

All India Aakash Test Series for NEET - 2027

TEST - 4 (Code-I)[Click here for Code-J Sol.](#)

Test Date : 15/02/2026

ANSWERS

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

HINTS & SOLUTIONS**[PHYSICS]**

1. Answer (1)

Hint: Tangential stress, $\tau = \frac{\text{Restoring force}}{\text{Cross-sectional area}}$

$$\text{Sol.: } \tau = \frac{F}{A} \Rightarrow \tau = \frac{100 \times 1}{2 \times 3 \times 2} = \frac{100}{12} = 8.33 \text{ N/m}^2$$

2. Answer (1)

Hint: Maximum weight bearing capacity will depend on material and cross-sectional area.

Sol.: Since the material and area of cross-section remains same, hence it can bear a maximum weight of 30 kg only.

3. Answer (1)

Hint & Sol.: We know that, $T^2 \propto R^3$

4. Answer (2)

Hint & Sol.: The SI unit of gravitational field at a particular point is N/kg.

5. Answer (2)

Hint & Sol.

$$v_e = \sqrt{\frac{2GM}{R}}, v_o = \sqrt{\frac{GM}{R}} \Rightarrow v_e = \sqrt{2} v_o$$

6. Answer (3)

Hint & Sol.: In an elliptical orbit, the angular momentum of planet about sun is conserved. While the speed of the planet changes, so linear momentum and kinetic energy will change.

7. Answer (1)

Hint: The areal velocity remains constant.

Sol.: Since areal velocity remains constant hence,

$$\frac{\Delta A}{\Delta t} = C \Rightarrow \frac{A}{\Delta t_1} = \frac{2A}{\Delta t_2} \Rightarrow \frac{\Delta t_1}{\Delta t_2} = \frac{1}{2}$$

8. Answer (3)

Hint: Use Pascal's law.

Sol.: Using Pascal's law,

$$(\Delta p)_{\text{at centre}} = \left[\frac{F/2}{A} \right] = \frac{F}{2A}$$

9. Answer (1)

Hint & Sol.: Equation of continuity is based on the principle of conservation of mass.

10. Answer (3)

Hint & Sol: Volume of liquid flowing per second out of an orifice is equal to $v = A\sqrt{2gh}$, hence it is independent of density of liquid.

11. Answer (2)

Hint & Sol.: Pressure at point D = $P_{\text{atm}} - \frac{\rho gh}{4}$

and $P_{\text{atm}} = \rho gh$

$$\Rightarrow P_D = \rho gh - \frac{\rho gh}{4} = \frac{3}{4} \times 10^5$$

$$= 0.75 \times 10^5 \text{ Pa}$$

12. Answer (1)

Hint & Sol.: The value of Bulk modulus for solids is very large i.e., tending to infinity.

13. Answer (3)

Hint & Sol.: The slope of load-elongation curve will give force constant i.e., $F = \frac{YA}{l} \Delta l$.

$$F = K \Delta l$$

14. Answer (3)

Hint: Orbital speed, $v = \sqrt{\frac{GM}{r}}$

$$\text{Sol.: } v_0 = \sqrt{\frac{GM}{r}},$$

M = Mass of planet, r = orbital radius

For same planet and same orbital radius, $v_1 = v_2$

15. Answer (3)

Hint & Sol.: Areal velocity remains constant.

16. Answer (3)

Hint: Use the concept of gravitational field due to solid sphere.

Sol.: We know that inside solid sphere, gravitational field is proportional to distance from centre, hence acceleration of particle is proportional to r .

17. Answer (1)

Hint: Shearing stress, $\frac{F}{A} = \eta \times \frac{v}{y}$

Sol.: Shearing stress, $\frac{F}{A} = \eta \times \frac{v}{y} = \frac{10^{-3} \times 5}{10}$

$= 5 \times 10^{-4} \text{ N/m}^2$

18. Answer (3)

Hint & Sol.: According to Hooke's law of elasticity, stress \propto strain within proportional limit.

19. Answer (2)

Hint: $B = \frac{-P}{\frac{\Delta V}{V}}$, for constant hydraulic stress,

$P = -\frac{B\Delta V}{V}$

20. Answer (4)

Hint & Sol.: The gravitational field inside a spherical shell is zero.

21. Answer (1)

Hint & Sol.: Force between two point masses is independent of the presence of other masses.

22. Answer (2)

Hint & Sol.: The tensile stress at distance x from bottom, $\sigma = \frac{mgx}{AL}$

Since σ is directly proportional to x , the graph of tensile stress vs distance x is a straight line.

23. Answer (1)

Hint: Use conservation of energy.

Sol.: $U_i + K_i = U_f + K_f$, $K_f = 0$, $K_i = \frac{1}{2}mv^2$

$U_i = \frac{-GMm}{R} = -mgR$, $U_f = \frac{-GMm}{\frac{3R}{2}} = \frac{-2mgR}{3}$

$\Rightarrow \frac{1}{2}mv^2 = \frac{-2mgR}{3} + mgR$

$\Rightarrow \frac{mv^2}{2} = \frac{mgR}{3} \Rightarrow v = \sqrt{\frac{2gR}{3}}$

24. Answer (3)

Hint & Sol.: As orbital radius decreases the satellite must speed up to maintain orbit at a smaller radius, the satellite gravitational potential energy decreases (becomes more negative) and total energy decreases.

K.E. \uparrow P.E. \downarrow and T.E. \downarrow

25. Answer (4)

Hint: Use conservation of mechanical energy.

Sol.: Since mechanical energy remains conserved, hence total mechanical energy would be zero.

Linear momentum of system will remain conserved.

For total ME to be zero, if P.E. = $\frac{-G \times 4m \times m}{\alpha^2}$

So, K.E. = $\frac{4Gm^2}{\alpha}$

26. Answer (2)

Hint: Use the concept of intensity of field due to thin spherical shell.

Sol.: At B, particle is just outside shell \rightarrow gravity acts normally

$a_B = I_G = \frac{G \times M}{R^2}$

27. Answer (1)

Hint: Above the earth's surface, $g' = g \left[\frac{R}{R+h} \right]^2$

Sol.: Percentage decrease of 75% means,

$g' = 25\% \text{ of } g$

$\Rightarrow g' = \frac{g}{4} = g \left[\frac{R}{R+h} \right]^2 \Rightarrow \frac{R}{R+h} = \frac{1}{2}$

$\Rightarrow 2R = R+h \Rightarrow h = R$

28. Answer (4)

Hint: $\Delta P = \rho gh = \frac{2T}{r}$

Sol.: As initially water rises upto 8 cm but now available length is 4 cm, hence the radius of meniscus increases so that water doesn't overflow.

If h becomes smaller, then ΔP becomes smaller, and thus r must increase.

29. Answer (1)

Hint: Apply Bernoulli's theorem,

$$P_1 + \frac{1}{2}\rho V_1^2 + \rho gh_1 = P_2 + \frac{1}{2}\rho V_2^2 + \rho gh_2$$

Sol.: $P_1 + \frac{1}{2}\rho V_1^2 = P_2 + \frac{1}{2}\rho V_2^2$

$$\frac{1}{2}\rho(V_2^2 - V_1^2) = P_1 - P_2 = 8$$

Change in Kinetic energy per unit mass

$$= \frac{1}{2}(V_2^2 - V_1^2) = P_1 - P_2 = 8$$

Change in Kinetic energy per unit mass

$$= \frac{1}{2}(V_2^2 - V_1^2) = \frac{P_1 - P_2}{\rho}$$

$$= 0.01 \text{ J/kg}$$

30. Answer (4)

Hint: According to meniscus geometry capillary radius, $r = R\cos\theta$, where R denotes radius of meniscus.

Sol.: Rise of liquid, $h = \frac{2s}{R\rho g}$ or $\frac{2s\cos\theta}{r\rho g}$

31. Answer (4)

Hint: Work done is proportional to the change in surface area of bubble.

Sol.: $W = 2s \times \Delta A$, $V = \frac{4}{3}\pi R^3$

$$\Rightarrow R^2 \propto (V)^{2/3}$$

$$\Rightarrow \frac{W}{W'} = \frac{R^2}{(R')^2} \Rightarrow \frac{W}{W'} = \frac{(V)^{2/3}}{(2V)^{2/3}}$$

$$\Rightarrow W' = (2)^{3/2} \cdot W \Rightarrow W' = (4)^{3/2} W$$

32. Answer (1)

Hint: Breaking stress = $\frac{\text{Breaking Force}}{\text{Cross-sectional Area}}$

Sol.: Maximum breaking stress, $\sigma_{\max} = \frac{mg}{A} = \sigma$

$$\Rightarrow \frac{\rho \times A \times l \times g}{A} = \sigma \Rightarrow l = \frac{\sigma}{\rho g}$$

33. Answer (2)

Hint: Young's modulus is the property of material hence it is independent of dimensions of wire.

Sol.: Young's modulus of wire will be Y .

34. Answer (1)

Hint: $U = \frac{-Gm_1m_2}{r}$,

$$V_{\text{centre}} = \frac{-3GM}{2R}$$

$$V_{\text{surface}} = \frac{-GM}{R}$$

Sol.: When two masses come closer, the potential energy decreases and potential at centre of solid surface is less as compared to surface, hence potential increases.

35. Answer (1)

Hint & Sol.: $\alpha = \frac{GM}{\beta} \Rightarrow GM = \alpha\beta$

• Field strength at distance,

$$2\beta = \frac{GM}{4\beta^2} = \frac{\alpha\beta}{4\beta^2} = \frac{\alpha}{4\beta}$$

• Field strength at distance, $\frac{\beta}{2}$

$$= \frac{GM}{\beta^3} \times \frac{\beta}{2} = \frac{GM}{2\beta^2} = \frac{\alpha\beta}{2\beta^2} = \frac{\alpha}{2\beta}$$

• Potential at distance, 3β from centre

$$= \frac{GM}{3\beta} = \frac{\alpha\beta}{3\beta} = \frac{\alpha}{3}$$

• Potential at centre = $\frac{3}{2} \times \frac{GM}{\beta} = \frac{3\alpha}{2}$

36. Answer (1)

Hint: Unit of surface tension, $S = \text{N/m}$

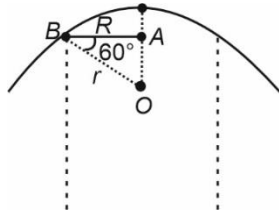
Sol.: Surface tension,

$$[S] = \frac{[MLT^{-2}]}{[L]} = [M^1L^0T^{-2}]$$

37. Answer (4)

Hint: Excess pressure in soap bubble equals $\frac{4T}{r}$

Sol.:



In $\triangle OAB$, $r = \frac{R}{\cos 60^\circ}$ also $\Delta P = \frac{4 \times T}{r}$

$$\Rightarrow \Delta P = \frac{4 \times 5 \times 10^{-2}}{\frac{1 \times 10^{-2}}{0.5}} \Rightarrow 4 \times 5 \times 0.5 = \frac{20}{2} = 10 \text{ Pa}$$

38. Answer (4)

Hint: $V_T = \frac{2r^2(\rho - \sigma)g}{9\eta}$

Sol.: After a long time the ball will attain terminal velocity as the net upward force (upthrust + viscous force) balances the downwards force (weight of body).

39. Answer (2)

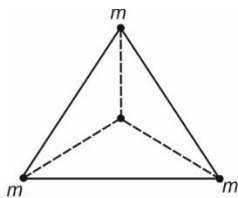
Hint: Use Bernoulli's theorem

Sol.: We know that, as streamlines get closer at point B, then $v_B > v_A \Rightarrow P_A > P_B$

40. Answer (1)

Hint: All the particles will revolve about their centre of mass.

Sol.:



The coordinates of COM will be, $\left[\frac{a}{2}, \frac{a}{2\sqrt{3}}\right]$

\Rightarrow Distance of each particle from COM

$$= \sqrt{\frac{a^2}{4} + \frac{a^2}{12}} = \frac{a}{\sqrt{3}}$$

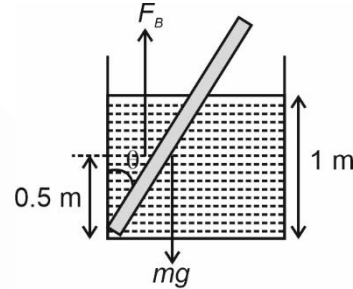
Also, net gravitational force on each particle

$$= \frac{\sqrt{3} Gm^2}{a^2}$$

$$\Rightarrow \frac{\sqrt{3} \times Gm^2}{a^2} = \frac{m \times v^2 \times \sqrt{3}}{a} \Rightarrow v = \sqrt{\frac{Gm}{a}}$$

41. Answer (3)

Hint & Sol.:



For equilibrium of rod

$$mg \times 1 \cdot \sin \theta - F_B \times \frac{1}{2} \cdot \tan \theta = 0$$

$$0.5 \times \rho \times 2 \times A \times g \times \frac{1}{2} \sin \theta - \rho_w \times A \times g \times \frac{1}{\cos \theta} \times \frac{1}{2} \tan \theta = 0$$

On solving

$$\cos^2 \theta = \frac{1}{2}$$

$$\cos \theta = \frac{1}{\sqrt{2}}$$

$$\theta = 45^\circ$$

42. Answer (3)

Hint & Sol.: In a streamline flow, the velocity of all particles at a given point are same, hence, kinetic energy and linear momentum will be same.

43. Answer (3)

Hint & Sol.: Pressure is not a vector quantity as it does not follow vector law of addition.

44. Answer (1)

Hint: Normal stress = Pressure being exerted

$$\text{Sol.} \Delta P = P_0 + \rho gh = 10^5 + 10^3 \times 10 \times 10^3$$

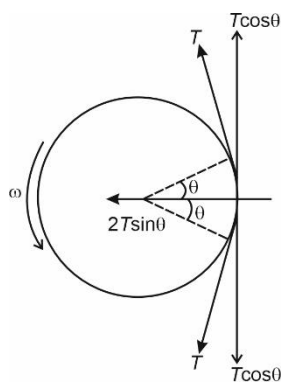
$$= 10^5 + 10^7 = 10^5 (1 + 100)$$

$$= 101 \times 10^5 \text{ Pa}$$

45. Answer (3)

Hint: Stress developed in the ring should be less than breaking stress of the material of the ring.

Sol.: As per the FBD of ring,



If tension in the ring is T , then

$$2T \sin \theta = dm \times \omega^2 R$$

$$2T \sin \theta = \frac{M}{2\pi R} \cdot R \times 2\theta \times \omega^2 R$$

$$2T\theta = \frac{M \cdot 2\theta \cdot \omega^2 R}{2\pi}$$

$$T = \frac{M\omega^2 R}{2\pi}$$

$$\text{Stress developed in ring } \sigma = \frac{T}{A}$$

For safe rotation $\sigma < \sigma_0$

$$\frac{T}{A} < \sigma_0$$

$$\Rightarrow \frac{M\omega^2 R}{2\pi A} < \sigma_0$$

$$\omega < \sqrt{\frac{2\pi\sigma_0 A}{mR}}$$

[CHEMISTRY]

46. Answer (2)

$$\text{Hint: } K_{\text{eq}} = \frac{K_f}{K_b}$$

$$\text{Sol.: } 0.05 = \frac{2.5 \times 10^{-4}}{K_b}$$

$$= 5 \times 10^{-3}$$

47. Answer (1)

Hint: If K_C is higher then equilibrium is rich in product and vice versa is for domination of reactant.

Sol.: $E(g) \rightleftharpoons F(g)$ has maximum K_C hence F is richest product

$C(g) \rightleftharpoons D(g)$ has minimum K_C hence C is richest reactant.

48. Answer (4)

Hint: If reaction gets subtracted, then their equilibrium constant gets divided for resultant reaction.

Sol.: $A(g) + D(g) \rightleftharpoons B(g) + C(g)$

$$K_C = \frac{K_{C_1}}{K_{C_2}} = \frac{4 \times 10^{-2}}{2 \times 10^{-4}} = 2 \times 10^2$$

49. Answer (3)

$$\text{Hint: } K_P = K_C(RT)^{\Delta n_g}$$

$$\text{Sol.: } K_P = 3 \times 10^{-4} (0.0821 \times 400)^{-1}$$

$$= 9.1 \times 10^{-6}$$

50. Answer (1)

Hint: Increase in temperature of an endothermic equilibrium shifts it forward.

Sol.: At 12.181 K temperature

$$R \times T = 0.0821 \times 12.181 = 1$$

$$K_P = K_C(RT)^{\Delta n_g}$$

$$K_P = K_C(1)^{\Delta n_g}$$

$$K_P = K_C$$

51. Answer (4)

Hint: As K_C of dissociation of oxide increases, its stability decreases.

Sol.: According to given K_C

$$\text{Stability: } N_2O_5 < NO < NO_2$$

52. Answer (2)

Hint: K_C changes with temperature only.

Sol.: On changing concentration of reactant, K_C will be unchanged.

Equilibrium constant expression will get affected by stoichiometry too hence it will not always 1 even if concentration of reactant and product is same at equilibrium.

53. Answer (4)

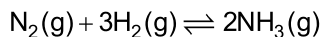
Hint: In case of equilibrium involving physical processes, there is a dynamic but stable condition.

Sol.: At the state of equilibrium, both the processes occur at the same rate but the amount of product and reactant may or may not be equal.

54. Answer (2)

Hint: For $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

$$K_P = \frac{P_{NH_3}^2}{P_{N_2} \times P_{H_2}^3}$$

Sol.:

t = 0 3atm 3atm 0atm

At eq. (3 - 0.6)(3 - 1.8) 1.2

$$K_P = \frac{(1.2)^2}{2.4 \times (1.2)^3}$$

$$= \frac{1}{2.88}$$

$$= 0.35$$

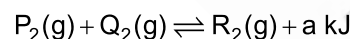
55. Answer (3)

Hint: Salt of strong acid and weak base will undergo cationic hydrolysis.**Sol.:****Salt Hydrolysis**Na₂CO₃ Anionic

KCN Anionic

NH₄Cl CationicNa₂SO₄ No Hydrolysis

56. Answer (4)

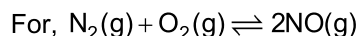
Hint: Increase in temperature of exothermic equilibrium shifts it backward.**Sol.:** Decrease in pressure shifts equilibrium towards more number of moles

Above reaction will shift forward on decreasing temperature and increasing pressure.

57. Answer (4)

Hint: Catalyst does not appear in the equilibrium constant expression or in the balanced chemical equation.**Sol.:** A catalyst does not affect the equilibrium composition of a reaction mixture.

58. Answer (2)

Hint: $K_P = K_C (RT)^{\Delta n_g}$ **Sol.:** The reaction for which $\Delta n_g = 0$, $K_P = K_C$ 

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

Hence, $K_P = K_C$

59. Answer (3)

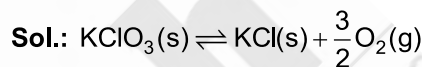
Hint: Species with lone pair of electrons or negative charge act as Lewis base.**Sol.:** AlCl₃ acts as Lewis acid due to vacant orbital.

60. Answer (2)

Hint: NH₄CN is WAWB type of salt.

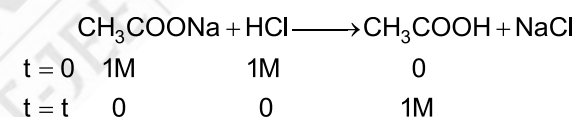
$$\begin{aligned} \text{Sol.} \quad \text{pH} &= 7 + \frac{1}{2} \text{p}K_a - \frac{1}{2} \text{p}K_b \\ &= 7 + \frac{1}{2} \times 9.4 - \frac{1}{2} (4.76) \\ &= 9.32 \end{aligned}$$

61. Answer (2)

Hint : Equilibrium in which all the components are not in same phase is called heterogeneous equilibrium.

All reactants and products are not in same phase.

62. Answer (1)

Hint: Mixture of CH₃COOH and CH₃COONa will act as buffer solution.**Sol.:**For 1st solution:

$$[\text{H}^+] = \sqrt{K_a \times C}$$

$$\text{pH} = \frac{1}{2} \text{p}K_a = a$$

For 2nd solution:

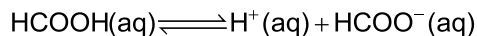
$$b = \text{p}K_a + \log \frac{[\text{CH}_3\text{COONa}]}{[\text{CH}_3\text{COOH}]}$$

$$b = \text{p}K_a$$

$$a : b = \frac{\text{p}K_a}{2 \times \text{p}K_a} = 1 : 2$$

63. Answer (2)

Hint: Total mole of H⁺ ions will contributed by both of the weak acids.

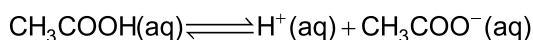
Sol.:

$$t = 0 \quad C_1 \quad 0 \quad 0$$

$$t = t \quad C_1 - x \quad x + y \quad x$$

$$K_1 = \frac{x(x+y)}{C_1-x} \quad (x \ll C_1)$$

$$K_1 C_1 = x(x+y) \quad \dots(i)$$



$$t = 0 \quad 2 \quad 0 \quad 0$$

$$t = t \quad C_2 - y \quad y + x \quad y$$

$$K_2 C_2 = (x+y)y \quad \dots(ii)$$

Adding (i) + (ii)

$$(x+y)^2 = K_1 C_1 + K_2 C_2$$

$$[\text{H}^+] = (x+y) = \sqrt{K_1 C_1 + K_2 C_2}$$

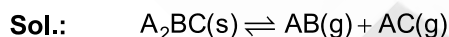
64. Answer (4)

$$\text{Hint: } Q_C = \frac{[\text{B}][\text{C}]}{[\text{A}]}$$

$$\text{Sol.: } Q_C = \frac{[\text{B}][\text{C}]}{[\text{A}]} = 2 \times 10^{-4}$$

As $K_C > Q_C$, then reaction will proceed in forward direction.

65. Answer (2)

Hint: Value of K_p does not get affected on any addition of gas or pressure change.

$$t = 0 \quad a \quad 0$$

$$t = t_{\text{eq}} \quad p \quad p$$

$$p_{\text{total}} = p_{\text{AB}} + p_{\text{AC}}$$

$$2 = 2p$$

$$p = 1$$

$$K_p = p_{\text{AB}} \times p_{\text{AC}}$$

$$= 1$$



$$t = 0 \quad a \quad 0 \quad 0$$

$$t = t' \quad 2 \quad p'$$

$$K_p = p_{\text{AB}} \times p_{\text{AC}}$$

$$1 = 2 \times p_{\text{AC}}$$

$$p_{\text{AC}} = \frac{1}{2} \text{ atm}$$

$$= 0.5 \text{ atm}$$

66. Answer (4)

Hint: Decomposition of PCl_5 to PCl_3 and Cl_2 is an endothermic reaction with increasing number of gaseous moles.**Sol.:**

- Introduction of inert gas at constant volume does not affect equilibrium.
- Introduction of inert gas at constant pressure will shift equilibrium towards more number of moles.
- Addition of product that is PCl_3 will shift equilibrium backward.

67. Answer (1)

$$\text{Hint: } [\text{H}^+]_{\text{R}} = \frac{M_1 V_1 + M_2 V_2}{V_1 + V_2}$$

$$\text{Sol.: } [\text{H}^+]_{\text{R}} = \frac{10^{-3} V + 10^{-4} V}{2V}$$

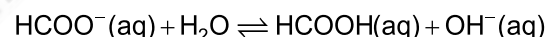
$$= \frac{11 \times 10^{-4}}{2}$$

$$= 5.5 \times 10^{-4}$$

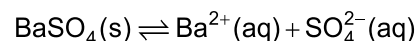
$$\text{pH} = -\log(5.5 \times 10^{-4}) = 4 - 0.74$$

$$= 3.26$$

68. Answer (4)

Hint: pH of water can change on addition of salt due to salt hydrolysis.**Sol.:** WASB type of salt gives basic solution with pH more than 7 due to anionic hydrolysis.

69. Answer (2)

Hint: For BaSO_4 solution,

$$K_{\text{sp}} = [\text{Ba}^{2+}] [\text{SO}_4^{2-}]$$

$$\text{Sol.: } (K_{\text{sp}})_{\text{BaSO}_4} = S^2$$

$$S = \frac{2.33 \times 10^{-3}}{233} = 10^{-5} \text{ M}$$

$$K_{\text{sp}} = (10^{-5})^2$$

$$= 10^{-10}$$

70. Answer (4)

Hint: at 25°C

$$\text{pH} + \text{pOH} = 14$$

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

Sol.: pOH = 1

$$\text{pH} = 13$$

$$[\text{H}^+] = 10^{-13} \text{ mol/L}$$

$$\text{mole of H}^+ \text{ in 1 L} = 10^{-13}$$

$$\text{mole of H}^+ \text{ in 2 mL} = \frac{10^{-13}}{10^3} \times 2$$

$$= 2 \times 10^{-16}$$

$$\text{Number of H}^+ \text{ ions} = 2 \times 10^{-16} \times 6.02 \times 10^{23}$$

$$= 1.2 \times 10^8$$

71. Answer (1)

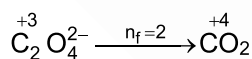
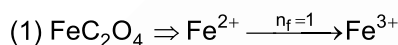
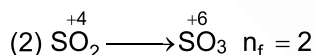
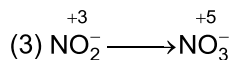
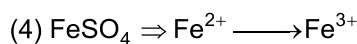
Hint: In a Galvanic cell:

Anode – Negatively charged electrode

Cathode – Positively charged electrode

Sol.: Salt bridge provides electrode contact between solutions without mixing them.

72. Answer (1)

Hint: During redox reaction number of gram equivalent of both reducing agent and oxidising agent is same.**Sol.:**3 equivalents of KMnO_4 required2 equivalents of KMnO_4 required2 equivalents of KMnO_4 required1 equivalent of KMnO_4 required

73. Answer (1)

Hint: For a molecule algebraic sum of oxidation state of each and every element must be zero.**Sol.:** For $\text{A}(\text{BC}_2)_2$

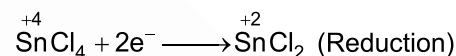
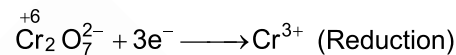
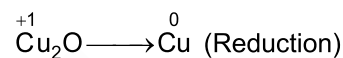
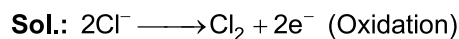
Algebraic sum of oxidation states =

$$+2 + 2 \times (+3) + 4(-2) = 0$$

74. Answer (4)

Hint & Sol.: Metal with positive SRP does not liberate H_2 gas with dilute acid, these metals are Cu, Hg, Ag, Pt, Au.

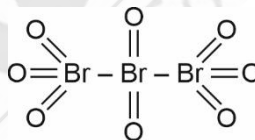
75. Answer (1)

Hint: Oxidation requires an oxidising agent.

76. Answer (3)

Hint: Algebraic summation of oxidation state of each element in a compound is zero.**Sol.:** In OF_2 O.S. of oxygen is +2.In KO_2 , O.S. of K is +1.In $\text{Ni}(\text{CO})_4$, O.S. of Ni is zero.In Na_2CO_3 , O.S. of C is +4.

77. Answer (1)

Hint: Structure of Br_3O_8 .**Sol.:** Oxidation state of middle Br = +4

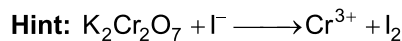
Oxidation state of terminal Br = +6

For Fe_3O_4 average oxidation state of Fe = $\frac{8}{3}$

78. Answer (1)

Hint: $\text{AgNO}_3 + \text{Na(s)} \longrightarrow \text{NaNO}_3 + \text{Ag(s)}$ is a metal displacement reaction.**Sol.:** $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ is combination reaction. $\text{Ca} + 2\text{H}_2\text{O} \longrightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$ is non-metal displacement reaction. $2\text{KClO}_3 \longrightarrow 2\text{KCl} + 3\text{O}_2$ is decomposition reaction.

79. Answer (2)

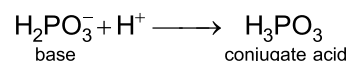
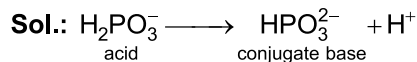


$$n \times 6 = 0.1 \times 2$$

$$n = 0.033 \text{ mol}$$

80. Answer (2)

Hint: Conjugate acid base pair has difference of one H^+ or OH^- .



81. Answer (3)

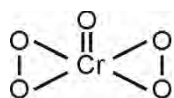
Hint: Algebraic summation of oxidation state of each element in a charged species is equal to its charge.

Sol.:

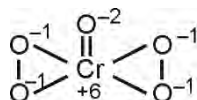
- Oxidation state of Cl in NaClO_3 is +5 but highest oxidation state of Cl is +7.
- There is no oxidation state change during conversion of $\text{Cr}_2\text{O}_7^{2-}$ to CrO_4^{2-} hence it does not require any OA or RA.
- Oxidation state of Cl in CaOCl_2 is +1 and -1.

82. Answer (2)

Hint:



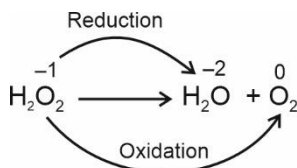
Sol.:



83. Answer (4)

Hint: In disproportionation reaction, oxidation and reduction of same element takes place.

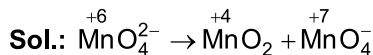
Sol.:



84. Answer (4)

Hint: n-factor for a disproportionation reaction per element is given as

$$n = \frac{n_1 n_2}{n_1 + n_2}$$



$$n\text{-factor} = \frac{1 \times 2}{1 + 2} = \frac{2}{3}$$

$$E = \frac{M}{n\text{-factor}} = \frac{M}{\frac{2}{3}}$$

$$E = \frac{3M}{2}$$

85. Answer (2)

Hint: Element with more positive value at SRP are good oxidising agent.

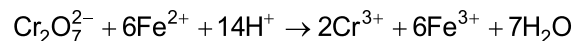
Sol.:

- Since $E_{A^{2+}/A} > E_{B^{2+}/B}$, A will be insoluble in BSO_4 .
- Since $E_{A^{2+}/A} > E_{C^{2+}/C}$, C will be insoluble in $\text{A}(\text{NO}_3)_2$.
- C^{2+} has least SRP hence it will be weakest oxidising agent.
- $\text{B}(\text{s}) + \text{CSO}_4 \rightarrow \text{BSO}_4 + \text{C}(\text{s})$, is non spontaneous hence will have negative EMF.

86. Answer (1)

Hint: To balance any redox reaction number of atom in both side of reaction and number of electron exchanged must be same.

Sol.:



$$x = 1$$

$$y = 6$$

$$z = 14$$

$$e = 2$$

$$f = 6$$

$$g = 7$$

87. Answer (1)

Hint: For a cell

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

Sol.: For $A(s) + B^{2+}(aq) \rightarrow B(s) + A^{2+}(aq)$

A is anode and B is cathode

$$E_{\text{cell}}^{\circ} = E_{B^{2+}/B}^{\circ} - E_{A^{2+}/A}^{\circ}$$

$$= 0.22 - (-0.45)$$

$$= 0.67 \text{ V}$$

88. Answer (1)

Hint: As positive SRP increases reducing power of metal decreases.

Sol.: Since B^{2+}/B has most negative SRP, metal B will be strongest reducing agent.

89. Answer (3)

Hint: For salt hydrolysis,

Degree of hydrolysis

$$h = \sqrt{\frac{K_h}{C}}$$

Sol.: For WASB type salt,

$$h = \sqrt{\frac{K_w}{K_a \times C}}$$

For SAWB type salt

$$h = \sqrt{\frac{K_w}{K_b \times C}}$$

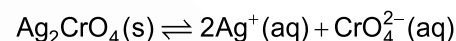
For WAWB type salt

$$h = \sqrt{\frac{K_w}{K_a \times K_b}}$$

90. Answer (4)

Hint: Presence of common ion decreases the solubility of sparingly soluble salt.

Sol.: $[\text{CrO}_4^{2-}] = 0.01 \text{ M}$



$$K_{\text{sp}} = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}]$$

$$1.1 \times 10^{-12} = (2s)^2 \times 0.01$$

$$4s^2 = 1.1 \times 10^{-10}$$

$$s = \sqrt{\frac{1.1}{4} \times 10^{-10}}$$

$$= 0.524 \times 10^{-5}$$

$$= 5.24 \times 10^{-6} \text{ M}$$

[BOTANY]

91. Answer (4)

Hint: Medullary rays are present in dicot stem.

Sol.: Cortex consists of several layers of thin-walled parenchymatous cells with intercellular spaces.

92. Answer (2)

Hint: Next to endodermis lies a few layers of thick-walled parenchymatous cells referred to as pericycle.

Sol.: In dicot root, pericycle initiates roots and vascular cambium development during the secondary growth.

93. Answer (3)

Hint: All the tissues on the inner side of the endodermis constitute the stele.

Sol.: Pericycle, conjunctive tissue, vascular bundles and pith constitute the stele.

94. Answer (4)

Hint: Roots have exarch xylem.

Sol.: In a monocot root, vascular bundles are usually more, than that present in a dicot root.

95. Answer (3)

Hint: The outermost layer of the cortex in a dicot stem is hypodermis.

Sol.: Hypodermis in a dicot stem is made up of several layers of collenchyma.

96. Answer (4)

Hint: Ring-like arrangement of vascular bundles is a characteristic of dicot stems.

Sol.: In a monocot stem, vascular bundles are scattered in the ground tissue. Endarch xylem is present.

97. Answer (2)

Hint: This layer is present below the starch sheath.

Sol.: Pericycle is present in the form of patches of semi-lunar shape and comprises of sclerenchymatous cells.

98. Answer (2)

Hint: Bulliform cells help in rolling of leaves.

Sol.:

Bulliform cells	–	Modified epidermal cells in grasses that regulate the rolling and expansion of leaves
Palisade parenchyma	–	It lies below the upper epidermis and made up of the elongated cells which are arranged perpendicular to the upper epidermis
Spongy parenchyma	–	It is abaxially placed in leaf and made up of oval or rounded cells which are irregularly arranged
Bundle sheath cells	–	Thick-walled cells that form a layer around each vascular bundle

99. Answer (4)

Hint: Chlorophyceae is commonly called green algae and the major pigments in its members are chlorophyll *a* and *b*.

Sol.: In brown algae, gametes are pyriform, *i.e.*, pear-shaped and bear two laterally attached flagella.

100. Answer (1)

Hint: In *Spirogyra*, gametes are non-flagellated and similar in size.

Sol.: In *Ulothrix*, gametes are flagellated and similar in size.

101. Answer (1)

Hint: Red algae store food in the form of floridean starch.

Sol.: In red algae, sexual reproduction is accompanied by complex post fertilisation development. Mosses have upright, slender axes bearing spirally arranged leaves.

102. Answer (3)

Hint: Some members of brown algae are rich source of iodine.

Sol.: *Fucus* and *Laminaria* are rich source of iodine.

103. Answer (3)

Hint: *Funaria* is a moss.

Sol.: Mosses lack vascular system.

104. Answer (3)

Hint: Spermatophytes bear seeds.

Sol.: Spermatophytes include gymnosperms and angiosperms and they are phanerogams.

105. Answer (3)

Hint: *Cycas* possesses pinnate leaves that persist for a few years.

Sol.: Vessels are absent in gymnosperms.

106. Answer (4)

Hint: Natural system of classification was proposed by Bentham and Hooker.

Sol.: Phylogenetic classification systems assumed that organisms belonging to the same taxa have a common ancestor.

107. Answer (2)

Hint: *Polysiphonia* is red algae and *Polytrichum* is a moss.

Sol.:

<i>Laminaria</i>	–	Asexual reproduction is by biflagellated zoospores
<i>Polysiphonia</i>	–	Sexual reproduction by fusion between one large, non-motile female gamete and a smaller, non-motile male gamete
<i>Marchantia</i>	–	Asexual reproduction takes place by fragmentation of thalli, or by gemma.
<i>Polytrichum</i>	–	The sex organs antheridia and archegonia are produced at the apex of the leafy shoots

108. Answer (3)

Hint: Bryophytes also grow in cool, damp and shady places but they lack vascular tissues.

Sol.: Some pteridophytes are able to grow and flourish well in sandy soil. They are the first terrestrial plants to possess vascular tissue and they do not contain all the elements of xylem and phloem as that of angiosperm.

109. Answer (2)

Hint: Main plant body in bryophytes is the gametophyte.

Sol.: The predominant stage of the life cycle of a moss is the gametophyte.

Protonema → Leafy stage → Formation of archegonia and antheridia in gametophyte → Transfer of antherozoids to the archegonia in presence of water → Fertilisation → Meiosis in spore mother cell.

110. Answer (2)

Hint: Mosses, along with lichens, are the first to colonise rocks.

Sol.: Bryophytes play an important role in plant succession on bare rocks/soil.

111. Answer (4)

Hint: *Selaginella* possesses small leaves (microphylls).

Sol.: The female gametophyte in heterosporous pteridophytes is retained on the parent sporophyte for variable periods. The development of zygote into a young embryo takes place within the female gametophyte.

112. Answer (3)

Hint: *Cycas* has coralloid roots.

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

113. Answer (3)

Hint: The megaspore mother cell is differentiated from one of the cells of the nucellus.

Sol.: The correct sequence for female sex organ formation in gymnosperms is:

One of the cells of nucellus differentiates to form megaspore mother cell

↓

Meiotic division in megaspore mother cell

↓

Repeated mitosis in one of the megaspores enclosed within the ovule

↓

Formation of a multicellular female gametophyte that bears two or more archegonia.

114. Answer (2)

Hint: Joseph Priestley performed the series of bell jar experiments.

Sol.: Using a similar setup, as the one used by Priestley, but by placing it once in the dark and once in the sunlight. Jan Ingenhousz showed that sunlight is essential to the plant processes that somehow purifies the air fouled by burning candles or breathing animals.

115. Answer (1)

Sol.: The plant factors or internal factors are dependent on the genetic predisposition and growth of the plant.

116. Answer (3)

Hint: The graph drawn for the rate of photosynthesis and wavelength of light in nanometres represents the action spectrum of photosynthesis.

Sol.: The first action spectrum of photosynthesis described through T.W. Engelmann's experiment which resembles roughly the absorption spectrum of chlorophyll *a* and *b*.

117. Answer (2)

Hint: Bundle sheath cells of C_4 plants lack grana in their chloroplast.

Sol.: RuBisCO is the most abundant enzyme on Earth which is found inside the stroma of chloroplast.

118. Answer (3)

Sol.: Xanthophylls show yellow colour in the chromatogram.

119. Answer (2)

Hint: Antennae have accessory pigments as well as chief pigment.

Sol.: Each photosystem has all the pigments (except one molecule of chlorophyll *a*) forming a light harvesting system, also called antennae. These pigments help to make the process of photosynthesis more efficient by absorbing different wavelengths of light.

120. Answer (4)

Hint: Photochemical phase is also called light reaction of photosynthesis.

Sol.: Light reaction includes light absorption, water splitting, oxygen release and the formation of ATP and NADPH that is used in biosynthetic reaction.

121. Answer (1)

Hint: Water splitting complex is associated with the photosystem II.

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

122. Answer (4)

Hint: Tomato is a C_3 plants.

Sol.: Primary carbon dioxide acceptor in a C_3 plant is RuBP (5-carbon ketose sugar).

123. Answer (4)

Hint: For the fixation of one CO_2 molecule in C_3 plants, 3 ATP and 2 NADPH are required.

Sol.: In C_3 plants, fixation of $6CO_2$ requires 18ATP and 12NADPH.

\therefore Sucrose, which has glucose and fructose will require 36ATP and 24NADPH.

124. Answer (2)

Hint: Redox potential of the primary e^- acceptor of PS I is lower than the redox potential of the primary e^- acceptor of PS II.

Sol.: The first discovered photosystem is PS I and it transfers electron to Fd-FNR complex.

125. Answer (3)

Hint: Cyclic photophosphorylation occurs in the stroma lamellae.

Sol.: Non-cyclic photophosphorylation involves both ATP and NADPH + H^+ production. It involves two photosystems, *i.e.*, PS I and PS II. Both cyclic and non-cyclic photophosphorylation occurs in the wavelength of light beyond 680 nm.

126. Answer (4)

Hint: Primary stable product of CO_2 fixation in C_4 plants is a 4-carbon acid.

Sol.: The C_4 acid OAA in C_4 plants is formed in the mesophyll cells.

127. Answer (2)

Hint: PGA is a 3-carbon organic acid.

Sol.: All photosynthetic plants undergo Calvin cycle, in which the primary stable product is PGA.

128. Answer (4)

Hint: Regeneration of RuBP requires ATP.

Sol.: NADPH is not required for the regeneration of RuBP.

129. Answer (1)

Hint: C_4 plants have Kranz anatomy.

Sol.: In C_4 plants, photorespiration does not occur. This is because they have a mechanism that increases the concentration of CO_2 at the enzyme site.

130. Answer (2)

Hint: The cold sensitive enzyme is involved in the regeneration of PEP.

Sol.: Enzyme pyruvate orthophosphate dikinase, a cold sensitive enzyme converts 3-carbon molecules into phosphoenol pyruvate.

131. Answer (2)

Hint: RuBisCO can act as oxygenase in C_3 plants in the presence of abundant O_2 in atmosphere.

Sol.: Productivity and yields are better in C_4 plants as they lack photorespiration.

132. Answer (4)

Hint: Age of leaves is a plant factor.

Sol.: Availability of sunlight is an external factor that can affect the rate of photosynthesis.

133. Answer (1)

Hint: Plastocyanin transfers e^- from cytochrome B_6f to PS I.

Sol.:

Plastocyanin	–	It transfers the electron from cytochrome to PS I
Plastoquinone	–	This molecule removes a proton from the stroma while transporting an electron
CF_1 particle	–	It protrudes from the outer surface of the thylakoid membrane
CF_0 particle	–	Transmembrane protein in thylakoid that carries out facilitated diffusion of protons across the membrane

134. Answer (4)

Hint: C_4 plants can tolerate higher temperature.

Sol.: At high light intensities, C_4 plants show CO_2 concentration saturation at about $360 \mu L^{-1}$, while C_3 plants show saturation only beyond $450 \mu L^{-1}$.

135. Answer (3)

[ZOOLOGY]

136. Answer (3)

Hint: Belongs to the phylum Echinodermata

Sol.: Animals belonging to the phylum Echinodermata have an endoskeleton of calcareous ossicles. The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

Antedon (Sea lily) is an echinoderm.

Dentalium and *Sepia* are molluscs and *Limulus* is an arthropod.

137. Answer (1)

Hint: Diploblastic animals

Sol.: An undifferentiated layer, mesoglea, is present in between the ectoderm and the endoderm in diploblastic animals. It is observed in animals of phyla Coelenterata and Ctenophora.

Meandrina, *Gorgonia* and *Pennatula* are coelenterates.

Ctenoplana is a ctenophore.

Sepia and *Chaetopleura* are molluscs.

Fasciola is a flatworm and *Ancylostoma* is a roundworm.

138. Answer (3)

Hint: *Sycon* is a porifer.

Sol.: Sponges have a water transport or canal system. Water enters through minute pores (ostia) in the body wall into a central cavity called spongocoel, from where it goes out through the osculum.

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

139. Answer (4)

Hint: Equal to the number of limbs in humans.

Sol.: Members of the phylum Platyhelminthes have a dorso-ventrally flattened body, hence are called flatworms. These are mostly endoparasites found in animals including humans. Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ level of body

Sol.: Water as a factor, has its effect more through its effect on the plant rather than directly on photosynthesis.

organisation. Specialised cells called flame cells help in osmoregulation and excretion. Some members like *Planaria* possesses high regeneration capacity.

140. Answer (3)

Hint: *Apis* is also associated with the same fact.

Sol.: *Laccifer* (Lac insect) is an economically important insect. Mosquitoes (*Culex*, *Aedes*) act as vectors.

Locusta is a gregarious pest.

King crab is the living fossil.

141. Answer (4)

Hint: Scorpions do not lay eggs.

Sol.: Arthropoda is the largest phylum of the kingdom Animalia which includes insects. Over two-thirds of all named species on Earth are arthropods. The body of arthropods is covered by a chitinous exoskeleton.

Mollusca is the second largest animal phylum. The mouth of these animals contains a file-like rasping organ for feeding, called radula.

Arthropods are mostly oviparous.

Scorpion is a viviparous arthropod.

142. Answer (2)

Hint: Emits light

Sol.: *Pleurobrachia* is a ctenophore. Ctenophores, commonly known as sea walnuts or comb jellies, are exclusively marine animals. Their body bears eight external rows of ciliated comb plates which help in locomotion. Bioluminescence is well-marked in ctenophores.

Metagenesis (alternation of generation) is a feature of cnidarians.

Ctenophores perform both extracellular and intracellular digestion.

Pleurobrachia contains a pair of tentacles that possess lasso cells.

143. Answer (1)

Hint: *Ancylostoma* is also known as hookworm.

Sol.: *Ancylostoma* is a bilaterally symmetrical triploblastic animal with pseudocoelom.

Sexual dimorphism is seen in roundworms. Females are longer than males.

In *Nereis*, parapodia help in swimming.

Anopheles is an arthropod.

144. Answer (2)

Hint: Seen in cnidarians

Sol.: In porifers, choanocytes or collar cells line the spongocoel and the canals. Presence of collar cells is a characteristic feature of the members belonging to the phylum Porifera.

The gastrovascular cavity is present in coelenterates. Choanocytes are flagellated cells that ingest food particles.

145. Answer (3)

Hint: Sea anemone

Sol.: *Sycon* – Scypha

Spongilla – Fresh water sponge

Adamsia – Sea anemone

Wuchereria – Filaria worm

146. Answer (2)

Hint: Derived from the middle germinal layer

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

147. Answer (4)

Hint: *Obelia* exhibits metagenesis.

Sol.:

<i>Aurelia</i>	–	Umbrella-shaped, free swimming
<i>Hirudinaria</i>	–	Body surface distinctly marked into segments
<i>Wuchereria</i>	–	Body cavity is not lined by mesoderm, instead mesoderm is present as scattered pouches
<i>Obelia</i>	–	Polyps produce medusae asexually

148. Answer (3)

Hint: Think about their nutrition.

Sol.: *Meandrina* belongs to the phylum Coelenterata while *Ctenoplana* is a ctenophore. Both exhibit intracellular and extracellular mode of digestion. In ctenophores, reproduction takes place only by sexual means. Metagenesis (alternation of generation) is a characteristic feature of coelenterates only. Members of both the phyla have tissue level of body organisation and are diploblastic.

149. Answer (3)

Hint: Gills are present in the mantle cavity.

Sol.: Body of molluscs are covered by 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.

150. Answer (3)

Hint: Member of the phylum Arthropoda.

Sol.: *Aedes* is an arthropod. In arthropods, fertilisation is internal and they lay fertilised eggs. *Asterias* and *Antedon* are echinoderms. They exhibit external fertilization.

151. Answer (4)

Hint: Sponges have cellular level of body organisation.

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

- Flatworms are mostly parasites; *Planaria* is free-living.
- Annelids can be free-living or sometimes parasitic.
- Molluscs are terrestrial or aquatic.

152. Answer (3)

Hint: Open type of circulation

Sol.: Hemichordata was earlier considered as a sub-phylum under the phylum Chordata. Hemichordata consists of a small group of worm-like marine animals with organ-system level of body organisation.

Their cylindrical body is composed of an anterior proboscis, a collar and long trunk.

Respiration occurs *via* gills and they have open circulatory system.

Sexes are not separate; fertilisation is external with indirect development.

153. Answer (2)

Hint: Adhesive pointed structures are absent.

Sol.: Platyhelminths are mostly endoparasites found in animals. Hooks and suckers are present in the parasitic forms. In *Fasciola*, hooks are absent.

Thick tegument acts as a protective layer that protects the worm inside the digestive system of the host.

Circulatory system is absent in platyhelminths.

154. Answer (2)

Hint: Involuntary control

Sol.: Cerebellum is a part of the hind brain. It is present dorsal to the brain stem.

- **Mid brain** – Receives and integrates visual, tactile and auditory inputs.
- **Cerebellum** – Integrates information received from semi-circular canals of the ear and the auditory system.
- Cerebrum is the most developed and major part of the human brain.

155. Answer (4)

Hint: No saltatory conduction of nerve impulse.

Sol.: Unmyelinated nerve fibres of PNS are enclosed by the Schwann cells. But these Schwann cells do not produce a myelin sheath, instead form a neurilemma (sheath of Schwann) cells.

Nodes of Ranvier are absent in the unmyelinated axons.

156. Answer (4)

Hint: Innermost layer of the cranial meninges.

Sol.: The human brain is well protected by the skull. Inside the skull, the brain is covered by cranial meninges, consisting of an outer layer called dura mater; a very thin middle layer called arachnoid and an inner layer, which is in close contact with the brain tissue, called pia mater.

157. Answer (4)

Hint: True for limbic system.

Sol.:

Cerebral cortex	–	Referred to as the grey matter due to its greyish appearance that occurs
-----------------	---	--

		due to accumulation of neuronal cell bodies.
Unipolar neuron	–	Usually present in the embryonic stage
Electrical synapse	–	Rare in our system
Forebrain	–	Can regulate the expression of emotional reactions

158. Answer (4)

Hint: Lobes are visible from the dorsal side.

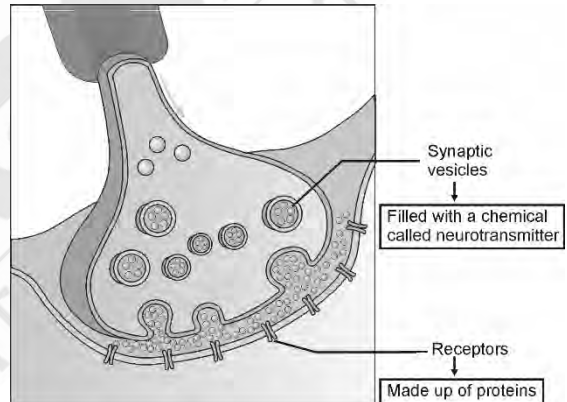
Sol.: The dorsal side of the mid brain consists mainly of four round swellings called corpora quadrigemina.

A canal called the cerebral aqueduct passes through the midbrain and connects different ventricles of the brain.

159. Answer (3)

Hint: Receptors are specific for their chemicals.

Sol.:



Ca²⁺ stimulates the movement of synaptic vesicles towards the pre-synaptic membrane.

Neurotransmitters can be excitatory or inhibitory in nature.

160. Answer (1)

Hint: Member of the phylum Coelenterata.

Sol.: The neural organisation is very simple in lower invertebrates. For example, in *Hydra*, it is composed of a network of neurons. The neural system is better organised in insects, where a brain is present along with a number of ganglia and neural tissue.

161. Answer (2)

Hint: ANS is classified into sympathetic and parasympathetic neural systems.

Sol.: The PNS is divided into two divisions called somatic neural system and autonomic neural system (ANS). The somatic neural system relays impulses from the CNS to skeletal muscles while the autonomic neural system transmits impulses from the CNS to the involuntary organs and smooth muscles of the body.

162. Answer (1)

Hint: Our kidney is involved in RBC formation.

Sol.: The juxtaglomerular cells of kidney produce erythropoietin which stimulates the formation of RBCs. Androgens also play a role in erythropoiesis, which are secreted by testis.

Testis is an organised endocrine gland.

Hormones are also secreted by some tissues which are not endocrine glands. For example, juxtaglomerular cells of kidneys are not organised endocrine glands.

Ovary and thyroid are organised endocrine glands.

163. Answer (1)

Hint: K^+ efflux leads to repolarisation.

Sol.: Depolarisation of axonal membrane starts with opening of voltage-gated Na^+ channels, this leads to a rapid influx of Na^+ followed by the reversal of the polarity at that site.

During repolarisation, Na^+ voltage-gated channels start to close and K^+ starts diffusing outside the membrane and restores the resting membrane potential at the site of excitation.

164. Answer (4)

Hint: Part of midbrain

Sol.: Corpora quadrigemina is a part of midbrain. The inner parts of cerebral hemispheres and a group of associated deep structures like amygdala, hippocampus, etc., form a complex structure called the limbic lobe or limbic system.

165. Answer (4)

Hint: Role of glucagon

Sol.: Insulin is a peptide hormone secreted by β -cells of pancreas. It is a peptide hormone which plays a major role in regulation of glucose homeostasis. Prolonged deficiency of this hormone leads to diabetes mellitus.

Glucagon is a peptide hormone which stimulates the process of gluconeogenesis that contributes in hyperglycaemia.

Insulin stimulates the synthesis of fatty acids, i.e., lipogenesis.

166. Answer (2)

Hint: GH is secreted by the anterior pituitary.

Sol.:

Heart	–	ANF
GIT	–	Secretin
Pars distalis	–	GH
Adrenal gland	–	Epinephrine

167. Answer (4)

Hint: LH stimulates the synthesis of androgens.

Sol.: Increased level of gonadotrophins during puberty helps in spermatogenesis in human males. Release of GnRH from hypothalamus causes secretion of gonadotrophins at the onset of puberty.

LH and FSH stimulates the gonadal activity and hence are called gonadotrophins.

168. Answer (1)

Hint: T_4 – Tetraiodothyronine.

Sol.: Iodine is the most essential component for the normal rate of hormone synthesis in thyroid gland.

169. Answer (1)

Hint: Caused due to underproduction of hormones.

Sol.: Cushing syndrome occurs due to hypersecretion of cortisol, which is secreted from the adrenal cortex.

Underproduction of hormones by the adrenal cortex alters the carbohydrate metabolism causing acute weakness and fatigue leading to a disease called Addison's disease.

Adrenal virilism occurs due to hypersecretion of sex corticoids in females which leads to the development of male-like characters like excess facial hair, deepening of voice, etc., in females.

170. Answer (4)

Hint: Secretion of thyroxine is regulated by negative feedback loop

Sol.: After the complete removal of the thyroid gland (thyroidectomy), the primary source of T_3 and T_4 gets eliminated. Thus, its blood levels will drop to very low or even undetectable levels.

T_3/T_4 normally exerts a negative feedback effect on the pituitary gland. So, when T_3/T_4 levels are low, this inhibitory feedback is removed. In response, the release of TSH will increase from the anterior pituitary.

The hypothalamus produces TRH, which stimulates the pituitary gland to release TSH. With the extremely low T_3/T_4 , the release of TRH will also increase.

171. Answer (3)

Hint: ADH

Sol.: Vasopressin acts mainly at the kidney and stimulates reabsorption of water and electrolytes by the DCT and thereby reduces loss of water through urine (Diuresis), hence, prevents diuresis. It is also called anti-diuretic hormone (ADH). It is a protein hormone.

ADH causes constriction of arterioles, which increases blood pressure.

172. Answer (4)

Hint: Secretion of oxytocin increases due to positive feedback from continuous uterine contractions.

Sol.: Nerve impulses to the adrenal medulla regulate the release of epinephrine.

Blood Ca^{+2} level regulates the secretion of parathyroid hormone.

A hormone from the anterior pituitary stimulates the release of cortisol by the adrenal cortex.

Most hormonal regulatory systems work *via* negative feedback, but a few operate *via* positive feedback as well.

For example, during child birth, the hormone oxytocin stimulates contractions of the uterus, and uterine contractions in turn stimulate more oxytocin release, a positive feedback effect.

173. Answer (2)

Hint: Exclude the lipid-soluble hormones.

Sol.: Water-soluble hormones interact with membrane-bound receptors and normally do not enter the target cell, but generate second messengers (e.g., cyclic AMP, IP_3 , Ca^{++} , etc.) which in turn regulate cellular metabolism, like pituitary and hypothalamic hormones.

Thyroxine, cortisol and estrogen are lipid-soluble hormones.

ACTH, PRL, TSH and GH are water-soluble hormones.

174. Answer (1)

Hint: Equal to the number of ear a man has.

Sol.: Cortisol stimulates proteolysis, lipolysis and gluconeogenesis. It suppresses the immune response and produces anti-inflammatory reactions.

Glucagon also stimulates proteolysis and lipolysis. It is also involved in glycogenolysis.

Melatonin is derived from tryptophan.

175. Answer (2)

Hint: Between lungs

Sol.: The thymus gland is a lobular structure located between lungs behind the sternum on the ventral side of aorta.

176. Answer (1)

Hint: ADH is synthesized by the cells present in the hypothalamus.

Sol.:

Anterior pituitary	–	Dwarfism
Thyroid gland	–	Cretinism
Hypothalamus	–	Diabetes insipidus
Parathyroid gland	–	Tetany

177. Answer (2)

Hint: Epinephrine and norepinephrine are commonly called catecholamines.

Sol.: Adrenal medulla secretes two hormones which are commonly called catecholamines.

Adrenaline and noradrenaline are rapidly secreted in response to stress of any kind and during

emergency situations and are called emergency hormones.

178. Answer (2)

Hint: Involved in RAAS mechanism

Sol.: Aldosterone is the main mineralocorticoid of the human body. It acts mainly on the renal tubules and stimulates the reabsorption of Na^+ and water and excretion of K^+ .

ACTH is a trophic hormone. Somatostatin is secreted from the hypothalamus.

Vasopressin is formed by the neurosecretory cells of hypothalamus. It is a protein hormone.

179. Answer (2)

Hint: Source gland is located at the back side of the thyroid gland.

Sol.:

Thymosin	–	Plays a major role in the differentiation of T-lymphocytes
PTH	–	Peptide hormone secreted by parathyroid gland which increases Ca^{+2} level in the blood by stimulating osteoblast activity

Secretin	–	Acts on exocrine pancreas and stimulates secretion of water and bicarbonate ions
Melatonin	–	Plays a role in regulation of diurnal rhythm of human body and body temperature

180. Answer (2)

Hint: LH acts on the Leydig cells in males.

Sol.: 'Y' is LH and 'X' is GnRH (Gonadotrophin releasing hormone).

In females, LH induces ovulation of fully mature follicles (Graafian follicles) and maintains the corpus luteum.

Prolactin and progesterone stimulate milk formation.

FSH stimulates the growth and development of ovarian follicles.

Estrogen regulates the development of ducts in the mammary gland.

□ □ □

All India Aakash Test Series for NEET - 2027

TEST - 4 (Code-J)[Click here for Code-I Sol.](#)

Test Date : 15/02/2026

ANSWERS

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

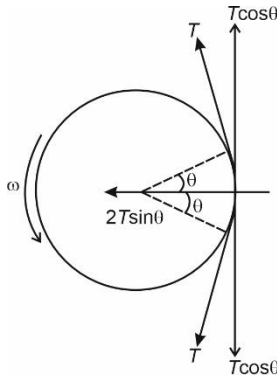
HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Stress developed in the ring should be less than breaking stress of the material of the ring.

Sol.: As per the FBD of ring,



If tension in the ring is T , then

$$2T \sin \theta = dm \times \omega^2 R$$

$$2T \sin \theta = \frac{M}{2\pi R} \cdot R \times 2\theta \times \omega^2 R$$

$$2T \theta = \frac{M \cdot 2\theta \cdot \omega^2 R}{2\pi}$$

$$T = \frac{M \omega^2 R}{2\pi}$$

Stress developed in ring $\sigma = \frac{T}{A}$

For safe rotation $\sigma < \sigma_0$

$$\frac{T}{A} < \sigma_0$$

$$\Rightarrow \frac{M \omega^2 R}{2\pi A} < \sigma_0$$

$$\omega < \sqrt{\frac{2\pi \sigma_0 A}{mR}}$$

2. Answer (1)

Hint: Normal stress = Pressure being exerted

Sol.: $\Delta P = P_0 + \rho gh = 10^5 + 10^3 \times 10 \times 10^3$
 $= 10^5 + 10^7 = 10^5 (1 + 100)$
 $= 101 \times 10^5 \text{ Pa}$

3. Answer (3)

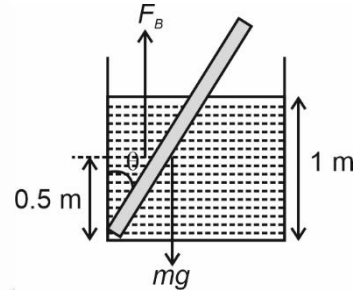
Hint & Sol.: Pressure is not a vector quantity as it does not follow vector law of addition.

4. Answer (3)

Hint & Sol.: In a streamline flow, the velocity of all particles at a given point are same, hence, kinetic energy and linear momentum will be same.

5. Answer (3)

Hint & Sol.:



For equilibrium of rod

$$mg \times 1 \cdot \sin \theta - F_B \times \frac{1}{2} \cdot \tan \theta = 0$$

$$0.5 \times \rho \times 2 \times A \times g \times \frac{1}{2} \sin \theta - \rho_w \times A \times g \times \frac{1}{\cos \theta} \times \frac{1}{2} \tan \theta = 0$$

On solving

$$\cos^2 \theta = \frac{1}{2}$$

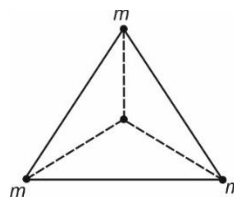
$$\cos \theta = \frac{1}{\sqrt{2}}$$

$$\theta = 45^\circ$$

6. Answer (1)

Hint: All the particles will revolve about their centre of mass.

Sol.:



The coordinates of COM will be, $\left[\frac{a}{2}, \frac{a}{2\sqrt{3}} \right]$

\Rightarrow Distance of each particle from COM

$$= \sqrt{\frac{a^2}{4} + \frac{a^2}{12}} = \frac{a}{\sqrt{3}}$$

Also, net gravitational force on each particle

$$= \frac{\sqrt{3} Gm^2}{a^2}$$

$$\Rightarrow \frac{\sqrt{3} \times Gm^2}{a^2} = \frac{m \times v^2 \times \sqrt{3}}{a} \Rightarrow v = \sqrt{\frac{Gm}{a}}$$

7. Answer (2)

Hint: Use Bernoulli's theorem

Sol.: We know that, as streamlines get closer at point B, then $v_B > v_A \Rightarrow P_A > P_B$

8. Answer (4)

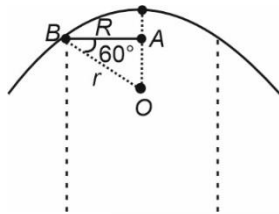
Hint: $V_T = \frac{2 r^2 (\rho - \sigma)}{9 \eta} g$

Sol.: After a long time the ball will attain terminal velocity as the net upward force (upthrust + viscous force) balances the downwards force (weight of body).

9. Answer (4)

Hint: Excess pressure in soap bubble equals $\frac{4T}{r}$

Sol.:



In $\triangle OAB$, $r = \frac{R}{\cos 60^\circ}$ also $\Delta P = \frac{4 \times T}{r}$

$$\Rightarrow \Delta P = \frac{4 \times 5 \times 10^{-2}}{\frac{1 \times 10^{-2}}{0.5}} \Rightarrow 4 \times 5 \times 0.5 = \frac{20}{2} = 10 \text{ Pa}$$

10. Answer (1)

Hint: Unit of surface tension, $S = \text{N/m}$

Sol.: Surface tension,

$$[S] = \frac{[MLT^{-2}]}{[L]} = [M^1 L^0 T^{-2}]$$

11. Answer (1)

Hint & Sol.: $\alpha = \frac{GM}{\beta} \Rightarrow GM = \alpha\beta$

- Field strength at distance,

$$2\beta = \frac{GM}{4\beta^2} = \frac{\alpha\beta}{4\beta^2} = \frac{\alpha}{4\beta}$$

- Field strength at distance, $\frac{\beta}{2}$

$$= \frac{GM}{\beta^3} \times \frac{\beta}{2} = \frac{GM}{2\beta^2} = \frac{\alpha\beta}{2\beta^2} = \frac{\alpha}{2\beta}$$

- Potential at distance, 3β from centre

$$= \frac{GM}{3\beta} = \frac{\alpha\beta}{3\beta} = \frac{\alpha}{3}$$

- Potential at centre = $\frac{3}{2} \times \frac{GM}{\beta} = \frac{3\alpha}{2}$

12. Answer (1)

Hint: $U = \frac{-Gm_1 m_2}{r}$,

$$V_{\text{centre}} = \frac{-3 GM}{2 R}$$

$$V_{\text{surface}} = \frac{-GM}{R}$$

Sol.: When two masses come closer, the potential energy decreases and potential at centre of solid surface is less as compared to surface, hence potential increases.

13. Answer (2)

Hint: Young's modulus is the property of material hence it is independent of dimensions of wire.

Sol.: Young's modulus of wire will be Y.

14. Answer (1)

Hint: Breaking stress = $\frac{\text{Breaking Force}}{\text{Cross-sectional Area}}$

Sol.: Maximum breaking stress, $\sigma_{\text{max}} = \frac{mg}{A} = \sigma$

$$\Rightarrow \frac{\rho \times A \times l \times g}{A} = \sigma \Rightarrow l = \frac{\sigma}{\rho g}$$

15. Answer (4)

Hint: Work done is proportional to the change in surface area of bubble.

Sol.: $W = 2s \times \Delta A$, $V = \frac{4}{3} \pi R^3$

$$\Rightarrow R^2 \propto (V)^{2/3}$$

$$\Rightarrow \frac{W}{W'} = \frac{R^2}{(R')^2} \Rightarrow \frac{W}{W'} = \frac{(V)^{2/3}}{(2V)^{2/3}}$$

$$\Rightarrow W' = (2)^{3/2} \cdot W \Rightarrow W' = (4)^{3/2} W$$

16. Answer (4)

Hint: According to meniscus geometry capillary radius, $r = R\cos\theta$, where R denotes radius of meniscus.

Sol.: Rise of liquid, $h = \frac{2s}{R\rho g}$ or $\frac{2s\cos\theta}{r\rho g}$

17. Answer (1)

Hint: Apply Bernoulli's theorem,

$$P_1 + \frac{1}{2}\rho V_1^2 + \rho gh_1 = P_2 + \frac{1}{2}\rho V_2^2 + \rho gh_2$$

$$\text{Sol.} P_1 + \frac{1}{2}\rho V_1^2 = P_2 + \frac{1}{2}\rho V_2^2$$

$$\frac{1}{2}\rho(V_2^2 - V_1^2) = P_1 - P_2 = 8$$

Change in Kinetic energy per unit mass

$$= \frac{1}{2}(V_2^2 - V_1^2) = P_1 - P_2 = 8$$

Change in Kinetic energy per unit mass

$$= \frac{1}{2}(V_2^2 - V_1^2) = \frac{P_1 - P_2}{\rho}$$

$$= 0.01 \text{ J/kg}$$

18. Answer (4)

$$\text{Hint: } \Delta P = \rho gh = \frac{2T}{r}$$

Sol.: As initially water rises upto 8 cm but now available length is 4 cm, hence the radius of meniscus increases so that water doesn't overflow.

If h becomes smaller, then ΔP becomes smaller, and thus r must increase.

19. Answer (1)

$$\text{Hint: Above the earth's surface, } g' = g \left[\frac{R}{R+h} \right]^2$$

Sol.: Percentage decrease of 75% means,

$$g' = 25\% \text{ of } g$$

$$\Rightarrow g' = \frac{g}{4} = g \left[\frac{R}{R+h} \right]^2 \Rightarrow \frac{R}{R+h} = \frac{1}{2}$$

$$\Rightarrow 2R = R+h \Rightarrow h = R$$

20. Answer (2)

Hint: Use the concept of intensity of field due to thin spherical shell.

Sol.: At B , particle is just outside shell \rightarrow gravity acts normally

$$a_B = I_G = \frac{G \times M}{R^2}$$

21. Answer (4)

Hint: Use conservation of mechanical energy.

Sol.: Since mechanical energy remains conserved, hence total mechanical energy would be zero.

Linear momentum of system will remain conserved.

$$\text{For total ME to be zero, if P.E.} = \frac{-G \times 4m \times m}{\alpha^2}$$

$$\text{So, K.E.} = \frac{4Gm^2}{\alpha}$$

22. Answer (3)

Hint & Sol.: As orbital radius decreases the satellite must speed up to maintain orbit at a smaller radius, the satellite gravitational potential energy decreases (becomes more negative) and total energy decreases.

K.E. \uparrow P.E. \downarrow and T.E. \downarrow

23. Answer (1)

Hint: Use conservation of energy.

$$\text{Sol.} U_i + K_i = U_f + K_f, K_f = 0, K_i = \frac{1}{2}mv^2$$

$$U_i = \frac{-GMm}{R} = -mgR, U_f = \frac{-GMm}{3R} = \frac{-2mgR}{3}$$

$$\Rightarrow \frac{1}{2}mv^2 = \frac{-2mgR}{3} + mgR$$

$$\Rightarrow \frac{mv^2}{2} = \frac{mgR}{3} \Rightarrow v = \sqrt{\frac{2gR}{3}}$$

24. Answer (2)

Hint & Sol.: The tensile stress at distance x from

$$\text{bottom, } \sigma = \frac{mgx}{AL}$$

Since σ is directly proportional to x , the graph of tensile stress vs distance x is a straight line.

25. Answer (1)

Hint & Sol.: Force between two point masses is independent of the presence of other masses.

26. Answer (4)

Hint & Sol.: The gravitational field inside a spherical shell is zero.

27. Answer (2)

Hint: $B = \frac{-P}{\frac{\Delta V}{V}}$, for constant hydraulic stress,

$$P = -\frac{B\Delta V}{V}$$

28. Answer (3)

Hint & Sol.: According to Hooke's law of elasticity, stress \propto strain within proportional limit.

29. Answer (1)

Hint: Shearing stress, $\frac{F}{A} = \eta \times \frac{v}{y}$

Sol.: Shearing stress, $\frac{F}{A} = \eta \times \frac{v}{y} = \frac{10^{-3} \times 5}{10}$

$$= 5 \times 10^{-4} \text{ N/m}^2$$

30. Answer (3)

Hint: Use the concept of gravitational field due to solid sphere.

Sol.: We know that inside solid sphere, gravitational field is proportional to distance from centre, hence acceleration of particle is proportional to r .

31. Answer (3)

Hint & Sol.: Areal velocity remains constant.

32. Answer (3)

Hint: Orbital speed, $v = \sqrt{\frac{GM}{r}}$

Sol.: $v_0 = \sqrt{\frac{GM}{r}}$,

M = Mass of planet, r = orbital radius

For same planet and same orbital radius, $v_1 = v_2$

33. Answer (3)

Hint & Sol.: The slope of load-elongation curve will give force constant *i.e.*, $F = \frac{YA}{l} \Delta l$.

$$F = K\Delta l$$

34. Answer (1)

Hint & Sol.: The value of Bulk modulus for solids is very large *i.e.*, tending to infinity.

35. Answer (2)

Hint & Sol.: Pressure at point $D = P_{\text{atm}} - \frac{\rho gh}{4}$

and $P_{\text{atm}} = \rho gh$

$$\Rightarrow P_D = \rho gh - \frac{\rho gh}{4} = \frac{3}{4} \times 10^5$$

$$= 0.75 \times 10^5 \text{ Pa}$$

36. Answer (3)

Hint & Sol.: Volume of liquid flowing per second out of an orifice is equal to $v = A\sqrt{2gh}$, hence it is independent of density of liquid.

37. Answer (1)

Hint & Sol.: Equation of continuity is based on the principle of conservation of mass.

38. Answer (3)

Hint: Use Pascal's law.

Sol.: Using Pascal's law,

$$(\Delta p)_{\text{at centre}} = \left[\frac{F/2}{A} \right] = \frac{F}{2A}$$

39. Answer (1)

Hint: The areal velocity remains constant.

Sol.: Since areal velocity remains constant hence,

$$\frac{\Delta A}{\Delta t} = C \Rightarrow \frac{A}{\Delta t_1} = \frac{2A}{\Delta t_2} \Rightarrow \frac{\Delta t_1}{\Delta t_2} = \frac{1}{2}$$

40. Answer (3)

Hint & Sol.: In an elliptical orbit, the angular momentum of planet about sun is conserved. While the speed of the planet changes, so linear momentum and kinetic energy will change.

41. Answer (2)

Hint & Sol.

$$v_e = \sqrt{\frac{2GM}{R}}, v_o = \sqrt{\frac{GM}{R}} \Rightarrow v_e = \sqrt{2} v_o$$

42. Answer (2)

Hint & Sol.: The SI unit of gravitational field at a particular point is N/kg.

43. Answer (1)

Hint & Sol.: We know that, $T^2 \propto R^3$

44. Answer (1)

Hint: Maximum weight bearing capacity will depend on material and cross-sectional area.

Sol.: Since the material and area of cross-section remains same, hence it can bear a maximum weight of 30 kg only.

45. Answer (1)

Hint: Tangential stress, $\tau = \frac{\text{Restoring force}}{\text{Cross-sectional area}}$

$$\text{Sol.} \quad \tau = \frac{F}{A} \Rightarrow \tau = \frac{100 \times 1}{2 \times 3 \times 2} = \frac{100}{12} = 8.33 \text{ N/m}^2$$

[CHEMISTRY]

46. Answer (4)

Hint: Presence of common ion decreases the solubility of sparingly soluble salt.

$$\text{Sol.} \quad [\text{CrO}_4^{2-}] = 0.01 \text{ M}$$



$$K_{\text{sp}} = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}]$$

$$1.1 \times 10^{-12} = (2s)^2 \times 0.01$$

$$4s^2 = 1.1 \times 10^{-10}$$

$$s = \sqrt{\frac{1.1}{4} \times 10^{-10}}$$

$$= 0.524 \times 10^{-5}$$

$$= 5.24 \times 10^{-6} \text{ M}$$

47. Answer (3)

Hint: For salt hydrolysis,

Degree of hydrolysis

$$h = \sqrt{\frac{K_h}{C}}$$

Sol.: For WASB type salt,

$$h = \sqrt{\frac{K_w}{K_a \times C}}$$

For SAWB type salt

$$h = \sqrt{\frac{K_w}{K_b \times C}}$$

For WAWB type salt

$$h = \sqrt{\frac{K_w}{K_a \times K_b}}$$

48. Answer (1)

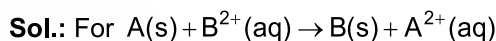
Hint: As positive SRP increases reducing power of metal decreases.

Sol.: Since B^{2+}/B has most negative SRP, metal B will be strongest reducing agent.

49. Answer (1)

Hint: For a cell

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



A is anode and B is cathode

$$E_{\text{cell}}^\circ = E_{\text{B}^{2+}/\text{B}}^\circ - E_{\text{A}^{2+}/\text{A}}^\circ$$

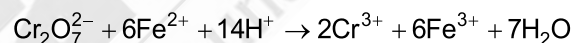
$$= 0.22 - (-0.45)$$

$$= 0.67 \text{ V}$$

50. Answer (1)

Hint: To balance any redox reaction number of atom in both side of reaction and number of electron exchanged must be same.

Sol.:



$$x = 1$$

$$y = 6$$

$$z = 14$$

$$e = 2$$

$$f = 6$$

$$g = 7$$

51. Answer (2)

Hint: Element with more positive value at SRP are good oxidising agent.

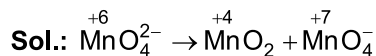
Sol.:

- Since $E_{\text{A}^{2+}/\text{A}} > E_{\text{B}^{2+}/\text{B}}$, A will be insoluble in BSO_4 .
- Since $E_{\text{A}^{2+}/\text{A}} > E_{\text{C}^{2+}/\text{C}}$, C will be insoluble in $\text{A}(\text{NO}_3)_2$.
- C^{2+} has least SRP hence it will be weakest oxidising agent.
- $\text{B}(\text{s}) + \text{CSO}_4 \rightarrow \text{BSO}_4 + \text{C}(\text{s})$, is non spontaneous hence will have negative EMF.

52. Answer (4)

Hint: n-factor for a disproportionation reaction per element is given as

$$n = \frac{n_1 n_2}{n_1 + n_2}$$



$$n\text{-factor} = \frac{1 \times 2}{1 + 2} = \frac{2}{3}$$

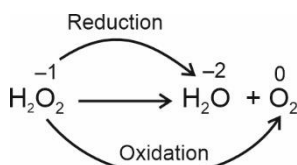
$$E = \frac{M}{n\text{-factor}} = \frac{M}{\frac{2}{3}}$$

$$E = \frac{3M}{2}$$

53. Answer (4)

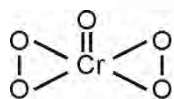
Hint: In disproportionation reaction, oxidation and reduction of same element takes place.

Sol.:

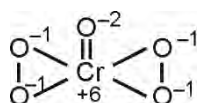


54. Answer (2)

Hint:



Sol.:



55. Answer (3)

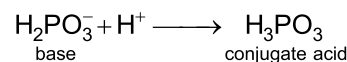
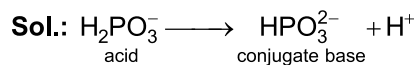
Hint: Algebraic summation of oxidation state of each element in a charged species is equal to its charge.

Sol.:

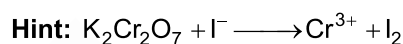
- Oxidation state of Cl in NaClO_3 is +5 but highest oxidation state of Cl is +7.
- There is no oxidation state change during conversion of $\text{Cr}_2\text{O}_7^{2-}$ to CrO_4^{2-} hence it does not require any OA or RA.
- Oxidation state of Cl in CaOCl_2 is +1 and -1.

56. Answer (2)

Hint: Conjugate acid base pair has difference of one H^+ or OH^- .



57. Answer (2)



$$n \times 6 = 0.1 \times 2$$

$$n = 0.033 \text{ mol}$$

58. Answer (1)

Hint: $\text{AgNO}_3 + \text{Na(s)} \rightarrow \text{NaNO}_3 + \text{Ag(s)}$ is a metal displacement reaction.

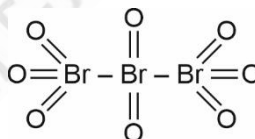
Sol.: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ is combination reaction.

$\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2$ is non-metal displacement reaction.

$2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$ is decomposition reaction.

59. Answer (1)

Hint: Structure of Br_3O_8 .



Sol.: Oxidation state of middle Br = +4

Oxidation state of terminal Br = +6

$$\text{For } \text{Fe}_3\text{O}_4 \text{ average oxidation state of Fe} = \frac{8}{3}$$

60. Answer (3)

Hint: Algebraic summation of oxidation state of each element in a compound is zero.

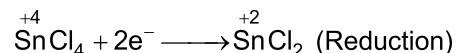
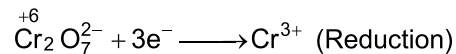
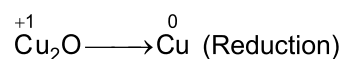
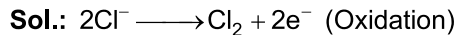
Sol.: In OF_2 O.S. of oxygen is +2.

In KO_2 , O.S. of K is +1.

In Ni(CO)_4 , O.S. of Ni is zero.

In Na_2CO_3 , O.S. of C is +4.

61. Answer (1)

Hint: Oxidation requires an oxidising agent.

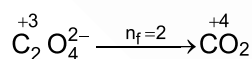
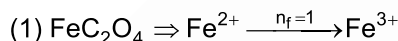
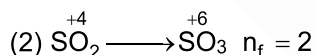
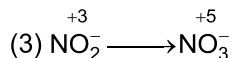
62. Answer (4)

Hint & Sol.: Metal with positive SRP does not liberate H_2 gas with dilute acid, these metals are Cu, Hg, Ag, Pt, Au.

63. Answer (1)

Hint: For a molecule algebraic sum of oxidation state of each and every element must be zero.**Sol.:** For $\text{A}(\text{BC}_2)_2$ Algebraic sum of oxidation states =
 $+2 + 2 \times (+3) + 4(-2) = 0$

64. Answer (1)

Hint: During redox reaction number of gram equivalent of both reducing agent and oxidising agent is same.**Sol.:**3 equivalents of KMnO_4 required2 equivalents of KMnO_4 required2 equivalents of KMnO_4 required1 equivalent of KMnO_4 required

65. Answer (1)

Hint: In a Galvanic cell:

Anode – Negatively charged electrode

Cathode – Positively charged electrode

Sol.: Salt bridge provides electrode contact between solutions without mixing them.

66. Answer (4)

Hint: at 25°C

$\text{pH} + \text{pOH} = 14$

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

Sol.: $\text{pOH} = 1$

$\text{pH} = 13$

$[\text{H}^+] = 10^{-13} \text{ mol/L}$

mole of H^+ in 1 L = 10^{-13}

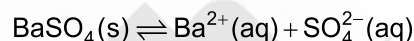
mole of H^+ in 2 mL = $\frac{10^{-13}}{10^3} \times 2$

$= 2 \times 10^{-16}$

Number of H^+ ions = $2 \times 10^{-16} \times 6.02 \times 10^{23}$

$= 1.2 \times 10^8$

67. Answer (2)

Hint: For BaSO_4 solution,

$K_{\text{sp}} = [\text{Ba}^{2+}][\text{SO}_4^{2-}]$

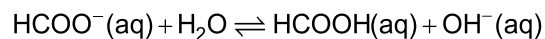
Sol.: $(K_{\text{sp}})_{\text{BaSO}_4} = S^2$

$S = \frac{2.33 \times 10^{-3}}{233} = 10^{-5} \text{ M}$

$K_{\text{sp}} = (10^{-5})^2$

$= 10^{-10}$

68. Answer (4)

Hint: pH of water can change on addition of salt due to salt hydrolysis.**Sol.:** WASB type of salt gives basic solution with pH more than 7 due to anionic hydrolysis.

69. Answer (1)

Hint: $[\text{H}^+]_{\text{R}} = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$

Sol.: $[\text{H}^+]_{\text{R}} = \frac{10^{-3}V + 10^{-4}V}{2V}$

$= \frac{11 \times 10^{-4}}{2}$

$= 5.5 \times 10^{-4}$

$\text{pH} = -\log(5.5 \times 10^{-4}) = 4 - 0.74$

$= 3.26$

70. Answer (4)

Hint: Decomposition of PCl_5 to PCl_3 and Cl_2 is an endothermic reaction with increasing number of gaseous moles.

Sol.:

- Introduction of inert gas at constant volume does not affect equilibrium.
- Introduction of inert gas at constant pressure will shift equilibrium towards more number of moles.
- Addition of product that is PCl_3 will shift equilibrium backward.

71. Answer (2)

Hint: Value of K_p does not get affected on any addition of gas or pressure change.

Sol.: $\text{A}_2\text{BC}(\text{s}) \rightleftharpoons \text{AB}(\text{g}) + \text{AC}(\text{g})$



$$p_{\text{total}} = p_{\text{AB}} + p_{\text{AC}}$$

$$2 = 2p$$

$$p = 1$$

$$K_p = p_{\text{AB}} \times p_{\text{AC}}$$

$$= 1$$



$$K_p = p_{\text{AB}} \times p_{\text{AC}}$$

$$1 = 2 \times p_{\text{AC}}$$

$$p_{\text{AC}} = \frac{1}{2} \text{ atm}$$

$$= 0.5 \text{ atm}$$

72. Answer (4)

Hint: $Q_c = \frac{[\text{B}][\text{C}]}{[\text{A}]}$

Sol.: $Q_c = \frac{[\text{B}][\text{C}]}{[\text{A}]} = 2 \times 10^{-4}$

As $K_c > Q_c$, then reaction will proceed in forward direction.

73. Answer (2)

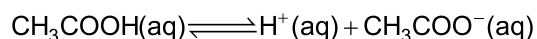
Hint: Total mole of H^+ ions will contributed by both of the weak acids.

Sol.:



$$K_1 = \frac{x(x+y)}{C_1-x} \quad (x \ll C_1)$$

$$K_1 C_1 = x(x+y) \quad \dots(i)$$



$$K_2 C_2 = (x+y)y \quad \dots(ii)$$

Adding (i) + (ii)

$$(x+y)^2 = K_1 C_1 + K_2 C_2$$

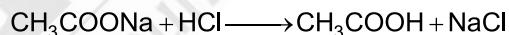
$$[\text{H}^+] = (x+y) = \sqrt{K_1 C_1 + K_2 C_2}$$

74. Answer (1)

Hint: Mixture of CH_3COOH and CH_3COONa will act as buffer solution.

Sol.:

For 1st solution:



$$[\text{H}^+] = \sqrt{K_a \times C}$$

$$\text{pH} = \frac{1}{2} \text{p}K_a = a$$

For 2nd solution:

$$b = \text{p}K_a + \log \frac{[\text{CH}_3\text{COONa}]}{[\text{CH}_3\text{COOH}]}$$

$$b = \text{p}K_a$$

$$a : b = \frac{\text{p}K_a}{2 \times \text{p}K_a} = 1 : 2$$

75. Answer (2)

Hint : Equilibrium in which all the components are not in same phase is called heterogeneous equilibrium.

Sol.: $\text{KClO}_3(\text{s}) \rightleftharpoons \text{KCl}(\text{s}) + \frac{3}{2} \text{O}_2(\text{g})$

All reactants and products are not in same phase.

76. Answer (2)

Hint: NH_4CN is WAWB type of salt.

$$\begin{aligned}\text{Sol.: } \text{pH} &= 7 + \frac{1}{2}\text{p}K_a - \frac{1}{2}\text{p}K_b \\ &= 7 + \frac{1}{2} \times 9.4 - \frac{1}{2}(4.76) \\ &= 9.32\end{aligned}$$

77. Answer (3)

Hint: Species with lone pair of electrons or negative charge act as Lewis base.**Sol.:** AlCl_3 acts as Lewis acid due to vacant orbital.

78. Answer (2)

Hint: $K_p = K_c(\text{RT})^{\Delta n_g}$ **Sol.:** The reaction for which $\Delta n_g = 0$, $K_p = K_c$ For, $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$

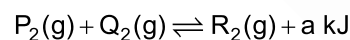
$$\Delta n_g = 2 - 2 = 0$$

Hence, $K_p = K_c$

79. Answer (4)

Hint: Catalyst does not appear in the equilibrium constant expression or in the balanced chemical equation.**Sol.:** A catalyst does not affect the equilibrium composition of a reaction mixture.

80. Answer (4)

Hint: Increase in temperature of exothermic equilibrium shifts it backward.**Sol.:** Decrease in pressure shifts equilibrium towards more number of moles

Above reaction will shift forward on decreasing temperature and increasing pressure.

81. Answer (3)

Hint: Salt of strong acid and weak base will undergo cationic hydrolysis.**Sol.:****Salt** **Hydrolysis** Na_2CO_3 Anionic

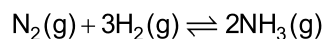
KCN Anionic

 NH_4Cl Cationic Na_2SO_4 No Hydrolysis

82. Answer (2)

Hint: For $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$

$$K_p = \frac{p_{\text{NH}_3}^2}{p_{\text{N}_2} \times p_{\text{H}_2}^3}$$

Sol.:

t = 0 3atm 3atm 0atm

At eq. (3 - 0.6)(3 - 1.8) 1.2

$$K_p = \frac{(1.2)^2}{2.4 \times (1.2)^3}$$

$$= \frac{1}{2.88}$$

$$= 0.35$$

83. Answer (4)

Hint: In case of equilibrium involving physical processes, there is a dynamic but stable condition.**Sol.:** At the state of equilibrium, both the processes occur at the same rate but the amount of product and reactant may or may not be equal.

84. Answer (2)

Hint: K_c changes with temperature only.**Sol.:** On changing concentration of reactant, K_c will be unchanged.

Equilibrium constant expression will get affected by stoichiometry too hence it will not always 1 even if concentration of reactant and product is same at equilibrium.

85. Answer (4)

Hint: As K_c of dissociation of oxide increases, its stability decreases.**Sol.:** According to given K_c Stability: $\text{N}_2\text{O}_5 < \text{NO} < \text{NO}_2$

86. Answer (1)

Hint: Increase in temperature of an endothermic equilibrium shifts it forward.**Sol.:** At 12.181 K temperature

$$R \times T = 0.0821 \times 12.181 = 1$$

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

$$K_p = K_c(1)^{\Delta n_g}$$

$$K_p = K_c$$

87. Answer (3)

Hint: $K_P = K_C(RT)^{\Delta n_g}$ **Sol.:** $K_P = 3 \times 10^{-4} (0.0821 \times 400)^{-1}$
 $= 9.1 \times 10^{-6}$

88. Answer (4)

Hint: If reaction gets subtracted, then their equilibrium constant gets divided for resultant reaction.**Sol.:** $A(g) + D(g) \rightleftharpoons B(g) + C(g)$

$$K_C = \frac{K_{C_1}}{K_{C_2}} = \frac{4 \times 10^{-2}}{2 \times 10^{-4}} = 2 \times 10^2$$

89. Answer (1)

Hint: If K_C is higher then equilibrium is rich in product and vice versa is for domination of reactant.**Sol.:** $E(g) \rightleftharpoons F(g)$ has maximum K_C hence F is richest product $C(g) \rightleftharpoons D(g)$ has minimum K_C hence C is richest reactant.

90. Answer (2)

Hint: $K_{eq} = \frac{K_f}{K_b}$ **Sol.:** $0.05 = \frac{2.5 \times 10^{-4}}{K_b}$
 $= 5 \times 10^{-3}$

[BOTANY]

91. Answer (4)

Hint: Medullary rays are present in dicot stem.**Sol.:** Cortex consists of several layers of thin-walled parenchymatous cells with intercellular spaces.

92. Answer (2)

Hint: Next to endodermis lies a few layers of thick-walled parenchymatous cells referred to as pericycle.**Sol.:** In dicot root, pericycle initiates roots and vascular cambium development during the secondary growth.

93. Answer (3)

Hint: All the tissues on the inner side of the endodermis constitute the stele.**Sol.:** Pericycle, conjunctive tissue, vascular bundles and pith constitute the stele.

94. Answer (4)

Hint: Roots have exarch xylem.**Sol.:** In a monocot root, vascular bundles are usually more, than that present in a dicot root.

95. Answer (3)

Hint: The outermost layer of the cortex in a dicot stem is hypodermis.**Sol.:** Hypodermis in a dicot stem is made up of several layers of collenchyma.

96. Answer (4)

Hint: Ring-like arrangement of vascular bundles is a characteristic of dicot stems.**Sol.:** In a monocot stem, vascular bundles are scattered in the ground tissue. Endarch xylem is present.

97. Answer (2)

Hint: This layer is present below the starch sheath.**Sol.:** Pericycle is present in the form of patches of semi-lunar shape and comprises of sclerenchymatous cells.

98. Answer (2)

Hint: Bulliform cells help in rolling of leaves.**Sol.:**

Bulliform cells	–	Modified epidermal cells in grasses that regulate the rolling and expansion of leaves
Palisade parenchyma	–	It lies below the upper epidermis and made up of the elongated cells which are arranged perpendicular to the upper epidermis
Spongy parenchyma	–	It is abaxially placed in leaf and made up of oval or rounded cells which are irregularly arranged
Bundle sheath cells	–	Thick-walled cells that form a layer around each vascular bundle

99. Answer (4)

Hint: Chlorophyceae is commonly called green algae and the major pigments in its members are chlorophyll *a* and *b*.

Sol.: In brown algae, gametes are pyriform, *i.e.*, pear-shaped and bear two laterally attached flagella.

100. Answer (1)

Hint: In *Spirogyra*, gametes are non-flagellated and similar in size.

Sol.: In *Ulothrix*, gametes are flagellated and similar in size.

101. Answer (1)

Hint: Red algae store food in the form of floridean starch.

Sol.: In red algae, sexual reproduction is accompanied by complex post fertilisation development. Mosses have upright, slender axes bearing spirally arranged leaves.

102. Answer (3)

Hint: Some members of brown algae are rich source of iodine.

Sol.: *Fucus* and *Laminaria* are rich source of iodine.

103. Answer (3)

Hint: *Funaria* is a moss.

Sol.: Mosses lack vascular system.

104. Answer (3)

Hint: Spermatophytes bear seeds.

Sol.: Spermatophytes include gymnosperms and angiosperms and they are phanerogams.

105. Answer (3)

Hint: *Cycas* possesses pinnate leaves that persist for a few years.

Sol.: Vessels are absent in gymnosperms.

106. Answer (4)

Hint: Natural system of classification was proposed by Bentham and Hooker.

Sol.: Phylogenetic classification systems assumed that organisms belonging to the same taxa have a common ancestor.

107. Answer (2)

Hint: *Polysiphonia* is red algae and *Polytrichum* is a moss.

Sol.:

<i>Laminaria</i>	–	Asexual reproduction is by biflagellated zoospores
<i>Polysiphonia</i>	–	Sexual reproduction by fusion between one large, non-motile female gamete and a smaller, non-motile male gamete
<i>Marchantia</i>	–	Asexual reproduction takes place by fragmentation of thalli, or by gemma.
<i>Polytrichum</i>	–	The sex organs antheridia and archegonia are produced at the apex of the leafy shoots

108. Answer (3)

Hint: Bryophytes also grow in cool, damp and shady places but they lack vascular tissues.

Sol.: Some pteridophytes are able to grow and flourish well in sandy soil. They are the first terrestrial plants to possess vascular tissue and they do not contain all the elements of xylem and phloem as that of angiosperm.

109. Answer (2)

Hint: Main plant body in bryophytes is the gametophyte.

Sol.: The predominant stage of the life cycle of a moss is the gametophyte.

Protonema → Leafy stage → Formation of archegonia and antheridia in gametophyte → Transfer of antherozoids to the archegonia in presence of water → Fertilisation → Meiosis in spore mother cell.

110. Answer (2)

Hint: Mosses, along with lichens, are the first to colonise rocks.

Sol.: Bryophytes play an important role in plant succession on bare rocks/soil.

111. Answer (3)

Sol.: Water as a factor, has its effect more through its effect on the plant rather than directly on photosynthesis.

112. Answer (4)

Hint: C₄ plants can tolerate higher temperature.

Sol.: At high light intensities, C₄ plants show CO₂ concentration saturation at about 360 μL⁻¹, while C₃ plants show saturation only beyond 450 μL⁻¹.

113. Answer (1)

Hint: Plastocyanin transfers e⁻ from cytochrome *b₆f* to PS I.

Sol.:

Plastocyanin	–	It transfers the electron from cytochrome to PS I
Plastoquinone	–	This molecule removes a proton from the stroma while transporting an electron
CF ₁ particle	–	It protrudes from the outer surface of the thylakoid membrane
CF ₀ particle	–	Transmembrane protein in thylakoid that carries out facilitated diffusion of protons across the membrane

114. Answer (4)

Hint: Age of leaves is a plant factor.

Sol.: Availability of sunlight is an external factor that can affect the rate of photosynthesis.

115. Answer (2)

Hint: RuBisCO can act as oxygenase in C₃ plants in the presence of abundant O₂ in atmosphere.

Sol.: Productivity and yields are better in C₄ plants as they lack photorespiration.

116. Answer (2)

Hint: The cold sensitive enzyme is involved in the regeneration of PEP.

Sol.: Enzyme pyruvate orthophosphate dikinase, a cold sensitive enzyme converts 3-carbon molecules into phosphoenol pyruvate.

117. Answer (1)

Hint: C₄ plants have Kranz anatomy.

Sol.: In C₄ plants, photorespiration does not occur. This is because they have a mechanism that increases the concentration of CO₂ at the enzyme site.

118. Answer (4)

Hint: Regeneration of RuBP requires ATP.

Sol.: NADPH is not required for the regeneration of RuBP.

119. Answer (2)

Hint: PGA is a 3-carbon organic acid.

Sol.: All photosynthetic plants undergo Calvin cycle, in which the primary stable product is PGA.

120. Answer (4)

Hint: Primary stable product of CO₂ fixation in C₄ plants is a 4-carbon acid.

Sol.: The C₄ acid OAA in C₄ plants is formed in the mesophyll cells.

121. Answer (3)

Hint: Cyclic photophosphorylation occurs in the stroma lamellae.

Sol.: Non-cyclic photophosphorylation involves both ATP and NADPH + H⁺ production. It involves two photosystems, *i.e.*, PS I and PS II. Both cyclic and non-cyclic photophosphorylation occurs in the wavelength of light beyond 680 nm.

122. Answer (2)

Hint: Redox potential of the primary e⁻ acceptor of PS I is lower than the redox potential of the primary e⁻ acceptor of PS II.

Sol.: The first discovered photosystem is PS I and it transfers electron to Fd-FNR complex.

123. Answer (4)

Hint: For the fixation of one CO₂ molecule in C₃ plants, 3 ATP and 2 NADPH are required.

Sol.: In C₃ plants, fixation of 6CO₂ requires 18ATP and 12NADPH.

∴ Sucrose, which has glucose and fructose will require 36ATP and 24NADPH.

124. Answer (4)

Hint: Tomato is a C₃ plants.

Sol.: Primary carbon dioxide acceptor in a C₃ plant is RuBP (5-carbon ketose sugar).

125. Answer (1)

Hint: Water splitting complex is associated with the photosystem II.

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

126. Answer (4)

Hint: Photochemical phase is also called light reaction of photosynthesis.

Sol.: Light reaction includes light absorption, water splitting, oxygen release and the formation of ATP and NADPH that is used in biosynthetic reaction.

127. Answer (2)

Hint: Antennae have accessory pigments as well as chief pigment.

Sol.: Each photosystem has all the pigments (except one molecule of chlorophyll *a*) forming a light harvesting system, also called antennae. These pigments help to make the process of photosynthesis more efficient by absorbing different wavelengths of light.

128. Answer (3)

Sol.: Xanthophylls show yellow colour in the chromatogram.

129. Answer (2)

Hint: Bundle sheath cells of C_4 plants lack grana in their chloroplast.

Sol.: RuBisCO is the most abundant enzyme on Earth which is found inside the stroma of chloroplast.

130. Answer (3)

Hint: The graph drawn for the rate of photosynthesis and wavelength of light in nanometres represents the action spectrum of photosynthesis.

Sol.: The first action spectrum of photosynthesis described through T.W. Engelmann's experiment which resembles roughly the absorption spectrum of chlorophyll *a* and *b*.

131. Answer (1)

Sol.: The plant factors or internal factors are dependent on the genetic predisposition and growth of the plant.

132. Answer (2)

Hint: Joseph Priestley performed the series of bell jar experiments.

Sol.: Using a similar setup, as the one used by Priestley, but by placing it once in the dark and once in the sunlight. Jan Ingenhousz showed that sunlight is essential to the plant processes that somehow purifies the air fouled by burning candles or breathing animals.

133. Answer (3)

Hint: The megaspore mother cell is differentiated from one of the cells of the nucellus.

Sol.: The correct sequence for female sex organ formation in gymnosperms is:

One of the cells of nucellus differentiates to form megaspore mother cell

↓

Meiotic division in megaspore mother cell

↓

Repeated mitosis in one of the megaspores enclosed within the ovule

↓

Formation of a multicellular female gametophyte that bears two or more archegonia.

134. Answer (3)

Hint: *Cycas* has coralloid roots.

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

135. Answer (4)

Hint: *Selaginella* possesses small leaves (microphylls).

Sol.: The female gametophyte in heterosporous pteridophytes is retained on the parent sporophyte for variable periods. The development of zygote into a young embryo takes place within the female gametophyte.

[ZOOLOGY]

136. Answer (2)

Hint: LH acts on the Leydig cells in males.

Sol.: 'Y' is LH and 'X' is GnRH (Gonadotrophin releasing hormone).

In females, LH induces ovulation of fully mature follicles (Graafian follicles) and maintains the corpus luteum.

Prolactin and progesterone stimulate milk formation.

FSH stimulates the growth and development of ovarian follicles.

Estrogen regulates the development of ducts in the mammary gland.

137. Answer (2)

Hint: Source gland is located at the back side of the thyroid gland.

Sol.:

Thymosin	–	Plays a major role in the differentiation of T-lymphocytes
PTH	–	Peptide hormone secreted by parathyroid gland which increases Ca^{+2} level in the blood by stimulating osteoblast activity
Secretin	–	Acts on exocrine pancreas and stimulates secretion of water and bicarbonate ions
Melatonin	–	Plays a role in regulation of diurnal rhythm of human body and body temperature

138. Answer (2)

Hint: Involved in RAAS mechanism

Sol.: Aldosterone is the main mineralocorticoid of the human body. It acts mainly on the renal tubules and stimulates the reabsorption of Na^+ and water and excretion of K^+ .

ACTH is a trophic hormone. Somatostatin is secreted from the hypothalamus.

Vasopressin is formed by the neurosecretory cells of hypothalamus. It is a protein hormone.

139. Answer (2)

Hint: Epinephrine and norepinephrine are commonly called catecholamines.

Sol.: Adrenal medulla secretes two hormones which are commonly called catecholamines.

Adrenaline and noradrenaline are rapidly secreted in response to stress of any kind and during emergency situations and are called emergency hormones.

140. Answer (1)

Hint: ADH is synthesized by the cells present in the hypothalamus.

Sol.:

Anterior pituitary	–	Dwarfism
Thyroid gland	–	Cretinism
Hypothalamus	–	Diabetes insipidus
Parathyroid gland	–	Tetany

141. Answer (2)

Hint: Between lungs

Sol.: The thymus gland is a lobular structure located between lungs behind the sternum on the ventral side of aorta.

142. Answer (1)

Hint: Equal to the number of ear a man has.

Sol.: Cortisol stimulates proteolysis, lipolysis and gluconeogenesis. It suppresses the immune response and produces anti-inflammatory reactions.

Glucagon also stimulates proteolysis and lipolysis. It is also involved in glycogenolysis.

Melatonin is derived from tryptophan.

143. Answer (2)

Hint: Exclude the lipid-soluble hormones.

Sol.: Water-soluble hormones interact with membrane-bound receptors and normally do not enter the target cell, but generate second messengers (e.g., cyclic AMP, IP_3 , Ca^{++} , etc.) which in turn regulate cellular metabolism, like pituitary and hypothalamic hormones.

Thyroxine, cortisol and estrogen are lipid-soluble hormones.

ACTH, PRL, TSH and GH are water-soluble hormones.

144. Answer (4)

Hint: Secretion of oxytocin increases due to positive feedback from continuous uterine contractions.

Sol.: Nerve impulses to the adrenal medulla regulate the release of epinephrine.

Blood Ca^{+2} level regulates the secretion of parathyroid hormone.

A hormone from the anterior pituitary stimulates the release of cortisol by the adrenal cortex.

Most hormonal regulatory systems work *via* negative feedback, but a few operate *via* positive feedback as well.

For example, during child birth, the hormone oxytocin stimulates contractions of the uterus, and uterine contractions in turn stimulate more oxytocin release, a positive feedback effect.

145. Answer (3)

Hint: ADH

Sol.: Vasopressin acts mainly at the kidney and stimulates reabsorption of water and electrolytes by the DCT and thereby reduces loss of water through urine (Diuresis), hence, prevents diuresis. It is also called anti-diuretic hormone (ADH). It is a protein hormone.

ADH causes constriction of arterioles, which increases blood pressure.

146. Answer (4)

Hint: Secretion of thyroxine is regulated by negative feedback loop

Sol.: After the complete removal of the thyroid gland (thyroidectomy), the primary source of T_3 and T_4 gets eliminated. Thus, its blood levels will drop to very low or even undetectable levels.

T_3/T_4 normally exerts a negative feedback effect on the pituitary gland. So, when T_3/T_4 levels are low, this inhibitory feedback is removed. In response, the release of TSH will increase from the anterior pituitary.

The hypothalamus produces TRH, which stimulates the pituitary gland to release TSH. With the extremely low T_3/T_4 , the release of TRH will also increase.

147. Answer (1)

Hint: Caused due to underproduction of hormones.

Sol.: Cushing syndrome occurs due to hypersecretion of cortisol, which is secreted from the adrenal cortex.

Underproduction of hormones by the adrenal cortex alters the carbohydrate metabolism causing acute weakness and fatigue leading to a disease called Addison's disease.

Adrenal virilism occurs due to hypersecretion of sex corticoids in females which leads to the development of male-like characters like excess facial hair, deepening of voice, etc., in females.

148. Answer (1)

Hint: T_4 – Tetraiodothyronine.

Sol.: Iodine is the most essential component for the normal rate of hormone synthesis in thyroid gland.

149. Answer (4)

Hint: LH stimulates the synthesis of androgens.

Sol.: Increased level of gonadotrophins during puberty helps in spermatogenesis in human males. Release of GnRH from hypothalamus causes secretion of gonadotrophins at the onset of puberty.

LH and FSH stimulates the gonadal activity and hence are called gonadotrophins.

150. Answer (2)

Hint: GH is secreted by the anterior pituitary.

Sol.:

Heart	–	ANF
GIT	–	Secretin
Pars distalis	–	GH
Adrenal gland	–	Epinephrine

151. Answer (4)

Hint: Role of glucagon

Sol.: Insulin is a peptide hormone secreted by β -cells of pancreas. It is a peptide hormone which plays a major role in regulation of glucose homeostasis. Prolonged deficiency of this hormone leads to diabetes mellitus.

Glucagon is a peptide hormone which stimulates the process of gluconeogenesis that contributes in hyperglycaemia.

Insulin stimulates the synthesis of fatty acids, *i.e.*, lipogenesis.

152. Answer (4)

Hint: Part of midbrain

Sol.: Corpora quadrigemina is a part of midbrain. The inner parts of cerebral hemispheres and a group of associated deep structures like amygdala, hippocampus, etc., form a complex structure called the limbic lobe or limbic system.

153. Answer (1)

Hint: K^+ efflux leads to repolarisation.

Sol.: Depolarisation of axonal membrane starts with opening of voltage-gated Na^+ channels, this leads to a rapid influx of Na^+ followed by the reversal of the polarity at that site.

During repolarisation, Na^+ voltage-gated channels start to close and K^+ starts diffusing outside the membrane and restores the resting membrane potential at the site of excitation.

154. Answer (1)

Hint: Our kidney is involved in RBC formation.

Sol.: The juxtaglomerular cells of kidney produce erythropoietin which stimulates the formation of RBCs. Androgens also play a role in erythropoiesis, which are secreted by testis.

Testis is an organised endocrine gland.

Hormones are also secreted by some tissues which are not endocrine glands. For example, juxtaglomerular cells of kidneys are not organised endocrine glands.

Ovary and thyroid are organised endocrine glands.

155. Answer (2)

Hint: ANS is classified into sympathetic and parasympathetic neural systems.

Sol.: The PNS is divided into two divisions called somatic neural system and autonomic neural system (ANS). The somatic neural system relays impulses from the CNS to skeletal muscles while the autonomic neural system transmits impulses from the CNS to the involuntary organs and smooth muscles of the body.

156. Answer (1)

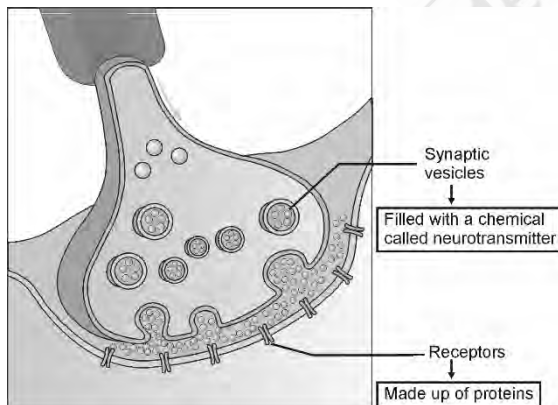
Hint: Member of the phylum Coelenterata.

Sol.: The neural organisation is very simple in lower invertebrates. For example, in *Hydra*, it is composed of a network of neurons. The neural system is better organised in insects, where a brain is present along with a number of ganglia and neural tissue.

157. Answer (3)

Hint: Receptors are specific for their chemicals.

Sol.:



Ca²⁺ stimulates the movement of synaptic vesicles towards the pre-synaptic membrane.

Neurotransmitters can be excitatory or inhibitory in nature.

158. Answer (4)

Hint: Lobes are visible from the dorsal side.

Sol.: The dorsal side of the mid brain consists mainly of four round swellings called corpora quadrigemina.

A canal called the cerebral aqueduct passes through the midbrain and connects different ventricles of the brain.

159. Answer (4)

Hint: True for limbic system.

Sol.:

Cerebral cortex	–	Referred to as the grey matter due to its greyish appearance that occurs due to accumulation of neuronal cell bodies.
Unipolar neuron	–	Usually present in the embryonic stage
Electrical synapse	–	Rare in our system
Forebrain	–	Can regulate the expression of emotional reactions

160. Answer (4)

Hint: Innermost layer of the cranial meninges.

Sol.: The human brain is well protected by the skull. Inside the skull, the brain is covered by cranial meninges, consisting of an outer layer called dura mater; a very thin middle layer called arachnoid and an inner layer, which is in close contact with the brain tissue, called pia mater.

161. Answer (4)

Hint: No saltatory conduction of nerve impulse.

Sol.: Unmyelinated nerve fibres of PNS are enclosed by the Schwann cells. But these Schwann cells do not produce a myelin sheath, instead form a neurilemma (sheath of Schwann) cells.

Nodes of Ranvier are absent in the unmyelinated axons.

162. Answer (2)

Hint: Involuntary control**Sol.:** Cerebellum is a part of the hind brain. It is present dorsal to the brain stem.

- **Mid brain** – Receives and integrates visual, tactile and auditory inputs.
- **Cerebellum** – Integrates information received from semi-circular canals of the ear and the auditory system.
- Cerebrum is the most developed and major part of the human brain.

163. Answer (2)

Hint: Adhesive pointed structures are absent.**Sol.:** Platyhelminths are mostly endoparasites found in animals. Hooks and suckers are present in the parasitic forms. In *Fasciola*, hooks are absent.

Thick tegument acts as a protective layer that protects the worm inside the digestive system of the host.

Circulatory system is absent in platyhelminths.

164. Answer (3)

Hint: Open type of circulation**Sol.:** Hemichordata was earlier considered as a sub-phylum under the phylum Chordata. Hemichordata consists of a small group of worm-like marine animals with organ-system level of body organisation.

Their cylindrical body is composed of an anterior proboscis, a collar and long trunk.

Respiration occurs *via* gills and they have open circulatory system.

Sexes are not separate; fertilisation is external with indirect development.

165. Answer (4)

Hint: Sponges have cellular level of body organisation.**Sol.:** Though all members of the kingdom Animalia are multicellular, all of them do not exhibit the same pattern of organisation of cells.

- Flatworms are mostly parasites; *Planaria* is free-living.
- Annelids can be free-living or sometimes parasitic.
- Molluscs are terrestrial or aquatic.

166. Answer (3)

Hint: Member of the phylum Arthropoda.**Sol.:** *Aedes* is an arthropod. In arthropods, fertilisation is internal and they lay fertilised eggs. *Asterias* and *Antedon* are echinoderms. They exhibit external fertilization.

167. Answer (3)

Hint: Gills are present in the mantle cavity.**Sol.:** Body of molluscs are covered by 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.

168. Answer (3)

Hint: Think about their nutrition.**Sol.:** *Meandrina* belongs to the phylum Coelenterata while *Ctenoplana* is a ctenophore. Both exhibit intracellular and extracellular mode of digestion. In ctenophores, reproduction takes place only by sexual means. Metagenesis (alternation of generation) is a characteristic feature of coelenterates only. Members of both the phyla have tissue level of body organisation and are diploblastic.

169. Answer (4)

Hint: *Obelia* exhibits metagenesis.**Sol.:**

<i>Aurelia</i>	–	Umbrella-shaped, free swimming
<i>Hirudinaria</i>	–	Body surface distinctly marked into segments
<i>Wuchereria</i>	–	Body cavity is not lined by mesoderm, instead mesoderm is present as scattered pouches
<i>Obelia</i>	–	Polyps produce medusae asexually

170. Answer (2)

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

171. Answer (3)

Hint: Sea anemone

Sol.: *Sycon* – Scypha
Spongilla – Fresh water sponge
Adamsia – Sea anemone
Wuchereria – Filaria worm

172. Answer (2)

Hint: Seen in cnidarians

Sol.: In porifers, choanocytes or collar cells line the spongocoel and the canals. Presence of collar cells is a characteristic feature of the members belonging to the phylum Porifera.

The gastrovascular cavity is present in coelenterates. Choanocytes are flagellated cells that ingest food particles.

173. Answer (1)

Hint: *Ancylostoma* is also known as hookworm.

Sol.: *Ancylostoma* is a bilaterally symmetrical triploblastic animal with pseudocoelom.

Sexual dimorphism is seen in roundworms. Females are longer than males.

In *Nereis*, parapodia help in swimming.

Anopheles is an arthropod.

174. Answer (2)

Hint: Emits light

Sol.: *Pleurobrachia* is a ctenophore. Ctenophores, commonly known as sea walnuts or comb jellies, are exclusively marine animals. Their body bears eight external rows of ciliated comb plates which help in locomotion. Bioluminescence is well-marked in ctenophores.

Metagenesis (alternation of generation) is a feature of cnidarians.

Ctenophores perform both extracellular and intracellular digestion.

Pleurobrachia contains a pair of tentacles that possess lasso cells.

175. Answer (4)

Hint: Scorpions do not lay eggs.

Sol.: Arthropoda is the largest phylum of the kingdom Animalia which includes insects. Over two-thirds of all named species on Earth are arthropods. The body of arthropods is covered by a chitinous exoskeleton.

Mollusca is the second largest animal phylum. The mouth of these animals contains a file-like rasping organ for feeding, called radula.

Arthropods are mostly oviparous.

Scorpion is a viviparous arthropod.

176. Answer (3)

Hint: *Apis* is also associated with the same fact.

Sol.: *Laccifer* (Lac insect) is an economically important insect. Mosquitoes (*Culex*, *Aedes*) act as vectors.

Locusta is a gregarious pest.

King crab is the living fossil.

177. Answer (4)

Hint: Equal to the number of limbs in humans.

Sol.: Members of the phylum Platyhelminthes have a dorso-ventrally flattened body, hence are called flatworms. These are mostly endoparasites found in animals including humans. Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ level of body organisation. Specialised cells called flame cells help in osmoregulation and excretion. Some members like *Planaria* possesses high regeneration capacity.

178. Answer (3)

Hint: *Sycon* is a porifer.

Sol.: Sponges have a water transport or canal system. Water enters through minute pores (ostia) in the body wall into a central cavity called spongocoel, from where it goes out through the osculum.

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

179. Answer (1)

Hint: Diploblastic animals

Sol.: An undifferentiated layer, mesoglea, is present in between the ectoderm and the endoderm in diploblastic animals. It is observed in animals of phyla Coelenterata and Ctenophora.

Meandrina, *Gorgonia* and *Pennatula* are coelenterates.

Ctenoplana is a ctenophore.

Sepia and *Chaetopleura* are molluscs.

Fasciola is a flatworm and *Ancylostoma* is a roundworm.

180. Answer (3)

Hint: Belongs to the phylum Echinodermata

Sol.: Animals belonging to the phylum Echinodermata have an endoskeleton of calcareous ossicles. The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

Antedon (Sea lily) is an echinoderm.

Dentalium and *Sepia* are molluscs and *Limulus* is an arthropod.

