All India Aakash Test Series for NEET - 2027

TEST - 4 (Code-C)

Click here for Code-D Sol.

Test Date : 25/01/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Use, $P = \vec{\tau} \cdot \vec{\omega}$

Sol.: $P = \tau\omega \Rightarrow \tau = \frac{75 \times 10^3}{150} = 500$ N m

2. Answer (4)

Hint: Use, $\vec{R} = \vec{A} \times \vec{B}$

Sol.: $\vec{R} = (\hat{i} + 2\hat{j}) \times (\hat{i} - 2\hat{j})$

$$\Rightarrow \quad \vec{R} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 0 \\ 1 & -2 & 0 \end{vmatrix}$$

$= \hat{i}(0) + \hat{j}(0) + \hat{k}(-2-2)$

$= -4\hat{k}$

$\Rightarrow$ Unit vector = $-\hat{k}$

Similarly, $\hat{k}$ can also be a possible solution.

3. Answer (3)

Hint & Sol.: The cross product of two vectors is not commutative but it is distributive w.r.t. vector addition.

4. Answer (4)

Hint & Sol.: The mutual gravitational force of interaction between two masses is independent of medium around them.

5. Answer (1)

Hint: Use the concept of variation of acceleration due to gravity with height.

Sol.: $g' = \frac{GM}{(R+h)^2} = \frac{GM}{R^2\left(1+\frac{h}{R}\right)^2} = \frac{g}{\left(1+\frac{h}{R}\right)^2}$,

$h = \frac{R}{3}$

$\Rightarrow \quad g = \frac{9g}{16} \Rightarrow$ weight = $\frac{9}{16} \times 72 = 40.5$ N

6. Answer (3)

Hint & Sol.: The angular momentum remains conserved, hence $L_A = L_B = L_C$

7. Answer (2)

Hint: Use, $g = \frac{GM}{R^2}$

Sol.: $g_p = \frac{4G \times M_p}{D_p^2} = \frac{4GM_p}{D_p^2}$

8. Answer (2)

Hint: Use conservation of angular momentum

Sol.: $L_i = MR^2 \times \omega_0$, $L_f = [MR^2 + 3mR^2] \times \omega'$

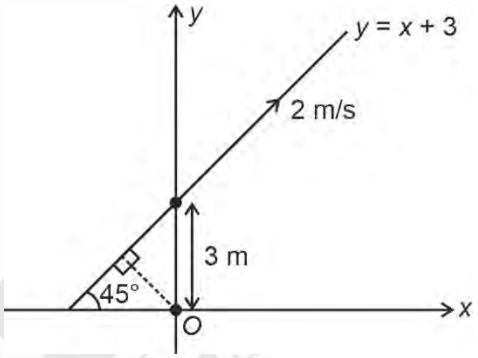
$\Rightarrow \quad MR^2 \times \omega_0 = [MR^2 + 3mR^2] \times \omega'$

$\omega' = \frac{M\omega_0}{M+3m}$

9. Answer (3)

Hint: Angular momentum, $\vec{L} = \vec{r} \times \vec{p}$

Sol.:

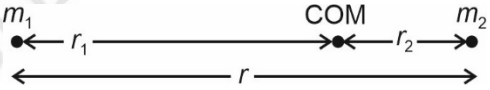


$|\vec{L}| = \frac{1 \times 2 \times 3}{\sqrt{2}} = 3\sqrt{2}$ kg m^{2}s^{-1}

10. Answer (1)

Hint: Gravitational force will provide necessary centripetal force.

Sol.:



$m_1 r_1 \omega^2 = m_2 r_2 \omega^2 = \frac{Gm_1m_2}{r^2}$, and $r_1 = \frac{r(m_2)}{m_1+m_2}$

$\Rightarrow \omega^2 = \frac{G(m_1+m_2)}{r^3}$

$\Rightarrow \quad \omega = \sqrt{\frac{G(m_1+m_2)}{r^3}}$

11. Answer (1)

Hint: Use principle of superposition.

Sol.:

$$\Rightarrow \quad V_R = \frac{-GM}{3R} + \frac{G \times \left(\frac{M}{64}\right)}{\left(2R + \frac{R}{4}\right)} = \frac{-GM}{3R} + \frac{\frac{GM}{64}}{\frac{9R}{4}}$$

$$= \frac{-GM}{3R} + \frac{GM}{144R} = \frac{-47GM}{144R}$$

12. Answer (4)

Hint & Sol.: Since initially the system is at rest and no net external force is acting, hence COM would continue to remain at rest.

13. Answer (1)

Hint & Sol.: Centre of mass may or may not coincide with the centre of gravity of body and COM is the point at which total mass can be assumed to be concentrated.

14. Answer (2)

Hint: Use, $X_{COM} \times \int dM = \int xdM$

Sol.: $X_{COM} = \dfrac{\int xdM}{\int dM}$,

$dM = \lambda dx$, $(\lambda = kx)$

$\therefore \quad dM = kxdx$

$$X_{COM} = \frac{\int_0^L kx^2dx}{\int_0^L kxdx} = \frac{\left[\frac{kx^3}{3}\right]_0^L}{\left[\frac{kx^2}{2}\right]_0^L} = \frac{\frac{L^3}{3}}{\frac{L^2}{2}} = \frac{2L}{3} = 2 \text{ m}$$

Distance of centre of mass from end B

$= 3 - 2 = 1$ m

15. Answer (1)

Hint: Use, $g' = g\left[1 - \dfrac{2h}{R_e}\right]$

Sol.: $\dfrac{g'}{g} = 1 - \dfrac{2h}{R_e}$

$$\Rightarrow \quad \frac{2h}{R_e} = \frac{2}{100} \Rightarrow h = \frac{R_e}{100}$$

16. Answer (2)

Hint: Use work energy theorem

Sol.: $W = \Delta U = U_f - U_i = \dfrac{-GMm}{\frac{3R}{2}} + \dfrac{GMm}{R}$

$$W = \frac{-2GMm}{3R} + \frac{GMm}{R} = \frac{GMm}{3R} = \frac{gR^2 \times m}{3R} = \frac{gmR}{3}$$

17. Answer (1)

Hint & Sol.: In case of thin uniform spherical shell,

$V = \dfrac{-GM}{R}$, for $r \le R$

and $V = \dfrac{-GM}{r}$, for $r > R$

18. Answer (2)

Hint: Angular speed, $\omega = \dfrac{2\pi f}{60}$

Sol.: $f = \dfrac{90}{60}$ rev/s

$\omega = 2\pi \times \dfrac{90}{60} = 3\pi$ rad/s

19. Answer (4)

Hint: Use conservation of angular momentum

Sol.: $L = I_1\omega_1 = I_2\omega_2 \Rightarrow MK_1^2\omega_1 = MK_2^2\omega_2$

$$\Rightarrow \quad \frac{K_1}{K_2} = \sqrt{\frac{\omega_2}{\omega_1}}$$

20. Answer (3)

Hint: Angular acceleration is defined as rate of change of angular velocity.

Sol.: $\alpha = \dfrac{\omega_f - \omega_i}{\Delta t} \Rightarrow \alpha = \dfrac{2\pi}{60}\dfrac{[4500 - 1200]}{10}$

$$\Rightarrow \quad \alpha = 2\pi\left[\frac{4500}{600} - \frac{1200}{600}\right] = 2\pi \times \left(\frac{15-4}{2}\right)$$

$= 11\pi$ rad/s^2

21. Answer (4)

Hint: Areal velocity, $\dfrac{dA}{dt} = \dfrac{L}{2m}$

Sol.: $\dfrac{dA}{dt} = \dfrac{L}{2m}, L = mvr \Rightarrow \dfrac{dA}{dt} = \dfrac{mvr}{2m} = \dfrac{vr}{2}$

$$\Rightarrow \quad \frac{dA}{dt} = \frac{10 \times 1.2 \times 10^9}{2} = 6 \times 10^9 \text{ km}^2\text{s}^{-1}$$

22. Answer (3)

Hint & Sol.: If $P.E = E_0 \Rightarrow T.E = \dfrac{E_0}{2}$ &

$K.E = \dfrac{-E_0}{2}$

23. Answer (2)

Hint: $g' = g\left[1 - \dfrac{d}{R}\right]$

Sol.: $g' = g\left[1 - \dfrac{R}{2R}\right] = \dfrac{g}{2} = 4.9$ m/s^2

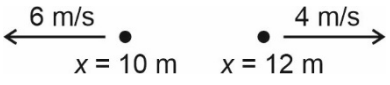
24. Answer (3)

Hint & Sol.: When two masses come together their gravitational potential energy decreases as work done by gravitational force is positive.

$W_{cons} = -\Delta U$

25. Answer (1)

Hint: Use, $\vec{r}_F - \vec{r}_i = \vec{v} \times t$

Sol.: 

$$X_{COM} = \frac{m_1x_1 + m_2x_2}{m_1 + m_2} = \frac{1\times10 + 2\times12}{3}$$

$$= \frac{10+24}{3} = \frac{34}{3} \text{ m}$$

$$V_{COM} = \frac{-1\times6 + 2\times4}{3} = \frac{8-6}{3} = \frac{2}{3} \text{ m/s}$$

$$X_F - X_i = V \times t \Rightarrow X_F = \frac{34}{3} + \frac{2}{3}\times2$$

$$X_F = \frac{34}{3} + \frac{4}{3} = \frac{38}{3} \text{ m}$$

26. Answer (2)
Hint & Sol.: The centre of mass of two particle system lies on the line joining the two particles.

27. Answer (2)
Hint: Angular momentum of planet, $|\vec{L}| = mvr$
Sol.: We know that, $L = mvr \Rightarrow v = \frac{L}{mr}$

$$K = \frac{1}{2}mv^2 = \frac{1}{2}\times m \times \frac{L^2}{m^2r^2} = \frac{L^2}{2mr^2}$$

28. Answer (2)
Hint & Sol.: The astronaut will be in the condition of weightlessness, hence weight will be zero.

29. Answer (4)
Hint: Gravitational force, $F_G = \frac{Gm_1m_2}{r^2}$
Sol.: When the point masses are at separation x, then

$$F_G = \frac{GMm}{x^2} \Rightarrow a_1 = \frac{Gm}{x^2} \text{ & } a_2 = \frac{GM}{x^2}$$

$$\Rightarrow \quad a_{rel} = \frac{G(M+m)}{x^2}$$

30. Answer (1)
Hint: Use principle of superposition
Sol.: Mass of portion which has been cut out,

$$M' = \frac{M\times\pi\times4}{\pi\times36}$$

$$\Rightarrow \quad M' = \frac{M}{9}$$

Shift

$$= \frac{M\times0 - \frac{M}{9}\times3.2}{M - \frac{M}{9}} = \frac{\frac{-M}{9}\times3.2}{\frac{8M}{9}} = \frac{-3.2}{8} = -0.4 \text{ cm}$$

i.e., there is a shift of 0.4 cm

31. Answer (1)
Hint: Use, $\tau = I\alpha$
Sol.: $\theta = 4t^3 - 12t^2 \Rightarrow \omega = 12t^2 - 24t$
$\Rightarrow \alpha = 24t - 24$
$\alpha = 0 \Rightarrow t = 1$

32. Answer (2)
Hint: $\vec{\tau} = \vec{r} \times \vec{F}$
Sol.: Since, $\vec{\tau} = \vec{r} \times \vec{F}$, $\vec{\tau} \cdot \vec{r} = 0$ & $\vec{F} \cdot \vec{\tau} = 0$

33. Answer (3)
Hint & Sol.: The moment of inertia of any object is minimum about an axis passing through its centre of mass.

34. Answer (2)
Hint: More is the mass away from axis of rotation, more will be the moment of inertia.
Sol.: The moment of inertia would be higher when the core is made up of wood and iron is at outer rim of the disc.

35. Answer (1)
Hint & Sol.: Kinetic energy due to rotation

$$= \frac{1}{2}I\omega^2 = \frac{1}{2}\times mr^2 \times \omega^2 = \frac{mr^2\omega^2}{2}$$

36. Answer (2)
Hint: Use conservation of energy
Sol.: Using conservation of energy,

$$m\times g\times\frac{1}{2} = \frac{1}{2}I\omega^2$$

$$\Rightarrow \quad m\times g\times\frac{1}{2} = \frac{1}{2}\times\frac{m\times(1)^2}{3}\omega^2$$

$$\Rightarrow \quad \omega^2 = 3g \Rightarrow \omega = \sqrt{3g}$$

$$\Rightarrow \quad \text{Velocity} = r\omega = \sqrt{3g} = 5.42 \text{ ms}^{-1}$$

37. Answer (3)
Hint: Use, $\vec{a}_{COM} = \frac{m_1\vec{a_1} + m_2\vec{a_2}}{m_1 + m_2}$
Sol.: $\left.\begin{matrix} m_2g - T = m_2a & ...(1) \\ T = m_1a & ...(2) \end{matrix}\right\rangle a = \frac{m_2g}{m_1+m_2}$

$$\left|\vec{a}_{COM,\,y}\right| = \frac{m_1\times0 + m_2\times\frac{m_2g}{m_1+m_2}}{m_1+m_2} = \left(\frac{m_2}{m_1+m_2}\right)^2 g$$

38. Answer (1)
Hint & Sol.: When all five point masses are placed, $\left|\vec{E}_G\right| = 0$ & $V = \frac{-5Gm}{a}$
When one mass is removed,

$$\left|\vec{E}_G\right| = \frac{Gm}{a^2} \text{ & } V = \frac{-4Gm}{a}$$

39. Answer (3)

Hint: $v_{orbital} = \sqrt{\frac{GM}{R+h}}$

Sol.: $v_{orbital} = \sqrt{\frac{GM}{R+h}}$ and $g = \frac{GM}{R^2}$

$v_0 = \sqrt{\frac{gR^2}{R+x}}$

40. Answer (4)

Hint & Sol.: The escape velocity of a body depends upon mass and radius of planet while it is independent of mass of body.

41. Answer (4)

Hint & Sol.: The COM of system must lie at diagonal BD if $m_1 = m_3$.

42. Answer (3)

Hint: Use, $\vec{\tau} = \vec{r} \times \vec{F}$

Sol.: $\vec{\tau} = 4\hat{k} \times 6\hat{j} = -24\hat{i}$ N m

43. Answer (3)

Hint & Sol.: As the radius of sphere is decreased keeping the mass constant, the angular momentum would remain constant.

44. Answer (2)

Hint: Use parallel axis theorem

Sol.: $I = \frac{MR^2}{2} + MR^2 = \frac{3MR^2}{2}$

45. Answer (2)

Hint: Use, $\tau = I\alpha$

Sol.: Let impulse due to hinge is N

$P - N = mv_{cm}$

$P - N = mR\omega$

$P(R + \alpha) = I\omega$

$P(R + \alpha) = \frac{3}{2}mR^2\omega$

For $N = 0$,

$mR\omega(R + \alpha) = \frac{3}{2}mR^2\omega$

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

[CHEMISTRY]

46. Answer (4)

Hint: KNO_3 is the salt of strong acid and strong base.

Sol.: $\overset{+}{N}H_4 + H_2O \rightarrow NH_4OH + H^+$

It undergoes cationic hydrolysis.

47. Answer (1)

Hint: $NH_4Cl(aq) \rightarrow NH_4^+(aq) + Cl^-(aq)$

Sol.: Ionisation of NH_4OH decreases on addition of NH_4Cl due to common ion effect.

48. Answer (2)

Hint: In the presence of strong acid, ionisation of weak acid is suppressed.

Sol.:

	$HCl \rightarrow$	H^+	+	Cl^-
	0.1	–		–
	0	0.1		0.1

	$CH_3COOH \rightleftharpoons$	CH_3COO^-	+	H^+
Initial	0.01	0		0
Final	$0.01 - 0.01\alpha$	0.01α		$0.01\alpha + 0.1$

$K_a = \frac{[CH_3COO^-][H^+]}{[CH_3COOH]}$

$K_a = \frac{0.01\alpha(0.01\alpha + 0.1)}{0.01(1-\alpha)}$

$K_a = 0.1\alpha$

$\alpha = \frac{1.74 \times 10^{-5}}{0.1}$

$= 1.74 \times 10^{-4}$

$= 1.74 \times 10^{-2}\%$

49. Answer (3)

Hint: $Ca(OH)_2(s) \rightleftharpoons Ca^{2+}(aq) + 2OH^-(aq)$
S 2S

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

$K_{sp} = 4S^3$

Sol.: For AgCl; $K_{sp} = S^2$

$S = \sqrt{1.8 \times 10^{-10}}$

$\approx 10^{-5}$ M

For CuI; $K_{sp} = S^2$

$S = \sqrt{1.1 \times 10^{-12}}$

$\approx 10^{-6}$ M

For $Ca(OH)_2$; $K_{sp} = 4S^3$

$S = \left(\frac{5.5 \times 10^{-6}}{4}\right)^{1/3}$

$\approx 10^{-2}$ M

50. Answer (4)

Hint: $A(s) \rightleftharpoons \underset{3P_B}{3B(g)} + \underset{2P_C}{2C(g)}$

$K_P = (3P_B)^3(2P_C)^2$

Sol.: $K_P = (3P_B)^3(2P_C)^2 = (3P'_B)^3(4P_C)^2$

$P_B^3 \times 4P_C^2 = P'^3_B \times 16P_C^2$

$P_B^3 = P'^3_B \times 4$

$P'_B = \frac{P_B}{(4)^{1/3}}$

51. Answer (1)

Hint: pH = –log[H⁺]

Sol.: $[H^+]_1 = 10^{-2}M;\ [H^+]_2 = 10^{-3}\ M; [H^+]_3 = 10^{-4}\ M$

$= \frac{10^{-2} \times V + 10^{-3} \times V + 10^{-4}V}{3V}$

$= \frac{1}{3}[10^{-2} + 10^{-3} + 10^{-4}]\ M$

$= \frac{1}{3} \times 10^{-2}[1 + 0.1 + 0.01]\ M$

$= \frac{1.11}{3} \times 10^{-2}\ M$

$= 0.37 \times 10^{-2}$ M

$= 3.7 \times 10^{-3}$ M

52. Answer (4)

Hint: pH = –log[H⁺]

Sol.: Millimoles of H^+ ions = 40 mmol

Millimoles of OH^- ions = 20 mmol

Millimoles of H^+ ions left = 20 mmol

$[H^+] = \frac{20}{1000} \times \frac{1000}{400} = 5 \times 10^{-2}\ M$

pH = –log[H⁺]

$= -\log[5 \times 10^{-2}]$

$= 2 - 0.6990 = 1.3$

53. Answer (3)

Hint: In case of metal hydrides, hydrogen has –1 oxidation state

Sol.: In $H\underline{Au}Cl_4$; +1 + x + 4(–1) = 0

x = +3

In $H_3\underline{P}O_4$; +3 + x + 4(–2) = 0

x = +5

In $\underline{N}H_3$; x + 3(+1) = 0

x = –3

54. Answer (4)

Hint: $\underset{S}{Hg_2I_2(s)} \rightleftharpoons \underset{S}{Hg_2^{2+}(aq)} + \underset{2S}{2I^-(aq)}$

Sol.: pH = 10

pOH = 4

$[OH^-] = 10^{-4}$ M

$Ni(OH)_2(s) \rightleftharpoons \underset{S}{Ni^{2+}(aq)} + \underset{2S+10^{-4}}{2OH^-(aq)}$

$2 \times 10^{-15} = S(2S + 10^{-4})^2$

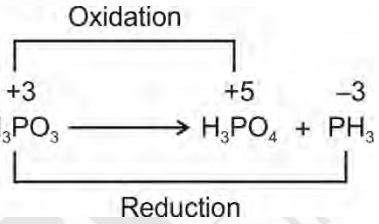
$S \times 10^{-8} = 2 \times 10^{-15}$

$S = \frac{2 \times 10^{-15}}{10^{-8}} = 2 \times 10^{-7}\ M$

55. Answer (1)

Hint: In elements, in the free or the uncombined state, each atom bears an oxidation number of zero

Sol.: • In S_8, each sulphur atom has zero oxidation state



n factor of $H_3PO_3 = \frac{2 \times 6}{8} = \frac{12}{8} = \frac{3}{2}$

Equivalent weight of $H_3PO_3 = \frac{2M}{3}$

• $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

56. Answer (1)

Hint: The element which is already present in its highest oxidation state cannot be oxidised further.

Sol.: Oxidation number of sulphur in SO_4^{2-}

x + 4(–2) = –2

x = +6

It is the highest oxidation state of sulphur. Oxidation state of phosphorus in PO_4^{3-} is

x + 4(–2) = –3

x = +5

It is the highest oxidation state of phosphorus.

57. Answer (1)

Hint: $K_C = \frac{K_f}{K_b}$

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

Sol.: $K_f = K_b \times 10$

$K_C = \frac{K_f \times 10}{K_b} = 10$

$K_p = 10 \times (0.0831 \times 100)^1$

$K_p = 83.1$

58. Answer (2)

Hint: It is an example of disproportionation redox reaction

Sol.: $S_8(s) + 12OH^-(aq) \rightarrow 4S^{2-}(aq) + 2S_2O_3^{2-}(aq) + 6H_2O(l)$

So, sum of a, b, c and d is 12 + 4 + 2 + 6 = 24

59. Answer (1)

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

Sol.:

	$2NH_4OH$	+ H_2SO_4	$\rightarrow (NH_4)_2SO_4$
Initially	6 m mol	1 m mol	
	$6-2 \Rightarrow$ 4 mmol	0 mmol	2 mmol

$$pOH = 4.7 + \log\frac{2}{4}$$

$= 4.7 + [\log 2 - 2\log 2]$

$= 4.7 - 1 \times 0.3$

pOH = 4.4

pH + pOH = pK_w

pH = 14 – 4.4 = 9.6

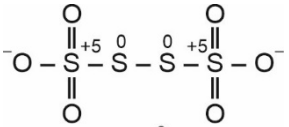
60. Answer (2)

Hint: In a displacement reaction, an ion (or an atom) in a compound is replaced by an ion (or an atom) of another element

Sol.:

List-I (Reaction)	**List-II (Type of redox reaction)**
$CH_4(g) + 2O_2(g) \xrightarrow{\Delta} CO_2(g) + 2H_2O(l)$	Combination
$Ca(s) + 2H_2O(l) \xrightarrow{\Delta} Ca(OH)_2(aq) + H_2(g)$	Non metal displacement
$2H_2O(l) \xrightarrow{\Delta} 2H_2(g) + O_2(g)$	Decomposition
$Cl_2(g) + 2OH^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + H_2O(l)$	Disproportionation

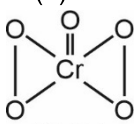
61. Answer (1)

Hint: 

$(S_4O_6^{2-})$

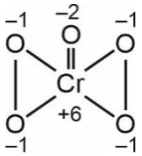
Sol.: F_2 does not show a disproportionation tendency.

62. Answer (4)

Hint: 

(CrO_5)

Sol.: In CrO_5 molecule; Cr show +6 oxidation state.



Species	**Oxidation state of sulphur**
$\underline{S}O_3^{2-}$	+4
$\underline{S}_2O_4^{2-}$	+3
$\underline{S}_2O_6^{2-}$	+5

63. Answer (4)

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

Sol.: $E^\circ_{cell} = 0.80 - (-0.76)$

= 1.56 V

64. Answer (2)

Hint: Addition of inert gas at constant volume which does not take part in the reaction, the equilibrium remains undisturbed

Sol.: In the following reaction, if the pressure or temperature or both is decreased, yield of SO_3 will be minimum.

65. Answer (3)

Hint: $E^\circ_{red} \propto \frac{1}{\text{Reducing power}}$

Sol.: The correct order of reducing power will be Z > Y > X

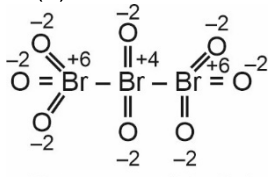
66. Answer (3)

Hint: $E^\circ_{red} \propto \frac{1}{\text{Reducing power}}$

$E^\circ_{red} \propto$ oxidising power

Sol.: In electrochemical series $F_2 + 2e^- \rightarrow 2F^-$, E° = 2.87 V so it cannot oxidised by any other species.

67. Answer (3)

Hint: 

(Structure of Br_3O_8)

Sol.: Oxidation states of (a), (b) and (c) bromine atoms are +6, +4 and +6 respectively.

68. Answer (4)

Hint: In faintly alkaline medium, Br^- is converted into BrO_3^- ion

Sol.: $2MnO_4^-(aq) + Br^-(aq) + H_2O(l) \rightarrow BrO_3^-(aq) + 2OH^-(aq) + 2MnO_2(s)$

69. Answer (1)

Hint: In peroxide (H_2O_2), oxidation state of oxygen atom is –1

Sol.: $BaSO_4$ → oxidation state of oxygen atom is –2.

70. Answer (1)

Hint: $3MnO_4^- + 5FeC_2O_4 + 24H^+ \rightarrow 3Mn^{2+} + 5Fe^{3+} + 10CO_2 + 12H_2O$

Sol.: For 5 moles FeC_2O_4 = 3 moles of MnO_4^- required

For 1 mole of FeC_2O_4 = $\frac{3}{5}$ mole of MnO_4^- required

71. Answer (4)

Hint: Alkali metals show +1 oxidation state.

Sol.:

- In KO_2; oxidation number of oxygen

  $\Rightarrow$ +1+2x=0

  $x = \frac{-1}{2}$

- In H_2O_2; oxidation number of oxygen

  $\Rightarrow$ +2 + 2x = 0

  x = –1

72. Answer (1)

Hint: For salt of WAWB

$pH = 7 + \frac{1}{2}[pK_a - pK_b]$

Sol.: $NH_4^+ + NO_3^- + H_2O \rightarrow NH_4OH + H^+ + NO_3^-$

solution is acidic in nature

73. Answer (2)

Hint: Species which can donate lone pair(s) is called Lewis base

Sol.: $AlCl_3$, BF_3, $BeCl_2$, → Lewis acid

H_2O → Lewis base

74. Answer (4)

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

Δn_g = gaseous moles of products – gaseous moles of reactants

Sol.: $S(s) + O_2(g) \rightleftharpoons SO_2(g)$

$\Delta n_g = 1 - 1 = 0$

$K_P = K_C(RT)$

$K_P = K_C$

- $4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(l)$

  $\Delta n_g = 4 - 9 = -5$

  $K_P = K_C(RT)^{-5}$

- $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$

  $\Delta n_g = 3 - 2 = 1$

  $K_P = K_C(RT)^1$

- $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$

  $\Delta n_g = 1 - \frac{3}{2} = \frac{-1}{2}$

  $K_P = K_C(RT)^{-½}$

75. Answer (3)

Hint: According to Le-chatelier principle, an increase in pressure always favours the reaction, where volume or moles decrease.

Sol.: • $Fe_2O_3(s)$ is solid, it will not effect the state of equilibrium.

- $2NaNO_3(s) \rightleftharpoons 2NaNO_2(s) + O_2(g)$

  is an endothermic reactions, is supported in forward direction with increase in temperature.

- Ice(s) $\rightleftharpoons$ water(l); pressure increases, equilibrium shift in forward direction.

76. Answer (1)

Hint: At equilibrium $\Delta G = 0$

Sol.:

	$2HBr(g)$	$\rightleftharpoons$	$H_2(g)$	+	$Br_2(g)$
t_i	1		0		0
	1 – 0.6		0.3		0.3

$K = \frac{0.3 \times 0.3}{0.4 \times 0.4} = \frac{9}{16}$

$\Delta G = \Delta G^\circ + RT\ln K$

$\Delta G^\circ = -RT\ln K$

$= -2.303 \times 8.314 \times 400 \times \log\frac{9}{16}$

$= -2.303 \times 8.314 \times 400\ [2\log 3 - 4\log 2]$

$= -2.303 \times 8.314 \times 400\ [2 \times 0.4771 - 4 \times 0.3010]$

$= 1.91\ kJ\ mol^{-1}$

77. Answer (3)

Hint: $E^\circ_{red} \propto$ oxidising power

Sol.: $Cr_2O_7^{2-}$ ion in acidic medium can oxidize Sn, Cu, Pb and Ag

78. Answer (1)

Hint & Sol.: PV = nRT

$$n = \frac{PV}{RT}$$

	$CO(g)$	+ $2H_2(g)$	$\rightleftharpoons$ $CH_3OH(g)$
moles at t = 0	0.2	a	0
moles at equilibrium	0.2 – x	a – 2x	0.04
	(0.2 – 0.04)	a – 0.08	0.04

Total moles at equilibrium

= 0.2 – 0.04 + a – 0.08 + 0.04

= 0.12 + a

Total moles at equilibrium can also be calculated from the following relation,

$$n = \frac{10 \times 2}{0.0821 \times 750} \Rightarrow \frac{20}{61.575} = 0.32$$

0.32 = 0.12 + a

a = 0.2

Thus moles of CO at equilibrium = 0.16

Moles of H_2 at equilibrium = 0.12

Moles of CH_3OH at equilibrium = 0.04

$$K_C = \frac{\frac{0.04}{2}}{\left(\frac{0.12}{2}\right)^2\left(\frac{0.16}{2}\right)} \Rightarrow \frac{0.02 \times 8}{0.12 \times 0.12 \times 0.16}$$

$K_C = 69.44$

79. Answer (2)

Hint: The acid-base pair that differs only by one proton is called a conjugate acid-base pair

Sol.:

	Conjugate acid	Conjugate base
H_2O	H_3O^+	OH^-

80. Answer (4)

Hint: Mohr's salt is $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$

Sol.: $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

For 1 mole $Cr_2O_7^{2-} \rightarrow$ 6 moles of Mohr's salt required

For 2 moles $Cr_2O_7^{2-} \rightarrow$ 12 moles of Mohr's salt required

81. Answer (1)

Hint: Weak acid and it's salt with strong base form an acidic buffer.

Sol.:

CH_3COOH	+ NaOH	$\rightarrow$ CH_3COONa	+ H_2O
14 m mol	8 m mol	0	
(14 – 8) $\Rightarrow$ 6 m mol	0 m mol	10 m mol	

It forms an acidic buffer.

CH_3COOH +	NaOH	$\rightarrow$ CH_3COONa +	H_2O
25 m mol	10 m mol	0	
15 m mol	0 m mol	10 m mol	

It forms an acidic buffer.

82. Answer (3)

Hint: $Ag_2CrO_4 \rightleftharpoons 2Ag^+ + CrO_4^{2-}$

$K_{SP} = [Ag^+]^2[CrO_4^{2-}]$

Sol.: $\underset{S}{Ag_2CrO_4} \rightleftharpoons \underset{2S}{2Ag^+} + \underset{S}{CrO_4^{2-}}$

$\underset{0.1}{AgNO_3} \rightleftharpoons \underset{0.1}{Ag^+} + NO_3^-$

$K_{SP} = (Ag^+)^2(CrO_4^{2-})$

$1.1 \times 10^{-12} = (2S + 0.1)^2(S)$

$1.1 \times 10^{-12} = (0.1)^2S$

$$S = \frac{1.1 \times 10^{-12}}{0.1 \times 0.1} \Rightarrow 1.1 \times 10^{-10}$$

83. Answer (3)

Hint: In neutral species, sum of oxidation state of each elements is zero

Sol.: In $A_2(BC_3)_3$;

2 × (+3) + 3 (4 – 6) = 0

6 – 6 = 0

84. Answer (1)

Hint: In a homogenous system, all the reactants and products are in the same phase

Sol.: $2C(s) + O_2(g) \rightleftharpoons 2CO(g)$ is heterogenous equilibrium.

85. Answer (3)

Hint: Equilibrium constant for the reverse reaction is the inverse of the equilibrium constant of original reaction.

Sol.: $2A(g) + B(g) \rightleftharpoons 2C(g)$, K = 16

$$2C(g) \rightleftharpoons 2A(g) + B(g),\ K' = \frac{1}{K} \Rightarrow \frac{1}{16}$$

$$C(g) \rightleftharpoons A(g) + \frac{B}{2}(g),\ K'' = \sqrt{\frac{1}{K}} = \frac{1}{4}$$

86. Answer (3)

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

Sol.: In N_2O_5; oxidation number of nitrogen is +5. It cannot undergo further oxidation.

In MnO_4^-; oxidation number of Mn is +7. It cannot undergo further oxidation.

In $Cr_2O_7^{2-}$; oxidation number of Cr is +6. It cannot undergo further oxidation.

87. Answer (4)

Hint & Sol.: $H_2C_2O_4$ is a dibasic acid

$$H_2C_2O_4 \rightleftharpoons H^+ + HC_2O_4^-;\ K_{a_1}$$

$$HC_2O_4^- \rightleftharpoons H^+ + C_2O_4^{2-};\ K_{a_2}$$

$$K = K_{a_1} \times K_{a_2}$$

$$\log K = \log K_{a_1} + \log K_{a_2}$$

88. Answer (1)

Hint: For weak base and strong acid salt.

$$pH = 7 - \frac{1}{2}pK_b - \frac{1}{2}\log C$$

Sol.: $pH = 7 - \frac{1}{2}pK_b - \frac{1}{2}\log C$

$$= 7 - \frac{1}{2} \times 4.75 - \frac{1}{2}\log\left(\frac{1}{15}\right)$$

= 5.2

89. Answer (3)

Hint: $K_w = [H_3O^+][OH^-]$

Sol.: $K_w = 10^{-6} \times 10^{-6}$

$K_w = 10^{-12}$

$pK_w = -\log K_w$

$pK_w = 12$

90. Answer (1)

Hint: For weak acid weak base salt at 25°C

$$pH = 7 + \frac{1}{2}pK_a - \frac{1}{2}pK_b$$

Sol.: $K_h = \frac{K_w}{K_a} = \frac{10^{-14}}{1.8 \times 10^{-5}} = 5.5 \times 10^{-10}$

[BOTANY]

91. Answer (1)

Hint: The floral diagram is of solanaceae family.

Sol.: Solanaceae has bicarpellary ovary. Persistent calyx is not visible in floral diagram. Position of ovary with other floral parts is also not visible in floral diagram.

92. Answer (4)

Hint: Sieve tube element possess a peripheral cytoplasm and a large vacuole at maturity.

Sol.: Sclereids are abundant in tea leaves and fruit walls of nuts. Bast fibres are much elongated and unbranched. Tracheids are found in all categories of vascular plants.

93. Answer (2)

Hint: Bulliform cells are found in monocot leaves, not in dicot leaves.

Sol.: Subsidiary cells do not possess chloroplasts but provide mechanical support to guard cells. Bulliform cells are colourless, empty, modified adaxial epidermal cells.

94. Answer (3)

Hint: There are usually two to four xylem and phloem patches in dicot root.

Sol.: Hypodermis, bundle sheath cells and polyarch xylem bundles are not seen in dicot root.

95. Answer (3)

Hint: Monocots and dicots are anatomically different.

Sol.: Epidermal tissue system provides protection from external injuries, excessive evaporation, secondary solar radiations, etc. with the help of cuticle, trichomes, etc.

96. Answer (4)

Hint: Calyx and corolla are accessory organs in a flower.

Sol.: Bulb modification is seen in onion. Pea and castor are dicots.

97. Answer (1)

Hint: Pericycle is sclerenchymatous in dicot stem.

Sol.: In dicot stem, pith rays help in the radial conduction of food.

98. Answer (3)

Hint: Trichomes are epidermal outgrowths on stem, not in roots.

Sol.: Trichomes are mainly helpful in preventing water loss due to transpiration. They are usually multicellular, may be soft or stiff.

99. Answer (2)

Hint: Albuminous cells are found in gymnosperms in place of companion cells.

Sol.:

- Phloem parenchyma – Absent in monocots
- Vessels – Exclusive feature of flowering plants.
- Xylem parenchyma – Radial conduction of water

100. Answer (3)

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

Sol.: Endodermis is innermost layer of cortex, and present outside the pericycle. It is not the part of stele.

101. Answer (2)
Hint: In monocot stem, ground tissue is not differentiated into cortex and pith.
Sol.: Pith, pericycle and medullary rays are absent in monocot stem.

102. Answer (3)
Hint: Bundle sheath can be found in monocot stem and dicot leaf.
Sol.: Ring arrangement of vascular bundles are seen in dicot stem.

103. Answer (2)
Hint: Casparian strips are found in the innermost layer of cortex in roots.
Sol.: Casparian strips are found in the endodermis of root.

104. Answer (3)
Hint: Large, empty, colourless cells are found in monocot leaf, not in dicot leaf.
Sol.: In monocot leaf, equal number of stomata are present on lower and upper epidermis and mesophyll is differentiated in dicot leaf.

105. Answer (3)
Hint: Pericycle is the innermost layer of stele.
Sol.: Pericycle is composed of thick walled parenchyma cells and become meristematic when required.

106. Answer (1)
Hint: Ground tissue system forms main bulk of plant.
Sol.: Ground tissue system is also called the fundamental tissue system.

107. Answer (3)
Hint: Guard cells possess chloroplasts and regulate opening and closing of stomata.
Sol.: Guard cells have thin outer walls (away from stomatal pore) and thick inner walls (towards the stomatal pore).

108. Answer (3)
Hint: In conjoint type of vascular bundles, xylem and phloem are jointly situated along the same radius of vascular bundles.
Sol.: In stems and leaves, the conjoint type of vascular bundles are seen. In roots, radial type is seen.

109. Answer (3)
Hint: Pith is small and inconspicuous in dicot root, while it is well developed in monocot root.
Sol.: Hypodermis is absent in roots but found in stem.

110. Answer (2)
Hint: Conjunctive tissue is found in roots and palisade parenchyma is found in leaves.
Sol.: Palisade parenchyma and conjunctive tissue (parenchymatous) both are made up of simple tissue that forms major component within plant organs.

111. Answer (3)
Hint: In brinjal, epipetalous stamens are found.
Sol.: • Apocarpous ovary – Rose
• Berry fruit – Tomato
• Legume fruit – Muliathi

112. Answer (3)
Hint: Bracts are reduced leaf found at the base of the pedicel.
Sol.: Calyx is the outermost whorl of flower and its members are called sepals, which are green, leaf-like and protect the flower in bud stage.

113. Answer (2)
Hint: Pineapple is a composite fruit.
Sol.: Pineapple develops from entire inflorescence.

114. Answer (2)
Hint: Muliathi and Indigofera have zygomorphic flowers.
Sol.: Belladonna is a medicinal plant of solanaceae family.

115. Answer (4)
Hint: Both coconut and mango are drupe type of fruits.
Sol.: Coconut fruit has fibrous mesocarp but in mango, mesocarp is fleshy.

116. Answer (2)
Hint: Gram has non-endospermous seeds.
Sol.: Members of solanaceae family *e.g.*, *Petunia* show the characteristics like-
• Exstipulated leaves
• Persistent calyx
• Endospermous seed
• Tap root system

117. Answer (2)
Hint: % represents the zygomorphic flower.
Sol.: $\overset{\frown}{C\ A}$ – Epipetalous
G_n - Apocarpous ovary

118. Answer (3)
Hint: Canna produces asymmetric flowers
Sol.: Tobacco, Makoi, Brinjal produces actinomorphic flowers.

119. Answer (1)
Hint: Endosperm is not present in mature seeds of gram.
Sol.: Endosperm is found in castor.

120. Answer (2)
Hint: In members of Asteraceae family, basal placentation can be seen.

Sol.: Marigold shows development of placenta at the base of ovary.

121. Answer (3)
Hint: Hypogynous flowers have superior ovary
Sol.: In epigynous flowers, ovary is inferior and the other parts arise above it.

122. Answer (1)
Hint: Pea has non-endospermous seeds.
Sol.: Endosperm in pea is consumed by developing embryo.

123. Answer (2)
Hint: Cotyledons are full of reserve food materials and often are fleshy.
Sol.: • Vexillum – Standard, which overlaps the two lateral petals
• Staminode – Sterile stamen
• Receptacle or thalamus – Swollen end of pedicel

124. Answer (3)
Hint: In parthenocarpy, fruit develops without fertilisation
Sol.: Banana is an example of parthenocarpic fruit

125. Answer (3)
Hint: In pea, stamens are united into two bundles.
Sol.: In *Salvia*, length of filaments varies.

126. Answer (2)
Hint: In wheat, basal placentation is seen, where single ovule is attached to placenta.
Sol.:

•	*Triticum aestivum*	–	
•	*Dianthus*	–	
•	*Hibiscus*	–	
•	*Argemone*	–	

127. Answer (3)
Hint: In China rose, mustard and makoi syncarpous ovary is seen.
Sol.: In China rose, valvate aestivation is seen in calyx, not corolla. Polysepalous condition is found in mustard.

128. Answer (2)
Hint: Testa is the outer layer of seed coat.
Sol.: Hilum is a scar on the seed coat through which developing seeds were attached to the fruit.

129. Answer (2)
Hint: Coleoptile is a sheath which encloses the plumule.
Sol.: Scutellum is a shield shaped cotyledon in monocots.

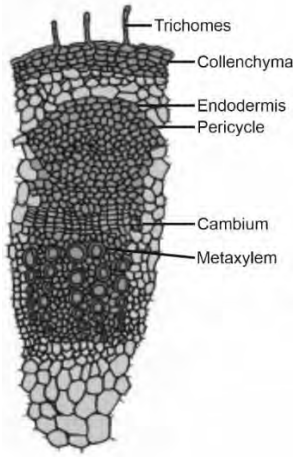
130. Answer (3)
Hint: Endosperm is a result of double fertilisation, for providing nourishment to developing embryo.
Sol.: Embryo is small and situated in a groove at one end of endosperm in maize seed.

131. Answer (3)
Hint: In flowers of cucumber and guava, ovary is inferior.
Sol.: In plum, rose and peach, perigynous flowers are found.

132. Answer (2)
Hint: In cotton and china rose, monoadelphous condition is found.
Sol.: In *Citrus*, polyadelphous condition is seen.

133. Answer (2)
Hint: Vexillary aestivation is seen in Fabaceae family.
Sol.: Bean being a members of Fabaceae shows vexillary aestivation.

134. Answer (3)
Hint: The given structure is of dicot stem in which endarch type of xylem is seen.
Sol.: Hypodermis is made up of collenchyma tissue which is absent in monocot plants.



135. Answer (2)
Hint: Monocot stem lacks endodermis.
Sol.: Monocot has conjoint vascular bundles where phloem is situated on the outer side of xylem.

[ZOOLOGY]

136. Answer (4)
Hint: Plays a role in T-lymphocyte differentiation
Sol.: Hormones are secreted by some tissues which are not organised endocrine glands. Erythropoietin is secreted by JG cells of kidneys; gastrin and secretin are secreted by endocrine cells of GIT. Thymosin is secreted by an organised endocrine gland called thymus.

137. Answer (4)
Hint: Antagonistic to glucagon
Sol.: Insulin acts on hepatocytes and adipocytes and enhances cellular glucose uptake which results in decreased blood glucose levels. Cortisol, glucagon and adrenaline increase blood sugar levels.

138. Answer (2)
Hint: Similar to glucagon in chemical nature
Sol.: β-cells of pancreas secrete insulin which is a peptide hormone. It is a hypoglycaemic hormone that increases cellular glucose uptake. Glucagon released from α-cells is a hyperglycaemic hormone. It reduces cellular glucose uptake and stimulates glycogenolysis.
Insulin requires second messengers to show its effect.

139. Answer (4)
Hint: Source of a mineralocorticoid
Sol.: Aldosterone is a mineralocorticoid secreted from the adrenal cortex. It is mainly responsible for controlling osmoregulation in humans. Adrenal medulla secretes catecholamines and parathyroid gland secretes PTH.
PTH is responsible for calcium homeostasis.
Pancreas secrete hormones that maintain glucose homeostasis.

140. Answer (2)
Hint: Secreted from the gland located on dorsal side of forebrain
Sol.: Melatonin, secreted from the pineal gland, plays a very important role in the regulation of the 24 hour (diurnal) rhythm of our body.
MSH and TSH are secreted from adenohypophysis.

141. Answer (3)
Hint: All interact with intracellular receptors.
Sol.: Cortisol, progesterone and estrogen are chemically steroids and their mode of action is similar *i.e.*, they all interact with intracellular receptors. Cortisol is secreted from adrenal cortex (located in the abdominal region) while estrogen and progesterone are secreted from ovary and placenta.

142. Answer (4)
Hint: Decreases blood pressure
Sol.: ANF is secreted from the atrial wall of the heart and is a peptide hormone. It is a vasodilator.

143. Answer (3)
Hint: Glucocorticoids
Sol.: Glucocorticoids, particularly cortisol, released from the adrenal cortex produce anti-inflammatory reactions and suppress the immune response. Cortisol is also involved in maintaining the cardiovascular system as well as the kidney functions. Glucocorticoids are steroids that stimulate lipolysis.

144. Answer (1)
Hint: TCT is antagonistic to PTH.
Sol.: PTH increases the Ca^{+2} levels in blood. PTH stimulates the process of bone resorption and also stimulates reabsorption of Ca^{+2} by the renal tubules and increases Ca^{+2} absorption from the digested food. It is thus clear that PTH is a hypercalcemic hormone.

145. Answer (2)
Hint: Synaptic cleft is present between pre and post-synaptic membrane.
Sol.: The receptors for neurotransmitters released from synaptic vesicles are present on the post-synaptic membrane. A synapse is formed by the membranes of pre-synaptic neuron and a post-synaptic neuron, which may or may not be separated by a gap called synaptic cleft.

146. Answer (3)
Hint: Potential difference across the membrane
Sol.: Neurons are excitable cells because their membranes are in a polarised state. Neurons have only one axon but may have more than one dendrites.

147. Answer (4)
Hint: Connects both the components of CNS
Sol.: Brain stem forms the connection between the brain and spinal cord. Two cerebral hemispheres are connected by corpus callosum.

148. Answer (3)
Hint: Also called Graves' disease
Sol.: Exopthalmic goitre is a form of hyperthyroidism characterised by enlargement of thyroid gland, protrusion of eyeballs, increased BMR and weight loss, also called Graves' disease. Disease caused by the underproduction of hormones of adrenal cortex is called Addison's disease.

149. Answer (3)

Hint: Myelin sheath is absent

Sol.: Unmyelinated nerve fibre is enclosed by a Schwann cell that does not form a myelin sheath around the axon, and is commonly found in autonomous and the somatic neural systems.

Nodes of Ranvier will not be present in an unmyelinated neuron.

Axolemma is the cell membrane of the axon.

Neurilemma is the cytoplasmic sheath of Schwann cell that is present over the unmyelinated axon.

150. Answer (4)

Hint: Skull includes both facial and cranial bones.

Sol.: The human brain is well protected by the skull. The skull is composed of 8 paired bones.

151. Answer (3)

Hint: A steroid hormone

Sol.: The corpus luteum secretes mainly progesterone. Progesterone supports pregnancy. It also acts on the mammary glands and stimulates the formation of alveoli and milk secretion.

152. Answer (4)

Hint: Secretion of adrenal medulla

Sol.: The adrenal medulla secretes two hormones called adrenaline or epinephrine and noradrenaline or norepinephrine. These are commonly called catecholamines.

Cortisol is a glucocorticoid.

Aldosterone is a mineralocorticoid.

153. Answer (3)

Hint: CCK acts on gall bladder.

Sol.: Secretin – Acts on the exocrine pancreas and stimulates the secretion of water and bicarbonate ions.

GIP – Inhibits gastric secretion and motility.

CCK – Acts on both pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juices, respectively.

Gastrin – Acts on the gastric glands and stimulates the secretion of HCl and pepsinogen.

154. Answer (2)

Hint: It is divided into 3 layers.

Sol.: Adrenal cortex secretes a small amount of androgenic steroids which play a role in the growth of axial hair, pubic hair and facial hair during puberty. Thymus secretes thymosins while adrenal medulla secretes catecholamines.

Neurohypophysis stores and releases oxytocin and vasopressin.

155. Answer (4)

Hint: In vertebrates, the heart is located on the ventral side.

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

Thymosin plays a major role in the differentiation of T-lymphocytes, but it also promotes the production of antibodies.

156. Answer (3)

Hint: Located in the CNS region

Sol.: Melatonin is a peptide hormone which influences metabolism and pigmentation. It is secreted from the pineal gland that is located on the dorsal side of the forebrain. The two lobes of the thyroid gland is located one on either side of the trachea. Four parathyroid glands are present on the back side of the thyroid gland.

157. Answer (2)

Hint: Pia mater remains in contact with the brain tissue.

Sol.: The correct order of cranial meninges from inner side to outside is :

Pia mater $\rightarrow$ Arachnoid $\rightarrow$ Dura mater

158. Answer (2)

Hint: Contains convoluted surface

Sol.: Thalamus and cerebrum are the parts of forebrain.

The dorsal portion of the midbrain consists of four round swellings called corpora quadrigemina.

The cerebellum plays a role in motor movement regulation and balance control.

159. Answer (3)

Hint: Axon emerges out from the cyton.

Sol.: The axon transmits nerve impulses away from the cell body towards the nerve endings while dendrites conduct nerve impulse towards the cell body.

160. Answer (3)

Hint: A gonadotrophin

Sol.: ACTH stimulates the synthesis and secretion of steroid hormones called glucocorticoids from the adrenal cortex. GnRH stimulates the anterior pituitary to synthesise and release gonadotrophins. LH and FSH are called gonadotrophins.

161. Answer (3)

Hint: Exclude hormones associated with neurohypophysis.

Sol.: Hypothalamus secretes somatostatin that inhibits the release of growth hormone from the anterior pituitary gland. Neurohypophysis stores and releases oxytocin and vasopressin (ADH), which are actually synthesised by the hypothalamus and are transported axonally to neurohypophysis.

162. Answer (4)

Hint: Produces ADH and oxytocin

Sol.: Here, 'P' represents hypothalamus. It is the basal part of diencephalon; forebrain and it regulates a wide spectrum of body functions. The posterior pituitary is under the direct neural regulation of the hypothalamus. Pituitary gland is located in the sella tursica and anatomically divided into adenohypophysis and neurohypophysis.

163. Answer (4)

Hint: Half of the total number of fingers present in the forelimb.

Sol.: Peptide hormones interact with membrane-bound receptors while steroid hormones and iodothyronine interact with intracellular receptors. FSH, prolactin, thyrocalcitonin, erythropoietin and glucagon are peptide hormones; hence they interact with membrane-bound receptors.

164. Answer (4)

Hint: Helps in osmoregulation

Sol.: Aldosterone acts mainly at the renal tubules and stimulates the reabsorption of Na^+ and water and excretion of K^+ and phosphate ions. Thus, aldosterone helps in the maintenance of the electrolytes, body fluid volume, osmotic pressure and blood pressure.

165. Answer (1)

Hint: Major portion of pancreas is exocrine in nature.

Sol.: Pancreas is a composite gland. The endocrine part of pancreas consists of Islets of Langerhans. There are about 1 to 2 million of Islets of Langerhans in a normal human pancreas representing only 1 to 2 per cent of the pancreatic tissue. Two main types of cells in the Islets of Langerhans are α-cells and β-cells. They secrete glucagon and insulin, respectively. These are peptide hormones.

Other cells present in the Islets of Langerhans are delta cells and pancreatic polypeptide cells.

166. Answer (3)

Hint: Secreted from pars intermedia

Sol.: Pars distalis produces GH, PRL, TSH, ACTH, FSH and LH. Pars intermedia secretes only one hormone called MSH.

167. Answer (3)

Hint: Testis and ovary

Sol.: Liver, heart, kidney, GIT, *etc.*, are not organised endocrine structures but secrete certain hormones. Gonads are organised endocrine bodies.

168. Answer (2)

Hint: Energy currency of the cell

Sol.: Hormones are intercellular messengers. Hormones which interact with membrane-bound receptors normally do not enter the target cells, but generate second messengers, *e.g.,* cyclic AMP, IP_3, Ca^{++}, *etc*.

ATP does not act as the second messenger.

169. Answer (2)

Hint: Cytoplasm of cell body is rich in Nissl's granules.

Sol.: Nissl's granules are absent in axoplasm.

Dendrites and cell body contain the Nissl's granules.

The glial cells perform many house-keeping functions, for example-astrocytes provide nutritional support to neurons.

170. Answer (4)

Hint: Eliminate the functions of hypothalamus

Sol.: The association areas are responsible for complex functions like intersensory association, memory and communication. Hypothalamus has centres for controlling the body temperature.

171. Answer (1)

Hint: Neurotransmitters are not required in electrical synapses.

Sol.: In chemical synapses, release of neurotransmitters and stimulation of post-synaptic neuron consume extra time that results in synaptic delay, while in electrical synapses, neurotransmitters are not used.

172. Answer (3)

Hint: Hypothalamus is a part of brain.

Sol.: Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts. Hypothalamus is a part of brain which secretes many hormones.

173. Answer (4)

Hint: One of them helps in water retention.

Sol.: GnRH, oxytocin and vasopressin are synthesised by the hypothalamus; gonadotropins are secreted from the anterior pituitary. Oxytocin and vasopressin are axonally transported to the neurohypophysis and released from there according to the requirement.

174. Answer (3)

Hint: Water retention is hampered.

Sol.: Gigantism and acromegaly are caused due to hypersecretion of growth hormone while dwarfism is caused due to hyposecretion of growth hormone. Diabetes insipidus is caused due to the hyposecretion of ADH.

175. Answer (2)

Hint: Emergency hormones.

Sol.: Under acute stress, sympathetic nervous system stimulates the adrenal medulla to secrete epinephrine. This leads to increased heart rate and increased blood glucose level to provide energy to combat the stressful situation.

176. Answer (4)

Hint: Parasympathetic effect

Sol.: Hormones of fight or flight increase alertness, pupillary dilation, piloerection, *etc*. They also increase the heartbeat, rate the strength of heart contraction, the rate of respiration, *etc*.

177. Answer (4)

Hint: Secreted from the adrenal medulla

Sol.: Epinephrine is an amino acid derived hormone, while insulin, glucagon, somatostatin, *etc*., are peptide hormones.

178. Answer (2)

Hint: Generation of second messenger is important to amplify the signal.

Sol.: The correct order of action is:-

- Binding of hormone with membrane-bound receptors
- Generation of second messenger
- Biochemical response
- Physiological response

179. Answer (3)

Hint: Components of ANS

Sol.: The autonomic nervous system is divided into sympathetic and parasympathetic neural systems. Neural signals from sympathetic neural system increase the strength of ventricular contraction, rate of heart beat and cardiac output while parasympathetic neural system has effects opposite to that of sympathetic neural system.

180. Answer (2)

Hint: Equal to the number of ear ossicles in one ear of man

Sol.: The inner part of cerebral hemispheres and group of associated deep structures like amygdala, hippocampus, *etc*., form a complex structure called the limbic lobe or limbic system. Along with the hypothalamus, it is involved in the regulation of sexual behaviour, expression of emotional reactions and motivation.

❑ ❑ ❑

All India Aakash Test Series for NEET - 2027

TEST - 4 (Code-D)

Click here for Code-C Sol.

Test Date : 25/01/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint: Use, $\tau = I\alpha$

Sol.: Let impulse due to hinge is N

$P - N = mv_{cm}$

$P - N = mR\omega$

$P(R + \alpha) = I\omega$

$P(R + \alpha) = \frac{3}{2}mR^2\omega$

For $N = 0$,

$mR\omega(R + \alpha) = \frac{3}{2}mR^2\omega$

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

2. Answer (2)

Hint: Use parallel axis theorem

Sol.: $I = \frac{MR^2}{2} + MR^2 = \frac{3MR^2}{2}$

3. Answer (3)

Hint & Sol.: As the radius of sphere is decreased keeping the mass constant, the angular momentum would remain constant.

4. Answer (3)

Hint: Use, $\vec{\tau} = \vec{r} \times \vec{F}$

Sol.: $\vec{\tau} = 4\hat{k} \times 6\hat{j} = -24\hat{i}$ N m

5. Answer (4)

Hint & Sol.: The COM of system must lie at diagonal BD if $m_1 = m_3$.

6. Answer (4)

Hint & Sol.: The escape velocity of a body depends upon mass and radius of planet while it is independent of mass of body.

7. Answer (3)

Hint: $v_{orbital} = \sqrt{\frac{GM}{R+h}}$

Sol.: $v_{orbital} = \sqrt{\frac{GM}{R+h}}$ and $g = \frac{GM}{R^2}$

$v_0 = \sqrt{\frac{gR^2}{R+x}}$

8. Answer (1)

Hint & Sol.: When all five point masses are placed, $|\vec{E}_G| = 0$ & $V = \frac{-5Gm}{a}$

When one mass is removed,

$|\vec{E}_G| = \frac{Gm}{a^2}$ & $V = \frac{-4Gm}{a}$

9. Answer (3)

Hint: Use, $\vec{a}_{COM} = \frac{m_1\vec{a_1} + m_2\vec{a_2}}{m_1 + m_2}$

Sol.: $\left.\begin{matrix} m_2g - T = m_2a & ...(1) \\ T = m_1a & ...(2) \end{matrix}\right\rangle a = \frac{m_2g}{m_1 + m_2}$

$|\vec{a}_{COM,\,y}| = \frac{m_1 \times 0 + m_2 \times \frac{m_2g}{m_1 + m_2}}{m_1 + m_2} = \left(\frac{m_2}{m_1 + m_2}\right)^2 g$

10. Answer (2)

Hint: Use conservation of energy

Sol.: Using conservation of energy,

$m \times g \times \frac{1}{2} = \frac{1}{2}I\omega^2$

$\Rightarrow \quad m \times g \times \frac{1}{2} = \frac{1}{2} \times \frac{m \times (1)^2}{3}\omega^2$

$\Rightarrow \quad \omega^2 = 3g \Rightarrow \omega = \sqrt{3g}$

$\Rightarrow$ Velocity = $r\omega = \sqrt{3g} = 5.42$ ms^{-1}

11. Answer (1)

Hint & Sol.: Kinetic energy due to rotation

$= \frac{1}{2}I\omega^2 = \frac{1}{2} \times mr^2 \times \omega^2 = \frac{mr^2\omega^2}{2}$

12. Answer (2)

Hint: More is the mass away from axis of rotation, more will be the moment of inertia.

Sol.: The moment of inertia would be higher when the core is made up of wood and iron is at outer rim of the disc.

13. Answer (3)

Hint & Sol.: The moment of inertia of any object is minimum about an axis passing through its centre of mass.

14. Answer (2)

Hint: $\vec{\tau} = \vec{r} \times \vec{F}$

Sol.: Since, $\vec{\tau} = \vec{r} \times \vec{F}$, $\vec{\tau} \cdot \vec{r} = 0$ & $\vec{F} \cdot \vec{\tau} = 0$

15. Answer (1)

Hint: Use, $\tau = I\alpha$

Sol.: $\theta = 4t^3 - 12t^2 \Rightarrow \omega = 12t^2 - 24t$

$\Rightarrow \alpha = 24t - 24$

$\alpha = 0 \Rightarrow t = 1$

16. Answer (1)

Hint: Use principle of superposition

Sol.: Mass of portion which has been cut out,

$$M' = \frac{M \times \pi \times 4}{\pi \times 36}$$

$$\Rightarrow \quad M' = \frac{M}{9}$$

Shift

$$= \frac{M \times 0 - \frac{M}{9} \times 3.2}{M - \frac{M}{9}} = \frac{\frac{-M}{9} \times 3.2}{\frac{8M}{9}} = \frac{-3.2}{8} = -0.4 \text{ cm}$$

i.e., there is a shift of 0.4 cm

17. Answer (4)

Hint: Gravitational force, $F_G = \frac{Gm_1m_2}{r^2}$

Sol.: When the point masses are at separation x, then

$$F_G = \frac{GMm}{x^2} \Rightarrow a_1 = \frac{Gm}{x^2} \ \& \ a_2 = \frac{GM}{x^2}$$

$$\Rightarrow \quad a_{rel} = \frac{G(M+m)}{x^2}$$

18. Answer (2)

Hint & Sol.: The astronaut will be in the condition of weightlessness, hence weight will be zero.

19. Answer (2)

Hint: Angular momentum of planet, $|\vec{L}| = mvr$

Sol.: We know that, $L = mvr \Rightarrow v = \frac{L}{mr}$

$$K = \frac{1}{2}mv^2 = \frac{1}{2} \times m \times \frac{L^2}{m^2r^2} = \frac{L^2}{2mr^2}$$

20. Answer (2)

Hint & Sol.: The centre of mass of two particle system lies on the line joining the two particles.

21. Answer (1)

Hint: Use, $\vec{r}_F - \vec{r}_i = \vec{v} \times t$

Sol.: 6 m/s ← ● ● → 4 m/s

$x = 10$ m $\quad$ $x = 12$ m

$$X_{COM} = \frac{m_1x_1 + m_2x_2}{m_1 + m_2} = \frac{1 \times 10 + 2 \times 12}{3}$$

$$= \frac{10 + 24}{3} = \frac{34}{3} \text{ m}$$

$$V_{COM} = \frac{-1 \times 6 + 2 \times 4}{3} = \frac{8 - 6}{3} = \frac{2}{3} \text{ m/s}$$

$$X_F - X_i = V \times t \Rightarrow X_F = \frac{34}{3} + \frac{2}{3} \times 2$$

$$X_F = \frac{34}{3} + \frac{4}{3} = \frac{38}{3} \text{ m}$$

22. Answer (3)

Hint & Sol.: When two masses come together their gravitational potential energy decreases as work done by gravitational force is positive.

$W_{cons} = -\Delta U$

23. Answer (2)

Hint: $g' = g\left[1 - \frac{d}{R}\right]$

Sol.: $g' = g\left[1 - \frac{R}{2R}\right] = \frac{g}{2} = 4.9 \text{ m/s}^2$

24. Answer (3)

Hint & Sol.: If $P.E = E_0 \Rightarrow T.E = \frac{E_0}{2}$ &

$$K.E = \frac{-E_0}{2}$$

25. Answer (4)

Hint: Areal velocity, $\frac{dA}{dt} = \frac{L}{2m}$

Sol.: $\frac{dA}{dt} = \frac{L}{2m}, L = mvr \Rightarrow \frac{dA}{dt} = \frac{mvr}{2m} = \frac{vr}{2}$

$$\Rightarrow \quad \frac{dA}{dt} = \frac{10 \times 1.2 \times 10^9}{2} = 6 \times 10^9 \text{ km}^2\text{s}^{-1}$$

26. Answer (3)

Hint: Angular acceleration is defined as rate of change of angular velocity.

Sol.: $\alpha = \frac{\omega_f - \omega_i}{\Delta t} \Rightarrow \alpha = \frac{2\pi}{60} \frac{[4500 - 1200]}{10}$

$$\Rightarrow \quad \alpha = 2\pi\left[\frac{4500}{600} - \frac{1200}{600}\right] = 2\pi \times \left(\frac{15 - 4}{2}\right)$$

$= 11\pi$ rad/s^2

27. Answer (4)

Hint: Use conservation of angular momentum

Sol.: $L = I_1\omega_1 = I_2\omega_2 \Rightarrow MK_1^2\omega_1 = MK_2^2\omega_2$

$$\Rightarrow \quad \frac{K_1}{K_2} = \sqrt{\frac{\omega_2}{\omega_1}}$$

28. Answer (2)

Hint: Angular speed, $\omega = \frac{2\pi f}{60}$

Sol.: $f = \frac{90}{60}$ rev/s

$\omega = 2\pi \times \frac{90}{60} = 3\pi$ rad/s

29. Answer (1)

Hint & Sol.: In case of thin uniform spherical shell,

$V = \frac{-GM}{R}$, for $r \le R$

and $V = \frac{-GM}{r}$, for $r > R$

30. Answer (2)

Hint: Use work energy theorem

Sol.: $W = \Delta U = U_f - U_i = \frac{-GMm}{\frac{3R}{2}} + \frac{GMm}{R}$

$W = \frac{-2GMm}{3R} + \frac{GMm}{R} = \frac{GMm}{3R} = \frac{gR^2 \times m}{3R} = \frac{gmR}{3}$

31. Answer (1)

Hint: Use, $g' = g\left[1 - \frac{2h}{R_e}\right]$

Sol.: $\frac{g'}{g} = 1 - \frac{2h}{R_e}$

$\Rightarrow \quad \frac{2h}{R_e} = \frac{2}{100} \Rightarrow h = \frac{R_e}{100}$

32. Answer (2)

Hint: Use, $X_{COM} \times \int dM = \int x dM$

Sol.: $X_{COM} = \frac{\int x dM}{\int dM}$,

d$M = \lambda dx$, ($\lambda = kx$)

$\therefore \quad dM = kx dx$

$X_{COM} = \frac{\int_0^L kx^2 dx}{\int_0^L kx dx} = \frac{\left[\frac{kx^3}{3}\right]_0^L}{\left[\frac{kx^2}{2}\right]_0^L} = \frac{\frac{L^3}{3}}{\frac{L^2}{2}} = \frac{2L}{3} = 2$ m

Distance of centre of mass from end B

$= 3 - 2 = 1$ m

33. Answer (1)

Hint & Sol.: Centre of mass may or may not coincide with the centre of gravity of body and COM is the point at which total mass can be assumed to be concentrated.

34. Answer (4)

Hint & Sol.: Since initially the system is at rest and no net external force is acting, hence COM would continue to remain at rest.

35. Answer (1)

Hint: Use principle of superposition.

Sol.:

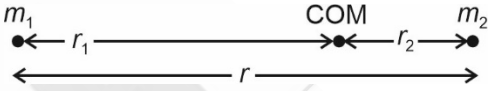
$\Rightarrow \quad V_R = \frac{-GM}{3R} + \frac{G \times \left(\frac{M}{64}\right)}{\left(2R + \frac{R}{4}\right)} = \frac{-GM}{3R} + \frac{\frac{GM}{64}}{\frac{9R}{4}}$

$= \frac{-GM}{3R} + \frac{GM}{144R} = \frac{-47GM}{144R}$

36. Answer (1)

Hint: Gravitational force will provide necessary centripetal force.

Sol.:



$m_1 r_1 \omega^2 = m_2 r_2 \omega^2 = \frac{Gm_1 m_2}{r^2}$, and $r_1 = \frac{r(m_2)}{m_1 + m_2}$

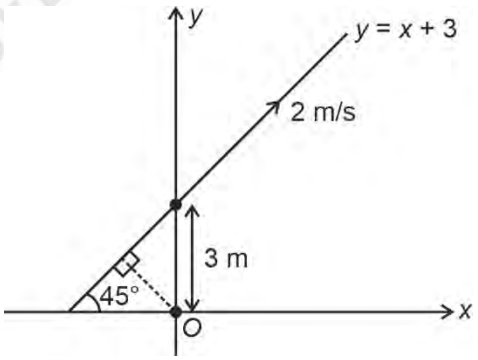
$\Rightarrow \omega^2 = \frac{G(m_1 + m_2)}{r^3}$

$\Rightarrow \quad \omega = \sqrt{\frac{G(m_1 + m_2)}{r^3}}$

37. Answer (3)

Hint: Angular momentum, $\vec{L} = \vec{r} \times \vec{p}$

Sol.:



$|\vec{L}| = \frac{1 \times 2 \times 3}{\sqrt{2}} = 3\sqrt{2}$ kg m^{2}s^{-1}

38. Answer (2)

Hint: Use conservation of angular momentum

Sol.: $L_i = MR^2 \times \omega_0$, $L_f = [MR^2 + 3mR^2] \times \omega'$

$\Rightarrow \quad MR^2 \times \omega_0 = [MR^2 + 3mR^2] \times \omega'$

$\omega' = \frac{M\omega_0}{M + 3m}$

39. Answer (2)

Hint: Use, $g = \frac{GM}{R^2}$

Sol.: $g_p = \frac{4G \times M_p}{D_p^2} = \frac{4GM_p}{D_p^2}$

40. Answer (3)

Hint & Sol.: The angular momentum remains conserved, hence $L_A = L_B = L_C$

41. Answer (1)

Hint: Use the concept of variation of acceleration due to gravity with height.

Sol.: $g' = \frac{GM}{(R+h)^2} = \frac{GM}{R^2\left(1+\frac{h}{R}\right)^2} = \frac{g}{\left(1+\frac{h}{R}\right)^2}$,

$h = \frac{R}{3}$

$\Rightarrow \quad g = \frac{9g}{16} \Rightarrow$ weight = $\frac{9}{16} \times 72 = 40.5$ N

42. Answer (4)

Hint & Sol.: The mutual gravitational force of interaction between two masses is independent of medium around them.

43. Answer (3)

Hint & Sol.: The cross product of two vectors is not commutative but it is distributive w.r.t. vector addition.

44. Answer (4)

Hint: Use, $\vec{R} = \vec{A} \times \vec{B}$

Sol.: $\vec{R} = (\hat{i} + 2\hat{j}) \times (\hat{i} - 2\hat{j})$

$\Rightarrow \quad \vec{R} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 0 \\ 1 & -2 & 0 \end{vmatrix}$

$= \hat{i}(0) + \hat{j}(0) + \hat{k}(-2-2)$

$= -4\hat{k}$

$\Rightarrow$ Unit vector = $-\hat{k}$

Similarly, $\hat{k}$ can also be a possible solution.

45. Answer (3)

Hint: Use, $P = \vec{\tau} \cdot \vec{\omega}$

Sol.: $P = \tau\omega \Rightarrow \tau = \frac{75 \times 10^3}{150} = 500$ N m

[CHEMISTRY]

46. Answer (4)

Hint: KNO_3 is the salt of strong acid and strong base.

Sol.: $\overset{+}{N}H_4 + H_2O \rightarrow NH_4OH + H^+$

It undergoes cationic hydrolysis.

47. Answer (1)

Hint: $NH_4Cl(aq) \rightarrow NH_4^+(aq) + Cl^-(aq)$

Sol.: Ionisation of NH_4OH decreases on addition of NH_4Cl due to common ion effect.

48. Answer (2)

Hint: In the presence of strong acid, ionisation of weak acid is suppressed.

Sol.:

	$HCl \rightarrow$	H^+	+	Cl^-
	0.1	–		–
	0	0.1		0.1

	$CH_3COOH \rightleftharpoons$	CH_3COO^-	+	H^+
Initial	0.01	0		0
Final	$0.01 - 0.01\alpha$	0.01α		$0.01\alpha + 0.1$

$K_a = \frac{[CH_3COO^-][H^+]}{[CH_3COOH]}$

$K_a = \frac{0.01\alpha(0.01\alpha + 0.1)}{0.01(1-\alpha)}$

$K_a = 0.1\alpha$

$\alpha = \frac{1.74 \times 10^{-5}}{0.1}$

$= 1.74 \times 10^{-4}$

$= 1.74 \times 10^{-2}\%$

49. Answer (3)

Hint:

	$Ca(OH)_2(s) \rightleftharpoons$	$Ca^{2+}(aq)$	+	$2OH^-(aq)$
		S		2S

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

$K_{sp} = 4S^3$

Sol.: For AgCl; $K_{sp} = S^2$

$S = \sqrt{1.8 \times 10^{-10}}$

$\approx 10^{-5}$ M

For CuI; $K_{sp} = S^2$

$S = \sqrt{1.1 \times 10^{-12}}$

$\approx 10^{-6}$ M

For $Ca(OH)_2$; $K_{sp} = 4S^3$

$S = \left(\frac{5.5 \times 10^{-6}}{4}\right)^{1/3}$

$\approx 10^{-2}$ M

50. Answer (4)

Hint: $A(s) \rightleftharpoons \underset{3P_B}{3B(g)} + \underset{2P_C}{2C(g)}$

$K_P = (3P_B)^3(2P_C)^2$

Sol.: $K_P = (3P_B)^3(2P_C)^2 = (3P'_B)^3(4P_C)^2$

$P_B^3 \times 4P_C^2 = P'^3_B \times 16P_C^2$

$P_B^3 = P'^3_B \times 4$

$P'_B = \frac{P_B}{(4)^{1/3}}$

51. Answer (1)

Hint: pH = –log[H⁺]

Sol.: $[H^+]_1 = 10^{-2}M;\ [H^+]_2 = 10^{-3}\ M; [H^+]_3 = 10^{-4}\ M$

$= \frac{10^{-2} \times V + 10^{-3} \times V + 10^{-4} V}{3V}$

$= \frac{1}{3}[10^{-2} + 10^{-3} + 10^{-4}]\ M$

$= \frac{1}{3} \times 10^{-2}[1 + 0.1 + 0.01]\ M$

$= \frac{1.11}{3} \times 10^{-2}\ M$

$= 0.37 \times 10^{-2}$ M

$= 3.7 \times 10^{-3}$ M

52. Answer (4)

Hint: pH = –log[H⁺]

Sol.: Millimoles of H^+ ions = 40 mmol

Millimoles of OH^- ions = 20 mmol

Millimoles of H^+ ions left = 20 mmol

$[H^+] = \frac{20}{1000} \times \frac{1000}{400} = 5 \times 10^{-2}\ M$

pH = –log[H⁺]

= –log[5 × 10⁻²]

=2 – 0.6990 = 1.3

53. Answer (3)

Hint: In case of metal hydrides, hydrogen has –1 oxidation state

Sol.: In $H\underline{Au}Cl_4$; +1 + x + 4(–1) = 0

x = +3

In $H_3\underline{P}O_4$; +3 + x + 4(–2) = 0

x = +5

In $\underline{N}H_3$; x + 3(+1) = 0

x = –3

54. Answer (4)

Hint: $\underset{S}{Hg_2I_2(s)} \rightleftharpoons \underset{S}{Hg_2^{2+}(aq)} + \underset{2S}{2I^-(aq)}$

Sol.: pH = 10

pOH = 4

$[OH^-] = 10^{-4}$ M

$Ni(OH)_2(s) \rightleftharpoons \underset{S}{Ni^{2+}(aq)} + \underset{2S+10^{-4}}{2OH^-(aq)}$

$2 \times 10^{-15} = S(2S + 10^{-4})^2$

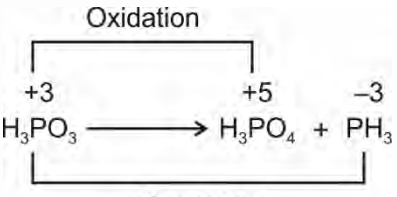
$S \times 10^{-8} = 2 \times 10^{-15}$

$S = \frac{2 \times 10^{-15}}{10^{-8}} = 2 \times 10^{-7}\ M$

55. Answer (1)

Hint: In elements, in the free or the uncombined state, each atom bears an oxidation number of zero

Sol.: • In S_8, each sulphur atom has zero oxidation state



n factor of $H_3PO_3 = \frac{2 \times 6}{8} = \frac{12}{8} = \frac{3}{2}$

Equivalent weight of $H_3PO_3 = \frac{2M}{3}$

• $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

56. Answer (1)

Hint: The element which is already present in its highest oxidation state cannot be oxidised further.

Sol.: Oxidation number of sulphur in SO_4^{2-}

x + 4(–2) = –2

x = +6

It is the highest oxidation state of sulphur. Oxidation state of phosphorus in PO_4^{3-} is

x + 4(–2) = –3

x = +5

It is the highest oxidation state of phosphorus.

57. Answer (1)

Hint: $K_C = \frac{K_f}{K_b}$

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

Sol.: $K_f = K_b \times 10$

$K_C = \frac{K_f \times 10}{K_b} = 10$

$K_p = 10 \times (0.0831 \times 100)^1$

$K_p = 83.1$

58. Answer (2)

Hint: It is an example of disproportionation redox reaction

Sol.: $S_8(s) + 12OH^-(aq) \rightarrow 4S^{2-}(aq) + 2S_2O_3^{2-}(aq) + 6H_2O(l)$

So, sum of a, b, c and d is 12 + 4 + 2 + 6 = 24

59. Answer (1)

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

Sol.:

	$2NH_4OH$	+ H_2SO_4	$\rightarrow (NH_4)_2SO_4$
Initially	6 m mol	1 m mol	
	$6-2 \Rightarrow$ 4 mmol	0 mmol	2 mmol

$pOH = 4.7 + \log\frac{2}{4}$

$= 4.7 + [\log 2 - 2\log 2]$

$= 4.7 - 1 \times 0.3$

pOH = 4.4

$pH + pOH = pK_w$

pH = 14 – 4.4 = 9.6

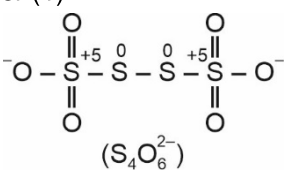
60. Answer (2)

Hint: In a displacement reaction, an ion (or an atom) in a compound is replaced by an ion (or an atom) of another element

Sol.:

List-I (Reaction)	**List-II (Type of redox reaction)**
$CH_4(g) + 2O_2(g) \xrightarrow{\Delta} CO_2(g) + 2H_2O(l)$	Combination
$Ca(s) + 2H_2O(l) \xrightarrow{\Delta} Ca(OH)_2(aq) + H_2(g)$	Non metal displacement
$2H_2O(l) \xrightarrow{\Delta} 2H_2(g) + O_2(g)$	Decomposition
$Cl_2(g) + 2OH^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + H_2O(l)$	Disproportionation

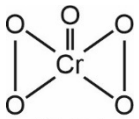
61. Answer (1)

Hint: 

$(S_4O_6^{2-})$

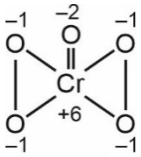
Sol.: F_2 does not show a disproportionation tendency.

62. Answer (4)

Hint: 

(CrO_5)

Sol.: In CrO_5 molecule; Cr show +6 oxidation state.



Species	**Oxidation state of sulphur**
SO_3^{2-}	+4
$S_2O_4^{2-}$	+3
$S_2O_6^{2-}$	+5

63. Answer (4)

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

Sol.: $E^\circ_{cell} = 0.80 - (-0.76)$

= 1.56 V

64. Answer (2)

Hint: Addition of inert gas at constant volume which does not take part in the reaction, the equilibrium remains undisturbed

Sol.: In the following reaction, if the pressure or temperature or both is decreased, yield of SO_3 will be minimum.

65. Answer (3)

Hint: $E^\circ_{red} \propto \frac{1}{\text{Reducing power}}$

Sol.: The correct order of reducing power will be Z > Y > X

66. Answer (1)

Hint: For weak acid weak base salt at 25°C

$pH = 7 + \frac{1}{2}pK_a - \frac{1}{2}pK_b$

Sol.: $K_h = \frac{K_w}{K_a} = \frac{10^{-14}}{1.8\times10^{-5}} = 5.5\times10^{-10}$

67. Answer (3)

Hint: $K_w = [H_3O^+][OH^-]$

Sol.: $K_w = 10^{-6} \times 10^{-6}$

$K_w = 10^{-12}$

$pK_w = -\log K_w$

$pK_w = 12$

68. Answer (1)

Hint: For weak base and strong acid salt.

$$pH = 7 - \frac{1}{2}pK_b - \frac{1}{2}\log C$$

Sol.: $pH = 7 - \frac{1}{2}pK_b - \frac{1}{2}\log C$

$$= 7 - \frac{1}{2}\times 4.75 - \frac{1}{2}\log\left(\frac{1}{15}\right)$$

= 5.2

69. Answer (4)

Hint & Sol.: $H_2C_2O_4$ is a dibasic acid

$H_2C_2O_4 \rightleftharpoons H^+ + HC_2O_4^-;\ K_{a_1}$

$HC_2O_4^- \rightleftharpoons H^+ + C_2O_4^{2-};\ K_{a_2}$

$K = K_{a_1} \times K_{a_2}$

$\log K = \log K_{a_1} + \log K_{a_2}$

70. Answer (3)

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

Sol.: In N_2O_5; oxidation number of nitrogen is +5. It cannot undergo further oxidation.

In MnO_4^-; oxidation number of Mn is +7. It cannot undergo further oxidation.

In $Cr_2O_7^{2-}$; oxidation number of Cr is +6. It cannot undergo further oxidation.

71. Answer (3)

Hint: Equilibrium constant for the reverse reaction is the inverse of the equilibrium constant of original reaction.

Sol.: $2A(g) + B(g) \rightleftharpoons 2C(g)$, K = 16

$2C(g) \rightleftharpoons 2A(g) + B(g)$, $K' = \frac{1}{K} \Rightarrow \frac{1}{16}$

$C(g) \rightleftharpoons A(g) + \frac{B}{2}(g)$, $K'' = \sqrt{\frac{1}{K}} = \frac{1}{4}$

72. Answer (1)

Hint: In a homogenous system, all the reactants and products are in the same phase

Sol.: $2C(s) + O_2(g) \rightleftharpoons 2CO(g)$ is heterogenous equilibrium.

73. Answer (3)

Hint: In neutral species, sum of oxidation state of each elements is zero

Sol.: In $A_2(BC_3)_3$;

$2 \times (+3) + 3\,(4 - 6) = 0$

$6 - 6 = 0$

74. Answer (3)

Hint: $Ag_2CrO_4 \rightleftharpoons 2Ag^+ + CrO_4^{2-}$

$K_{SP} = [Ag^+]^2[CrO_4^{2-}]$

Sol.: $\underset{S}{Ag_2CrO_4} \rightleftharpoons \underset{2S}{2Ag^+} + \underset{S}{CrO_4^{2-}}$

$AgNO_3 \rightleftharpoons \underset{0.1}{Ag^+} + \underset{0.1}{NO_3^-}$

$K_{SP} = (Ag^+)^2(CrO_4^{2-})$

$1.1 \times 10^{-12} = (2S + 0.1)^2(S)$

$1.1 \times 10^{-12} = (0.1)^2 S$

$S = \frac{1.1\times 10^{-12}}{0.1\times 0.1} \Rightarrow 1.1\times 10^{-10}$

75. Answer (1)

Hint: Weak acid and it's salt with strong base form an acidic buffer.

Sol.:

$$\underset{14\text{ m mol}}{CH_3COOH} + \underset{8\text{ m mol}}{NaOH} \rightarrow \underset{0}{CH_3COONa} + H_2O$$
$$\underset{(14-8)\Rightarrow 6\text{ m mol}}{} \quad \underset{0\text{ m mol}}{} \quad \underset{10\text{ m mol}}{}$$

It forms an acidic buffer.

$$\underset{25\text{ m mol}}{CH_3COOH} + \underset{10\text{ m mol}}{NaOH} \rightarrow \underset{0}{CH_3COONa} + H_2O$$
$$\underset{15\text{ m mol}}{} \quad \underset{0\text{ m mol}}{} \quad \underset{10\text{ m mol}}{}$$

It forms an acidic buffer.

76. Answer (4)

Hint: Mohr's salt is $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$

Sol.: $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

For 1 mole $Cr_2O_7^{2-}$ $\rightarrow$ 6 moles of Mohr's salt required

For 2 moles $Cr_2O_7^{2-}$ $\rightarrow$ 12 moles of Mohr's salt required

77. Answer (2)

Hint: The acid-base pair that differs only by one proton is called a conjugate acid-base pair

Sol.:

	Conjugate acid	Conjugate base
H_2O	H_3O^+	OH^-

78. Answer (1)

Hint & Sol.: PV = nRT

$n = \frac{PV}{RT}$

	$CO(g)$	$+ \; 2H_2(g)$	$\rightleftharpoons CH_3OH(g)$
moles at t = 0	0.2	a	0
moles at equilibrium	0.2 – x	a – 2x	0.04
	(0.2 – 0.04)	a – 0.08	0.04

Total moles at equilibrium

= 0.2 – 0.04 + a – 0.08 + 0.04

= 0.12 + a

Total moles at equilibrium can also be calculated from the following relation,

$$n = \frac{10 \times 2}{0.0821 \times 750} \Rightarrow \frac{20}{61.575} = 0.32$$

0.32 = 0.12 + a

a = 0.2

Thus moles of CO at equilibrium = 0.16

Moles of H_2 at equilibrium = 0.12

Moles of CH_3OH at equilibrium = 0.04

$$K_C = \frac{\frac{0.04}{2}}{\left(\frac{0.12}{2}\right)^2\left(\frac{0.16}{2}\right)} \Rightarrow \frac{0.02 \times 8}{0.12 \times 0.12 \times 0.16}$$

$K_C = 69.44$

79. Answer (3)

Hint: $E^\circ_{red} \propto$ oxidising power

Sol.: $Cr_2O_7^{2-}$ ion in acidic medium can oxidize Sn, Cu, Pb and Ag

80. Answer (1)

Hint: At equilibrium $\Delta G = 0$

	$2HBr(g)$	$\rightleftharpoons H_2(g)$	$+ \; Br_2(g)$
Sol.: t_i	1	0	0
	1 – 0.6	0.3	0.3

$$K = \frac{0.3 \times 0.3}{0.4 \times 0.4} = \frac{9}{16}$$

$\Delta G = \Delta G^\circ + RT\ln K$

$\Delta G^\circ = -RT\ln K$

$$= -2.303 \times 8.314 \times 400 \times \log\frac{9}{16}$$

= –2.303 × 8.314 × 400 [2log3 – 4log2]

= –2.303 × 8.314 × 400 [2 × 0.4771 – 4 × 0.3010]

= 1.91 kJ mol^{-1}

81. Answer (3)

Hint: According to Le-chatelier principle, an increase in pressure always favours the reaction, where volume or moles decrease.

Sol.: • $Fe_2O_3(s)$ is solid, it will not effect the state of equilibrium.

- $2NaNO_3(s) \rightleftharpoons 2NaNO_2(s) + O_2(g)$

  is an endothermic reactions, is supported in forward direction with increase in temperature.
- Ice(s) $\rightleftharpoons$ water(l); pressure increases, equilibrium shift in forward direction.

82. Answer (4)

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

Δn_g = gaseous moles of products – gaseous moles of reactants

Sol.: $S(s) + O_2(g) \rightleftharpoons SO_2(g)$

$\Delta n_g = 1 - 1 = 0$

$K_P = K_C(RT)$

$K_P = K_C$

- $4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(l)$

  $\Delta n_g = 4 - 9 = -5$

  $K_P = K_C(RT)^{-5}$
- $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$

  $\Delta n_g = 3 - 2 = 1$

  $K_P = K_C(RT)^1$
- $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$

  $\Delta n_g = 1 - \frac{3}{2} = \frac{-1}{2}$

  $K_P = K_C(RT)^{-½}$

83. Answer (2)

Hint: Species which can donate lone pair(s) is called Lewis base

Sol.: $AlCl_3$, BF_3, $BeCl_2$, $\rightarrow$ Lewis acid

$H_2O \rightarrow$ Lewis base

84. Answer (1)

Hint: For salt of WAWB

$$pH = 7 + \frac{1}{2}[pK_a - pK_b]$$

Sol.: $NH_4^+ + NO_3^- + H_2O \rightarrow NH_4OH + H^+ + NO_3^-$

solution is acidic in nature

85. Answer (4)

Hint: Alkali metals show +1 oxidation state.

Sol.:

- In $K\underline{O}_2$; oxidation number of oxygen

  $\Rightarrow$ +1+2x=0

$x = \frac{-1}{2}$

- In H_2O_2; oxidation number of oxygen

  $\Rightarrow +2 + 2x = 0$

  $x = -1$

86. Answer (1)

Hint: $3MnO_4^- + 5FeC_2O_4 + 24H^+ \rightarrow$

$3Mn^{2+} + 5Fe^{3+} + 10CO_2 + 12H_2O$

Sol.: For 5 moles FeC_2O_4 = 3 moles of MnO_4^- required

For 1 mole of FeC_2O_4 = $\frac{3}{5}$ mole of MnO_4^- required

87. Answer (1)

Hint: In peroxide (H_2O_2), oxidation state of oxygen atom is –1

Sol.: $BaSO_4$ $\rightarrow$ oxidation state of oxygen atom is –2.

88. Answer (4)

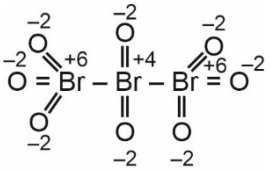
Hint: In faintly alkaline medium, Br^- is converted into BrO_3^- ion

Sol.: $2MnO_4^-(aq) + Br^-(aq) + H_2O(l) \rightarrow$

$BrO_3^-(aq) + 2OH^-(aq) + 2MnO_2(s)$

89. Answer (3)

Hint:



(Structure of Br_3O_8)

Sol.: Oxidation states of (a), (b) and (c) bromine atoms are +6, +4 and +6 respectively.

90. Answer (3)

Hint: $E^\circ_{red} \propto \frac{1}{\text{Reducing power}}$

$E^\circ_{red} \propto$ oxidising power

Sol.: In electrochemical series $F_2 + 2e^- \rightarrow 2F^-$, E° = 2.87 V so it cannot oxidised by any other species.

[BOTANY]

91. Answer (2)

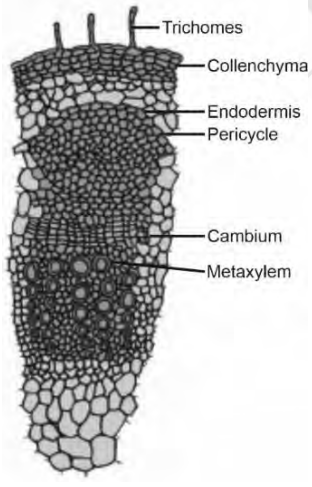
Hint: Monocot stem lacks endodermis.

Sol.: Monocot has conjoint vascular bundles where phloem is situated on the outer side of xylem.

92. Answer (3)

Hint: The given structure is of dicot stem in which endarch type of xylem is seen.

Sol.: Hypodermis is made up of collenchyma tissue which is absent in monocot plants.



93. Answer (2)

Hint: Vexillary aestivation is seen in Fabaceae family.

Sol.: Bean being a members of Fabaceae shows vexillary aestivation.

94. Answer (2)

Hint: In cotton and china rose, monoadelphous condition is found.

Sol.: In *Citrus*, polyadelphous condition is seen.

95. Answer (3)

Hint: In flowers of cucumber and guava, ovary is inferior.

Sol.: In plum, rose and peach, perigynous flowers are found.

96. Answer (3)

Hint: Endosperm is a result of double fertilisation, for providing nourishment to developing embryo.

Sol.: Embryo is small and situated in a groove at one end of endosperm in maize seed.

97. Answer (2)

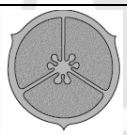
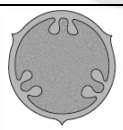
Hint: Coleoptile is a sheath which encloses the plumule.

Sol.: Scutellum is a shield shaped cotyledon in monocots.

98. Answer (2)
Hint: Testa is the outer layer of seed coat.
Sol.: Hilum is a scar on the seed coat through which developing seeds were attached to the fruit.

99. Answer (3)
Hint: In China rose, mustard and makoi syncarpous ovary is seen.
Sol.: In China rose, valvate aestivation is seen in calyx, not corolla. Polysepalous condition is found in mustard.

100. Answer (2)
Hint: In wheat, basal placentation is seen, where single ovule is attached to placenta.
Sol.:

•	*Triticum aestivum*	–	
•	*Dianthus*	–	
•	*Hibiscus*	–	
•	*Argemone*	–	

101. Answer (3)
Hint: In pea, stamens are united into two bundles.
Sol.: In *Salvia*, length of filaments varies.

102. Answer (3)
Hint: In parthenocarpy, fruit develops without fertilisation
Sol.: Banana is an example of parthenocarpic fruit

103. Answer (2)
Hint: Cotyledons are full of reserve food materials and often are fleshy.
Sol.: • Vexillum – Standard, which overlaps the two lateral petals
• Staminode – Sterile stamen
• Receptacle or thalamus – Swollen end of pedicel

104. Answer (1)
Hint: Pea has non-endospermous seeds.
Sol.: Endosperm in pea is consumed by developing embryo.

105. Answer (3)
Hint: Hypogynous flowers have superior ovary
Sol.: In epigynous flowers, ovary is inferior and the other parts arise above it.

106. Answer (2)
Hint: In members of Asteraceae family, basal placentation can be seen.
Sol.: Marigold shows development of placenta at the base of ovary.

107. Answer (1)
Hint: Endosperm is not present in mature seeds of gram.
Sol.: Endosperm is found in castor.

108. Answer (3)
Hint: Canna produces asymmetric flowers
Sol.: Tobacco, Makoi, Brinjal produces actinomorphic flowers.

109. Answer (2)
Hint: % represents the zygomorphic flower.
Sol.: $\overset{C}{\frown}\overset{A}{}$ – Epipetalous
G_n - Apocarpous ovary

110. Answer (2)
Hint: Gram has non-endospermous seeds.
Sol.: Members of solanaceae family *e.g.*, *Petunia* show the characteristics like-
• Exstipulated leaves
• Persistent calyx
• Endospermous seed
• Tap root system

111. Answer (4)
Hint: Both coconut and mango are drupe type of fruits.
Sol.: Coconut fruit has fibrous mesocarp but in mango, mesocarp is fleshy.

112. Answer (2)
Hint: Muliathi and Indigofera have zygomorphic flowers.
Sol.: Belladonna is a medicinal plant of solanaceae family.

113. Answer (2)
Hint: Pineapple is a composite fruit.
Sol.: Pineapple develops from entire inflorescence.

114. Answer (3)
Hint: Bracts are reduced leaf found at the base of the pedicel.
Sol.: Calyx is the outermost whorl of flower and its members are called sepals, which are green, leaf-like and protect the flower in bud stage.

115. Answer (3)
Hint: In brinjal, epipetalous stamens are found.
Sol.: • Apocarpous ovary – Rose
• Berry fruit – Tomato
• Legume fruit – Muliathi

116. Answer (2)

Hint: Conjunctive tissue is found in roots and palisade parenchyma is found in leaves.

Sol.: Palisade parenchyma and conjunctive tissue (parenchymatous) both are made up of simple tissue that forms major component within plant organs.

117. Answer (3)

Hint: Pith is small and inconspicuous in dicot root, while it is well developed in monocot root.

Sol.: Hypodermis is absent in roots but found in stem.

118. Answer (3)

Hint: In conjoint type of vascular bundles, xylem and phloem are jointly situated along the same radius of vascular bundles.

Sol.: In stems and leaves, the conjoint type of vascular bundles are seen. In roots, radial type is seen.

119. Answer (3)

Hint: Guard cells possess chloroplasts and regulate opening and closing of stomata.

Sol.: Guard cells have thin outer walls (away from stomatal pore) and thick inner walls (towards the stomatal pore).

120. Answer (1)

Hint: Ground tissue system forms main bulk of plant.

Sol.: Ground tissue system is also called the fundamental tissue system.

121. Answer (3)

Hint: Pericycle is the innermost layer of stele.

Sol.: Pericycle is composed of thick walled parenchyma cells and become meristematic when required.

122. Answer (3)

Hint: Large, empty, colourless cells are found in monocot leaf, not in dicot leaf.

Sol.: In monocot leaf, equal number of stomata are present on lower and upper epidermis and mesophyll is differentiated in dicot leaf.

123. Answer (2)

Hint: Casparian strips are found in the innermost layer of cortex in roots.

Sol.: Casparian strips are found in the endodermis of root.

124. Answer (3)

Hint: Bundle sheath can be found in monocot stem and dicot leaf.

Sol.: Ring arrangement of vascular bundles are seen in dicot stem.

125. Answer (2)

Hint: In monocot stem, ground tissue is not differentiated into cortex and pith.

Sol.: Pith, pericycle and medullary rays are absent in monocot stem.

126. Answer (3)

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

Sol.: Endodermis is innermost layer of cortex, and present outside the pericycle. It is not the part of stele.

127. Answer (2)

Hint: Albuminous cells are found in gymnosperms in place of companion cells.

Sol.:

- Phloem parenchyma – Absent in monocots
- Vessels – Exclusive feature of flowering plants.
- Xylem parenchyma – Radial conduction of water

128. Answer (3)

Hint: Trichomes are epidermal outgrowths on stem, not in roots.

Sol.: Trichomes are mainly helpful in preventing water loss due to transpiration. They are usually multicellular, may be soft or stiff.

129. Answer (1)

Hint: Pericycle is sclerenchymatous in dicot stem.

Sol.: In dicot stem, pith rays help in the radial conduction of food.

130. Answer (4)

Hint: Calyx and corolla are accessory organs in a flower.

Sol.: Bulb modification is seen in onion. Pea and castor are dicots.

131. Answer (3)

Hint: Monocots and dicots are anatomically different.

Sol.: Epidermal tissue system provides protection from external injuries, excessive evaporation, secondary solar radiations, etc. with the help of cuticle, trichomes, etc.

132. Answer (3)

Hint: There are usually two to four xylem and phloem patches in dicot root.

Sol.: Hypodermis, bundle sheath cells and polyarch xylem bundles are not seen in dicot root.

133. Answer (2)

Hint: Bulliform cells are found in monocot leaves, not in dicot leaves.

Sol.: Subsidiary cells do not possess chloroplasts but provide mechanical support to guard cells. Bulliform cells are colourless, empty, modified adaxial epidermal cells.

134. Answer (4)

Hint: Sieve tube element possess a peripheral cytoplasm and a large vacuole at maturity.

Sol.: Sclereids are abundant in tea leaves and fruit walls of nuts. Bast fibres are much elongated and unbranched. Tracheids are found in all categories of vascular plants.

135. Answer (1)

Hint: The floral diagram is of solanaceae family.

Sol.: Solanaceae has bicarpellary ovary. Persistent calyx is not visible in floral diagram. Position of ovary with other floral parts is also not visible in floral diagram.

[ZOOLOGY]

136. Answer (2)

Hint: Equal to the number of ear ossicles in one ear of man

Sol.: The inner part of cerebral hemispheres and group of associated deep structures like amygdala, hippocampus, *etc.*, form a complex structure called the limbic lobe or limbic system. Along with the hypothalamus, it is involved in the regulation of sexual behaviour, expression of emotional reactions and motivation.

137. Answer (3)

Hint: Components of ANS

Sol.: The autonomic nervous system is divided into sympathetic and parasympathetic neural systems. Neural signals from sympathetic neural system increase the strength of ventricular contraction, rate of heart beat and cardiac output while parasympathetic neural system has effects opposite to that of sympathetic neural system.

138. Answer (2)

Hint: Generation of second messenger is important to amplify the signal.

Sol.: The correct order of action is:-

- Binding of hormone with membrane-bound receptors
- Generation of second messenger
- Biochemical response
- Physiological response

139. Answer (4)

Hint: Secreted from the adrenal medulla

Sol.: Epinephrine is an amino acid derived hormone, while insulin, glucagon, somatostatin, *etc.*, are peptide hormones.

140. Answer (4)

Hint: Parasympathetic effect

Sol.: Hormones of fight or flight increase alertness, pupillary dilation, piloerection, *etc*. They also increase the heartbeat, rate the strength of heart contraction, the rate of respiration, *etc*.

141. Answer (2)

Hint: Emergency hormones.

Sol.: Under acute stress, sympathetic nervous system stimulates the adrenal medulla to secrete epinephrine. This leads to increased heart rate and increased blood glucose level to provide energy to combat the stressful situation.

142. Answer (3)

Hint: Water retention is hampered.

Sol.: Gigantism and acromegaly are caused due to hypersecretion of growth hormone while dwarfism is caused due to hyposecretion of growth hormone. Diabetes insipidus is caused due to the hyposecretion of ADH.

143. Answer (4)

Hint: One of them helps in water retention.

Sol.: GnRH, oxytocin and vasopressin are synthesised by the hypothalamus; gonadotropins are secreted from the anterior pituitary. Oxytocin and vasopressin are axonally transported to the neurohypophysis and released from there according to the requirement.

144. Answer (3)

Hint: Hypothalamus is a part of brain.

Sol.: Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts. Hypothalamus is a part of brain which secretes many hormones.

145. Answer (1)

Hint: Neurotransmitters are not required in electrical synapses.

Sol.: In chemical synapses, release of neurotransmitters and stimulation of post-synaptic neuron consume extra time that results in synaptic delay, while in electrical synapses, neurotransmitters are not used.

146. Answer (4)

Hint: Eliminate the functions of hypothalamus

Sol.: The association areas are responsible for complex functions like intersensory association, memory and communication. Hypothalamus has centres for controlling the body temperature.

147. Answer (2)

Hint: Cytoplasm of cell body is rich in Nissl's granules.

Sol.: Nissl's granules are absent in axoplasm.

Dendrites and cell body contain the Nissl's granules.

The glial cells perform many house-keeping functions, for example-astrocytes provide nutritional support to neurons.

148. Answer (2)

Hint: Energy currency of the cell

Sol.: Hormones are intercellular messengers. Hormones which interact with membrane-bound receptors normally do not enter the target cells, but generate second messengers, *e.g.,* cyclic AMP, IP_3, Ca^{++}, *etc*.

ATP does not act as the second messenger.

149. Answer (3)

Hint: Testis and ovary

Sol.: Liver, heart, kidney, GIT, *etc*., are not organised endocrine structures but secrete certain hormones. Gonads are organised endocrine bodies.

150. Answer (3)

Hint: Secreted from pars intermedia

Sol.: Pars distalis produces GH, PRL, TSH, ACTH, FSH and LH. Pars intermedia secretes only one hormone called MSH.

151. Answer (1)

Hint: Major portion of pancreas is exocrine in nature.

Sol.: Pancreas is a composite gland. The endocrine part of pancreas consists of Islets of Langerhans. There are about 1 to 2 million of Islets of Langerhans in a normal human pancreas representing only 1 to 2 per cent of the pancreatic tissue. Two main types of cells in the Islets of Langerhans are α-cells and β-cells. They secrete glucagon and insulin, respectively. These are peptide hormones.

Other cells present in the Islets of Langerhans are delta cells and pancreatic polypeptide cells.

152. Answer (4)

Hint: Helps in osmoregulation

Sol.: Aldosterone acts mainly at the renal tubules and stimulates the reabsorption of Na^+ and water and excretion of K^+ and phosphate ions. Thus, aldosterone helps in the maintenance of the electrolytes, body fluid volume, osmotic pressure and blood pressure.

153. Answer (4)

Hint: Half of the total number of fingers present in the forelimb.

Sol.: Peptide hormones interact with membrane-bound receptors while steroid hormones and iodothyronine interact with intracellular receptors. FSH, prolactin, thyrocalcitonin, erythropoietin and glucagon are peptide hormones; hence they interact with membrane-bound receptors.

154. Answer (4)

Hint: Produces ADH and oxytocin

Sol.: Here, 'P' represents hypothalamus. It is the basal part of diencephalon; forebrain and it regulates a wide spectrum of body functions. The posterior pituitary is under the direct neural regulation of the hypothalamus. Pituitary gland is located in the sella tursica and anatomically divided into adenohypophysis and neurohypophysis.

155. Answer (3)

Hint: Exclude hormones associated with neurohypophysis.

Sol.: Hypothalamus secretes somatostatin that inhibits the release of growth hormone from the anterior pituitary gland. Neurohypophysis stores and releases oxytocin and vasopressin (ADH), which are actually synthesised by the hypothalamus and are transported axonally to neurohypophysis.

156. Answer (3)

Hint: A gonadotrophin

Sol.: ACTH stimulates the synthesis and secretion of steroid hormones called glucocorticoids from the adrenal cortex. GnRH stimulates the anterior pituitary to synthesise and release gonadotrophins. LH and FSH are called gonadotrophins.

157. Answer (3)

Hint: Axon emerges out from the cyton.

Sol.: The axon transmits nerve impulses away from the cell body towards the nerve endings while dendrites conduct nerve impulse towards the cell body.

158. Answer (2)

Hint: Contains convoluted surface

Sol.: Thalamus and cerebrum are the parts of forebrain.

The dorsal portion of the midbrain consists of four round swellings called corpora quadrigemina.

The cerebellum plays a role in motor movement regulation and balance control.

159. Answer (2)

Hint: Pia mater remains in contact with the brain tissue.

Sol.: The correct order of cranial meninges from inner side to outside is :

Pia mater → Arachnoid → Dura mater

160. Answer (3)

Hint: Located in the CNS region

Sol.: Melatonin is a peptide hormone which influences metabolism and pigmentation. It is secreted from the pineal gland that is located on the dorsal side of the forebrain. The two lobes of the thyroid gland is located one on either side of the trachea. Four parathyroid glands are present on the back side of the thyroid gland.

161. Answer (4)

Hint: In vertebrates, the heart is located on the ventral side.

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

Thymosin plays a major role in the differentiation of T-lymphocytes, but it also promotes the production of antibodies.

162. Answer (2)

Hint: It is divided into 3 layers.

Sol.: Adrenal cortex secretes a small amount of androgenic steroids which play a role in the growth of axial hair, pubic hair and facial hair during puberty. Thymus secretes thymosins while adrenal medulla secretes catecholamines.

Neurohypophysis stores and releases oxytocin and vasopressin.

163. Answer (3)

Hint: CCK acts on gall bladder.

Sol.: Secretin – Acts on the exocrine pancreas and stimulates the secretion of water and bicarbonate ions.

GIP – Inhibits gastric secretion and motility.

CCK – Acts on both pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juices, respectively.

Gastrin – Acts on the gastric glands and stimulates the secretion of HCl and pepsinogen.

164. Answer (4)

Hint: Secretion of adrenal medulla

Sol.: The adrenal medulla secretes two hormones called adrenaline or epinephrine and noradrenaline or norepinephrine. These are commonly called catecholamines.

Cortisol is a glucocorticoid.

Aldosterone is a mineralocorticoid.

165. Answer (3)

Hint: A steroid hormone

Sol.: The corpus luteum secretes mainly progesterone. Progesterone supports pregnancy. It also acts on the mammary glands and stimulates the formation of alveoli and milk secretion.

166. Answer (4)

Hint: Skull includes both facial and cranial bones.

Sol.: The human brain is well protected by the skull. The skull is composed of 8 paired bones.

167. Answer (3)

Hint: Myelin sheath is absent

Sol.: Unmyelinated nerve fibre is enclosed by a Schwann cell that does not form a myelin sheath around the axon, and is commonly found in autonomous and the somatic neural systems.

Nodes of Ranvier will not be present in an unmyelinated neuron.

Axolemma is the cell membrane of the axon.

Neurilemma is the cytoplasmic sheath of Schwann cell that is present over the unmyelinated axon.

168. Answer (3)

Hint: Also called Graves' disease

Sol.: Exopthalmic goitre is a form of hyperthyroidism characterised by enlargement of thyroid gland, protrusion of eyeballs, increased BMR and weight loss, also called Graves' disease. Disease caused by the underproduction of hormones of adrenal cortex is called Addison's disease.

169. Answer (4)

Hint: Connects both the components of CNS

Sol.: Brain stem forms the connection between the brain and spinal cord. Two cerebral hemispheres are connected by corpus callosum.

170. Answer (3)

Hint: Potential difference across the membrane

Sol.: Neurons are excitable cells because their membranes are in a polarised state. Neurons have only one axon but may have more than one dendrites.

171. Answer (2)

Hint: Synaptic cleft is present between pre and post-synaptic membrane.

Sol.: The receptors for neurotransmitters released from synaptic vesicles are present on the post-synaptic membrane. A synapse is formed by the membranes of pre-synaptic neuron and a post-synaptic neuron, which may or may not be separated by a gap called synaptic cleft.

172. Answer (1)

Hint: TCT is antagonistic to PTH.

Sol.: PTH increases the Ca^{+2} levels in blood. PTH stimulates the process of bone resorption and also stimulates reabsorption of Ca^{+2} by the renal tubules and increases Ca^{+2} absorption from the digested food. It is thus clear that PTH is a hypercalcemic hormone.

173. Answer (3)

Hint: Glucocorticoids

Sol.: Glucocorticoids, particularly cortisol, released from the adrenal cortex produce anti-inflammatory reactions and suppress the immune response. Cortisol is also involved in maintaining the cardiovascular system as well as the kidney functions. Glucocorticoids are steroids that stimulate lipolysis.

174. Answer (4)

Hint: Decreases blood pressure

Sol.: ANF is secreted from the atrial wall of the heart and is a peptide hormone. It is a vasodilator.

175. Answer (3)

Hint: All interact with intracellular receptors.

Sol.: Cortisol, progesterone and estrogen are chemically steroids and their mode of action is similar *i.e.*, they all interact with intracellular receptors. Cortisol is secreted from adrenal cortex (located in the abdominal region) while estrogen and progesterone are secreted from ovary and placenta.

176. Answer (2)

Hint: Secreted from the gland located on dorsal side of forebrain

Sol.: Melatonin, secreted from the pineal gland, plays a very important role in the regulation of the 24 hour (diurnal) rhythm of our body.

MSH and TSH are secreted from adenohypophysis.

177. Answer (4)

Hint: Source of a mineralocorticoid

Sol.: Aldosterone is a mineralocorticoid secreted from the adrenal cortex. It is mainly responsible for controlling osmoregulation in humans. Adrenal medulla secretes catecholamines and parathyroid gland secretes PTH.

PTH is responsible for calcium homeostasis.

Pancreas secrete hormones that maintain glucose homeostasis.

178. Answer (2)

Hint: Similar to glucagon in chemical nature

Sol.: β-cells of pancreas secrete insulin which is a peptide hormone. It is a hypoglycaemic hormone that increases cellular glucose uptake. Glucagon released from α-cells is a hyperglycaemic hormone. It reduces cellular glucose uptake and stimulates glycogenolysis.

Insulin requires second messengers to show its effect.

179. Answer (4)

Hint: Antagonistic to glucagon

Sol.: Insulin acts on hepatocytes and adipocytes and enhances cellular glucose uptake which results in decreased blood glucose levels. Cortisol, glucagon and adrenaline increase blood sugar levels.

180. Answer (4)

Hint: Plays a role in T-lymphocyte differentiation

Sol.: Hormones are secreted by some tissues which are not organised endocrine glands. Erythropoietin is secreted by JG cells of kidneys; gastrin and secretin are secreted by endocrine cells of GIT. Thymosin is secreted by an organised endocrine gland called thymus.

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