

## All India Aakash Test Series for NEET - 2026

**TEST - I (Code-A)**[Click here for Code-B sol.](#)

Test Date : 20/07/2025

**ANSWERS**

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



$$C_1 = \frac{K\epsilon_0 A}{2d}$$

$$C_2 = \frac{2K\epsilon_0 A}{2d}$$

$$C_{eq} = C_1 + C_2$$

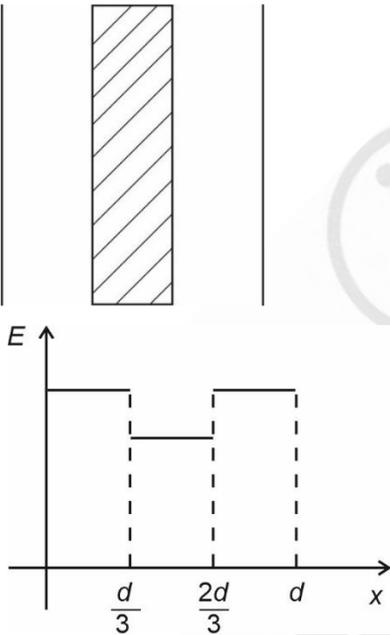
$$C_{eq} = \frac{3K\epsilon_0 A}{2d}$$

10. Answer (1)

**Hint:** Electric field inside dielectric is given by

$$= \frac{E_{air}}{K}$$

**Sol.:**



11. Answer (2)

**Hint:**  $V_A = \frac{k p \cos \theta}{r^2}$

**Sol.:**  $V_A = \frac{k p \cos 30^\circ}{r^2}$

$$V_A = \frac{\sqrt{3}}{2} \frac{k p}{r^2}$$

12. Answer (3)

**Hint:** Charge on capacitor  $Q = CV$

**Sol.:**  $C_{eq} = \frac{2 \times 12}{2 + 12} = \frac{24}{14} \mu F$

Charge through battery =  $C_{eq}V$

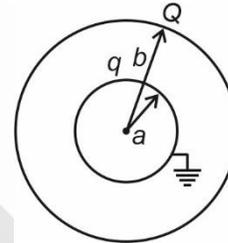
$$= \frac{24}{14} \times 7 = 12 \mu C$$

Charge on  $C_1 = 12 \mu C$

13. Answer (2)

**Hint:** On closing the switch, potential of inner sphere becomes zero.

**Sol.:**



Thus,

$$V_{in} = 0$$

$$\frac{kq}{a} + \frac{kQ}{b} = 0$$

$$q = \frac{Qa}{b}$$

Change in charge when switch is closed =  $q_f - q_i$

$$\Delta Q = -Q \left( \frac{a+b}{b} \right)$$

14. Answer (2)

**Hint:** Potential energy of two charge system

$$= \frac{kq_1q_2}{r}$$

**Sol.:** We know that  $U = \frac{kq_1q_2}{r}$

Since both the point charges are positive, then

$$U \propto \frac{1}{r}$$

$\therefore$  If  $r$  increases, then  $U$  decreases.

15. Answer (4)

**Hint:** Potential energy of a discrete charge system

$$\text{is } U = \sum_{i \neq j} \frac{kq_i q_j}{r_{ij}}$$

$$\text{Sol.: } U_{\text{system}} = U_{AB} + U_{AC} + U_{BC} = \frac{kq^2}{\sqrt{2}a} \times 3$$

16. Answer (2)

**Hint & Sol.:**  $Q = CV$

$$= 5 \times 5 = 25 \mu\text{C}$$

17. Answer (3)

**Hint:** Potential of a spherical system is equal to

$$\frac{kQ}{r}$$

**Sol.:** Charge on the bubble will remain constant.

$$\text{Therefore } V \propto \frac{1}{r}$$

$$\frac{V_i}{V_f} = \frac{r_f}{r_i} \Rightarrow \frac{6}{V_f} = \frac{3r}{r}$$

$$\Rightarrow V_f = 2 \text{ V}$$

18. Answer (4)

**Hint:** Potential energy of a dipole:  $U = -\vec{P} \cdot \vec{E}$

Torque experienced by a dipole:  $\vec{\tau} = \vec{P} \times \vec{E}$

**Sol.:**

- Potential energy is maximum when  $\vec{P}$  is antiparallel to  $\vec{E}$ .
- Torque experienced by the dipole is maximum when  $\vec{P}$  is perpendicular to  $\vec{E}$ .

19. Answer (2)

**Hint:** Capacitance of a parallel plate capacitor:

$$C = \frac{A\epsilon_0 k}{d}$$

**Sol.:** If plate area increases, then capacitance increases.

20. Answer (2)

**Hint & Sol.:** Both are true but II is not correct explanation of I.

Law of conservation of charge doesn't comment on charge being scalar.

21. Answer (2)

**Hint:** Use relation,  $\vec{E} = \frac{-\partial V}{\partial x} \hat{i} - \frac{\partial V}{\partial y} \hat{j} - \frac{\partial V}{\partial z} \hat{k}$

**Sol.:**  $V = 6x^2$

$$\vec{E} = \frac{-\partial V}{\partial x} \hat{i}$$

$$\vec{E} = -12x \hat{i}$$

$$\vec{E} \text{ at } (2, 0, -1) = -12 \times 2$$

$$= -24 \hat{i} \text{ V/m}$$

22. Answer (1)

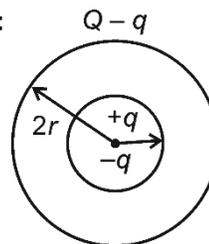
**Hint:** Electrostatic force is a type of conservative force.

**Sol.:** Net work done by conservative force is independent of path and depends on end points.

23. Answer (3)

**Hint:** Electric field inside conducting material is zero.

**Sol.:**



$\therefore$  Surface charge density on inner surface

$$\sigma = \frac{q}{4\pi r^2}$$

24. Answer (3)

**Hint:** Time period of pendulum is given by

$$T = 2\pi\sqrt{\frac{L}{g_{\text{eff}}}}$$

**Sol.:**  $g_{\text{eff}} = g - \frac{qE}{m}$

$$T' = 2\pi\sqrt{\frac{L}{g'}} = 2\pi\sqrt{\frac{L}{g - \frac{qE}{m}}}$$

25. Answer (2)

**Hint:** Motion in x direction is uniform and in y direction is uniformly accelerated.

**Sol.:** At time  $t_0$ ,

$$x = u_0 t_0$$

$$\text{and } y = \frac{1}{2} a t^2$$

$$y = \frac{1}{2} \frac{qE_0 t_0^2}{m}$$

Displacement

$$|s| = \sqrt{x^2 + y^2} = \sqrt{(u_0 t_0)^2 + \left(\frac{1}{2} \frac{qE_0 t_0^2}{m}\right)^2}$$

26. Answer (2)

**Hint:** Electric field due to solid non conducting uniformly charged sphere (for  $r < R$ ) is  $E = \frac{KQr}{R^3}$

$$(\text{for } r < R), E = \frac{KQ}{R^3} r$$

**Sol.:** From graph  $\tan\theta = \frac{E}{r}$

$$\Rightarrow \tan\theta = \frac{KQ}{R^3}$$

$$\Rightarrow \tan 37^\circ = \frac{KQ}{R^3}$$

$$\Rightarrow \frac{3}{4} = \frac{9 \times 10^9 \times Q}{4^3}$$

$$\Rightarrow Q = \frac{3 \times 16}{9 \times 10^9}$$

$$\Rightarrow Q = \frac{16}{3} \times 10^{-9}$$

$$\Rightarrow Q = 5.33 \text{ nC}$$

27. Answer (2)

**Hint:** Electric potential due to a conducting shell having surface charge density  $\sigma$  at centre is given

$$\text{by } V = \frac{\sigma R}{\epsilon_0}$$

**Sol.:**  $V_C = V_1 + V_2$

$$= \frac{\sigma R}{\epsilon_0} - \frac{\sigma(4R)}{\epsilon_0}$$

$$= \frac{-3\sigma R}{\epsilon_0}$$

28. Answer (2)

**Hint:** For  $n$  identical capacitors connected in series  $C_{\text{eq}} = \frac{C}{n}$  and for parallel  $C_{\text{eq}} = nC$

**Sol.:**  $C_1 = \frac{C}{5}$  and  $C_2 = 5C$

$$\frac{C_1}{C_2} = \frac{C}{5 \times 5C} = \frac{1}{25}$$

29. Answer (2)

**Hint:** Work done by external force  $W = U_f - U_i$

**Sol.:**  $W = U_f - U_i$

$$= \frac{K(q)(-2q)}{2r} - \left( \frac{K(q)(-2q)}{r} \right)$$

$$= \frac{-Kq^2}{r} + \frac{2Kq^2}{r}$$

$$= \frac{Kq^2}{r}$$

30. Answer (4)

**Hint:** Due to induction, net charge on sphere is zero

**Sol.:** Potential due to induced charge at centre

$$V_C = \frac{K(q_{\text{induced}})_{\text{net}}}{R}$$

= Zero

31. Answer (4)

**Hint:** Loss in energy =  $\frac{1}{2} \frac{C_1 C_2}{(C_1 + C_2)} (V_1 - V_2)^2$

**Sol.:** Change in energy = Loss in energy

$$= \frac{1}{2} \times \frac{C \times C}{C + C} (V - 2V)^2$$

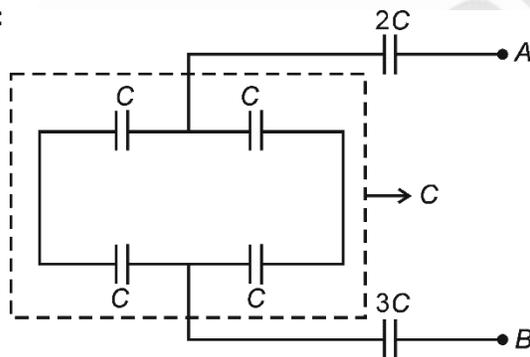
$$= \frac{1}{2} \times \frac{C}{2} \times V^2$$

$$= \frac{CV^2}{4}$$

32. Answer (1)

**Hint:** Use series and parallel combination of capacitor

**Sol.:**



$$\therefore \frac{1}{C_{\text{eq}}} = \frac{1}{C} + \frac{1}{2C} + \frac{1}{3C} = \frac{6 + 3 + 2}{6C}$$

$$C_{\text{eq}} = \frac{6C}{11}$$

33. Answer (3)

**Hint:** When battery is removed, the charge on plates remain constant.

**Sol.:**  $C' = \frac{A\epsilon_0}{d'} = \frac{2A\epsilon_0}{d} = 2C$

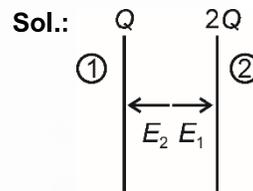
$$\Rightarrow U = \frac{Q^2}{2C}$$

and  $U' = \frac{Q^2}{2C'} = \frac{Q^2}{2(2C)} = \frac{U}{2}$

34. Answer (2)

**Hint:** Electric field due to a charged large metal

plate is  $E = \frac{Q}{2A\epsilon_0}$ .



$$E_{\text{net}} = E_2 - E_1$$

$$= \frac{2Q}{2A\epsilon_0} - \frac{Q}{2A\epsilon_0} = \frac{Q}{2A\epsilon_0}$$

35. Answer (2)

**Hint & Sol.:** Specific charge is  $\frac{q}{m}$ ; here  $m$  varies with speed and charge is independent of its speed. Therefore specific charge depends upon speed.

36. Answer (1)

**Hint:** Electric flux,  $\phi = \vec{E} \cdot \vec{A}$

**Sol.:**  $\phi = E_0 \hat{i} [L^2 \hat{i} + L^2 \hat{j}] \Rightarrow \phi = E_0 L^2$

37. Answer (4)

**Hint:** Linear charge density  $\lambda = \frac{q}{\text{length}}$

**Sol.:**  $\lambda = \frac{q_{\text{total}}}{\pi R}$

$$= \frac{4Q}{\pi R}$$

38. Answer (4)

**Hint:** Force on charge  $q$  in uniform electric field is  $F = qE$

**Sol.:**  $F = qE$

$$a = \frac{qE}{m}$$

For uniform acceleration

$$v = u + at$$

$$v = \frac{qE}{m}t$$

39. Answer (2)

**Hint:** Total charge of an isolated system is conserved.

**Sol.:**  $(Q_i)_{\text{system}} = (Q_f)_{\text{system}}$

$$\Rightarrow 17 - 13 + 4 = 6 + 6 + Q$$

$$\Rightarrow 8 - 12 = Q$$

$$\Rightarrow Q = -4 \text{ C}$$

40. Answer (3)

**Hint:** Here torque of electrostatic force is zero. Therefore, angular momentum is conserved *i.e.*

$$L_A = L_B$$

**Sol.:**  $L_A = L_B$

$$V_A r_A = V_B r_B$$

$$\Rightarrow V_A \times 3r = V_B \times r$$

$$\Rightarrow V_B = 3V_A \quad \dots(1)$$

$$K_B = 9K_A$$

K.E. is maximum at point B

$$\therefore K_B = 9 \text{ J}$$

$$\Rightarrow K_A = 1 \text{ J}$$

$$\Rightarrow \text{Work done by electrostatic force} = -\Delta U = \Delta K.E.$$

$$= K_B - K_A$$

$$= 9 - 1$$

$$= 8 \text{ J}$$

41. Answer (2)

**Hint:** By Gauss law,  $\phi = \frac{q_{\text{in}}}{\epsilon_0}$

**Sol.:** At edge centre,  $(q_{\text{in}})_{\text{effective}} = \frac{q}{4}$

$$\therefore \phi = \frac{q}{4\epsilon_0}$$

42. Answer (3)

**Hint:** Potential energy of dipole placed in uniform electric field is given by  $U = -\vec{P} \cdot \vec{E}$

**Sol.:**  $U_f - U_i = -PE\cos\theta_f + PE\cos\theta_i$

$$= PE[-\cos 37^\circ + \cos 0^\circ]$$

$$= 10^{-5} \times 2 \times 10^5 \left[ -\frac{4}{5} + 1 \right]$$

$$= \frac{2}{5} = 0.4 \text{ J}$$

43. Answer (1)

**Hint & Sol.:** The given charge can be completely enclosed using two circular surfaces. Due to symmetry flux through both the surfaces will be same. Hence flux through one surface would be

$$\frac{q}{2\epsilon_0}$$

44. Answer (3)

**Hint:** Apply volume conservation and charge conservation

$$\text{Sol.} \quad V = \frac{Kq}{r} \quad \dots(1)$$

Apply volume conservation

$$\frac{4}{3}\pi R^3 = 64 \times \frac{4}{3}\pi r^3 \quad (R \text{ is radius of bigger drop})$$

$$\Rightarrow R = 4r$$

$$Q = 64q$$

$$V' = \frac{KQ}{R} = \frac{K(64q)}{4r} = \frac{16Kq}{r} = 16V$$

45. Answer (2)

**Hint & Sol.:** Battery is disconnected.

Therefore charge cannot flow.

*i.e.*, Charge  $\rightarrow Q \rightarrow$  Same

$\Rightarrow$  Dielectric plate is inserted, so

$$C_{\text{new}} = KC; K > 1$$

$\therefore C \rightarrow$  Increases

$$\Rightarrow \text{Electric field } E_{\text{new}} = \frac{\sigma}{\epsilon_0 K}$$

$\Rightarrow E \rightarrow$  Decreases

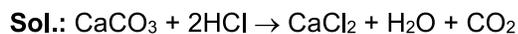
$$\Rightarrow \text{Energy density} = \frac{\text{Energy}}{\text{Volume}} = \frac{Q^2}{2CV}$$

Since  $C \uparrow$ , therefore energy density  $\downarrow$

**[CHEMISTRY]**

46. Answer (2)

**Hint:** During a chemical reaction only pure component reacts.



Mol of HCl =  $100 \times 0.4 \times 10^{-3}$

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

Mole of pure  $\text{CaCO}_3$  required =  $2 \times 10^{-2}$

% Purity =  $\frac{2 \times 10^{-2} \times 100}{\text{Mass of sample (W)}} \times 100$

$90 = \frac{2}{W} \times 100$

$W = \frac{2 \times 100}{90}$

= 2.22 g

47. Answer (3)

**Hint:** If a non-volatile solute is added to water then boiling point of solution ( $T_s$ ) can be calculated as  $T_s = (100 + \Delta T_b)^\circ\text{C}$

**Sol.:**  $\Delta T_b = i \times K_b \times m$

=  $2 \times 0.52 \times \frac{1}{9} \times 55.5$

=  $6.41^\circ\text{C}$

$T_s = (100 + 6.41)$

=  $106.41^\circ\text{C}$

48. Answer (4)

**Hint:** Solution of  $\text{HNO}_3$  in water shows negative deviation from Raoult's law

**Sol.:** • Only non-ideal solution forms azeotropic mixture

• Reverse osmosis is non spontaneous in nature



Before dissolution there were 4 ions and after dissolution 3 ions are produced hence colligative properties will decrease.

• When isotonic solutions are separated by semipermeable membrane, no osmosis occurs.

49. Answer (4)

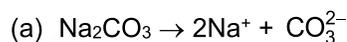
**Hint:** For dissociation of salt  $\text{A}_x\text{B}_y$



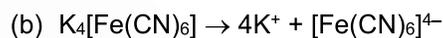
$i = 1 + (n - 1)\alpha$

$n = x + y$

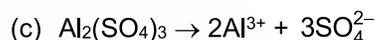
**Sol.:**



$i = 1 + (2) \times 0.7 = 2.4$



$i = 1 + (4) \times 0.6 = 3.4$



$i = 1 + (4) \times 0.75 = 4$



$i = 1 + 0.8 = 1.8$

50. Answer (1)

**Hint:** In vapour phase more volatile liquid has greater mole fraction.

**Sol.:** Colligative property  $\propto \frac{1}{\text{Molecular weight}}$

Hence molecular weight of unknown solute will be more than molecular weight of  $\text{C}_6\text{H}_{12}\text{O}_6$  that is 180.

51. Answer (1)

**Hint:** Colligative properties only depend on the number of solute particles.

**Sol.:** On complete ionisation, equimolar solutions of both NaCl and KCl will have same boiling points.

$K_b$  value remains constant for all aq. solutions.

52. Answer (1)

**Hint:** Isotonic solution will have same osmotic pressure.

**Sol.:**  $\pi_{\text{CaCl}_2} = (2.6) \times 0.1 \times \text{RT}$

$\pi_{\text{KCl}} = 0.13 \times 2 \times \text{RT}$

$\pi_{\text{Urea}} = 0.3\text{RT}$

$\pi_{\text{Na}_2\text{SO}_4} = 2.8 \times 0.1 \times \text{RT}$

=  $0.28 \text{RT}$

$\pi_{\text{C}_{12}\text{H}_{22}\text{O}_{11}} = 0.2\text{RT}$

53. Answer (2)

$$\text{Hint: Mass\%} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$\text{Sol.: (w/w)\%} = \frac{0.2 \times 180}{1000 + (0.1 \times 180)} \times 100$$

$$= \frac{18}{1018} \times 100$$

$$= 1.76\%$$

54. Answer (3)

**Hint:** Molality and mole fraction are temperature independent concentration terms.

**Sol.:** • A mixture of  $\text{CHCl}_3$  and acetone form a solution with negative deviation from Raoult's law.

- Solubility of gases in liquids decreases with rise in temperature.
- More solute cannot be dissolved in a saturated solution at constant temperature and pressure.

55. Answer (2)

**Hint:** As  $K_H$  increases, solubility decreases.

**Gas**       **$K_H$ /kbar at 298 K**

Ar      40.3

$\text{CO}_2$       1.67

$\text{CH}_4$       0.413

HCHO       $1.83 \times 10^{-5}$

**Sol.:** Order of solubility

$\text{Ar} < \text{CO}_2 < \text{CH}_4 < \text{HCHO}$

56. Answer (4)

**Hint:** According to Raoult's law

$$P_S = P_1^0 X_1 + P_2^0 X_2$$

$$\text{Sol.: } 39.52 = 0.6 \times P_T^0 + 0.4 \times 50.71$$

$$P_T^0 = 32.06 \text{ mm Hg}$$

57. Answer (4)

**Hint:** On dissolving non-volatile solute, freezing point of solvent decreases

$$\text{Sol.: } \Delta T_f = 6^\circ\text{C}$$

$$K_f \times m = 6^\circ\text{C}$$

$$1.86 \times \frac{w \times 1000}{62 \times 4000} = 6$$

$$w = 800 \text{ g}$$

58. Answer (3)

**Hint:** As number of particle of solute increases, colligative property also increases.

**Sol.:**  $\Delta T_b = iK_b m$ ;  $i$  increases,  $\Delta T_b$  also increases,  $\Delta T_f = iK_f m$ ;  $i$  increases,  $\Delta T_f$  also increases

59. Answer (2)

**Hint:** Boiling point of water increases at high pressure.

**Sol.:** In pressure cooker boiling point of water increases hence cooking time decreases.

60. Answer (1)

**Hint:** For non-volatile solute in solution

$$\text{RLVP} = \frac{P^0 - P_S}{P^0}$$

$$\text{Sol.: } \frac{P^0 - P_S}{P^0} = X_B$$

$$\frac{P^0 - P_S}{P^0} = \frac{n_B}{n_B + n_{\text{H}_2\text{O}}}$$

$$1 - \frac{P_S}{P^0} = \frac{n_B}{n_B + n_{\text{H}_2\text{O}}}$$

$$1 - \frac{n_B}{n_B + n_{\text{H}_2\text{O}}} = \frac{P_S}{P^0}$$

$$\frac{n_{\text{H}_2\text{O}}}{n_B + n_{\text{H}_2\text{O}}} = \frac{P_S}{P^0}$$

$$\frac{P^0}{P_S} = \frac{n_B + n_{\text{H}_2\text{O}}}{n_{\text{H}_2\text{O}}}$$

$$\frac{P^0}{P_S} = 1 + \frac{n_B}{n_{\text{H}_2\text{O}}}$$

$$\frac{P^0}{P_S} - 1 = \frac{n_B}{n_{\text{H}_2\text{O}}}$$

$$\boxed{\frac{P^0 - P_S}{P_S} = \frac{n_B}{n_{\text{H}_2\text{O}}}}$$

$$P_S = P_{\text{H}_2\text{O}}^0 \times X_{\text{H}_2\text{O}}$$

61. Answer (3)

**Hint:** According to Nernst's equation,

$$E_{\text{Cell}} = E_{\text{Cell}}^{\circ} - \frac{0.0591}{n} \log(Q_C)$$

$$\text{Sol.: } E_{\text{Cell}} = 0.76 - \frac{0.0591}{2} \log \frac{[\text{Zn}^{2+}] P_{\text{H}_2}}{[\text{H}^+]^2}$$

$$= 0.58 \text{ V}$$

62. Answer (2)

**Hint:** Metal with less standard reduction potential (SRP) has more reactivity**Sol.:** Cu has lesser SRP than Ag hence Cu is more reactive. $\text{Al}^{3+}/\text{Al}$  has more negative SRP than  $\text{Zn}^{2+}/\text{Zn}$ . $\text{Cl}_2 + \text{Br}^- \rightarrow \text{Br}_2 + \text{Cl}^-$  has positive  $E_{\text{cell}}$  value hence it is spontaneous.

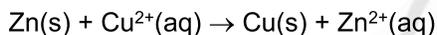
63. Answer (4)

**Hint:** Anode and cathode are made up of same metal in case of concentration cell.**Sol.:** For concentration cell ;

$$E_{\text{Cell}}^{\circ} = 0$$

$$\therefore K_c = 1$$

64. Answer (1)

**Hint:** Daniell cell is**Sol.:** Cell reaction is

65. Answer (1)

**Hint:** A cell that converts chemical energy to electrical energy is called Galvanic cell.**Sol.:** Electrode potential is a potential difference developed between the electrode and electrolyte.

66. Answer (2)

**Hint:** At anode oxidation takes place and at cathode reduction takes place.**Sol.:** In galvanic cell oxidation takes place at negative anode and reduction takes place at positive cathode.

67. Answer (1)

**Hint:** More reactive metal gets dissolved and release  $\text{H}_2$  gas from acids.**Sol.:** Cu is less reactive than  $\text{H}_2$  hence Cu will not be dissolved in HCl.

68. Answer (1)

**Hint:** For a half cell

$$E_{\text{M}^{n+}/\text{M}} = E_{\text{M}^{n+}/\text{M}}^{\circ} - \frac{RT}{nF} \ln \frac{1}{[\text{M}^{n+}]}$$

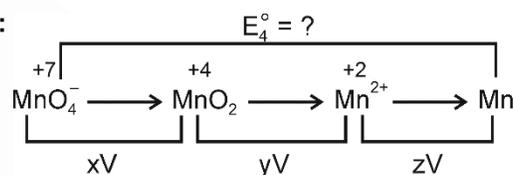
$$\text{Sol.}: E_{\text{M}^{2+}/\text{M}} = E_{\text{M}^{2+}/\text{M}}^{\circ} - \frac{RT}{2F} \ln \frac{1}{0.01}$$

$$= E - \frac{RT}{F} \ln 10$$

69. Answer (2)

**Hint:** Metal with less SRP has more reducing power.**Sol.:** Ca has lesser SRP than Mg hence Ca has more reducing power. $\text{F}_2$  is better oxidising agent than  $\text{Cl}_2$  as it has more SRP. $\text{Li}^+$  has minimum SRP value.

70. Answer (3)

**Hint:**  $\Delta G^{\circ} = -nFE^{\circ}$ **Sol.:**

$$\Delta G_4^{\circ} = \Delta G_1^{\circ} + \Delta G_2^{\circ} + \Delta G_3^{\circ}$$

$$7E_4^{\circ} = 3x + 2y + 2z$$

$$\therefore E_4^{\circ} = \frac{3x + 2y + 2z}{7}$$

71. Answer (3)

$$\text{Hint \& Sol.}: E_{\text{Cell}} = E_{\text{Cell}}^{\circ} - \frac{.00591}{n} \log \frac{[\text{X}^{2+}]}{[\text{Y}^{2+}]}$$

$$E_{\text{Cell}} = E_{\text{Cell}}^{\circ} + 0.06$$

$$(1) \text{ Ni(X) and Sn(Y) } E_{\text{Cell}}^{\circ} = -0.14 + 0.25 = 0.11 \text{ V}$$

$$(2) \text{ Fe(X) and Ni(Y) } E_{\text{Cell}}^{\circ} = +0.44 - 0.25 = 0.21 \text{ V}$$

$$(3) \text{ Ni(X) and Zn(Y) } E_{\text{Cell}}^{\circ} = -0.76 + 0.25 = -0.51 \text{ V}$$

$$(4) \text{ Zn(X) and Sn(Y) } E_{\text{Cell}}^{\circ} = -0.14 + 0.76 = 0.62 \text{ V}$$

72. Answer (4)

$$\text{Hint: } \Delta G^{\circ} = -nF E_{\text{Cell}}^{\circ}$$

$$\text{Sol.}: \Delta G^{\circ} = -2 \times 96500 \times 1.41$$

$$= -272.13 \text{ kJ/mol}$$

73. Answer (3)

**Hint & Sol.:** Ag has highest conductivity

Conductors	Conductivity ( $\text{S m}^{-1}$ )
Ag	$6.2 \times 10^3$
Fe	$1.0 \times 10^3$
Graphite	$1.2 \times 10$

74. Answer (1)

**Hint:** Both specific conductance and molar conductivity are concentration dependent.

**Sol.:** Molar conductivity increases but specific conductance decreases with increase in dilution.

75. Answer (2)

**Hint:** For conducting cell

$$k = C G^*$$

$$\text{Sol.}: k = C G^* \quad \left( C = \frac{1}{R} \right)$$

$$5 \times 10^{-3} = \frac{1}{200} \times G^*$$

$$G^* = 1 \text{ cm}^{-1}$$

76. Answer (4)

**Hint & Sol.:**  $\text{OH}^-$  will have maximum limiting molar conductivity in aqueous medium.

Ion	$\lambda^\circ (\text{Scm}^2 \text{mol}^{-1})$
$\text{Na}^+$	50.1
$\text{Mg}^{2+}$	106.0
$\text{Cl}^-$	76.3
$\text{OH}^-$	199.1

77. Answer (1)

$$\text{Hint: } \alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$$

$$\text{Sol.}: \Lambda^\circ = 349.6 + 40.9 = 390.5$$

$$\Lambda_m = \frac{1.85 \times 10^{-5} \times 1000}{10^{-3}}$$

$$= 18.5$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$$

$$= \frac{18.5}{390.5} \times 100$$

$$= 4.7\%$$

78. Answer (3)

**Hint:**  $\Delta T_f = iK_f m$

$$\text{Sol.}: \text{Weight of water} = 500 \times 0.997 = 498.5 \text{ g}$$

Number of moles of acetic acid

$$= \frac{\text{Weight of } \text{CH}_3\text{COOH}}{\text{Mol. wt. of } \text{CH}_3\text{COOH}} = \frac{6}{60} = 0.1 \text{ mol}$$

$$m = \frac{0.1}{498.5} \times 1000 \Rightarrow 0.2 \text{ m}$$

$$i = 1 - \alpha + n\alpha$$

$$= 1 - 0.46 + 2 \times 0.46$$

$$= 1.46$$

$$\Delta T_f = 1.46 \times 1.86 \times 0.2$$

$$= 0.54^\circ\text{C}$$

79. Answer (1)

**Hint:** 1 F charge deposits 1 gram equivalent metal during electrolysis.

**Sol.:** 1 mol Cu from  $\text{CuSO}_4$  is 2 eq. Cu

Hence 2 F required.

1 mol Al from  $\text{AlCl}_3(\text{l})$  is 3 eq. Al

Hence 3 F required.

1 mol Ag from AgBr is 1 eq.

Hence 1 F required.

1 mol Fe from  $\text{Fe}_3\text{O}_4$  is  $\frac{8}{3}$  eq.

Hence  $\frac{8}{3}$  F required.

80. Answer (3)

**Hint:** According to 1<sup>st</sup> law of Faraday

$$w = \frac{Eit}{96500}$$

$$\text{Sol.}: w = \frac{108 \times 3 \times 10 \times 60}{1 \times 96500}$$

$$= 2.01 \text{ g}$$

81. Answer (1)

**Hint:** On electrolysis of aq. NaCl,  $\text{H}_2\text{O}$  gets reduced at cathode.



Hence pH increases.

82. Answer (4)

**Hint:** Electrolyte used in dry cell is paste of  $\text{NH}_4\text{Cl}$  and  $\text{ZnCl}_2$

**Sol.:** Electrolyte used in mercury cell is paste of KOH and ZnO

Electrolyte used in  $(\text{H}_2 - \text{O}_2)$  fuel cell is conc. (aq) NaOH

Electrolyte used in Lead storage cell is 38% aq.  $\text{H}_2\text{SO}_4$ .

83. Answer (4)

**Hint:** More reactive metal can be used as sacrificial anode.

**Sol.:** Mg is more reactive than iron.

84. Answer (3)

**Hint:** Electrolysis of Brine solution will give  $H_2$  at cathode and  $Cl_2$  at anode

$$\begin{aligned}\text{Sol.}: \text{Charge supplied} &= \frac{965 \times 2}{96500} F \\ &= 2 \times 10^{-2} F = 0.02 F\end{aligned}$$

$$\text{Number of mole of } Cl_2 = \frac{0.02}{2} = 0.01 \text{ mol}$$

$$\text{Mole of } H_2 \text{ released} = 0.01$$

$$\text{Total mole of gases evolved} = 0.02 \text{ mol}$$

85. Answer (2)

**Hint:** Element with high value of SRP are good oxidising agent.

**Sol.:**

- Since  $E_{A^{2+}/A}^\circ > E_{B^{2+}/B}^\circ$ , A will be insoluble in  $BSO_4$
- Since  $E_{A^{2+}/A}^\circ > E_{C^{2+}/C}^\circ$ , C will be soluble in  $A(NO_3)_2$
- $C^{2+}$  has least SRP hence it will be weakest oxidising agent.
- $B(s) + CSO_4 \rightarrow BSO_4 + C(s)$ , is nonspontaneous hence will have negative EMF.

86. Answer (4)

**Hint:** Only solvent freezes during freezing of a solution.

$$\text{Sol.}: \Delta T = iK_f m$$

$$1 = 1 \times 1.86 \times \frac{0.1 \times 1000}{W}$$

$$W = 186 \text{ g}$$

$$\therefore \text{Mass of ice separated from solution} = 1000 - 186 = 814 \text{ g}$$

87. Answer (4)

$$\text{Hint: } \frac{P^0 - P_s}{P_s} = \frac{n_{\text{solute}}}{n_{\text{solvent}}}$$

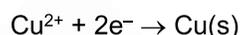
$$\text{Sol.}: \frac{640 - 600}{600} = \frac{2.175}{\frac{MM}{39}} \cdot \frac{78}{78}$$

$$MM = 65.25 \text{ g mol}^{-1}$$

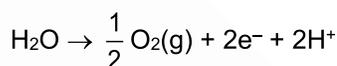
88. Answer (2)

**Hint:** On electrolysis of  $CuSO_4$  (aq) using inert electrode,  $Cu^{2+}$  will get reduced at cathode and  $H_2O$  will get oxidised at anode.

**Sol.:** At cathode



At anode



By passing 1 F charge 1 eq. of  $O_2$  will be evolved.

$$\text{Mole of } O_2 = \frac{1}{4} \times n_{\text{eq}} \text{ of } O_2$$

$$= \frac{1}{4}$$

$$\text{Volume of } O_2 \text{ at STP} = \frac{1}{4} \times 22.4 \text{ L}$$

$$= 5.6 \text{ L}$$

89. Answer (2)

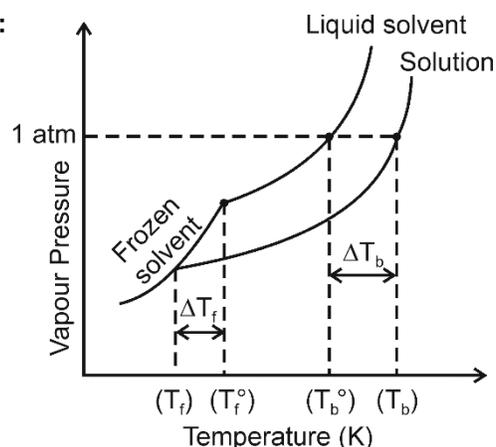
**Hint:** Isotonic solutions have same osmotic pressures.

**Sol.:** Cell fluid is isotonic with 0.9% (w/V) NaCl solution.

90. Answer (2)

**Hint:** Depression in freezing point is  $\Delta T_f$  and elevation in boiling point is  $\Delta T_b$

**Sol.:**



**[BOTANY]**

91. Answer (4)  
**Hint:** The proximal end of filament of stamen is attached to non-reproductive part of a flower.  
**Sol.:** The proximal end of filament of stamen can be attached to the thalamus or petal or tepal of a flower.
92. Answer (2)  
**Hint:** Microspore tetrads are produced after meiotic division.  
**Sol.:** Being products of meiosis, microspore tetrads have haploid cells.
93. Answer (1)  
**Hint:** In upto 40% of angiosperms, pollen grains are shed at three celled stage.  
**Sol.:** In these plants, generative cell divides into two male gametes before pollen grains are shed.
94. Answer (4)  
**Hint:** Pollen grain has a prominent two layered wall, outer is exine and inner is intine.  
**Sol.:** Chitin is found in the cell wall of fungi.
95. Answer (2)  
**Hint:** An embryo sac is 7-celled and 8-nucleate structure.  
**Sol.:** The egg apparatus is a three-celled structure. In an ovule, nucellus generally differentiate megaspore mother cell in the micropylar end.
96. Answer (4)  
**Hint:** Pollens of wheat and rice lose viability within 30 minutes of their release  
**Sol.:** Wheat and rice belong to Poaceae family.
97. Answer (4)  
**Hint:** Maize shows geitonogamy  
**Sol.:** Maize has chasmogamous flowers. It does not show cleistogamy.
98. Answer (4)  
**Hint:** Majority of flowering plants use biotic agents for pollination.  
**Sol.:** Mucilage covered unwettable pollen grains are produced by those plants which show hydrophily.
99. Answer (2)  
**Hint:** Given figure depicts a plant showing wind pollination.  
**Sol.:** Wind pollinated plants do not produce nectar.
100. Answer (2)  
**Hint:** Dioecious plants prevent both autogamy and geitonogamy.  
**Sol.:** Papaya is a dioecious plant.
101. Answer (1)  
**Hint:** Algae, bryophytes and pteridophytes do not form pollen.  
**Sol.:** *Vallisneria*, *Zostera* and *Hydrilla* show hydrophily.
102. Answer (2)  
**Hint:** In majority of aquatic plants, flowers emerge above water.  
**Sol.:** In majority of aquatic plants, flowers are pollinated by insects or wind.
103. Answer (2)  
**Hint:** Many primates have been reported as pollinators.  
**Sol.:** Larger animals such as lemurs, arboreal rodents or even reptiles also act as pollinators.
104. Answer (4)  
**Hint:** Plant in the given figure is *Vallisneria*.  
**Sol.:** *Vallisneria* is a fresh water plant and not called sea grass. Sea grasses such as *Zostera* has ribbon like pollen.
105. Answer (4)  
**Hint:** Members of Poaceae are usually pollinated by wind.  
**Sol.:** Rice shows wind pollination.
106. Answer (1)  
**Hint:** This structure is found in egg apparatus  
**Sol.:** Filiform apparatus is found in synergids, which guides the entry of pollen tube.
107. Answer (3)  
**Hint:** Apocarpous gynoecium is found in some early members of angiosperms.  
**Sol.:** *Papaver* has syncarpous gynoecium. *Michelia* has apocarpous gynoecium.
108. Answer (3)  
**Hint:** Hermaphrodite flowers are bisexual flowers.  
**Sol.:** Bisexual flowers promote self pollination.
109. Answer (4)  
**Hint:** Castor produces both male and female flowers on the same plant.  
**Sol.:** Castor prevents autogamy but not geitonogamy. It is a monoecious plant and has endospermous (albuminous) seeds.

110. Answer (2)  
**Hint:** Maize produces unisexual flowers.  
**Sol.:** Emasculation is required when the parent flower is bisexual.
111. Answer (3)  
**Hint:** One of the male gametes fuses with polar nuclei during triple fusion.  
**Sol.:** Polar nuclei fuse to form secondary nucleus before triple fusion.
112. Answer (4)  
**Hint:** In some plant species, diploid egg cells are formed without reduction division.  
**Sol.:** Diploid egg cell directly develops into embryo without fertilisation.
113. Answer (3)  
**Sol.:** A typical anther is tetragonal.
114. Answer (3)  
**Hint:** Perisperm is persistent nucellus.  
**Sol.:** Perisperm are diploid tissue seen in beet and black pepper.
115. Answer (4)  
**Hint:** False fruits develop from ovary along with thalamus.  
**Sol.:** Mango is a true fruit, rest all are false fruits.
116. Answer (4)  
**Hint:** This layer generally has more than one nucleus.  
**Sol.:** Tapetum nourishes developing pollen grains.
117. Answer (3)  
**Hint:** Pollen grains are male gametophytes  
**Sol.:** Pollen are 25-50  $\mu\text{m}$  in diameter. They are well preserved as fossil due to sporopollenin present in exine layer.
118. Answer (2)  
**Hint:** Male gametophytes are shed either at 2 celled or 3 celled stage.  
**Sol.:** Mature male gametophyte is two celled and it undergoes a mitotic division to form 2 gametes. Pollens are stored at  $-196^{\circ}\text{C}$  in liquid  $\text{N}_2$ . Only integuments are absent at micropyle.
119. Answer (4)  
**Hint:** Scutellum represents the cotyledon of grass.  
**Sol.:** Scutellum is a diploid structure.
120. Answer (2)  
**Hint:** Flowers do not produce rewards which are pollinated by abiotic agents.  
**Sol.:** Wind or water pollinated flowers are colourless and do not produce nectar.
121. Answer (4)  
**Hint:** Wind pollination is not common in aquatic plants.  
**Sol.:** Monosporic embryo sac is formed by three sequential mitotic divisions.
122. Answer (1)  
**Hint:** Double fertilisation is seen in angiosperms.  
**Sol.:** Seed producing and pollen producing plants include both gymnosperm and angiosperms but gymnosperms lack double fertilisation.
123. Answer (1)  
**Sol.:** Coconut water is free nuclear endosperm.
124. Answer (2)  
**Hint:** Plumule is enclosed in coleoptile.  
**Sol.:** Radicle and root cap are enclosed in coleorhiza.
125. Answer (1)  
**Hint:** A seed of orange contains many embryos.  
**Sol.:** Being polyembryonic, orange may have zygotic as well as nucellar or integument embryos which are genetically different and are diploid.
126. Answer (4)  
**Hint:** Both mango and citrus have apomictic embryos.  
**Sol.:** Both of them have embryos that arise from zygote and nucellus.
127. Answer (1)  
**Hint:** Archegonium leads to formation of megaspore mother cell.  
**Sol.:** Archegonium differentiates from nucellus.
128. Answer (1)  
**Sol.:** *Orobanch*e and *Striga* are parasitic plants producing fruits with many tiny seeds.
129. Answer (4)  
**Hint:** Zygote is a product of sexual reproduction.  
**Sol.:** Zygote does not form apomictic embryos.
130. Answer (2)  
**Hint:** Xenogamy is cross pollination.  
**Sol.:** Xenogamy involves, fertilisation of a flower by the pollen from a flower of another plant of same population.
131. Answer (1)  
**Hint:** In some fruits thalamus also contributes to fruit formation along with ovary.  
**Sol.:** The fruits in which thalamus also contributes in fruit formation are called false fruits, as seen in apple.

132. Answer (3)

**Hint:** Germ pore is the area of pollen where exine is absent.

**Sol.:** Germ pore allows growth of pollen tube.

133. Answer (2)

**Hint:** Parthenocarpic fruits are seedless.

**Sol.:** Banana is a parthenocarpic fruit.

134. Answer (4)

**Hint:** The oldest viable seed is 10,000 years old.

**Sol.:** Lupine seed is the oldest viable seed.

135. Answer (4)

**Hint:** Pollen transfer to stigma of a flower is pollination.

**Sol.:** Pollination is not an event of pollen-pistil interaction.

## [ZOOLOGY]

136. Answer (3)

**Hint:** Tiny finger-like structure

**Sol.:** The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris. The clitoris is a tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.

The oviducts (fallopian tubes), uterus and vagina constitute the female accessory ducts. The penis is the male external genitalia. It is made up of special tissue that helps in erection of the penis to facilitate insemination.

137. Answer (4)

**Hint:** Eliminate the placental hormones

**Sol.:** Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progesterones, etc. In the later phase of pregnancy, a hormone called relaxin is also secreted by the ovary.

138. Answer (2)

**Hint:** Disintegrates before implantation

**Sol.:** Primary oocyte as well as corona radiata possess  $2n$  chromosomes *i.e.*, both are diploid in nature. The secondary oocyte forms a new non-cellular membrane called zona pellucida surrounding it. Primary oocyte within the tertiary follicle grows in size and completes its first meiotic division. It is an unequal division resulting in the formation of a large haploid secondary oocyte and a tiny first polar body.

139. Answer (1)

**Hint:** 60% of sperms must have normal shape and size

**Sol.:** Sperm count = 200-300 million / ejaculate

Because sperms with normal shape and size are 60% of the sperm count and 40% of them show vigorous motility.

So, sperms with normal shape, size and vigorous motility

$$200 \text{ million} \times \frac{60}{100} \times \frac{40}{100} \text{ or}$$

$$300 \text{ million} \times \frac{60}{100} \times \frac{40}{100}$$

$$= 48-72 \text{ million /ejaculate}$$

140. Answer (3)

**Hint:** Thin piece of mucosal tissue

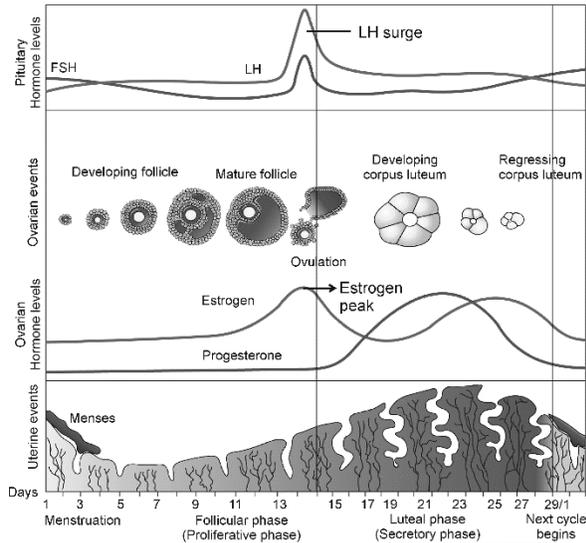
**Sol.:** The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris. Mons pubis is a cushion of fatty tissue covered by skin and pubic hair. The labia majora are fleshy folds of tissue, which extend down from the mons pubis and surround the vaginal opening. The labia minora are paired folds of tissue under the labia majora. The opening of the vagina is often covered partially by a membrane called hymen. The presence or absence of hymen is not a reliable indicator of virginity or sexual experience.

141. Answer (2)

**Hint:** Occurs in oviduct

**Sol.:** The secretions of the acrosome help the sperm to enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane. This induces the completion of the meiotic division of the secondary oocyte. The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid). Soon the haploid nucleus of the sperm and that of the ovum fuse together to form a diploid zygote in the fallopian tube.

142. Answer (2)

**Hint:** LH surge induces rupture of Graafian follicle**Sol.:**

143. Answer (3)

**Hint:** Both sperm and ovum are formed as a result of meiotic division**Sol.:** Sperms have many mitochondria that are arranged in a spiral in the middle piece of the sperm. This spiral arrangement of mitochondria is called the nebenkern. Ovum has higher amount of cytoplasm in comparison to sperm. Both ovum and spermatozoan are haploid structures *i.e.*, both possess 23 number of chromosomes.

144. Answer (2)

**Hint:** Immunoglobulins of type IgA**Sol.:** The milk produced during the initial few days of lactation is called colostrum which contains several antibodies absolutely essential to develop resistance for the new-born babies. Breast-feeding during the initial period of infant growth is recommended by doctors for bringing up a healthy baby.

145. Answer (1)

**Hint:** Exclude the site where sperms are formed**Sol.:** The male sex accessory ducts include rete testis, vasa efferentia, epididymis and vas deferens. The extra-testicular duct system is a set of ducts in the male reproductive system that transport sperm outside of the testes. The ducts include the epididymis, ductus deferens (vas deferens), and ejaculatory duct.

146. Answer (2)

**Hint:** Implantation normally occurs in uterus.**Sol.:** The enlarged end of penis called the glans penis is covered by a loose fold of skin called

foreskin. The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells. Other immunologically competent cells are also present. Ectopic pregnancy is defined as implantation of embryo at the site other than the uterus.

147. Answer (1)

**Hint:** Feature of smooth muscle fibres**Sol.:** The wall of the uterus has three layers of tissue. The external thin membranous perimetrium, middle thick layer of smooth muscle, myometrium and inner glandular layer called endometrium that lines the uterine cavity. The endometrium undergoes cyclical changes during menstrual cycle while the myometrium exhibits strong contractions during delivery of the baby.

148. Answer (4)

**Hint:** Also called oviduct**Sol.:** A functional mammary gland is characteristic of all female mammals. Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus, the part closer to the ovary is the funnel-shaped infundibulum. The edges of the infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation. The infundibulum leads to a wider part of the oviduct called ampulla. The last part of the oviduct, isthmus has a narrow lumen and it joins the uterus.

149. Answer (1)

**Hint:** Necessary for formation of sperms**Sol.:** The testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes (2-2.5°C lower than the normal internal body temperature) necessary for spermatogenesis.

150. Answer (2)

**Hint:** X = Nipple**Sol.:** The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli. The cells of alveoli secrete milk, which is stored in the cavities (lumens) of alveoli. The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct. Several mammary ducts join to form a wider mammary ampulla which is connected to lactiferous duct and opens at nipple, from where milk is expressed.

151. Answer (2)

**Hint:** GnRH stimulates the release the gonadotropins

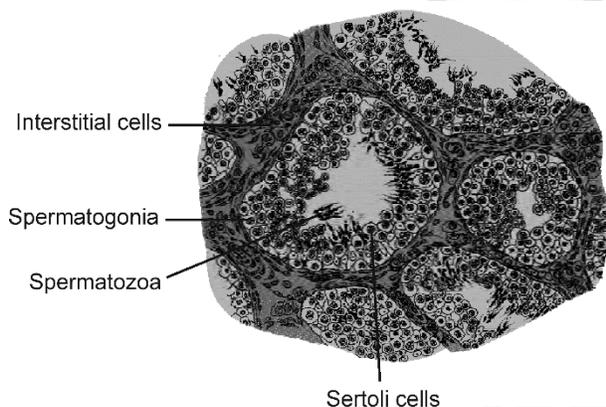
**Sol.:** Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary; no more oogonia are formed and added after birth. These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes.

Spermatogenesis starts at the age of puberty due to significant increase in the secretion of gonadotropin releasing hormone (GnRH). GnRH is a hypothalamic hormone.

152. Answer (4)

**Hint:** Identify the male germ cells

**Sol.:**



Each seminiferous tubule is lined on its inside by two types of cells called male germ cells (spermatogonia) and Sertoli cells. The male germ cells undergo meiotic divisions finally leading to sperm formation, while Sertoli cells provide nutrition to the germ cells. The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells. Leydig cells synthesise and secrete testicular hormones called androgens.

153. Answer (2)

**Hint:** Exclude the hormone released from anterior pituitary

**Sol.:** The process of childbirth is called parturition which is induced by a complex neuroendocrine mechanism involving cortisol, estrogens and oxytocin.

154. Answer (1)

**Hint:** Constant phase of menstrual cycle

**Sol.:** The ovulation (ovulatory phase) is followed by the luteal phase during which the remaining parts of the Graafian follicle transform as the corpus luteum. The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy.

155. Answer (2)

**Hint:** Basis of implantation

**Sol.:** The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass. The trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo. After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood.

156. Answer (3)

**Hint:** Contains mitochondria

**Sol.:** Human sperm is a microscopic structure composed of a head, neck, a middle piece and a tail. A plasma membrane envelops the whole body of sperm. The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap-like structure, acrosome. The acrosome is filled with enzymes that help in fertilisation of the ovum. The middle piece possesses numerous mitochondria, which produce energy for the movement of tail that facilitate sperm motility essential for fertilisation.

157. Answer (1)

**Hint:** Primary follicles undergo follicular atresia

**Sol.:** Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary; no more oogonia are formed and added after birth. These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes. Each primary oocyte then gets surrounded by a layer of granulosa cells and is called the primary follicle. A large number of these follicles degenerate during the phase from birth to puberty. Therefore, at puberty only 60,000-80,000 primary follicles are left in each ovary.

158. Answer (2)

**Hint:** Normally observed in the foetus by the end of 24 weeks of pregnancy

**Sol.:** In human beings, after one month of pregnancy, the embryo's heart is formed. By the end of the second month of pregnancy, the foetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systems are formed, for example, the limbs and external genital organs are well-developed. The first movements of the foetus and appearance of hair on the head are usually observed during the fifth month. By the end of about 24 weeks (end of second trimester), the body is covered with fine hair, eye-lids separate, and eyelashes are formed. By the end of nine months of pregnancy, the foetus is fully developed and is ready for delivery.

159. Answer (1)

**Hint:** The zygote carrying XX would develop into a female baby.

**Sol.:** The chromosome pattern in the human female is XX and that in the male is XY. Therefore, all the haploid gametes (ova) produced by the female have the sex chromosome X whereas in the male gametes (sperms) the sex chromosome could be either X or Y, hence, 50 per cent of sperms carry X chromosome while the other 50 per cent carry Y. After fusion of male and female gametes, the zygote would carry either XX or XY depending on whether the sperm carrying X or Y fertilised the ovum. The zygote carrying XX would develop into a female baby and XY would form a male baby. That is why, scientifically it is correct to say that the sex of the baby is determined by the father and not by the mother.

160. Answer (4)

**Hint:** Store and transport the sperms from the testis to the outside

**Sol.:** The seminiferous tubules of the testis open into the vasa efferentia through rete testis. The vasa efferentia leave the testis and open into epididymis located along the posterior surface of each testis. The epididymis leads to vas deferens that ascends to the abdomen and loops over the urinary bladder. It receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct. These ducts store and transport the sperms from the testis to the outside through urethra.

161. Answer (4)

**Hint:** Each lobule contains one to three highly coiled seminiferous tubules.

**Sol.:** Each testis has about 250 compartments called testicular lobules. Each lobule contains one to three highly coiled seminiferous tubules in which sperms are produced.

Thus, the total number of testicular lobules in human testes is 500 and the total number of seminiferous tubules is 500-1500.

162. Answer (2)

**Hint:** Also known as cowper's gland

**Sol.:** The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also help in the lubrication of the penis. Bartholin's gland is a female accessory gland.

163. Answer (1)

**Hint:** Include secretions of male accessory glands

**Sol.:** The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes.

164. Answer (1)

**Hint:** With advancing age there is decline in the number of primordial follicles

**Sol.:** The human ovaries become unresponsive to gonadotropins with advancing age, and their function declines, so that sexual cycles disappear (menopause). This unresponsiveness is associated with and probably caused by a decline in the number of primordial follicles, which becomes precipitous at the time of menopause. The ovaries no longer secrete progesterone and estradiol in appreciable quantities. As the negative feedback effect of estrogens and progesterone is reduced, secretion of FSH is increased, and plasma FSH increases to high levels, LH levels are moderately high.

165. Answer (4)

**Hint:** Corpus luteum secretes high amount of progesterone

**Sol.:** The ovulation (ovulatory phase) is followed by the luteal phase/secretory phase during which the remaining parts of the Graafian follicle transform as the corpus luteum. The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy.

166. Answer (1)

**Hint:** After expulsion of placenta at parturition, the levels of estrogen decline.

**Sol.:** The breasts enlarge during pregnancy in response to high circulating levels of estrogens, progesterone, prolactin. The drop in circulating estrogen initiates lactation.

167. Answer (3)

**Hint:** Function of umbilical cord

**Sol.:** The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (foetus) and maternal body called placenta.

The placenta facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory/waste materials produced by the embryo. The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo. Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progestogens, etc.

168. Answer (2)

**Hint:** Has function similar to birth hormone

**Sol.:** Synthetic form of oxytocin (pitocin) acts on the uterine muscle and causes stronger uterine contractions that leads to expulsion of the baby out of the uterus through the birth canal – parturition. Prolactin and T<sub>4</sub> have no role in parturition. Cortisol is also involved naturally in parturition.

169. Answer (1)

**Hint:** Ligament belong to the same category of tissue as tendon

**Sol.:** The female reproductive system consists of a pair of ovaries alongwith a pair of oviducts,

uterus, cervix, vagina and the external genitalia located in pelvic region. These parts of the system alongwith a pair of the mammary glands are integrated structurally and functionally to support the processes of ovulation, fertilisation, pregnancy, birth and child care. Each ovary is about 2 to 4 cm in length and is connected to the pelvic wall and uterus by ligaments. The uterus is single and it is also called womb. The shape of the uterus is like an inverted pear.

170. Answer (3)

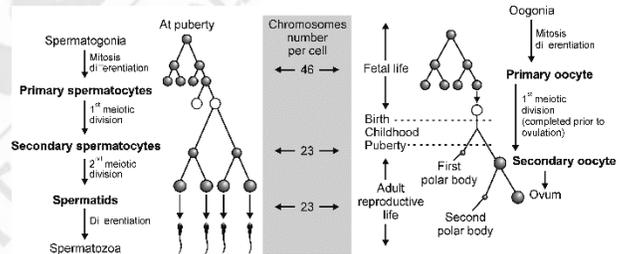
**Hint:** Physiological changes in sperms occur in female reproductive tract

**Sol.:** Capacitation is a series of biochemical and physiological changes that sperm undergo to prepare them for fertilization. It occurs in the female reproductive tract after ejaculation. The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilization. Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct. LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the process of spermatogenesis.

171. Answer (1)

**Hint:** Include male germ cells

**Sol.:**



172. Answer (2)

**Hint:** Graafian follicle is a mature ovarian follicle

**Sol.:** Oogonial cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes. Each primary oocyte then gets surrounded by a layer of granulosa cells and is called the primary follicle. A large number of these follicles degenerate during the phase from birth to puberty. The primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles. The secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum. The tertiary follicle further changes into the mature follicle or Graafian follicle.

173. Answer (3)

**Hint:** More than the number of facial bones in humans

**Sol.:** A functional mammary gland is characteristic of all female mammals. The mammary glands are paired structures (breasts) that contain glandular tissue and variable amount of fat. The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli.

174. Answer (1)

**Hint:** Site of syngamy

**Sol.:** The motile sperms swim rapidly, pass through the cervix, enter into the uterus and finally reach the ampullary region of the fallopian tube. The ovum released by the ovary is also transported to the ampullary region where fertilisation takes place. The mammary glands of the female undergo differentiation during pregnancy and starts producing milk towards the end of pregnancy by the process called lactation.

175. Answer (3)

**Hint:** Released from pars distalis

**Sol.:** hCG, hPL and relaxin are produced in women only during pregnancy. In addition, during pregnancy the levels of other hormones like estrogens, progestogens, cortisol, prolactin, thyroxine, etc., are increased several folds in the maternal blood. Increased production of these hormones is essential for supporting the fetal growth, metabolic changes in the mother and maintenance of pregnancy.

176. Answer (1)

**Hint:** One secondary spermatocyte produce two sperms

**Sol.:** Since, one secondary spermatocyte produce two sperms, thus, for formation of 600 million sperms, 300 million secondary spermatocytes are required.

177. Answer (1)

**Hint:** Prior to parturition

**Sol.:** The tertiary follicle further changes into the mature follicle or Graafian follicle. The secondary oocyte forms a new membrane called zona pellucida surrounding it. The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass.

Zona pellucida disappears in blastocyst stage prior to implantation.

178. Answer (3)

**Hint:** True for androgens

**Sol.:** Human sperm is a microscopic structure composed of a head, neck, a middle piece and a tail. The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap-like structure, acrosome. Lack of menstruation may be indicative of pregnancy. However, it may also be caused due to some other underlying causes like stress, poor health, etc.

179. Answer (4)

**Hint:** Process included under spermatogenesis

**Sol.:** The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.

Receptors for sperm binding are present in zona pellucida.

Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus, the part closer to the ovary is the funnel-shaped infundibulum.

180. Answer (4)

**Hint:** Maintains endometrium

**Sol.:** The menstrual phase is followed by follicular phase, during which the levels of gonadotrophins are gradually increased which stimulates follicular development as well as secretion of estrogen by the growing follicles.



## All India Aakash Test Series for NEET - 2026

**TEST - I (Code-B)**[Click here for Code-A sol.](#)

Test Date : 20/07/2025

**ANSWERS**

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

# HINTS & SOLUTIONS

## [PHYSICS]

1. Answer (2)

**Hint:** If sum of two numbers is known, then their product will be maximum when numbers are equal.

**Sol.:**

$$F = \frac{k q_1 q_2}{r^2}$$

$$q_1 = q_2 = \frac{q}{2} = 8 \mu\text{C} \quad [r = 0.1 \text{ m}]$$

$$F = \frac{9 \times 10^9 \times 8 \times 10^{-6} \times 8 \times 10^{-6}}{(0.1)^2}$$

$$F = 57.6 \text{ N}$$

2. Answer (1)

**Hint:** Tangent at point on curve represents the direction of electric field.

**Sol.:** Parallel lines having equal space represents uniform electric field.

3. Answer (1)

**Hint:** Use Gauss law:  $\phi_{\text{total}} = \frac{q_{\text{in}}}{\epsilon_0}$

$$\text{Sol.} \quad \phi_{\text{total}} = \frac{q_{\text{in}}}{\epsilon_0} = 2 \times 10^{-6} \times 4\pi \times 9 \times 10^9$$

$$\phi_{\text{total}} = 72\pi \times 10^3 \text{ Nm}^2/\text{C}$$

4. Answer (2)

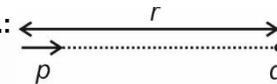
**Hint:** Electric field at axial point due to electric

$$\text{dipole} = \frac{2k \vec{p}}{r^3}$$

$$\text{Sol.} \quad \vec{E}_A = \vec{E}_B$$

5. Answer (4)

**Hint:** Force on dipole due to charge is equal to force on charge due to dipole

**Sol.:** 

$$F_{\text{dipole}/q} = F_{q/\text{dipole}}$$

$$= q E_p$$

$$= q \frac{2k p}{r^3} = \frac{2k p q}{r^3}$$

6. Answer (4)

**Hint:** Properties of electrostatic field lines.

**Sol.:** The electrostatic field lines can never form closed loops.

7. Answer (1)

**Hint:** In the direction of electric field, potential decreases.

**Sol.:** B and C lies on same level so potential will be equal and potential will be less at point A.

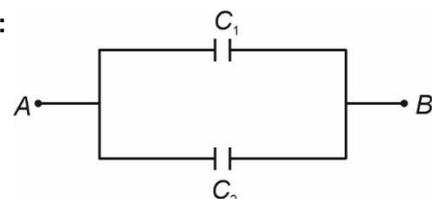
8. Answer (4)

**Hint & Sol.:** Electric field inside conductor is zero only under electrostatic condition.

9. Answer (2)

**Hint:** Potential difference in both dielectrics are equal, hence they are in parallel combination.

**Sol.:**



$$C_1 = \frac{K\epsilon_0 A}{2d}$$

$$C_2 = \frac{2K\epsilon_0 A}{2d}$$

$$C_{eq} = C_1 + C_2$$

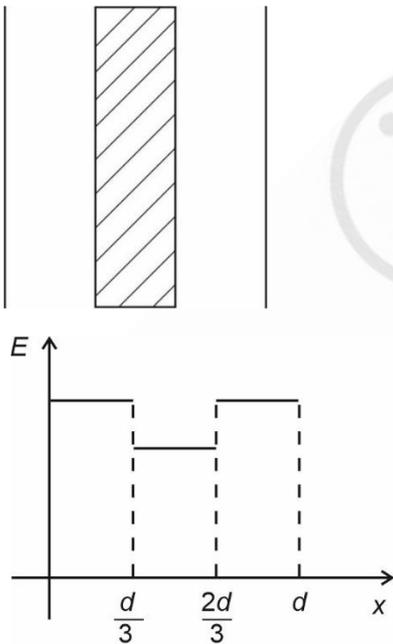
$$C_{eq} = \frac{3K\epsilon_0 A}{2d}$$

10. Answer (1)

**Hint:** Electric field inside dielectric is given by

$$= \frac{E_{air}}{K}$$

**Sol.:**



11. Answer (2)

**Hint:**  $V_A = \frac{k p \cos \theta}{r^2}$

**Sol.:**  $V_A = \frac{k p \cos 30^\circ}{r^2}$

$$V_A = \frac{\sqrt{3}}{2} \frac{k p}{r^2}$$

12. Answer (3)

**Hint:** Charge on capacitor  $Q = CV$

**Sol.:**  $C_{eq} = \frac{2 \times 12}{2 + 12} = \frac{24}{14} \mu F$

Charge through battery =  $C_{eq} V$

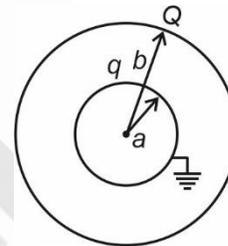
$$= \frac{24}{14} \times 7 = 12 \mu C$$

Charge on  $C_1 = 12 \mu C$

13. Answer (2)

**Hint:** On closing the switch, potential of inner sphere becomes zero.

**Sol.:**



Thus,

$$V_{in} = 0$$

$$\frac{kq}{a} + \frac{kQ}{b} = 0$$

$$q = -\frac{Qa}{b}$$

Change in charge when switch is closed =  $q_f - q_i$

$$\Delta Q = -Q \left( \frac{a+b}{b} \right)$$

14. Answer (2)

**Hint:** Potential energy of two charge system

$$= \frac{kq_1 q_2}{r}$$

**Sol.:** We know that  $U = \frac{kq_1 q_2}{r}$

Since both the point charges are positive, then

$$U \propto \frac{1}{r}$$

$\therefore$  If  $r$  increases, then  $U$  decreases.

15. Answer (4)

**Hint:** Potential energy of a discrete charge system

$$\text{is } U = \sum_{i \neq j} \frac{kq_i q_j}{r_{ij}}$$

$$\text{Sol.: } U_{\text{system}} = U_{AB} + U_{AC} + U_{BC} = \frac{kq^2}{\sqrt{2}a} \times 3$$

16. Answer (2)

**Hint & Sol.:**  $Q = CV$

$$= 5 \times 5 = 25 \mu\text{C}$$

17. Answer (3)

**Hint:** Potential of a spherical system is equal to

$$\frac{kQ}{r}$$

**Sol.:** Charge on the bubble will remain constant.

$$\text{Therefore } V \propto \frac{1}{r}$$

$$\frac{V_i}{V_f} = \frac{r_f}{r_i} \Rightarrow \frac{6}{V_f} = \frac{3r}{r}$$

$$\Rightarrow V_f = 2V$$

18. Answer (4)

**Hint:** Potential energy of a dipole:  $U = -\vec{P} \cdot \vec{E}$

Torque experienced by a dipole:  $\vec{\tau} = \vec{P} \times \vec{E}$

**Sol.:**

- Potential energy is maximum when  $\vec{P}$  is antiparallel to  $\vec{E}$ .
- Torque experienced by the dipole is maximum when  $\vec{P}$  is perpendicular to  $\vec{E}$ .

19. Answer (2)

**Hint:** Capacitance of a parallel plate capacitor:

$$C = \frac{A\epsilon_0 k}{d}$$

**Sol.:** If plate area increases, then capacitance increases.

20. Answer (2)

**Hint & Sol.:** Both are true but II is not correct explanation of I.

Law of conservation of charge doesn't comment on charge being scalar.

21. Answer (2)

**Hint & Sol.:** Battery is disconnected.

Therefore charge cannot flow.

i.e., Charge  $\rightarrow Q \rightarrow$  Same

$\Rightarrow$  Dielectric plate is inserted, so

$$C_{\text{new}} = KC; K > 1$$

$\therefore C \rightarrow$  Increases

$$\Rightarrow \text{Electric field } E_{\text{new}} = \frac{\sigma}{\epsilon_0 K}$$

$\Rightarrow E \rightarrow$  Decreases

$$\Rightarrow \text{Energy density} = \frac{\text{Energy}}{\text{Volume}} = \frac{Q^2}{2CV}$$

Since  $C \uparrow$ , therefore energy density  $\downarrow$

22. Answer (3)

**Hint:** Apply volume conservation and charge conservation

$$\text{Sol.: } V = \frac{Kq}{r} \quad \dots(1)$$

Apply volume conservation

$$\frac{4}{3}\pi R^3 = 64 \times \frac{4}{3}\pi r^3 \quad (R \text{ is radius of bigger drop})$$

$$\Rightarrow R = 4r$$

$$Q = 64q$$

$$V' = \frac{KQ}{R} = \frac{K(64q)}{4r} = \frac{16Kq}{r} = 16V$$

23. Answer (1)

**Hint & Sol.:** The given charge can be completely enclosed using two circular surfaces. Due to symmetry flux through both the surfaces will be same. Hence flux through one surface would be

$$\frac{q}{2\epsilon_0}$$

24. Answer (3)

**Hint:** Potential energy of dipole placed in uniform electric field is given by  $U = -\vec{P} \cdot \vec{E}$

**Sol.:**  $U_f - U_i = -PE\cos\theta_f + PE\cos\theta_i$

$$= PE[-\cos 37^\circ + \cos 0^\circ]$$

$$= 10^{-5} \times 2 \times 10^5 \left[ -\frac{4}{5} + 1 \right]$$

$$= \frac{2}{5} = 0.4 \text{ J}$$

25. Answer (2)

**Hint:** By Gauss law,  $\phi = \frac{q_{in}}{\epsilon_0}$

**Sol.:** At edge centre,  $(q_{in})_{effective} = \frac{q}{4}$

$$\therefore \phi = \frac{q}{4\epsilon_0}$$

26. Answer (3)

**Hint:** Here torque of electrostatic force is zero. Therefore, angular momentum is conserved i.e.

$$L_A = L_B$$

**Sol.:**  $L_A = L_B$

$$V_A r_A = V_B r_B$$

$$\Rightarrow V_A \times 3r = V_B \times r$$

$$\Rightarrow V_B = 3V_A \quad \dots(1)$$

$$K_B = 9K_A$$

K.E. is maximum at point B

$$\therefore K_B = 9 \text{ J}$$

$$\Rightarrow K_A = 1 \text{ J}$$

$$\Rightarrow \text{Work done by electrostatic force} = -\Delta U = \Delta K.E.$$

$$= K_B - K_A$$

$$= 9 - 1$$

$$= 8 \text{ J}$$

27. Answer (2)

**Hint:** Total charge of an isolated system is conserved.

**Sol.:**  $(Q_i)_{system} = (Q_f)_{system}$

$$\Rightarrow 17 - 13 + 4 = 6 + 6 + Q$$

$$\Rightarrow 8 - 12 = Q$$

$$\Rightarrow Q = -4 \text{ C}$$

28. Answer (4)

**Hint:** Force on charge  $q$  in uniform electric field is

$$F = qE$$

**Sol.:**  $F = qE$

$$a = \frac{qE}{m}$$

For uniform acceleration

$$v = u + at$$

$$v = \frac{qE}{m} t$$

29. Answer (4)

**Hint:** Linear charge density  $\lambda = \frac{q}{\text{length}}$

**Sol.:**  $\lambda = \frac{q_{total}}{\pi R}$

$$= \frac{4Q}{\pi R}$$

30. Answer (1)

**Hint:** Electric flux,  $\phi = \vec{E} \cdot \vec{A}$

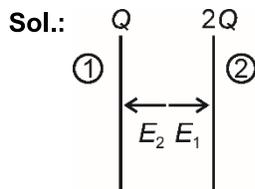
**Sol.:**  $\phi = E_0 \hat{i} [L^2 \hat{i} + L^2 \hat{j}] \Rightarrow \phi = E_0 L^2$

31. Answer (2)

**Hint & Sol.:** Specific charge is  $\frac{q}{m}$ ; here  $m$  varies with speed and charge is independent of its speed. Therefore specific charge depends upon speed.

32. Answer (2)

**Hint:** Electric field due to a charged large metal plate is  $E = \frac{Q}{2A\epsilon_0}$ .



$$E_{\text{net}} = E_2 - E_1$$

$$= \frac{2Q}{2A\epsilon_0} - \frac{Q}{2A\epsilon_0} = \frac{Q}{2A\epsilon_0}$$

33. Answer (3)

**Hint:** When battery is removed, the charge on plates remain constant.

**Sol.:**  $C' = \frac{A\epsilon_0}{d'} = \frac{2A\epsilon_0}{d} = 2C$

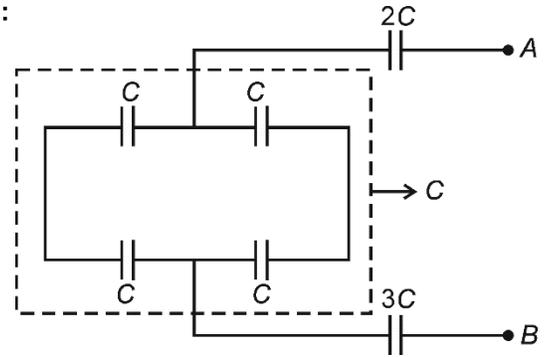
$$\Rightarrow U = \frac{Q^2}{2C}$$

and  $U' = \frac{Q^2}{2C'} = \frac{Q^2}{2(2C)} = \frac{U}{2}$

34. Answer (1)

**Hint:** Use series and parallel combination of capacitor

**Sol.:**



$$\therefore \frac{1}{C_{\text{eq}}} = \frac{1}{C} + \frac{1}{2C} + \frac{1}{3C} = \frac{6 + 3 + 2}{6C}$$

$$C_{\text{eq}} = \frac{6C}{11}$$

35. Answer (4)

**Hint:** Loss in energy =  $\frac{1}{2} \frac{C_1 C_2}{(C_1 + C_2)} (V_1 - V_2)^2$

**Sol.:** Change in energy = Loss in energy

$$= \frac{1}{2} \times \frac{C \times C}{C + C} (V - 2V)^2$$

$$= \frac{1}{2} \times \frac{C}{2} \times V^2$$

$$= \frac{CV^2}{4}$$

36. Answer (4)

**Hint:** Due to induction, net charge on sphere is zero

**Sol.:** Potential due to induced charge at centre

$$V_C = \frac{K(q_{\text{induced}})_{\text{net}}}{R}$$

= Zero

37. Answer (2)

**Hint:** Work done by external force  $W = U_f - U_i$

**Sol.:**  $W = U_f - U_i$

$$= \frac{K(q)(-2q)}{2r} - \left( \frac{K(q)(-2q)}{r} \right)$$

$$= \frac{-Kq^2}{r} + \frac{2Kq^2}{r}$$

$$= \frac{Kq^2}{r}$$

38. Answer (2)

**Hint:** For  $n$  identical capacitors connected in series  $C_{eq} = \frac{C}{n}$  and for parallel  $C_{eq} = nC$

**Sol.:**  $C_1 = \frac{C}{5}$  and  $C_2 = 5C$

$$\frac{C_1}{C_2} = \frac{C}{5 \times 5C} = \frac{1}{25}$$

39. Answer (2)

**Hint:** Electric potential due to a conducting shell having surface charge density  $\sigma$  at centre is given

by  $V = \frac{\sigma R}{\epsilon_0}$

**Sol.:**  $V_C = V_1 + V_2$

$$= \frac{\sigma R}{\epsilon_0} - \frac{\sigma(4R)}{\epsilon_0}$$

$$= \frac{-3\sigma R}{\epsilon_0}$$

40. Answer (2)

**Hint:** Electric field due to solid non conducting uniformly charged sphere (for  $r < R$ ) is  $E = \frac{KQr}{R^3}$

(for  $r < R$ ),  $E = \frac{KQ}{R^3} r$

**Sol.:** From graph  $\tan\theta = \frac{E}{r}$

$$\Rightarrow \tan\theta = \frac{KQ}{R^3}$$

$$\Rightarrow \tan 37^\circ = \frac{KQ}{R^3}$$

$$\Rightarrow \frac{3}{4} = \frac{9 \times 10^9 \times Q}{4^3}$$

$$\Rightarrow Q = \frac{3 \times 16}{9 \times 10^9}$$

$$\Rightarrow Q = \frac{16}{3} \times 10^{-9}$$

$$\Rightarrow Q = 5.33 \text{ nC}$$

41. Answer (2)

**Hint:** Motion in  $x$  direction is uniform and in  $y$  direction is uniformly accelerated.

**Sol.:** At time  $t_0$ ,

$$x = u_0 t_0$$

$$\text{and } y = \frac{1}{2} a t^2$$

$$y = \frac{1}{2} \frac{qE_0 t_0^2}{m}$$

Displacement

$$|s| = \sqrt{x^2 + y^2} = \sqrt{(u_0 t_0)^2 + \left(\frac{1}{2} \frac{qE_0 t_0^2}{m}\right)^2}$$

42. Answer (3)

**Hint:** Time period of pendulum is given by

$$T = 2\pi \sqrt{\frac{L}{g_{\text{eff}}}}$$

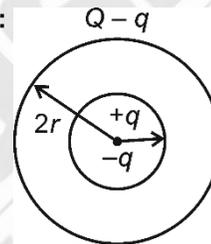
**Sol.:**  $g_{\text{eff}} = g - \frac{qE}{m}$

$$T' = 2\pi \sqrt{\frac{L}{g'}} = 2\pi \sqrt{\frac{L}{g - \frac{qE}{m}}}$$

43. Answer (3)

**Hint:** Electric field inside conducting material is zero.

**Sol.:**



$\therefore$  Surface charge density on inner surface

$$\sigma = \frac{q}{4\pi r^2}$$

44. Answer (1)

**Hint:** Electrostatic force is a type of conservative force.

**Sol.:** Net work done by conservative force is independent of path and depends on end points.

45. Answer (2)

**Hint:** Use relation,  $\vec{E} = -\frac{\partial V}{\partial x} \hat{i} - \frac{\partial V}{\partial y} \hat{j} - \frac{\partial V}{\partial z} \hat{k}$

**Sol.:**  $V = 6x^2$

$$\vec{E} = -\frac{\partial V}{\partial x} \hat{i}$$

$$\vec{E} = -12x \hat{i}$$

$$\vec{E} \text{ at } (2, 0, -1) = -12 \times 2$$

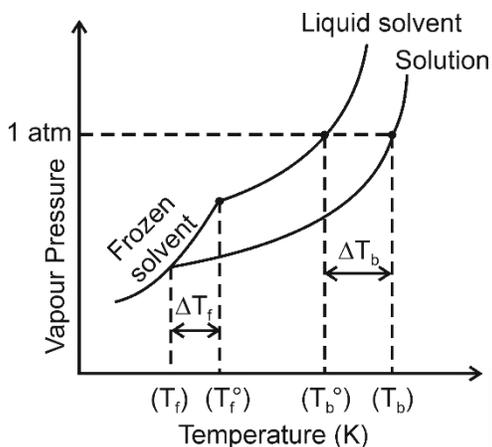
$$= -24 \hat{i} \text{ V/m}$$

## [CHEMISTRY]

46. Answer (2)

**Hint:** Depression in freezing point is  $\Delta T_f$  and elevation in boiling point is  $\Delta T_b$

**Sol.:**



47. Answer (2)

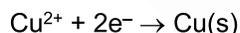
**Hint:** Isotonic solutions have same osmotic pressures.

**Sol.:** Cell fluid is isotonic with 0.9%(w/V) NaCl solution.

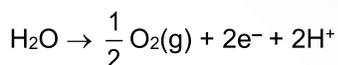
48. Answer (2)

**Hint:** On electrolysis of  $\text{CuSO}_4$  (aq) using inert electrode,  $\text{Cu}^{2+}$  will get reduced at cathode and  $\text{H}_2\text{O}$  will get oxidised at anode.

**Sol.:** At cathode



At anode



By passing 1 F charge 1 eq. of  $\text{O}_2$  will be evolved.

$$\text{Mole of O}_2 = \frac{1}{4} \times n_{\text{eq}} \text{ of O}_2$$

$$= \frac{1}{4}$$

$$\text{Volume of O}_2 \text{ at STP} = \frac{1}{4} \times 22.4 \text{ L}$$

$$= 5.6 \text{ L}$$

49. Answer (4)

**Hint:** 
$$\frac{P^0 - P_s}{P_s} = \frac{n_{\text{solute}}}{n_{\text{solvent}}}$$

$$\text{Sol.} \quad \frac{640 - 600}{600} = \frac{2.175}{\frac{\text{MM}}{39}} = \frac{\text{MM}}{78}$$

$$\text{MM} = 65.25 \text{ g mol}^{-1}$$

50. Answer (4)

**Hint:** Only solvent freezes during freezing of a solution.

**Sol.:**  $\Delta T = iK_m$

$$1 = 1 \times 1.86 \times \frac{0.1 \times 1000}{W}$$

$$W = 186 \text{ g}$$

$$\therefore \text{Mass of ice separated from solution} = 1000 - 186 = 814 \text{ g}$$

51. Answer (2)

**Hint:** Element with high value of SRP are good oxidising agent.

**Sol.:**

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

52. Answer (3)

**Hint:** Electrolysis of Brine solution will give  $\text{H}_2$  at cathode and  $\text{Cl}_2$  at anode

$$\text{Sol.} \quad \text{Charge supplied} = \frac{965 \times 2}{96500} \text{ F} = 2 \times 10^{-2} \text{ F} = 0.02 \text{ F}$$

$$\text{Number of mole of Cl}_2 = \frac{0.02}{2} = 0.01 \text{ mol}$$

$$\text{Mole of H}_2 \text{ released} = 0.01$$

$$\text{Total mole of gases evolved} = 0.02 \text{ mol}$$

53. Answer (4)

**Hint:** More reactive metal can be used as sacrificial anode.

**Sol.:** Mg is more reactive than iron.

54. Answer (4)

**Hint:** Electrolyte used in dry cell is paste of  $\text{NH}_4\text{Cl}$  and  $\text{ZnCl}_2$

**Sol.:** Electrolyte used in mercury cell is paste of  $\text{KOH}$  and  $\text{ZnO}$

Electrolyte used in  $(\text{H}_2 - \text{O}_2)$  fuel cell is conc. (aq)  $\text{NaOH}$

Electrolyte used in Lead storage cell is 38% aq.  $\text{H}_2\text{SO}_4$ .

55. Answer (1)

**Hint:** On electrolysis of aq.  $\text{NaCl}$ ,  $\text{H}_2\text{O}$  gets reduced at cathode.

**Sol.:**  $2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$

Hence pH increases.

56. Answer (3)

**Hint:** According to 1<sup>st</sup> law of Faraday

$$w = \frac{Eit}{96500}$$

**Sol.:**  $w = \frac{108 \times 3 \times 10 \times 60}{1 \times 96500}$

$$= 2.01 \text{ g}$$

57. Answer (1)

**Hint:** 1 F charge deposits 1 gram equivalent metal during electrolysis.

**Sol.:** 1 mol  $\text{Cu}$  from  $\text{CuSO}_4$  is 2 eq.  $\text{Cu}$

Hence 2 F required.

1 mol  $\text{Al}$  from  $\text{AlCl}_3(\text{l})$  is 3 eq.  $\text{Al}$

Hence 3 F required.

1 mol  $\text{Ag}$  from  $\text{AgBr}$  is 1 eq.

Hence 1 F required.

1 mol  $\text{Fe}$  from  $\text{Fe}_3\text{O}_4$  is  $\frac{8}{3}$  eq.

Hence  $\frac{8}{3}$  F required.

58. Answer (3)

**Hint:**  $\Delta T_f = iK_f m$

**Sol.:** Weight of water =  $500 \times 0.997 = 498.5 \text{ g}$

Number of moles of acetic acid

$$= \frac{\text{Weight of } \text{CH}_3\text{COOH}}{\text{Mol. wt. of } \text{CH}_3\text{COOH}} = \frac{6}{60} = 0.1 \text{ mol}$$

$$m = \frac{0.1}{498.5} \times 1000 \Rightarrow 0.2 \text{ m}$$

$$i = 1 - \alpha + n\alpha$$

$$= 1 - 0.46 + 2 \times 0.46$$

$$= 1.46$$

$$\Delta T_f = 1.46 \times 1.86 \times 0.2$$

$$= 0.54^\circ\text{C}$$

59. Answer (1)

**Hint:**  $\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$

**Sol.:**  $\Lambda^\circ = 349.6 + 40.9$

$$= 390.5$$

$$\Lambda_m = \frac{1.85 \times 10^{-5} \times 1000}{10^{-3}}$$

$$= 18.5$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$$

$$= \frac{18.5}{390.5} \times 100$$

$$= 4.7\%$$

60. Answer (4)

**Hint & Sol.:**  $\text{OH}^-$  will have maximum limiting molar conductivity in aqueous medium.

Ion	$\lambda^\circ (\text{Scm}^2 \text{mol}^{-1})$
$\text{Na}^+$	50.1
$\text{Mg}^{2+}$	106.0
$\text{Cl}^-$	76.3
$\text{OH}^-$	199.1

61. Answer (2)

**Hint:** For conducting cell

$$k = C G^*$$

**Sol.:**  $k = C G^*$   $\left( C = \frac{1}{R} \right)$

$$5 \times 10^{-3} = \frac{1}{200} \times G^*$$

$$G^* = 1 \text{ cm}^{-1}$$

62. Answer (1)

**Hint:** Both specific conductance and molar conductivity are concentration dependent.

**Sol.:** Molar conductivity increases but specific conductance decreases with increase in dilution.

63. Answer (3)

**Hint & Sol.:** Ag has highest conductivity**Conductors**                      **Conductivity (S m<sup>-1</sup>)**Ag                                      6.2 × 10<sup>3</sup>Fe                                      1.0 × 10<sup>3</sup>

Graphite                              1.2 × 10

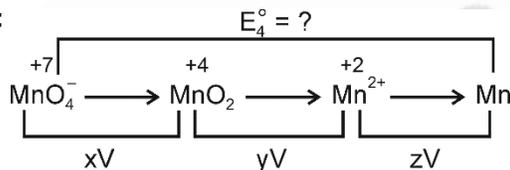
64. Answer (4)

**Hint:**  $\Delta G^\circ = -nF E_{\text{Cell}}^\circ$ **Sol.:**  $\Delta G^\circ = -2 \times 96500 \times 1.41$  $= -272.13 \text{ kJ/mol}$ 

65. Answer (3)

**Hint & Sol.:**  $E_{\text{Cell}} = E_{\text{Cell}}^\circ - \frac{0.0591}{n} \log \frac{[X^{2+}]}{[Y^{2+}]}$  $E_{\text{Cell}} = E_{\text{Cell}}^\circ + 0.06$ (1) Ni(X) and Sn(Y)  $E_{\text{Cell}}^\circ = -0.14 + 0.25 = 0.11 \text{ V}$ (2) Fe(X) and Ni(Y)  $E_{\text{Cell}}^\circ = +0.44 - 0.25 = 0.21 \text{ V}$ (3) Ni(X) and Zn(Y)  $E_{\text{Cell}}^\circ = -0.76 + 0.25 = -0.51 \text{ V}$ (4) Zn(X) and Sn(Y)  $E_{\text{Cell}}^\circ = -0.14 + 0.76 = 0.62 \text{ V}$ 

66. Answer (3)

**Hint:**  $\Delta G^\circ = -nFE^\circ$ **Sol.:**

$$\Delta G_4^\circ = \Delta G_1^\circ + \Delta G_2^\circ + \Delta G_3^\circ$$

$$7E_4^\circ = 3x + 2y + 2z$$

$$\therefore E_4^\circ = \frac{3x + 2y + 2z}{7}$$

67. Answer (2)

**Hint:** Metal with less SRP has more reducing power.**Sol.:** Ca has lesser SRP than Mg hence Ca has more reducing power.F<sub>2</sub> is better oxidising agent than Cl<sub>2</sub> as it has more SRP.Li<sup>+</sup> has minimum SRP value.

68. Answer (1)

**Hint:** For a half cell

$$E_{M^{n+}/M} = E_{M^{n+}/M}^\circ - \frac{RT}{nF} \ln \frac{1}{[M^{n+}]}$$

$$\text{Sol.} \quad E_{M^{2+}/M} = E_{M^{2+}/M}^\circ - \frac{RT}{2F} \ln \frac{1}{0.01}$$

$$= E - \frac{RT}{F} \ln 10$$

69. Answer (1)

**Hint:** More reactive metal gets dissolved and release H<sub>2</sub> gas from acids.**Sol.:** Cu is less reactive than H<sub>2</sub> hence Cu will not be dissolved in HCl.

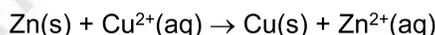
70. Answer (2)

**Hint:** At anode oxidation takes place and at cathode reduction takes place.**Sol.:** In galvanic cell oxidation takes place at negative anode and reduction takes place at positive cathode.

71. Answer (1)

**Hint:** A cell that converts chemical energy to electrical energy is called Galvanic cell.**Sol.:** Electrode potential is a potential difference developed between the electrode and electrolyte.

72. Answer (1)

**Hint:** Daniell cell is**Sol.:** Cell reaction is

73. Answer (4)

**Hint:** Anode and cathode are made up of same metal in case of concentration cell.**Sol.:** For concentration cell ;

$$E_{\text{Cell}}^\circ = 0$$

$$\therefore K_c = 1$$

74. Answer (2)

**Hint:** Metal with less standard reduction potential (SRP) has more reactivity**Sol.:** Cu has lesser SRP than Ag hence Cu is more reactive.Al<sup>3+</sup>/Al has more negative SRP than Zn<sup>2+</sup>/Zn.Cl<sub>2</sub> + Br<sup>-</sup> → Br<sub>2</sub> + Cl<sup>-</sup> has positive E<sub>cell</sub> value hence it is spontaneous.

75. Answer (3)

**Hint:** According to Nernst's equation,

$$E_{\text{Cell}} = E_{\text{Cell}}^{\circ} - \frac{0.0591}{n} \log(Q_C)$$

$$\text{Sol.: } E_{\text{Cell}} = 0.76 - \frac{0.0591}{2} \log \frac{[\text{Zn}^{2+}] P_{\text{H}_2}}{[\text{H}^+]^2}$$

$$= 0.58 \text{ V}$$

76. Answer (1)

**Hint:** For non-volatile solute in solution

$$\text{RLVP} = \frac{P^0 - P_S}{P^0}$$

$$\text{Sol.: } \frac{P^0 - P_S}{P^0} = X_B$$

$$\frac{P^0 - P_S}{P^0} = \frac{n_B}{n_B + n_{\text{H}_2\text{O}}}$$

$$1 - \frac{P_S}{P^0} = \frac{n_B}{n_B + n_{\text{H}_2\text{O}}}$$

$$1 - \frac{n_B}{n_B + n_{\text{H}_2\text{O}}} = \frac{P_S}{P^0}$$

$$\frac{n_{\text{H}_2\text{O}}}{n_B + n_{\text{H}_2\text{O}}} = \frac{P_S}{P^0}$$

$$\frac{P^0}{P_S} = \frac{n_B + n_{\text{H}_2\text{O}}}{n_{\text{H}_2\text{O}}}$$

$$\frac{P^0}{P_S} = 1 + \frac{n_B}{n_{\text{H}_2\text{O}}}$$

$$\frac{P^0}{P_S} - 1 = \frac{n_B}{n_{\text{H}_2\text{O}}}$$

$$\boxed{\frac{P^0 - P_S}{P_S} = \frac{n_B}{n_{\text{H}_2\text{O}}}}$$

$$P_S = P_{\text{H}_2\text{O}}^0 \times X_{\text{H}_2\text{O}}$$

77. Answer (2)

**Hint:** Boiling point of water increases at high pressure.**Sol.:** In pressure cooker boiling point of water increases hence cooking time decreases.

78. Answer (3)

**Hint:** As number of particle of solute increases, colligative property also increases.**Sol.:**  $\Delta T_b = iK_b m$  ;  $i$  increases,  $\Delta T_b$  also increases,  $\Delta T_f = iK_f m$  ;  $i$  increases,  $\Delta T_f$  also increases

79. Answer (4)

**Hint:** On dissolving non-volatile solute, freezing point of solvent decreases

$$\text{Sol.: } \Delta T_f = 6^\circ\text{C}$$

$$K_f \times m = 6^\circ\text{C}$$

$$1.86 \times \frac{w \times 1000}{62 \times 4000} = 6$$

$$w = 800 \text{ g}$$

80. Answer (4)

**Hint:** According to Raoult's law

$$P_S = P_1^0 X_1 + P_2^0 X_2$$

$$\text{Sol.: } 39.52 = 0.6 \times P_T^0 + 0.4 \times 50.71$$

$$P_T^0 = 32.06 \text{ mm Hg}$$

81. Answer (2)

**Hint:** As  $K_H$  increases, solubility decreases.**Gas**       **$K_H$ /kbar at 298 K**

Ar      40.3

CO<sub>2</sub>      1.67CH<sub>4</sub>      0.413HCHO       $1.83 \times 10^{-5}$ **Sol.:** Order of solubilityAr < CO<sub>2</sub> < CH<sub>4</sub> < HCHO

82. Answer (3)

**Hint:** Molality and mole fraction are temperature independent concentration terms.**Sol.:** • A mixture of CHCl<sub>3</sub> and acetone form a solution with negative deviation from Raoult's law.

- Solubility of gases in liquids decreases with rise in temperature.
- More solute cannot be dissolved in a saturated solution at constant temperature and pressure.

83. Answer (2)

$$\text{Hint: Mass\%} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$\text{Sol.: } (w/w)\% = \frac{0.2 \times 180}{1000 + (0.1 \times 180)} \times 100$$

$$= \frac{18}{1018} \times 100$$

$$= 1.76\%$$

84. Answer (1)

**Hint:** Isotonic solution will have same osmotic pressure.

$$\text{Sol.: } \pi_{\text{CaCl}_2} = (2.6) \times 0.1 \times RT$$

$$\pi_{\text{KCl}} = 0.13 \times 2 \times RT$$

$$\pi_{\text{Urea}} = 0.3RT$$

$$\pi_{\text{Na}_2\text{SO}_4} = 2.8 \times 0.1 \times RT \\ = 0.28 RT$$

$$\pi_{\text{C}_{12}\text{H}_{22}\text{O}_{11}} = 0.2RT$$

85. Answer (1)

**Hint:** Colligative properties only depend on the number of solute particles.

**Sol.:** On complete ionisation, equimolar solutions of both NaCl and KCl will have same boiling points.

$K_b$  value remains constant for all aq. solutions.

86. Answer (1)

**Hint:** In vapour phase more volatile liquid has greater mole fraction.

$$\text{Sol.: Colligative property} \propto \frac{1}{\text{Molecular weight}}$$

Hence molecular weight of unknown solute will be more than molecular weight of  $\text{C}_6\text{H}_{12}\text{O}_6$  that is 180.

87. Answer (4)

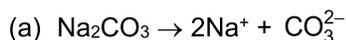
**Hint:** For dissociation of salt  $\text{A}_x\text{B}_y$



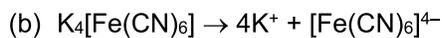
$$i = 1 + (n - 1)\alpha$$

$$n = x + y$$

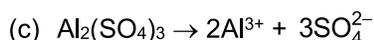
**Sol.:**



$$i = 1 + (2) \times 0.7 = 2.4$$



$$i = 1 + (4) \times 0.6 = 3.4$$



$$i = 1 + (4) \times 0.75 = 4$$



$$i = 1 + 0.8 = 1.8$$

88. Answer (4)

**Hint:** Solution of  $\text{HNO}_3$  in water shows negative deviation from Raoult's law

**Sol.:** • Only non-ideal solution forms azeotropic mixture

- Reverse osmosis is non spontaneous in nature



Before dissolution there were 4 ions and after dissolution 3 ions are produced hence colligative properties will decrease.

- When isotonic solutions are separated by semipermeable membrane, no osmosis occurs.

89. Answer (3)

**Hint:** If a non-volatile solute is added to water then boiling point of solution ( $T_s$ ) can be calculated as  $T_s = (100 + \Delta T_b)^\circ\text{C}$

$$\text{Sol.: } \Delta T_b = i \times K_b \times m$$

$$= 2 \times 0.52 \times \frac{1}{9} \times 55.5$$

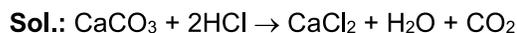
$$= 6.41^\circ\text{C}$$

$$T_s = (100 + 6.41)$$

$$= 106.41^\circ\text{C}$$

90. Answer (2)

**Hint:** During a chemical reaction only pure component reacts.



$$\text{Mol of HCl} = 100 \times 0.4 \times 10^{-3}$$

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

$$\text{Mole of pure CaCO}_3 \text{ required} = 2 \times 10^{-2}$$

$$\% \text{ Purity} = \frac{2 \times 10^{-2} \times 100}{\text{Mass of sample (W)}} \times 100$$

$$90 = \frac{2}{W} \times 100$$

$$W = \frac{2 \times 100}{90}$$

$$= 2.22 \text{ g}$$

**[BOTANY]**

91. Answer (4)  
**Hint:** Pollen transfer to stigma of a flower is pollination.  
**Sol.:** Pollination is not an event of pollen-pistil interaction.
92. Answer (4)  
**Hint:** The oldest viable seed is 10,000 years old.  
**Sol.:** Lupine seed is the oldest viable seed.
93. Answer (2)  
**Hint:** Parthenocarpic fruits are seedless.  
**Sol.:** Banana is a parthenocarpic fruit.
94. Answer (3)  
**Hint:** Germ pore is the area of pollen where exine is absent.  
**Sol.:** Germ pore allows growth of pollen tube.
95. Answer (1)  
**Hint:** In some fruits thalamus also contributes to fruit formation along with ovary.  
**Sol.:** The fruits in which thalamus also contributes in fruit formation are called false fruits, as seen in apple.
96. Answer (2)  
**Hint:** Xenogamy is cross pollination.  
**Sol.:** Xenogamy involves, fertilisation of a flower by the pollen from a flower of another plant of same population.
97. Answer (4)  
**Hint:** Zygote is a product of sexual reproduction.  
**Sol.:** Zygote does not form apomictic embryos.
98. Answer (1)  
**Sol.:** *Orobanche* and *Striga* are parasitic plants producing fruits with many tiny seeds.
99. Answer (1)  
**Hint:** Archegonium leads to formation of megaspore mother cell.  
**Sol.:** Archegonium differentiates from nucellus.
100. Answer (4)  
**Hint:** Both mango and citrus have apomictic embryos.  
**Sol.:** Both of them have embryos that arise from zygote and nucellus.
101. Answer (1)  
**Hint:** A seed of orange contains many embryos.  
**Sol.:** Being polyembryonic, orange may have zygotic as well as nucellar or integument embryos which are genetically different and are diploid.
102. Answer (2)  
**Hint:** Plumule is enclosed in coleoptile.  
**Sol.:** Radicle and root cap are enclosed in coleorhiza.
103. Answer (1)  
**Sol.:** Coconut water is free nuclear endosperm.
104. Answer (1)  
**Hint:** Double fertilisation is seen in angiosperms.  
**Sol.:** Seed producing and pollen producing plants include both gymnosperm and angiosperms but gymnosperms lack double fertilisation.
105. Answer (4)  
**Hint:** Wind pollination is not common in aquatic plants.  
**Sol.:** Monosporic embryo sac is formed by three sequential mitotic divisions.
106. Answer (2)  
**Hint:** Flowers do not produce rewards which are pollinated by abiotic agents.  
**Sol.:** Wind or water pollinated flowers are colourless and do not produce nectar.
107. Answer (4)  
**Hint:** Scutellum represents the cotyledon of grass.  
**Sol.:** Scutellum is a diploid structure.
108. Answer (2)  
**Hint:** Male gametophytes are shed either at 2 celled or 3 celled stage.  
**Sol.:** Mature male gametophyte is two celled and it undergoes a mitotic division to form 2 gametes. Pollens are stored at  $-196^{\circ}\text{C}$  in liquid  $\text{N}_2$ . Only integuments are absent at micropyle.
109. Answer (3)  
**Hint:** Pollen grains are male gametophytes  
**Sol.:** Pollen are 25-50  $\mu\text{m}$  in diameter. They are well preserved as fossil due to sporopollenin present in exine layer.

110. Answer (4)  
**Hint:** This layer generally has more than one nucleus.  
**Sol.:** Tapetum nourishes developing pollen grains.
111. Answer (4)  
**Hint:** False fruits develop from ovary along with thalamus.  
**Sol.:** Mango is a true fruit, rest all are false fruits.
112. Answer (3)  
**Hint:** Perisperm is persistent nucellus.  
**Sol.:** Perisperm are diploid tissue seen in beet and black pepper.
113. Answer (3)  
**Sol.:** A typical anther is tetragonal.
114. Answer (4)  
**Hint:** In some plant species, diploid egg cells are formed without reduction division.  
**Sol.:** Diploid egg cell directly develops into embryo without fertilisation.
115. Answer (3)  
**Hint:** One of the male gametes fuses with polar nuclei during triple fusion.  
**Sol.:** Polar nuclei fuse to form secondary nucleus before triple fusion.
116. Answer (2)  
**Hint:** Maize produces unisexual flowers.  
**Sol.:** Emasculation is required when the parent flower is bisexual.
117. Answer (4)  
**Hint:** Castor produces both male and female flowers on the same plant.  
**Sol.:** Castor prevents autogamy but not geitonogamy. It is a monoecious plant and has endospermous (albuminous) seeds.
118. Answer (3)  
**Hint:** Hermaphrodite flowers are bisexual flowers.  
**Sol.:** Bisexual flowers promote self pollination.
119. Answer (3)  
**Hint:** Apocarpous gynoecium is found in some early members of angiosperms.  
**Sol.:** *Papaver* has syncarpous gynoecium. *Michelia* has apocarpous gynoecium.
120. Answer (1)  
**Hint:** This structure is found in egg apparatus  
**Sol.:** Filiform apparatus is found in synergids, which guides the entry of pollen tube.
121. Answer (4)  
**Hint:** Members of Poaceae are usually pollinated by wind.  
**Sol.:** Rice shows wind pollination.
122. Answer (4)  
**Hint:** Plant in the given figure is *Vallisneria*.  
**Sol.:** *Vallisneria* is a fresh water plant and not called sea grass. Sea grasses such as *Zostera* has ribbon like pollen.
123. Answer (2)  
**Hint:** Many primates have been reported as pollinators.  
**Sol.:** Larger animals such as lemurs, arboreal rodents or even reptiles also act as pollinators.
124. Answer (2)  
**Hint:** In majority of aquatic plants, flowers emerge above water.  
**Sol.:** In majority of aquatic plants, flowers are pollinated by insects or wind.
125. Answer (1)  
**Hint:** Algae, bryophytes and pteridophytes do not form pollen.  
**Sol.:** *Vallisneria*, *Zostera* and *Hydrilla* show hydrophily.
126. Answer (2)  
**Hint:** Dioecious plants prevent both autogamy and geitonogamy.  
**Sol.:** Papaya is a dioecious plant.
127. Answer (2)  
**Hint:** Given figure depicts a plant showing wind pollination.  
**Sol.:** Wind pollinated plants do not produce nectar.
128. Answer (4)  
**Hint:** Majority of flowering plants use biotic agents for pollination.  
**Sol.:** Mucilage covered unwettable pollen grains are produced by those plants which show hydrophily.
129. Answer (4)  
**Hint:** Maize shows geitonogamy  
**Sol.:** Maize has chasmogamous flowers. It does not show cleistogamy.
130. Answer (4)  
**Hint:** Pollens of wheat and rice lose viability within 30 minutes of their release  
**Sol.:** Wheat and rice belong to Poaceae family.

131. Answer (2)

**Hint:** An embryo sac is 7-celled and 8-nucleate structure.

**Sol.:** The egg apparatus is a three-celled structure. In an ovule, nucellus generally differentiate megaspore mother cell in the micropylar end.

132. Answer (4)

**Hint:** Pollen grain has a prominent two layered wall, outer is exine and inner is intine.

**Sol.:** Chitin is found in the cell wall of fungi.

133. Answer (1)

**Hint:** In upto 40% of angiosperms, pollen grains are shed at three celled stage.

**Sol.:** In these plants, generative cell divides into two male gametes before pollen grains are shed.

134. Answer (2)

**Hint:** Microspore tetrads are produced after meiotic division.

**Sol.:** Being products of meiosis, microspore tetrads have haploid cells.

135. Answer (4)

**Hint:** The proximal end of filament of stamen is attached to non-reproductive part of a flower.

**Sol.:** The proximal end of filament of stamen can be attached to the thalamus or petal or tepal of a flower.

## [ZOOLOGY]

136. Answer (4)

**Hint:** Maintains endometrium

**Sol.:** The menstrual phase is followed by follicular phase, during which the levels of gonadotrophins are gradually increased which stimulates follicular development as well as secretion of estrogen by the growing follicles.

137. Answer (4)

**Hint:** Process included under spermatogenesis

**Sol.:** The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.

Receptors for sperm binding are present in zona pellucida.

Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus, the part closer to the ovary is the funnel-shaped infundibulum.

138. Answer (3)

**Hint:** True for androgens

**Sol.:** Human sperm is a microscopic structure composed of a head, neck, a middle piece and a tail. The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap-like structure, acrosome. Lack of menstruation may be indicative of pregnancy. However, it may also be caused due to some other underlying causes like stress, poor health, etc.

139. Answer (1)

**Hint:** Prior to parturition

**Sol.:** The tertiary follicle further changes into the mature follicle or Graafian follicle. The secondary oocyte forms a new membrane called zona pellucida surrounding it. The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass.

Zona pellucida disappears in blastocyst stage prior to implantation.

140. Answer (1)

**Hint:** One secondary spermatocyte produce two sperms

**Sol.:** Since, one secondary spermatocyte produce two sperms, thus, for formation of 600 million sperms, 300 million secondary spermatocytes are required.

141. Answer (3)

**Hint:** Released from pars distalis

**Sol.:** hCG, hPL and relaxin are produced in women only during pregnancy. In addition, during pregnancy the levels of other hormones like estrogens, progesterones, cortisol, prolactin, thyroxine, etc., are increased several folds in the maternal blood. Increased production of these hormones is essential for supporting the fetal growth, metabolic changes in the mother and maintenance of pregnancy.

142. Answer (1)

**Hint:** Site of syngamy

**Sol.:** The motile sperms swim rapidly, pass through the cervix, enter into the uterus and finally reach the ampullary region of the fallopian tube. The ovum released by the ovary is also transported to the ampullary region where fertilisation takes place. The mammary glands of the female undergo differentiation during pregnancy and starts producing milk towards the end of pregnancy by the process called lactation.

143. Answer (3)

**Hint:** More than the number of facial bones in humans

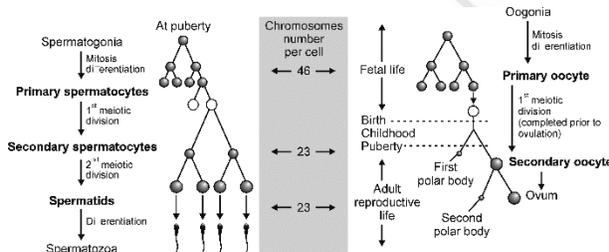
**Sol.:** A functional mammary gland is characteristic of all female mammals. The mammary glands are paired structures (breasts) that contain glandular tissue and variable amount of fat. The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli.

144. Answer (2)

**Hint:** Graafian follicle is a mature ovarian follicle

**Sol.:** Oogonial cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes. Each primary oocyte then gets surrounded by a layer of granulosa cells and is called the primary follicle. A large number of these follicles degenerate during the phase from birth to puberty. The primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles. The secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum. The tertiary follicle further changes into the mature follicle or Graafian follicle.

145. Answer (1)

**Hint:** Include male germ cells**Sol.:**

146. Answer (3)

**Hint:** Physiological changes in sperms occur in female reproductive tract

**Sol.:** Capacitation is a series of biochemical and physiological changes that sperm undergo to prepare them for fertilization. It occurs in the female reproductive tract after ejaculation. The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilization. Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct. LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the process of spermatogenesis.

147. Answer (1)

**Hint:** Ligament belong to the same category of tissue as tendon

**Sol.:** The female reproductive system consists of a pair of ovaries alongwith a pair of oviducts, uterus, cervix, vagina and the external genitalia located in pelvic region. These parts of the system alongwith a pair of the mammary glands are integrated structurally and functionally to support the processes of ovulation, fertilisation, pregnancy, birth and child care. Each ovary is about 2 to 4 cm in length and is connected to the pelvic wall and uterus by ligaments. The uterus is single and it is also called womb. The shape of the uterus is like an inverted pear.

148. Answer (2)

**Hint:** Has function similar to birth hormone

**Sol.:** Synthetic form of oxytocin (pitocin) acts on the uterine muscle and causes stronger uterine contractions that leads to expulsion of the baby out of the uterus through the birth canal – parturition. Prolactin and T<sub>4</sub> have no role in parturition. Cortisol is also involved naturally in parturition.

149. Answer (3)

**Hint:** Function of umbilical cord

**Sol.:** The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (foetus) and maternal body called placenta.

The placenta facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory/waste materials produced by the embryo. The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo. Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progestogens, etc.

150. Answer (1)

**Hint:** After expulsion of placenta at parturition, the levels of estrogen decline.

**Sol.:** The breasts enlarge during pregnancy in response to high circulating levels of estrogens, progesterone, prolactin. The drop in circulating estrogen initiates lactation.

151. Answer (4)

**Hint:** Corpus luteum secretes high amount of progesterone

**Sol.:** The ovulation (ovulatory phase) is followed by the luteal phase/secretory phase during which the remaining parts of the Graafian follicle transform as the corpus luteum. The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy.

152. Answer (1)

**Hint:** With advancing age there is decline in the number of primordial follicles

**Sol.:** The human ovaries become unresponsive to gonadotropins with advancing age, and their function declines, so that sexual cycles disappear (menopause). This unresponsiveness is associated with and probably caused by a decline in the number of primordial follicles, which becomes precipitous at the time of menopause. The ovaries no longer secrete progesterone and estradiol in appreciable quantities. As the negative feedback effect of estrogens and progesterone is reduced, secretion of FSH is increased, and plasma FSH increases to high levels, LH levels are moderately high.

153. Answer (1)

**Hint:** Include secretions of male accessory glands

**Sol.:** The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes.

154. Answer (2)

**Hint:** Also known as cowper's gland

**Sol.:** The male accessory glands include paired seminal vesicles, a prostate and paired

bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also help in the lubrication of the penis. Bartholin's gland is a female accessory gland.

155. Answer (4)

**Hint:** Each lobule contains one to three highly coiled seminiferous tubules.

**Sol.:** Each testis has about 250 compartments called testicular lobules. Each lobule contains one to three highly coiled seminiferous tubules in which sperms are produced.

Thus, the total number of testicular lobules in human testes is 500 and the total number of seminiferous tubules is 500-1500.

156. Answer (4)

**Hint:** Store and transport the sperms from the testis to the outside

**Sol.:** The seminiferous tubules of the testis open into the vasa efferentia through rete testis. The vasa efferentia leave the testis and open into epididymis located along the posterior surface of each testis. The epididymis leads to vas deferens that ascends to the abdomen and loops over the urinary bladder. It receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct. These ducts store and transport the sperms from the testis to the outside through urethra.

157. Answer (1)

**Hint:** The zygote carrying XX would develop into a female baby.

**Sol.:** The chromosome pattern in the human female is XX and that in the male is XY. Therefore, all the haploid gametes (ova) produced by the female have the sex chromosome X whereas in the male gametes (sperms) the sex chromosome could be either X or Y, hence, 50 per cent of sperms carry X chromosome while the other 50 per cent carry Y. After fusion of male and female gametes, the zygote would carry either XX or XY depending on whether the sperm carrying X or Y fertilised the ovum. The zygote carrying XX would develop into a female baby and XY would form a male baby. That is why, scientifically it is correct to say that the sex of the baby is determined by the father and not by the mother.

158. Answer (2)

**Hint:** Normally observed in the foetus by the end of 24 weeks of pregnancy

**Sol.:** In human beings, after one month of pregnancy, the embryo's heart is formed. By the end of the second month of pregnancy, the foetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systems are formed, for example, the limbs and external genital organs are well-developed. The first movements of the foetus and appearance of hair on the head are usually observed during the fifth month. By the end of about 24 weeks (end of second trimester), the body is covered with fine hair, eye-lids separate, and eyelashes are formed. By the end of nine months of pregnancy, the foetus is fully developed and is ready for delivery.

159. Answer (1)

**Hint:** Primary follicles undergo follicular atresia

**Sol.:** Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary; no more oogonia are formed and added after birth. These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes. Each primary oocyte then gets surrounded by a layer of granulosa cells and is called the primary follicle. A large number of these follicles degenerate during the phase from birth to puberty. Therefore, at puberty only 60,000-80,000 primary follicles are left in each ovary.

160. Answer (3)

**Hint:** Contains mitochondria

**Sol.:** Human sperm is a microscopic structure composed of a head, neck, a middle piece and a tail. A plasma membrane envelops the whole body of sperm. The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap-like structure, acrosome. The acrosome is filled with enzymes that help in fertilisation of the ovum. The middle piece possesses numerous mitochondria, which produce energy for the movement of tail that facilitate sperm motility essential for fertilisation.

161. Answer (2)

**Hint:** Basis of implantation

**Sol.:** The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and

an inner group of cells attached to trophoblast called the inner cell mass. The trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo. After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood.

162. Answer (1)

**Hint:** Constant phase of menstrual cycle

**Sol.:** The ovulation (ovulatory phase) is followed by the luteal phase during which the remaining parts of the Graafian follicle transform as the corpus luteum. The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy.

163. Answer (2)

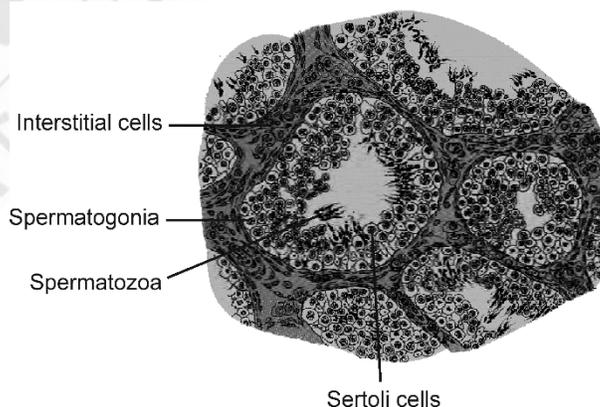
**Hint:** Exclude the hormone released from anterior pituitary

**Sol.:** The process of childbirth is called parturition which is induced by a complex neuroendocrine mechanism involving cortisol, estrogens and oxytocin.

164. Answer (4)

**Hint:** Identify the male germ cells

**Sol.:**



Each seminiferous tubule is lined on its inside by two types of cells called male germ cells (spermatogonia) and Sertoli cells. The male germ cells undergo meiotic divisions finally leading to sperm formation, while Sertoli cells provide nutrition to the germ cells. The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells. Leydig cells synthesise and secrete testicular hormones called androgens.

165. Answer (2)

**Hint:** GnRH stimulates the release the gonadotropins

**Sol.:** Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary; no more oogonia are formed and added after birth. These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes.

Spermatogenesis starts at the age of puberty due to significant increase in the secretion of gonadotropin releasing hormone (GnRH). GnRH is a hypothalamic hormone.

166. Answer (2)

**Hint:** X = Nipple

**Sol.:** The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli. The cells of alveoli secrete milk, which is stored in the cavities (lumens) of alveoli. The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct. Several mammary ducts join to form a wider mammary ampulla which is connected to lactiferous duct and opens at nipple, from where milk is expressed.

167. Answer (1)

**Hint:** Necessary for formation of sperms

**Sol.:** The testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes (2-2.5°C lower than the normal internal body temperature) necessary for spermatogenesis.

168. Answer (4)

**Hint:** Also called oviduct

**Sol.:** A functional mammary gland is characteristic of all female mammals. Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus, the part closer to the ovary is the funnel-shaped infundibulum. The edges of the infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation. The infundibulum leads to a wider part of the oviduct called ampulla. The last part of the oviduct, isthmus has a narrow lumen and it joins the uterus.

169. Answer (1)

**Hint:** Feature of smooth muscle fibres

**Sol.:** The wall of the uterus has three layers of tissue. The external thin membranous perimetrium, middle thick layer of smooth muscle, myometrium and inner glandular layer called endometrium that lines the uterine cavity. The endometrium undergoes cyclical changes during menstrual cycle while the myometrium exhibits strong contractions during delivery of the baby.

170. Answer (2)

**Hint:** Implantation normally occurs in uterus.

**Sol.:** The enlarged end of penis called the glans penis is covered by a loose fold of skin called foreskin. The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells. Other immunologically competent cells are also present. Ectopic pregnancy is defined as implantation of embryo at the site other than the uterus.

171. Answer (1)

**Hint:** Exclude the site where sperms are formed

**Sol.:** The male sex accessory ducts include rete testis, vasa efferentia, epididymis and vas deferens. The extra-testicular duct system is a set of ducts in the male reproductive system that transport sperm outside of the testes. The ducts include the epididymis, ductus deferens (vas deferens), and ejaculatory duct.

172. Answer (2)

**Hint:** Immunoglobulins of type IgA

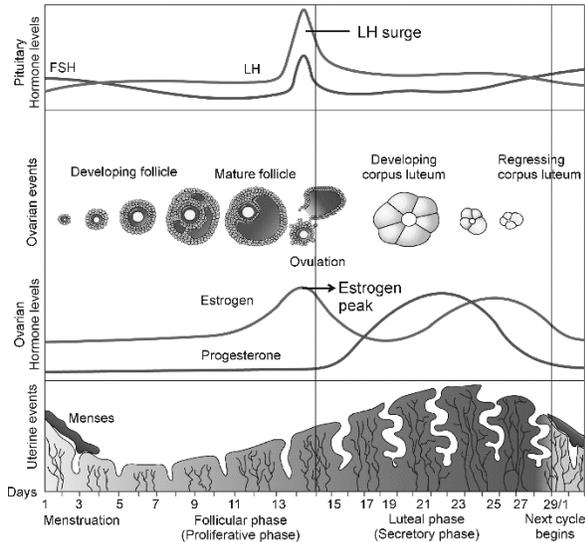
**Sol.:** The milk produced during the initial few days of lactation is called colostrum which contains several antibodies absolutely essential to develop resistance for the new-born babies. Breast-feeding during the initial period of infant growth is recommended by doctors for bringing up a healthy baby.

173. Answer (3)

**Hint:** Both sperm and ovum are formed as a result of meiotic division

**Sol.:** Sperms have many mitochondria that are arranged in a spiral in the middle piece of the sperm. This spiral arrangement of mitochondria is called the nebenkern. Ovum has higher amount of cytoplasm in comparison to sperm. Both ovum and spermatozoan are haploid structures *i.e.*, both possess 23 number of chromosomes.

174. Answer (2)

**Hint:** LH surge induces rupture of Graafian follicle**Sol.:**

175. Answer (2)

**Hint:** Occurs in oviduct

**Sol.:** The secretions of the acrosome help the sperm to enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane. This induces the completion of the meiotic division of the secondary oocyte. The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid). Soon the haploid nucleus of the sperm and that of the ovum fuse together to form a diploid zygote in the fallopian tube.

176. Answer (3)

**Hint:** Thin piece of mucosal tissue

**Sol.:** The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris. Mons pubis is a cushion of fatty tissue covered by skin and pubic hair. The labia majora are fleshy folds of tissue, which extend down from the mons pubis and surround the vaginal opening. The labia minora are paired folds of tissue under the labia majora. The opening of the vagina is often covered partially by a membrane called hymen. The presence or absence of hymen is not a reliable indicator of virginity or sexual experience.

177. Answer (1)

**Hint:** 60% of sperms must have normal shape and size

**Sol.:** Sperm count = 200-300 million / ejaculate  
Because sperms with normal shape and size are 60% of the sperm count and 40% of them show vigorous motility.

So, sperms with normal shape, size and vigorous motility

$$200 \text{ million} \times \frac{60}{100} \times \frac{40}{100} \quad \text{or}$$

$$300 \text{ million} \times \frac{60}{100} \times \frac{40}{100}$$

$$= 48-72 \text{ million /ejaculate}$$

178. Answer (2)

**Hint:** Disintegrates before implantation

**Sol.:** Primary oocyte as well as corona radiata possess  $2n$  chromosomes *i.e.*, both are diploid in nature. The secondary oocyte forms a new non-cellular membrane called zona pellucida surrounding it. Primary oocyte within the tertiary follicle grows in size and completes its first meiotic division. It is an unequal division resulting in the formation of a large haploid secondary oocyte and a tiny first polar body.

179. Answer (4)

**Hint:** Eliminate the placental hormones

**Sol.:** Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progestogens, *etc.* In the later phase of pregnancy, a hormone called relaxin is also secreted by the ovary.

180. Answer (3)

**Hint:** Tiny finger-like structure

**Sol.:** The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris. The clitoris is a tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.

The oviducts (fallopian tubes), uterus and vagina constitute the female accessory ducts. The penis is the male external genitalia. It is made up of special tissue that helps in erection of the penis to facilitate insemination.

