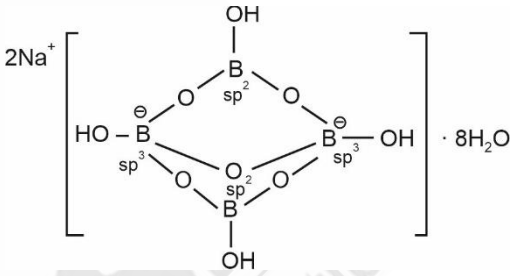


Number of atoms present in a plane (marked*) = 6

59. Answer (3)

Hint: $Na_2B_4O_7 \cdot 10H_2O$ is borax

Sol.:



60. Answer (1)

Hint: Maximum covalency of boron is 4

Sol.: Due to absence of d orbitals, boron trihalide does not hydrolyse to form $[M(H_2O)_6]^{3+}$ in aqueous solution.

61. Answer (4)

Hint & Sol.: $p\pi - p\pi$ back bonding is stronger in BF_3 because of involvement of 2p orbitals of both boron and fluorine in back bonding while in BI_3 back bonding between B and I is not that compatible and hence, BF_3 is not a better Lewis acid than BI_3.

62. Answer (2)

Hint: Atomic radius of gallium is lesser than that of aluminium

Sol.: For group 13 elements

Order of atomic radii: B < Ga < Al < In < Tl

63. Answer (3)

Hint: $K_P = p_Q \times (p_R)^2$

Sol.: $P(s) \rightleftharpoons Q(g) + 2R(g)$

$K_P = (p_Q)\,(p_R)^2$ …(1)

After tripling the partial pressure of R

$K_p = \left(p'_Q\right)(3p_R)^2$

$K_p = p'_Q 9p_R^2$ ...(2)

Comparing equation (1) and (2)

$(p_R)^2 p_Q = p'_Q 9p_R^2$

$\frac{p_Q}{9} = p'_Q$

64. Answer (2)

Hint:

	$CH_3NH_2 + H_2O(\ell) \rightleftharpoons$	$CH_3NH_3^+(aq)$	$+ OH^+(aq)$
Initially	0.1	0	0
At Eq.	$(0.1-0.1\alpha)$	0.1α	0.1α

Sol.: $[OH^-] = 0.1\alpha$

and $K_b = \frac{(0.1\alpha)^2}{0.1(1-\alpha)} = 0.1\alpha^2$

$\therefore \quad \alpha = \sqrt{\frac{5\times10^{-5}}{0.1}} = 2.23\times10^{-2}$

Percentage of $CH_3\overset{\oplus}{N}H_3$ = 2.23 × 10^{-2} × 100

= 2.23

pH of aqueous solution of methanamine is dependant of its concentration.

65. Answer (1)

Hint: $XY \rightleftharpoons X^+ + Y^-$

$K_{sp} = s^2$

$AB_3 \rightleftharpoons A^{3+} + 3B^-$

$s' \quad 3s'$

$K_{sp} = s'(3s')^3 \Rightarrow 27(s')^4$

Sol.: As per question, K_{sp} is same for both the salts.

Hence, $K_{SP} = S^2 = 27\,(S')^4$

$s' = \sqrt[4]{\frac{s^2}{27}}$

66. Answer (2)

Hint: Equivalent weight = $\frac{\text{Molecular weight}}{\text{n factor}}$

Sol.: $\overset{0}{Cl_2} \longrightarrow \overset{-1}{Cl^-}$ (Reduction half)

$(n_f)_{reduction} = 2$

$\overset{0}{Cl_2} \longrightarrow \overset{+5}{C}lO_3^-$ (oxidation half)

$(n_f)_{oxidation} = 10$

$n_f = \frac{(n_f)_{oxidation}\times(n_f)_{reduction}}{(n_f)_{oxidation}+(n_f)_{reduction}} = \frac{2\times10}{2+10} = \frac{20}{12} = \frac{5}{3}$

Hence equivalent weight = $\frac{M}{5/3} = \frac{3M}{5}$

67. Answer (4)

Hint & Sol.: By convention, the standard electrode potential of standard hydrogen electrode is 0.00 volts

68. Answer (1)

Hint: Sum of the total negative and positive charge in a compound is zero

Sol.: $X_3(YZ_2)_2 \Rightarrow (+2)3 + [+1 + (-2)2] \times 2 = 0$

$= 6 + 2 - 8 = 0$

69. Answer (3)

Hint: The reaction in which same element gets oxidised as well as reduced simultaneously is called disproportionation reaction.

Sol.:

(i) $\overset{+6}{3MnO_4^{2-}} + 4H^+ \longrightarrow \overset{+7}{2MnO_4^-} + \overset{+4}{MnO_2} + 2H_2O$ (Oxidation: +6 → +7; Reduction: +6 → +4)

Disproportionation reaction

(ii) $\overset{+7\ -2}{2KMnO_4} \xrightarrow{\Delta} K_2\overset{+6}{Mn}O_4 + \overset{+4}{Mn}O_2 + \overset{0}{O_2}$ (oxidation: −2 → 0; Reduction: +7 → +6; Reduction: +7 → +4)

Not a disproportionation reaction

(iii) $\overset{0}{P_4} + 3OH^- + 3H_2O \longrightarrow \overset{-3}{PH_3} + 3\overset{+1}{H_2}PO_2^-$ (Oxidation: 0 → +1; Reduction: 0 → −3)

Disproportionation reaction

70. Answer (3)

Hint: More negative value of standard reduction potential, more would be the reducing power of metal.

Sol.: The correct order of reducing power is Ca > Mg > Fe > Cu

71. Answer (2)

Hint: $\overset{+1\ -2}{NaO}\overset{+1}{H} + \overset{+1\ -1}{HCl} \longrightarrow \overset{+1\ -1}{NaCl} + \overset{+1\ -2}{H_2O}$

As there is no change in oxidation states of any element in the reaction therefore, it is a non-redox reaction.

Sol.:

(i) $V_2O_5(s) + 2Ca(s) \xrightarrow{\Delta} 5CaO(s) + 2V(s)$

Metal displacement

(ii) $Ca(s) + 2H_2O(\ell) \longrightarrow Ca(OH)_2(aq) + H_2(g)$

Non-metal displacement

(iii) $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$ Combination

72. Answer (1)

Hint: Standard reduction potentials of the given electrodes are

$Zn^{2+} + 2e^- \longrightarrow Zn \quad E^\circ = -0.76\ V$

$Fe^{2+} + 2e^- \longrightarrow Fe \quad E^\circ = -0.44\ V$

Sol.: $E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$

$= -0.44 - (-0.76)$

$= -0.44 + 0.76 = 0.32\ V$

73. Answer (3)

Hint: Sulphide ion – S^{2-}

Phosphate ion – PO_4^{3-}

Dichromate – $Cr_2O_7^{2-}$

Sol.: $S^{2-} \Rightarrow -2$

$\underline{P}O_4^{3-} \Rightarrow +5$

$Cr_2O_7^{2-} \Rightarrow +6$

74. Answer (2)

Hint: $Fe^{2+} \longrightarrow Fe^{3+}$

$C_2O_4^{2-} \longrightarrow 2CO_2$

Sol.: On balancing charges

$Fe^{2+} \longrightarrow Fe^{3+} + e^-$

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-$

$\therefore$ Total electrons involved (lost) = 3

75. Answer (4)

Hint: KO_2 is a superoxide

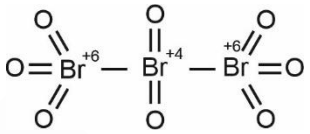
Sol.:

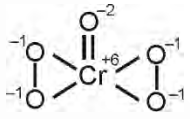
Underlined element in given compound	Oxidation state of underlined element
$\underline{N}_2O$	+1
$\underline{N}H_3$	–3
$H\underline{N}O_3$	+5
$H\underline{Cl}O_3$	+5
$H\underline{Cl}O_4$	+7
$\underline{Fe}_3O_4$	+2 and +3
$K\underline{O}_2$	$-\frac{1}{2}$

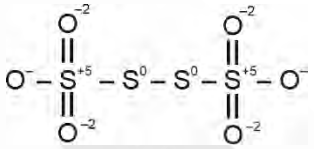
76. Answer (3)

Hint: $\overset{-2}{O} = \overset{+2}{C} = \overset{0}{C} = \overset{+2}{C} = \overset{-2}{O}$

Sol.:

1. 

2. 

3. 

77. Answer (2)

Hint:

$MnO_4^- + SO_3^{2-} + H^+ \longrightarrow SO_4^{2-} + Mn^{2+} + H_2O$

Sol.: On balancing the given equation

$2MnO_4^- + 5SO_3^{2-} + 6H^+ \longrightarrow 5SO_4^{2-} + 2Mn^{2+} + 3H_2O$

For 5 mol of SO_3^{2-} ions, MnO_4^- needed = 2 mol

Hence, for 0.1 mol of SO_3^{2-} ions, MnO_4^- needed = 0.04 mol

78. Answer (2)

Hint: pH of an acidic buffer $= pK_a + \log\frac{[Salt]}{[Acid]}$

Sol.:

	CH_3COOH	+ $NaOH$ $\rightleftharpoons$	CH_3COONa	+ H_2O
t = 0	100 × 0.05 = 5 mmol	100 × 0.01 = 1 mmol	0	0
At $t = t_{find}$	4 mmol	0	1 mmol	0

$pH = 4.74 + \log\frac{[1]}{[4]}$

$= 4.74 - 0.6 = 4.14$

79. Answer (4)

Hint: Salt of weak acid or weak base will undergo hydrolysis

Sol.: Ammonium chloride (NH_4Cl) – Cationic hydrolysis

Sodium acetate (CH_3COONa) – Anionic hydrolysis

Ammonium acetate (CH_3COONH_4) – Both cationic and anionic hydrolysis

Sodium chloride (NaCl) – No hydrolysis, as it is a salt of strong acid and strong base

80. Answer (1)

Hint: An aqueous solution of ammonium acetate will act as buffer.

Sol.: Electron deficient species like $AlCl_3$ and Co^{3+} can act as Lewis acids

81. Answer (3)

Hint: Calcium bromide will produce common ion in solution.

Sol.: $AgBr(s) \rightleftharpoons \underset{s}{Ag^+(aq)} + \underset{(s+0.1)}{Br^-(aq)}$

$K_{sp} = [Ag^+]\,[Br^-]$

$\Rightarrow 5 \times 10^{-13} = s\,(s + 0.1) \qquad (s << 0.1)$

$\therefore \; s = \dfrac{5\times10^{-13}}{0.1} = 5\times10^{-12}\ M$

82. Answer (4)

Hint: $pH = -\log[H^+]$

Sol.:

	$NaOH$	+ HCl	⟶ $NaCl$	+ H_2O
t = 0	0.1 M	0.08 M		
After reaction	0.02	0		

$(0.1\ V) - (0.08 \times V) = M(V + V)$

$\dfrac{0.02V}{2V} = M$

$[OH^-] = 10^{-2}\ M$

$\therefore \; pOH = -\log[10^{-2}] \Rightarrow 2$

$pH = 14 - 2 = 12$

83. Answer (3)

Hint: A mixture of a weak base and the salt of this weak base with a strong acid will make basic buffer.

Sol.:

1.

	HCl	+ $NaOH$	⟶ $NaCl$	+ H_2O
	5 mmol	5 mmol	0	0
After reaction	0	0	5 mmol	

2.

	CH_3COOH	+ $NaOH$	⇌ CH_3COONa	+ H_2O
	10 mmol	10 mmol	0	0
After reaction	0	0	10 mmol	

3.

	HCl	+ NH_4OH	⇌ NH_4Cl	+ H_2O
	10 mmol	15 mmol	0	0
After reaction	0	5 mmol	10 mmol	

Basic buffer

4.

	HCl	+ NH_4OH	⇌ NH_4Cl	+ H_2O
	5 mmol	5 mmol	0	
After reaction	0	0	5 mmol	

84. Answer (1)

Hint: If ionic product > solubility product, then precipitate will be obtained

Sol.:

For AB_2, $K_{ip} = [A^{2+}][B^-]^2$

(1) $K_{ip} = \dfrac{10^{-2}}{2} \times \left(\dfrac{10^{-2}}{2}\right)^2 = \dfrac{1}{8} \times 10^{-6} = 1.25 \times 10^{-7}$

As $K_{ip} > K_{sp}$ in case I, so it will precipitate

85. Answer (4)

Hint: As per Bronsted-Lowry concept of acid base, an acid donates proton (H^+) to form its conjugate base.

Sol.:

Species	Conjugate acid	Conjugate base
H_2CO_3	–	HCO_3^-
H_3O^+	–	H_2O
H_2O	H_3O^+	OH^-
NH_3	NH_4^+	NH_2^-

86. Answer (3)

Hint: Equation (a) + equation (c) × 3 – equation (b) to get given equation:

$2NH_3(g) + \dfrac{5}{2}O_2(g) \rightleftharpoons 2NO(g) + 3H_2O(g)$

Sol.: $K = \dfrac{K_1K_3^3}{K_2}$

87. Answer (4)

Hint: According to Le-Chatelier's principle, any change in equilibrium conditions will shift equilibrium in a direction in which the effect of the change gets counteracted.

Sol.:

- For exothermic reaction (given) equilibrium will shift in backward direction on increasing temperature.

- Increasing concentration of NH_3 will shift the equilibrium in backward direction.
- Decreasing pressure shifts the equilibrium in backward direction, where the number of moles are increasing.

88. Answer (2)

Hint:

	$AB_2(g)$	$\rightleftharpoons$	$AB(g)$	+	$B(g)$
At $t = 0$	600 mmHg		0		0
At $t = t_{eq}$	$(600 - p)$ mmHg		p mmHg		p mmHg

Sol.: Total pressure = 600 – p + p + p

= 600 + p = 800

$\therefore$ p = 200 mm Hg

Hence, p_{AB_2} at equilibrium = 600 – 200 = 400 mm Hg

$p_{AB} = p_B = 200$ mmHg

So, $K_p = \frac{(p_{AB})(p_B)}{(p_{AB_2})} = \frac{(200)^2}{400} = 100$

89. Answer (1)

Hint: One reversing equation $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$ and multiplying by $\frac{1}{2}$, we get equation $NO(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO_2(g)$

Sol.: K_C for equation,

$2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$; $K_C = 9.0 \times 10^{-6}$

For new equation, $NO(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO_2(g)$

$$K'_C = \left(\frac{1}{K_C}\right)^{\frac{1}{2}} = \sqrt{\frac{1}{9.0 \times 10^{-6}}} = 3.3 \times 10^2$$

90. Answer (2)

Hint: $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

Sol.: On addition of inert gas at constant pressure, volume will increase and equilibrium will shift in the direction where moles are increasing. Hence equilibrium will shift in backward direction and dissociation of SO_3 at equilibrium will increases.

[BOTANY]

91. Answer (1)

Hint: Protons are removed from the stroma with the help of NADP reductase enzyme.

Sol.: The gradient is broken down due to the movement of proton across the membrane to the stroma, through the transmembrane channel of the CF_0 of ATP synthase. Breakdown of the gradient provides enough energy to cause a conformational change in the CF_1 particle of ATP synthase.

92. Answer (4)

Hint: Spores on liberation germinate into creeping, green, branched and frequently filamentous stage called protonema.

Sol.: In the life cycle of mosses, the correct sequence of stages would be as follows:

A $\rightarrow$ Reduction division in spore mother cell

B $\rightarrow$ Protonema stage

C $\rightarrow$ Leafy stage

E $\rightarrow$ Syngamy

D $\rightarrow$ Formation of oospore

So, the correct sequence is A $\rightarrow$ B $\rightarrow$ C $\rightarrow$ E $\rightarrow$ D

93. Answer (1)

Hint: Rice is a C_3 plant.

Sol.: Maize is adapted to dry tropical region and has the C_4 pathway.

94. Answer (1)

Hint: Seta in *Funaria* is a part of sporophytic plant body.

Sol.: Gametophytic plant body (n) $\rightarrow$ leaves(n) $\Rightarrow$ 8 chromosomes

(2n) Sporophytic plant body $\rightarrow$ Seta (2n) $\Rightarrow$ 16 chromosomes

95. Answer (4)

Hint: Bryophytes are known as first embryophytes.

Sol.:

	Dominant phase	Nature of spores	Archegonia	Embryo
Algae	Gametophyte	Homosporous	Absent	Absent
Bryophyta	Gametophyte	Homosporous	Present	Present
Pteridophyta	Sporophyte	Homosporous/ Heterosporous	Present	Present
Gymnosperm	Sporophyte	Heterosporous	Present	Present

96. Answer (2)

Hint: Cyclic photophosphorylation occurs in stroma lamellae which lacks NADP reductase enzyme.

Sol.: Absorption of sunlight by chlorophyll and cyclic photophosphorylation do not require NADP reductase enzyme.

97. Answer (1)

Hint: Algae → *Polysiphonia*

Sol.: Bryophytes → *Polytrichum*

Pteridophyte → *Marsilea*

Angiosperm → *Eucalyptus*

98. Answer (3)

Hint: Calvin cycle is common in both C_3 and C_4 plants

Sol.: The CO_2 fixation during C_3 pathway occurs in the chloroplast of bundle sheath cell, guard cell and mesophyll cell.

99. Answer (2)

Hint: Carboxylase activity of RuBisCO forms 2 molecules of a C_3 acid.

Sol.: C_4 plants have Kranz anatomy, where in mesophyll cell CO_2 is fixed into a 4C compound. A C_4 acid is then transported to bundle sheath cells. In the bundle sheath cells, CO_2 is released, increasing its concentration around RuBisCO, enhancing photosynthesis efficiency.

100. Answer (2)

Hint: Red algae are present in both well lighted regions and also at great depths in the ocean.

Sol.: Brown algae usually are attached to the substratum by a holdfast, and have a stalk (stipe) and leaf-like photosynthetic organ called frond.

- *Polysiphonia* reproduces asexually by non-motile spores.
- Pyrenoids contain protein besides starch.

101. Answer (2)

Hint: *Riccia* is a monoecious plant.

Sol.: In *Riccia*, antheridia and archegonia are produced on same thalli.

102. Answer (2)

Hint: Members of Chlorophyceae have oil droplets as a reserve food material.

Sol.: Most of the members of Chlorophyceae have one or more storage bodies called pyrenoids located in the chloroplast.

103. Answer (1)

Hint: Dark reaction used to drive the process that results in the synthesis of food.

Sol.: Immediately after light becomes unavailable, the biosynthetic process continues for some time and then stops. It proves that dark rection does not directly depend on the presence of light but is dependent on the products of light reaction.

104. Answer (4)

Hint: Water splitting complex is associated with PS-II.

Sol.: Splitting of water produces protons or hydrogen ions within the lumen of the thylakoid that develop the proton gradient across the membrane.

105. Answer (3)

Hint: Large cells around the vascular bundles of C_4 plants are called bundle sheath cells.

Sol.: Bundle sheath cells are characterised by having large number of chloroplast, grana are absent, thick walls impervious to gas exchange and no intercellular spaces.

106. Answer (1)

Hint: Light saturation occurs at 10 percent of the full sunlight.

Sol.: Blackman gave the law of limiting factors that states, if a chemical process is affected by more than one factor, then its rate will be determined by the factor which is nearest to its minimum value.

107. Answer (3)

Hint: The graphic curve showing the relative rate of photosynthesis at different wavelengths of light represents the action spectrum.

Sol.: The graphic curve showing the amount of energy of different wavelengths of light absorbed by a pigment, represents the absorption spectrum.

108. Answer (1)

Hint: Cytotaxonomy is based on chromosome number

Sol.: Artificial classification – Vegetative character or on the androecium structure

Chemotaxonomy– Chemical constituents

109. Answer (1)

Hint: *Selaginella* and *Sphagnum* belongs to division Pteridophyta and Bryophyta respectively.

Sol.: In *Selaginella*, sporophylls may form strobili or cone. In *Selaginella*, spore germinates to give rise to either a male or a female gametophyte.

110. Answer (3)

Hint: For one turn of Calvin cycle to occur, 3 ATP and 2 NADPH + H^+ are required.

Sol.: 2 ATP and 2 NADPH + H^+ is required for the formation of two triose phosphate from two molecules of 3-PGA. 10 ATP and 10 NADPH + H^+ are required for the formation of 10 molecules of triose phosphate from 10 molecules of 3-PGA.

111. Answer (4)

Hint: Angiosperms and gymnosperms are seed producing plants.

Sol.: Pollen grains are formed only in angiosperms and gymnosperms.

112. Answer (2)

Hint: Major photosynthetic pigments found in Chlorophyceae members are chlorophyll *a*, *b*

Sol.: Major photosynthetic pigments found in phaeophyceae members are chlorophyll *a*, *c*

113. Answer (2)

Hint: Melvin Calvin identified that the first product of C_3 cycle was 3-PGA

Sol.: Under low light intensity, chloroplasts align themselves perpendicular to the incident light.

114. Answer (2)

Hint: T.W. Engelmann's experiments described first action spectrum of photosynthesis.

Sol.: Melvin Calvin – Used radioactive ^{14}C in algal photosynthesis.

Joseph Priestley– Revealed the essential role of air in the growth of green plant.

Julius von Sachs – Provided evidence for production of glucose when plant grows.

115. Answer (3)

Hint: Movement of electron is downhill in terms of redox potential scale.

Sol.: In terms of redox potential scale, transfer of electron, starting from PS-II, uphill to the acceptor, down the electron transport chain to PS-I, excitation of electron, transfer to another acceptor and finally downhill to $NADP^+$ is called the Z-scheme.

116. Answer (4)

Hint: Cyclic photophosphorylation occurs when only light of wavelength beyond 680 nm are available for excitation.

Sol.: As PS-II is not functional, water splitting will not take place. No oxygen and electrons will be released from water molecule.

117. Answer (3)

Hint: Duration of light affects the overall photosynthesis.

Sol.: Light duration does not affect the rate of photosynthesis.

118. Answer (3)

Hint: O_2 is utilised in chloroplast.

Sol.: During photorespiration, CO_2 is released in mitochondria.

119. Answer (3)

Hint: Calvin cycle or C_3 cycle is named after Melvin Calvin who discovered it.

Sol.: Melvin Calvin received the Nobel prize in 1961 for mapping the carbon fixation pathway.

120. Answer (4)

Hint: Beyond 0.05 per cent, CO_2 concentration becomes damaging over longer periods.

Sol.: Increase in concentration upto 0.05 per cent can cause an increase in CO_2 fixation rate.

121. Answer (3)

Hint & Sol. : For chemiosmosis, high concentration of protons is created within the thylakoid lumen. This creates a proton gradient across thylakoid membrane.

122. Answer (1)

Hint: Chlorophyll *a*, Chlorophyll *b* and xanthophyll appear bright or blue green, yellow-green and yellow respectively.

Sol.: Carotenoids appear yellow to yellow-orange in chromatogram.

123. Answer (4)

Hint: RuBisCO is the most abundant enzyme in the world.

Sol.:

C. Four carbon molecule is formed in mesophyll cell.

E. Four carbon compound is transported to the bundle sheath cells.

A. Release of CO_2 molecule to bind with the most abundant enzyme in the world.
B. Three carbon molecule transported back from bundle sheath cell to mesophyll cell.
D. Regeneration of primary CO_2 acceptor molecule.

124. Answer (4)

Hint: Maize is a C_4 plant.

Sol.: C_4 plants show saturation at about 360 μIL^{-1} concentration of CO_2. Most of the photosynthesis takes place in the blue and red region of visible spectrum. C_4 plants respond to higher temperature.

125. Answer (4)

Hint: *Chlorella* is unicellular green alga, and green algae is found primarily in fresh water.

Sol.: Many species of *Porphyra*, *Laminaria* and *Sargassum* are among the 70 species of marine algae used as food.

126. Answer (4)

Hint: External factors affecting photosynthesis – sunlight, temperature, CO_2 concentration in air.

Sol.: Internal factors which affect photosynthesis include internal CO_2 concentration.

127. Answer (4)

Hint: Gymnosperms have archegonia.

Sol.: Antheridia is absent in gymnosperms. In these plants, male gametophyte is represented by pollen grain and these are developed on macrosporophylls.

128. Answer (1)

Hint: In algae, gametophytic generation is dominant.

Sol.: During evolution, gametophyte became reduced and sporophyte became well developed.

129. Answer (4)

Hint: In *Cycas*, pinnate leaves persist for a few years.

Sol.: Stomata are present in gymnosperms. Spores are produced within sporangia that are borne on sporophyll which are arranged spirally along an axis to form cones.

130. Answer (1)

Hint: When the two photosystems work in a series, first PS-II and then the PS-I, a process called non-cyclic photophosphorylation occurs.

Sol.: All 6 components listed are associated with non-cyclic photophosphorylation.

131. Answer (4)

Hint: This group is characterised by the presence of naked seed.

Sol.: In gymnosperm, pollen tube carrying the male gamete grows towards the archegonia and discharge their content near the mouth of the archegonia.

132. Answer (3)

Hint: Protonema is a part of the haploid gametophytic stage in the life cycle of bryophytes.

Sol.: Both protonema of mosses and prothallus of ferns are haploid structures.

133. Answer (3)

Hint: Given diagram is of plant *Fucus* that is a member of Phaeophyceae.

Sol.: In Brown algae, vegetative cells have a cellulosic cell wall usually covered on the outside by a gelatinous coating of algin. In red algae, food is stored in the form of floridean starch. Structurally it is very similar to amylopectin and glycogen.

134. Answer (4)

Hint: A – Linear relationship between incident light and CO_2 fixation rate.

Sol.: B – Some factor other than light becomes the limiting factor.

C – At this region, light intensity is no longer the limiting factor.

D – Saturation point for light intensity

E – Maximum rate of photosynthesis

135. Answer (1)

Hint: This statement holds true for pteridophytes.

Sol.: *Adiantum* is a member of pteridophytes.

[ZOOLOGY]

136. Answer (4)

Hint: Gregarious pest

Sol.: Vectors – *Anopheles*, *Culex* and *Aedes*

Gregarious pest – *Locusta* (Locust)

137. Answer (2)

Hint: Exclude coelenterates

Sol.: Sea lily – *Antedon*

Sea hare – *Aplysia*

Sea pen – *Pennatula*

Sea fan – *Gorgonia*

138. Answer (4)

Hint: Common feature of arthropods, aschelminths and molluscs

Sol.: *Ancylostoma* and *Ascaris* are aschelminths while *Anopheles* is an arthropod and *Aplysia* is a mollusc.

Aschelminths, arthropods and molluscs are bilaterally symmetrical and triploblastic animals.

Aschelminths are pseudocoelomates while arthropods and molluscs are eucoelomates. They all are dioecious animals.

139. Answer (3)

Hint: Identify an echinoderm

Sol.: *Locusta* (Locust) is a gregarious and polyphagous (feeds on economically important agricultural and horticultural crops) insect. In *Echinus*, excretory system is absent, not circulatory system. *Hydra* is a fresh water polyp.

Sepia (Cuttlefish) is a mollusc.

140. Answer (1)

Hint: Housefly possesses jointed appendages.

Sol.: Hemichordata was earlier considered as a sub-phylum under the phylum Chordata. But now, it is placed as a separate phylum under non-chordates. This phylum consists of a small group of worm-like marine animals with organ-system level of body organisation. The body of hemichordates is differentiated into proboscis, collar and trunk.

141. Answer (4)

Hint: Both molluscs and arthropods possess exoskeleton.

Sol.: Both molluscs and arthropods are triploblastic and coelomate animals. Echinoderms have an endoskeleton of calcareous ossicles.

142. Answer (1)

Hint: The common name of *Pinctada* is pearl oyster

Sol.: Some molluscs are famous for pearl body formation, *e.g.*, *Pinctada.* Pearls are among the most beautiful and valuable of our jewels. An oyster naturally forms the pearl when any external particle like sand gets entangled in its skin which causes irritation to it.

The irritation stimulates the mantle to secrete thin concentric layers of nacre around this foreign particle. At the end of several years, a pearl is formed. Chemically, pearl is made up of calcium carbonate.

143. Answer (3)

Hint: Liver fluke is a platyhelminth.

Sol.: *Fasciola* (Liver fluke) – Have dorso-ventrally flattened body and are endoparasites.

Cucumaria (Sea cucumber) – Characterised by absence of excretory system.

Dentalium (Tusk shell) – Body covered by a calcareous shell.

Ancylostoma (Hookworm) – Pseudocoelomate with a well- developed muscular pharynx.

144. Answer (1)

Hint: Identify an aquatic arthropod.

Sol.: The statocyst is a sensory balancing organ present in some aquatic invertebrates, including bivalves, cnidarians, ctenophores, echinoderms, cephalopods, crustaceans and gastropods.

145. Answer (4)

Hint: Known as radula

Sol.: Dorsal heart is a non-chordate feature.

Open circulatory system is present in arthropods, non-cephalopod molluscs and hemichordates.

Echinoderms have an endoskeleton of calcareous ossicles.

The mouth of molluscs contains a file-like rasping organ for feeding, called radula.

146. Answer (1)

Hint: Tapeworm is a flatworm

Sol.: Tapeworm belongs to the phylum Platyhelminthes and hookworm belongs to the phylum Aschelminthes.

Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ level of body organisation. The body of the aschelminth is circular in cross-section, hence, the name roundworms. They are bilaterally symmetrical, triploblastic and pseudocoelomate animals.

Aschelminths are sexually dimorphic (females are longer) while tapeworm is monoecious.

147. Answer (4)

Hint: Also exhibit true metamerism

Sol.: When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry (radiata). Coelenterates, ctenophores and adult echinoderms have this kind of body plan. Larvae of echinoderms are bilaterally symmetrical (bilateria).

Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ-level of body organisation.

148. Answer (3)

Hint: Identify echinoderms

Sol.: Hemichordates, ctenophores and echinoderms are exclusively marine. *Planaria* is a free living flatworm.

Pleurobrachia and *Ctenoplana* are ctenophores. *Fasciola* is a parasitic flatworm. *Ascaris* is roundworm.

149. Answer (3)

Hint: Number of ear ossicles in one ear

Sol.: The body of hemichordates is cylindrical and is composed of an anterior proboscis, a collar and a long trunk. Circulatory system is of open type. Respiration takes place through gills.

150. Answer (2)

Hint: Identify an echinoderm and a mollusc

Sol.: When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry. Coelenterates, ctenophores and adult echinoderms have this kind of symmetry. Animals like annelids, arthropods, *etc*., where the body can be divided into identical left and right halves in only one plane, exhibit bilateral symmetry.

151. Answer (1)

Hint: Hermaphrodite organisms

Sol.: Sexes are not separate in sponges, platyhelminths and some annelids *i.e*., eggs and sperms are produced by the same individual. In porifers, fertilisation is internal and development is indirect having a larval stage which is morphologically distinct from the adult.

152. Answer (3)

Hint: Possesses tube within tube body plan

Sol.: *Wuchereria* is the causative agent of elephantiasis. Roundworms have organ-system level of body organisation. They are bilaterally symmetrical, triploblastic and pseudocoelomate animals. Alimentary canal is complete with a well-developed muscular pharynx.

153. Answer (3)

Hint: *Nereis* is an aquatic annelid

Sol.: *Nereis*, an aquatic form, is dioecious, but earthworms and leeches are monoecious. *Nereis* possesses lateral appendages parapodia, which help in swimming.

Body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump. A soft and spongy layer of skin forms a mantle over the visceral hump. The space between the hump and the mantle is called the mantle cavity in which feather-like gills are present. They have respiratory and excretory functions.

154. Answer (4)

Hint: Also known as coelenterata

Sol.: Cnidarians exhibit tissue level of body organisation and are diploblastic. They have a central gastro-vascular cavity with a single opening, mouth on hypostome.

Cnidoblasts or cnidocytes (which contain the stinging capsules or nematocysts) are present on the tentacles and the body. Cnidoblasts are used for anchorage, defense and for the capture of prey.

Cnidarians exhibit two basic body forms called polyp and medusa. Those cnidarians which exist in both forms exhibit alternation of generation (Metagenesis), *i.e*., polyps produce medusae asexually and medusae form the polyps sexually.

155. Answer (2)

Hint: Exclude the cnidarians

Sol.:

Molluscs	Dioecious and exhibit direct development
Coelenterates	Digestion is both extracellular and intracellular
Porifers	Most primitive multicellular organism

156. Answer (1)

Hint: Less than five

Sol.: Various types of respiratory structures are present in different groups of arthropods.

Gills: Present in aquatic arthropods like prawns, crabs, *etc*.

Book gills : Present in king crabs

Book lungs: Present in scorpions, spiders, *etc*.,

Tracheal system: Present in butterfly, cockroach, mosquito and other insects

157. Answer (1)

Hint: One of them is an arthropod and another one is a mollusc

Sol.: *Limulus* is an arthropod while *Loligo* is a mollusc. Molluscs are terrestrial or aquatic (marine or fresh water) having an organ-system level of body organisation. They are bilaterally symmetrical, triploblastic and coelomate animals. Arthropods have organ-system level of body organisation. They are bilaterally symmetrical, triploblastic, segmented and coelomate animals.

158. Answer (1)

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

Sol.: Sponges reproduce asexually by fragmentation and sexually by formation of gametes. Reproduction takes place only by sexual means in ctenophores. *Pleurobrachia* and *Ctenoplana* are ctenophores.

Echinoderms also reproduce by sexual means. *Antedon* and *Ophiura* are echinoderms.

159. Answer (4)

Hint: True for sea walnuts

Sol.: The body of arthropods can be divided into cephalothorax and abdomen.

Blood leeches have open type of circulatory system. Flatworms are mostly endoparasites found in animals including human beings. *Planaria* is a free-swimming flatworm. Bioluminescence (the property of a living organism to emit light) is well-marked in ctenophores.

160. Answer (2)

Hint: Feature of insects

Sol.: Ventral heart is the feature of chordates. Butterfly, belong to the phylum Arthropoda. The body of arthropods is covered by chitinous exoskeleton. Terrestrial arthropods exhibit internal fertilization.

161. Answer (1)

Hint: Feature of echinoderms

Sol.: *Euspongia* (Bath sponge) belongs to the phylum Porifera and sponges have a water transport or canal system. Water enters through minute pores (ostia) in the body wall into a central cavity, spongocoel, from where it goes out through the osculum. This pathway of water transport is helpful in food gathering, respiratory exchange and removal of waste.

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

162. Answer (3)

Hint: Mesoglea is an acellular layer

Sol.: Animals in which the cells are arranged in two embryonic layers, an external ectoderm and an internal endoderm, are called diploblastic animals, *e.g.*, coelenterates and ctenophores. An undifferentiated layer, mesoglea, is present in between the ectoderm and the endoderm.

163. Answer (3)

Hint: Free-swimming

Sol.: Cnidarians exhibit two basic body forms called polyp and medusa. The former is a sessile and cylindrical form like *Hydra*, *Adamsia*, *etc*., whereas, the latter is umbrella-shaped and free-swimming like *Aurelia* or jelly fish. Those cnidarians which exist in both forms exhibit alternation of generation (Metagenesis), *i.e*., polyps produce medusae asexually and medusae form the polyps sexually.

164. Answer (2)

Hint: *Taenia* does not have a digestive tract

Sol.: Hooks and suckers are present in the parasitic forms of members belonging to the phylum Platyhelminthes. Some of them absorb nutrients from the host directly through their body surface *e.g.*, tapeworms.

Over two-third of all named species are arthropods. Hemichordates have a rudimentary structure in their collar region called stomochord, a structure similar to notochord.

165. Answer (3)

Hint: (a) is *Spongilla* and (b) is *Pila*

Sol.: *Spongilla* belongs to the phylum Porifera and porifers are primitive multicellular animals and have cellular level of body organisation. Digestion is intracellular in them.

Pila belongs to the phylum Mollusca and they are bilaterally symmetrical, triploblastic and coelomate animals. *Pila* undergoes torsion during their development so they become asymmetrical.

166. Answer (2)

Hint: Devil fish is a mollusc and star fish is an echinoderm

Sol.: Devil fish belongs to the phylum Mollusca and starfish belongs to the phylum Echinodermata.

Molluscs are bilaterally symmetrical, triploblastic and coelomate animals. Their body is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.

Echinoderms have an endoskeleton of calcareous ossicles. All are marine with organ-system level of body organisation. The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

167. Answer (1)

Hint: Identify an echinoderm

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. An excretory system is absent. Sexes are separate. Reproduction is sexual. Fertilisation is usually external. Development is indirect with free-swimming larva.

Sea fan and sea anemone are coelenterates while sea hare is a mollusc.

168. Answer (3)

Hint: Malpighian tubules are the excretory structures in insects

Sol.: *Taenia* - Flame cells

Balanoglossus – Proboscis gland

Nereis – Nephridia

Locusta - Malpighian tubules

169. Answer (4)

Hint: Belong to the phylum Mollusca

Sol.: Sea fan and Sea pen – Coelenterates

Apple snail, Tusk shell, Devil fish, Cuttle fish and Pearl oyster – Molluscs

Sea cucumber and Starfish – Echinoderms

170. Answer (2)

Hint: *Asterias* is an echinoderm

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

171. Answer (1)

Hint: Echinoderms have tube within tube body plan

Sol.: Digestive system is complete in echinoderms with mouth on the lower (ventral) side and anus on the upper (dorsal) side. The most distinctive feature of echinoderms is the presence of water vascular system which helps in locomotion, capture and transport of food and respiration.

Some cnidarians exist in two basic body forms and exhibit alternation of generation (Metagenesis), *i.e.*, polyps produce medusae asexually and medusae form the polyps sexually (*e.g.*, *Obelia*).

172. Answer (2)

Hint: Feature of flatworms

Sol.: *Planaria* as well as *Hydra* possess high regeneration capacity. *Hydra* flourishes well in cool, clean and stagnant water while *Adamsia* is marine.

Ancylostoma belongs to the phylum Aschelminthes.

In *Adamsia* and *Hydra*, metagenesis is absent.

173. Answer (3)

Hint: Possess calcareous ossicles

Sol.: Body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump. In certain molluscs, this calcareous shell is reduced or absent.

In hemichordates, respiration takes place by gills.

Insects respire through tracheal tubes.

174. Answer (3)

Hint: *Laccifer* is lac insect

Sol.: Economically important insects – *Apis* (Honey bee), *Bombyx* (Silkworm), *Laccifer* (Lac insect)

Living fossil – *Limulus* (King crab)

175. Answer (2)

Hint: Identify a mollusc

Sol.: *Sycon* and *Spongilla* belong to the phylum Porifera. In porifers, fertilisation is internal and development is indirect having a larval stage which is morphologically distinct from the adults.

Sepia is a mollusc and body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.

Saccoglossus belongs to the phylum Hemichordata.

176. Answer (1)

Hint: Feature of sea walnuts

Sol.: *Ctenoplana* belongs to the phylum Ctenophora and in ctenophores, reproduction takes place only by sexual means. Only suckers are present in liver fluke. Both hooks and suckers are present in tapeworm. In sponges, sexes are not separate.

177. Answer (2)

Hint: True for annelids

Sol.: *Hirudinaria* (Blood sucking leech) belongs to the phylum Annelida. They exhibit organ-system level of body organisation and bilateral symmetry. They are triploblastic, metamerically segmented and coelomate animals.

Platyhelminths have dorso-ventrally flattened body, hence are called flatworms.

Cnidarians and ctenophores exhibit tissue level of body organisation and are diploblastic.

178. Answer (3)

Hint: Common feature between ctenophores and cnidarians

Sol.: *Physalia* belongs to the phylum Coelenterata and *Pleurobrachia* belongs to the phylum Ctenophora. The body of ctenophores bears eight external rows of ciliated comb plates, which help in locomotion. Digestion is extracellular and intracellular in both ctenophores and coelenterates. Some of the cnidarians, *e.g.*, corals have a skeleton composed of calcium carbonate.

179. Answer (4)

Hint: Identify an arthropod

Sol.: The circulatory system may be of two types:

(i) Open type in which the blood is pumped out of the heart and the cells and tissues are directly bathed in it, present in arthropods, non-cephalopod molluscs, hemichordates and tunicates.

(ii) Closed type in which the blood is circulated through a series of vessels of varying diameters (arteries, veins and capillaries), present in annelids (*Nereis*).

Spongilla and *Pleurobrachia* are diploblastic animals.

180. Answer (1)

Hint: Animals with more than one cells

Sol.: Though all members of kingdom Animalia are multicellular, all of them do not exhibit the same pattern of organisation of cells. Inspite of differences in structure and form of different animals, there are fundamental features common to various individuals in relation to the arrangement of cells, body symmetry, nature of coelom, patterns of digestive, circulatory or reproductive systems. These features are used as the basis of animal classification.

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