

All India Aakash Test Series for NEET - 2025

OPEN MOCK TEST - 3[Click here for Code-B sol.](#)

Test Date : 06/04/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint: Dimension of E is $[ML^2T^{-2}]$

$$\text{Sol.: } \frac{E}{g} = \frac{[ML^2T^{-2}]}{[LT^{-2}]}$$

$$= [MLT^0]$$

2. Answer (3)

$$\text{Hint: } a = \frac{d^2x}{dt^2}$$

$$\text{Sol.: } x = 2 - 3t + 4t^3$$

$$v = \frac{dx}{dt}$$

$$v = -3 + 12t^2$$

$$\text{For, } v = 0$$

$$\Rightarrow -3 + 12t^2 = 0$$

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

$$\text{Now, } a = \frac{dv}{dt}$$

$$a = 24t$$

$$a = 24 \times \frac{1}{2}$$

$$= 12 \text{ m/s}^2$$

3. Answer (4)

Hint & Sol.: Two vectors of same physical quantity are unequal if they have different magnitude as well as different direction, same magnitude but different direction and same direction but different magnitude.

4. Answer (2)

Hint: Kinetic energy at highest point

$$K = \frac{1}{2} M u^2 \cos^2 \theta$$

$$\text{Sol.: } K = 2 \text{ P.E}$$

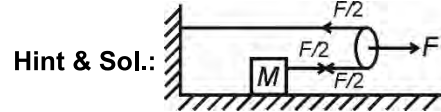
$$\frac{1}{2} M u^2 \cos^2 \theta = 2 M g H$$

$$\frac{1}{2} M u^2 \cos^2 \theta = 2 M g \frac{u^2 \sin^2 \theta}{2g}$$

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

$$\theta = \tan^{-1} \left(\frac{1}{\sqrt{2}} \right)$$

5. Answer (2)



$$\frac{F}{2} = Ma$$

$$a = \frac{F}{2M}$$

6. Answer (2)

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

$$\text{Sol.: } \omega = \omega_0 + \alpha t$$

$$12 = \alpha \times 4$$

$$\alpha = 3 \text{ rad/s}^2$$

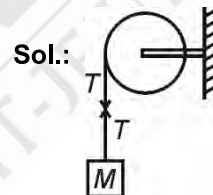
$$\tau = I\alpha$$

$$300 = I \times 3$$

$$I = 100 \text{ kg m}^2$$

7. Answer (4)

Hint: There is no slipping of string on disc, hence use equation $a = R\alpha$



$$Mg - T = Ma \quad \dots(1)$$

$$T \times R = I\alpha$$

$$a = R\alpha$$

$$TR = \frac{MR^2}{2} \times \frac{a}{R}$$

$$T = \frac{Ma}{2} \quad \dots(2)$$

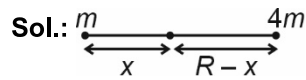
$$(1) + (2)$$

$$Mg = \frac{3Ma}{2}$$

$$a = \frac{2g}{3}$$

8. Answer (3)

Hint: Use equation $E = \frac{Gm}{r^2}$ and $V = -\frac{Gm}{r}$



$$\frac{Gm}{x^2} = \frac{4mG}{(R-x)^2}$$

$$R-x = 2x$$

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

$$V = \frac{-Gm}{\frac{R}{3}} - \frac{4Gm}{\frac{2R}{3}}$$

$$V = \frac{-3Gm}{R} - \frac{6Gm}{R}$$

$$= \frac{-9Gm}{R}$$

9. Answer (1)

Hint: $\Delta P = \rho gh$

Sol.: $B = \frac{-\Delta P}{\left(\frac{\Delta V}{V}\right)}$

$$P = 10^3 \times 10 \times 2 \times 10^3$$

$$= 2 \times 10^7$$

$$B = \frac{2 \times 10^7}{10^{-3}}$$

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

10. Answer (2)

Hint & Sol.: $W = \vec{F} \cdot \vec{d}$

$$= Fd \cos \theta$$

Dot product of two vectors is scalar

11. Answer (3)

Hint: Force is variable, therefore use $W = \int \vec{F} \cdot d\vec{r}$

Sol.: $W = \int \vec{F} \cdot d\vec{r}$

$$= \int (2x\hat{i} + \hat{j})(dx\hat{i} + dy\hat{j})$$

$$= \int_2^3 2x dx + \int_1^2 dy$$

$$= \left[x^2 \right]_2^3 + (2-1)$$

$$= 9 - 4 + 1$$

$$= 6 \text{ J}$$

12. Answer (4)

Hint: Time period of spring-mass system

$$T = 2\pi \sqrt{\frac{m}{k_{\text{eff}}}}$$

Sol.: For parallel combination

$$k_{\text{eff}} = \frac{k}{2} + k = \left(\frac{3k}{2}\right)$$

$$T = 2\pi \sqrt{\frac{m}{\frac{3k}{2}}}$$

$$= 2\pi \sqrt{\frac{2m}{3k}}$$

13. Answer (1)

Hint: Fundamental frequency of a string fixed at

both the ends, $f = \frac{1}{2\ell} \sqrt{\frac{T}{\mu}}$

Sol.: $f \propto \sqrt{T}$

$$\frac{f}{f_1} = \frac{\sqrt{T}}{\sqrt{\frac{144}{100} T}}$$

$$f_1 = 1.2f$$

$$\left(\frac{f_1 - f}{f}\right) = \left(\frac{1.2f - f}{f}\right) \times 100$$

$$= 20\%$$

14. Answer (3)

Hint & Sol.: Beat frequency = $f_1 - f_2$

Time taken in two consecutive maxima = $\frac{1}{f_1 - f_2}$

Time taken in two consecutive maxima and minima = $\frac{1}{2(f_1 - f_2)}$.

15. Answer (3)

Hint: Average kinetic energy per molecule per degree of freedom = $\frac{1}{2} k_B T$

Sol.: Rotational degree of freedom of diatomic gas is 2

$$\text{Average rotational kinetic energy} = 2 \left(\frac{1}{2} k_B T \right)$$

$$= k_B T$$

16. Answer (2)

Hint: Work done = $\int P dV$

Sol.: $W = (2V_0 - V_0)\left(\frac{P_0}{2}\right) + (2V_0 - V_0)\left(P_0 - \frac{P_0}{2}\right) \times \frac{1}{2}$
 $= \frac{P_0 V_0}{2} + \frac{P_0 V_0}{4}$
 $= \frac{3P_0 V_0}{4}$

17. Answer (4)

Hint: Use conduction formula: $\frac{dQ}{dt} = kA \frac{dT}{dx}$

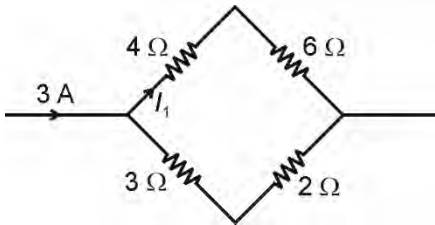
Sol.: $\frac{dT}{dx} = \frac{\left(\frac{dQ}{dt}\right)}{kA}$
 $\left(\frac{dQ}{dt}\right)$ and k is constant but $\frac{dT}{dx}$ change with area of cross-section.

18. Answer (3)

Hint & Sol.: Drift velocity is dependent on electric field and current flows in a conductor when electric field is applied.

19. Answer (1)

Hint: $P = I^2 R$



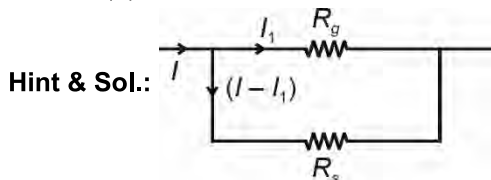
Sol.:

$I_1 = \frac{3 \times 5}{10 + 5}$
 $= 1 \text{ A}$
 $P = I_1^2 R$
 $= 1^2 \times 4$
 $= 4 \text{ W}$

20. Answer (4)

Hint & Sol.: By Curie's law for paramagnetic material $\chi \propto \frac{1}{T}$.

21. Answer (1)

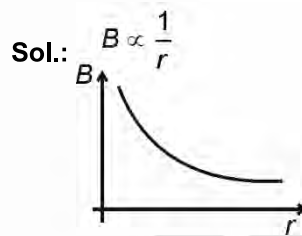


$I_1 R_g = (I - I_1) R_s$
 $I_1 (R_g + R_s) = I R_s$

$\frac{I_1}{I} = \left(\frac{R_s}{R_g + R_s}\right)$
 $= \frac{0.3}{60.3}$
 $= \left(\frac{1}{201}\right)$

22. Answer (3)

Hint: Magnetic field due to a long straight current carrying wire is given by $B = \left(\frac{\mu_0 I}{2\pi r}\right)$



23. Answer (3)

Hint: For bright fringe, phase difference $\Delta\phi = 2n\pi$

Sol.: For central fringe $n = 0$

$\phi = 0$

For 2nd bright $n = 2$

$(\Delta\phi)_{2-B} = 4\pi$

24. Answer (1)

Hint & Sol.: Intensity of bright fringe decrease on going away from central bright. In diffraction, light energy is redistributed.

25. Answer (1)

Hint: Energy of a photon $E = h\nu$

Sol.: $\frac{hc}{\lambda} = E$

$\left(\frac{hc}{\lambda} = h\nu\right)$

$\frac{h}{\lambda} = P$

$Pc = h\nu$

$\nu = \frac{Pc}{h}$

26. Answer (4)

Hint & Sol.: ${}_1\text{H}^2 + {}_1\text{H}^2 \rightarrow {}_1\text{H}^3 + \text{proton}$

27. Answer (4)

Hint & Sol.: Electrons on n-side and holes on p-side will move towards the junction.

28. Answer (2)

Hint: Use Boolean formula $\overline{\overline{A}} = A$

Sol.: $y = \overline{A + B}$

$$= \overline{A} \cdot \overline{B}$$

$$= A \cdot B$$

AND gate.

29. Answer (2)

Hint: Charge flowing through a coil is given by

$$Q = \frac{\Delta\phi}{R}$$

Sol.: $\phi_i = 5 + 3 + 16$

$$= 24$$

$$\phi_f = 20 + 6 + 16$$

$$= 42$$

$$Q = \frac{\phi_f - \phi_i}{R}$$

$$= \frac{42 - 24}{6} = 3 \text{ C}$$

30. Answer (1)

Hint & Sol.: Speed of light in vacuum is

$$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

$$c\sqrt{\mu_0 \epsilon_0} = 1$$

31. Answer (3)

Hint: Magnification through a spherical mirror,

$$m = -\frac{v}{u}$$

Sol.: $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{v} - \frac{1}{3f} = -\frac{1}{f}$$

$$\frac{1}{v} - \frac{2}{3f} = -\frac{1}{f}$$

$$\frac{1}{v} = -\frac{1}{f} + \frac{2}{3f}$$

$$\frac{1}{v} = \frac{-3 + 2}{3f}$$

$$v = -3f$$

$$m = -\frac{3f}{\frac{3f}{2}} = -2$$

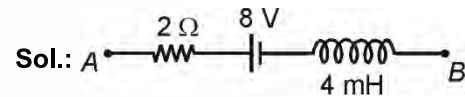
32. Answer (3)

Hint: Shift = $t \left(1 - \frac{1}{\mu} \right)$

Sol.: Shift = $4 \left(1 - \frac{1}{\frac{3}{2}} \right)$

$$= \frac{4}{3} \text{ cm}$$

33. Answer (1)

Hint: Potential drop across an inductor $V_L = -L \frac{di}{dt}$ 

$$V_A - V_B = 6 + 8 - 4$$

$$= 10 \text{ V}$$

34. Answer (3)

Hint: Resonant frequency, $f = \frac{1}{2\pi\sqrt{LC}}$

Sol.: $f_1 = \frac{1}{2\pi\sqrt{L_1 \times 3C}}$

$$f_1 = f$$

$$\frac{1}{2\pi\sqrt{L_1 \times 3C}} = \frac{1}{2\pi\sqrt{LC}}$$

$$L_1 = \frac{L}{3}$$

35. Answer (2)

Hint: $P = \frac{1}{f}$

Sol.: $P = P_1 + P_2$

$$= 2 + \left(\frac{-1}{20 \times 10^{-2}} \right)$$

$$= 2 - 5$$

$$= -3 \text{ D}$$

36. Answer (3)

Hint: Maximum number of lines in emission spectrum can be calculated using formula

$$N = \frac{n(n-1)}{2}$$

Sol.: $n = 4$

$$N = \frac{4(4-1)}{2} = 6$$

37. Answer (3)

Hint: Work done by external force = Change in potential energy

$$\text{Sol.: } U = -PE \cos\theta$$

$$U_i = -PE$$

$$U_f = -PE \cos\theta$$

$$W = -PE \cos\theta + PE$$

$$\frac{3PE}{2} = PE(1 - \cos\theta)$$

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

$$\theta = 120^\circ$$

38. Answer (4)

Hint & Sol.: Electric flux passing through a closed surface in uniform electric field is zero.

39. Answer (3)

Hint: Net electric dipole moment $\vec{P} = \vec{P}_1 + \vec{P}_2$

$$\text{Sol.: } \vec{P}_1 = \sqrt{2} qa \hat{i}$$

$$\vec{P}_2 = \sqrt{2} qa \hat{j}$$

$$\vec{P} = \sqrt{2} aq \hat{i} + \sqrt{2} aq \hat{j}$$

$$|\vec{P}| = 2qa$$

40. Answer (3)

Hint: According to Stoke's law $F_{\text{drag}} = 6\pi\eta r v$

$$\text{Sol.: } v = \frac{F_{\text{drag}}}{6\pi\eta r}$$

$$= \frac{18 \times 10^{-3}}{6 \times 3.14 \times 0.5 \times 1 \times 10^{-3}}$$

$$\approx 2 \text{ m/s}$$

41. Answer (1)

Hint: Process A \rightarrow B is isochoric

$$\text{Sol.: } \Delta U = n C_v \Delta T$$

$$= \frac{R}{\left(\frac{7}{5} - 1\right)} \times \frac{2 P_0 V_0}{R}$$

$$= 5 P_0 V_0$$

42. Answer (2)

Hint: In SHM, $v_{\text{max}} = A\omega$

$$\text{Sol.: } \omega = \frac{v_{\text{max}}}{A}$$

From graph

$$v_{\text{max}} = 0.3 \text{ m/s}, A = \frac{10}{100} \text{ m}$$

$$\omega = \frac{0.3}{10 \times 10^{-2}}$$

$$= 3 \text{ rad/s}$$

43. Answer (4)

Hint: Total time of flight = $t_1 + t_2$

$$\text{Sol.: Time of flight} = \frac{2u \sin\theta}{g}$$

$$t_1 + t_2 = \frac{2u \sin\theta}{g}$$

$$3 + 1 = \frac{2 \times 40 \sin\theta}{10}$$

$$\sin\theta = \frac{1}{2}$$

$$\theta = 30^\circ$$

44. Answer (3)

Hint & Sol.:

For perfectly elastic collision $e = 1$

For perfectly inelastic collision $e = 0$

For partially elastic collision $0 < e < 1$

45. Answer (4)

Hint & Sol.: Bulk modulus defined for all solids, liquids and gases.

[CHEMISTRY]

46. Answer (1)

Hint: Empirical formula is the simplest whole number ratio of elements present in a compound.

Sol.:

Element	%	Atomic mass	No. of moles	Simplest whole number ratio
C	38.71	12	$\frac{38.71}{12} = 3.22$	1
H	9.67	1	$\frac{9.67}{1} = 9.67$	3
O	51.62	16	$\frac{51.62}{16} = 3.22$	1

∴ The empirical formula is CH₃O.

47. Answer (2)

Hint: Number of angular nodes = ℓ

Number of radial nodes = $n - \ell - 1$

Sol.: For $4d_{x^2-y^2}$ subshell, $n = 4$, $\ell = 2$

Number of radial nodes = $4 - 2 - 1 = 1$

Number of angular nodes = $\ell = 2$

48. Answer (3)

Hint: IUPAC official name of element with atomic number 101 is Mendelevium.

Sol.:

Column I	Column II
101	Mendelevium
103	Lawrencium
104	Rutherfordium
108	Hassium

49. Answer (4)

Hint: Dipole moment (μ) = charge (Q) × bond length (l)

Sol.:

Molecules	Dipole moment μ (D)
H ₂ O	1.85
NH ₃	1.47
HI	0.38
CCl ₄	0

50. Answer (3)

Hint: Bond order (B.O.) = $\frac{1}{2} [N_b - N_a]$ where N_b is the number of electrons in bonding molecular orbital and N_a is the number of electrons in antibonding molecular orbital

Sol.: Bond order of $N_2 = \frac{10-4}{2} = 3$

Bond order of $N_2^+ = \frac{9-4}{2} = 2.5$

Bond order of $N_2^- = \frac{10-5}{2} = 2.5$

Bond order of $O_2 = \frac{10-6}{2} = 2$

Bond order $O_2^+ = \frac{10-5}{2} = 2.5$

Bond order $O_2^- = \frac{10-7}{2} = 1.5$

51. Answer (1)

Hint: For enthalpy change $\Delta H = nC_P\Delta T$

Sol.: For isothermal process temperature remains constant therefore $\Delta T = 0$

∴ $\Delta H = nC_P\Delta T = 0$

52. Answer (3)

Hint: The solubility of AgCl decreases because of common ion effect.

Sol.: $CaCl_2 \rightarrow Ca^{+2} + 2Cl^-$
 $0.1 \quad 2 \times 0.1 = 0.2$

Let the solubility of AgCl in 0.1 M CaCl₂ be S.

$AgCl \rightleftharpoons Ag^+ + Cl^-$
 $S \quad S + 0.2$

$K_{sp}(AgCl) = [Ag^+][Cl^-]$

$1.8 \times 10^{-10} = S \times 0.2$ [$S \ll 0.2$, $S + 0.2 \approx 0.2$]

$S = \frac{1.8 \times 10^{-10}}{0.2}$

$= 9 \times 10^{-10} \text{ mol L}^{-1}$

53. Answer (2)

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

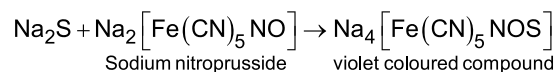
Sol.: Correct order of reducing power is

$Na > Al > Fe > Sn$

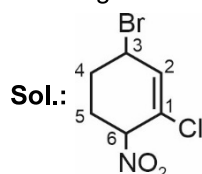
54. Answer (1)

Hint: Shape of sp^3 hybridised molecule is tetrahedral.**Sol.:** Bridged hydrogen atoms are above and below the π molecular plane.

55. Answer (2)

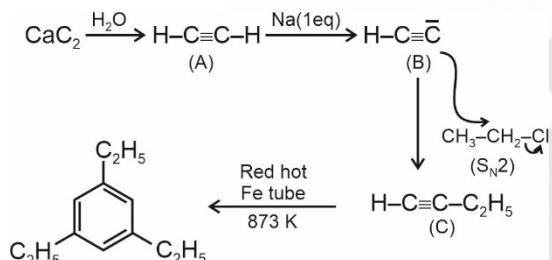
Hint: Appearance of violet colour indicates the presence of sulphur.**Sol.:**

56. Answer (3)

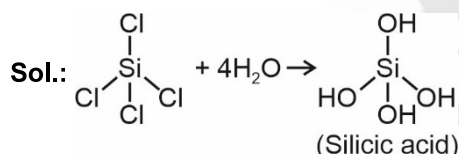
Hint: Numbering is done in accordance with the lowest set of locant rule so that multiple bond should get lowest number.

3-Bromo-1-chloro-6-nitrocyclohex-1-ene.

57. Answer (4)

Hint: Ethyne is prepared by treating calcium carbide with water.**Sol.:**

58. Answer (3)

Hint: The basic structural unit of silicates is SiO_4^{4-}  SiO_2 is an acidic oxide while PbO is an amphoteric oxide.

59. Answer (2)

Hint: $\Delta T_b = i \times K_b \times m$

$$T_b = T_b^\circ + \Delta T_b$$

Sol.: $i = 1 + (n - 1)\alpha$

$$= 1 + (4 - 1)0.8$$

$$= 1 + 2.4 = 3.4$$

$$\Delta T_b = 3.4 \times 0.52 \times 0.2$$

$$= 0.35$$

$$T_b = T_b^\circ + \Delta T_b$$

$$= 100 + 0.35 = 100.35^\circ\text{C}$$

60. Answer (1)

Hint: Rate = $k[\text{NH}_3]^0 = k$ **Sol.:** The decomposition of gaseous ammonia on a hot platinum surface is a zero order reaction at high pressure.

For zero order reaction

$$t_{1/2} = \frac{A_0}{2k}$$

61. Answer (3)

Hint: NH_3 has high boiling point due to intermolecular hydrogen bonding.**Sol.:**

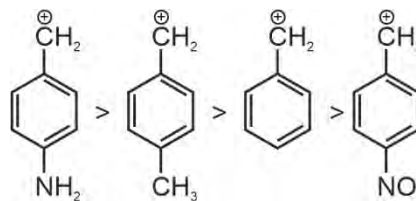
Compound	BP (K)
NH_3	238.5
PH_3	185.5
AsH_3	210.6
SbH_3	254.6
BiH_3	290

62. Answer (2)

Hint & Sol.:

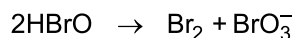
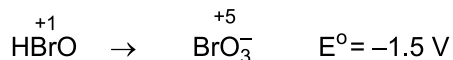
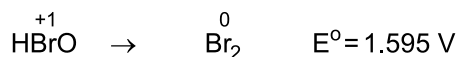
	Name of compound	Formula of compound
(a)	Chile saltpetre	NaNO_3
(b)	Indian saltpetre	KNO_3
(c)	Carnallite	$\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$
(d)	Cryolite	Na_3AlF_6

63. Answer (3)

Hint: Electron donating group increases the stability of carbocation and electron withdrawing group decreases the stability of carbocation.**Sol.:** Correct order of stability:

64. Answer (4)

Hint: If E_{cell}° value is +ve then disproportionation reaction will take place.

Sol.:

$$E_{\text{cell}}^{\circ} = 1.595 \text{ V} - 1.5 \text{ V} = 0.095 \text{ V}$$

65. Answer (3)

Hint: Crystal field splitting energy (Δ_0) depends on strength of ligand. $\left(\Delta_0 \propto \frac{1}{\lambda_{\text{absorb}}} \right)$

Sol.

(Coordination entity)	Wavelength of light absorbed (in nm)
$[\text{CoCl}(\text{NH}_3)_5]^{2+}$	535
$[\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{3+}$	500
$[\text{Co}(\text{NH}_3)_6]^{3+}$	475
$[\text{Co}(\text{CN})_6]^{3-}$	310

66. Answer (1)

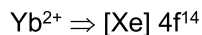
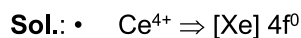
Hint: Paramagnetic species contain unpaired electron.



It contains one unpaired electron so behaves as paramagnetic species.

67. Answer (1)

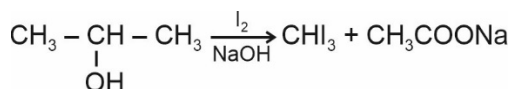
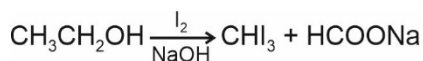
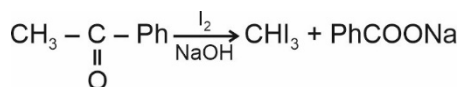
Hint: Both Ce^{4+} and Yb^{2+} do not have unpaired electrons.



• Absorption band of lanthanoid ions are narrow because of the excitation within f level.

68. Answer (4)

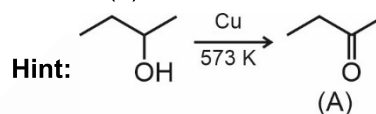
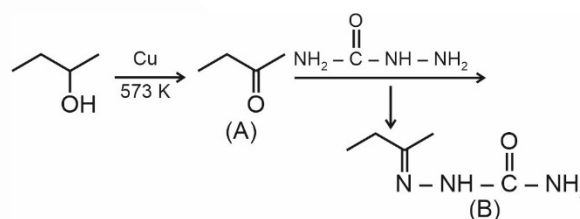
Hint: Compounds containing $\text{CH}_3 - \overset{\text{O}}{\parallel}{\text{C}} -$ group or $\text{CH}_3 - \underset{\text{OH}}{\text{CH}} -$ group will give positive iodoform test.

Sol.:

69. Answer (2)

Hint & Sol.: Boiling point of alcohol is more than the ether and hydrocarbon of similar molecular mass due to the presence of hydrogen bonding.


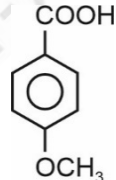

70. Answer (2)

**Sol.:**

71. Answer (4)

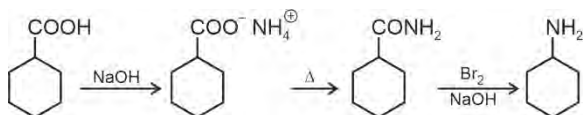
Hint: Lesser the pK_a value more will be the acidic strength.

Sol.:

Compound	pK_a
	4.19
	4.46
	3.41
HCOOH	3.75

72. Answer (1)

Hint: Hoffmann method is used for the preparation of primary amines by treating an amide with bromine in an aqueous solution of sodium hydroxide.

Sol.:

73. Answer (3)

Hint: Basic amino acids have more number of amino groups than the carboxyl groups.**Sol.:**

Amino acid	Structure
Lysine	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ (\text{CH}_2)_4 \\ \\ \text{NH}_2 \end{array}$
Leucine	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{CH}_2 \\ \\ \text{CH}-\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$
Valine	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{CH}-\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$
Phenylalanine	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{CH}_2 \\ \\ \text{C}_6\text{H}_5 \end{array}$

74. Answer (3)

Hint: Steam distillation is used to separate substances which are steam volatile and are immiscible with water.**Sol.:** Paper chromatography is a type of partition chromatography.

Glycerol can be separated from spent-lye in soap industry by using distillation under reduced pressure technique.

75. Answer (2)

Hint: For first order reaction: $t = \frac{1}{k} \ln \frac{[R]_0}{[R]}$

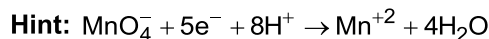
$$\text{Sol.: } t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$$

$$= \frac{2.303}{2.303 \times 10^{-3}} \log \frac{2}{0.2}$$

$$= 10^3 \log 10$$

$$= 1000 \text{ s}$$

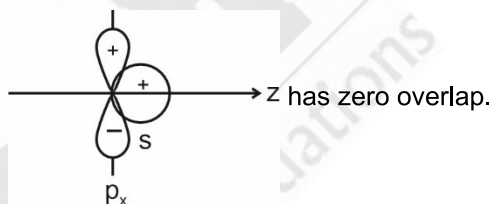
76. Answer (4)

**Sol.:** One mole MnO_4^- required five moles of electron to change into Mn^{2+} .Therefore 0.6 mole MnO_4^- required three moles of electrons to change into Mn^{2+} .

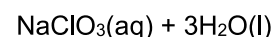
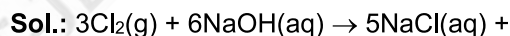
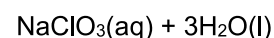
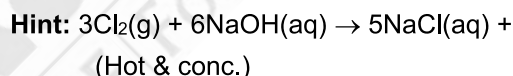
77. Answer (1)

Hint & Sol.: Two components A and B show negative deviations from Raoult's law when A-B interaction is stronger than A-A and B-B interaction.

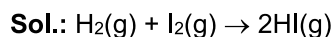
78. Answer (4)

Hint & Sol.:

79. Answer (4)

3 moles $\text{Cl}_2(\text{gas})$ react with = 6 moles of NaOH4 moles of $\text{Cl}_2(\text{gas})$ will react with = 8 moles of NaOH

80. Answer (2)

Hint: $\Delta H^\circ = \Sigma \text{BE of reactants} - \Sigma \text{BE of products}$ 

$$\Delta H^\circ = (x + y - 2z) \text{ kJ mol}^{-1}$$

81. Answer (3)

Hint: Exothermic reactions are favoured at low temperature.**Sol.:** Addition of inert gas at constant volume has no effect on equilibrium state.

When we decrease the pressure, reaction will shift towards that side which has higher number of gaseous moles.

82. Answer (1)

$$\text{Hint: } r_n = 52.9 \times \frac{n^2}{Z} \text{ pm and } n\lambda = 2\pi r_n$$

$$\text{Sol.: } r_n = 52.9 \times \frac{16}{4} = 211.6 \text{ pm}$$

$$\lambda = \frac{2\pi r_n}{n}$$

$$= \frac{2\pi \times 211.6}{4} = 105.8\pi \text{ pm}$$

83. Answer (4)

Hint: Group reagent is used to identify a group of radicals or cations in a salt.

Sol.:

Group of Basic radicals	Group reagent
Group-I	Dilute HCl
Group-II	H ₂ S gas in presence of dil. HCl
Group-III	NH ₄ OH in presence of NH ₄ Cl
Group-IV	H ₂ S in presence of NH ₄ OH

84. Answer (1)

Hint: $[H^+] = c\alpha$

$$\text{Sol.: } \alpha = 10\% = 0.01$$

$$[H^+] = c\alpha = 0.2 \times 0.01 = 2 \times 10^{-3}$$

$$\text{pH} = -\log[H^+] = -\log 2 \times 10^{-3}$$

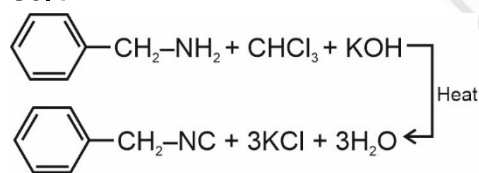
$$= 3 - \log 2 = 3 - 0.3$$

$$= 2.7$$

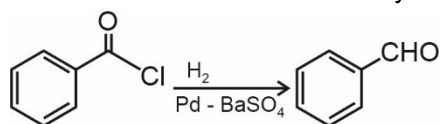
85. Answer (1)

Hint: Aliphatic and aromatic primary amines on heating with chloroform and ethanolic potassium hydroxide solution form isocyanides or carbylamines.

Sol.:



Above reaction is known as carbylamine reaction.



Reaction is known as Rosenmund reaction.

86. Answer (4)

Hint: For aldol condensation reaction, at least two α hydrogen atoms should be present in carbonyl compound.

Sol.:

	No α -hydrogen
	3 α -hydrogen atoms
	No α -hydrogen
	1 α hydrogen is present so aldol condensation will not occur.

87. Answer (1)

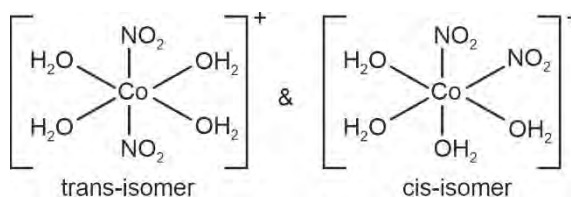
Hint: Complex will not exhibit coordination isomerism as there are no cationic and anionic coordination spheres separately

Sol.: It will exhibit linkage isomerism as ambidentate ligand (NO_2^-) can have different linkages with central metal atom.

Complex will exhibit ionization isomerism by giving different ions in solution or in molten state as



Complex will exhibit geometrical isomerism as cis/trans



No enantiomeric pairs possible, as the molecule is not chiral.

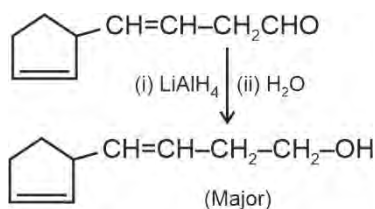
88. Answer (4)

Hint & Sol.: On addition of dil. H_2SO_4 in CO_3^{2-} solution, CO_2 gas will be evolved that will turn lime water milky.

89. Answer (3)

Hint: LiAlH_4 reduces aldehyde into 1° alcohol.

Sol.: LiAlH_4 cannot reduce double bond.



90. Answer (1)

Hint: Deficiency of vitamin C (Ascorbic acid) causes scurvy.

Sol.:

	Name of vitamins	Deficiency diseases
(a)	Thiamine	Beriberi
(b)	Riboflavin	Digestive disorder and burning sensation of the skin
(c)	Pyridoxine	Convulsions
(d)	Ascorbic acid	Bleeding gums

[BIOLOGY]

91. Answer (3)

Hint: In water hyacinth and water lily, the flowers emerge above the level of water.

Sol.: In majority of aquatic plants, the flowers emerge above the water level and they are pollinated by either insect or wind. Water hyacinth and water lily are pollinated by insects.

92. Answer (4)

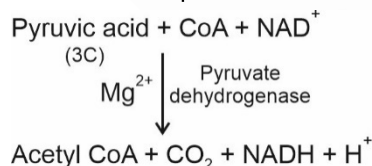
Hint: DNA duplication occurs during S phase.

Sol.: After S phase, chromosome number will remain the same but amount of DNA will be doubled. Therefore, there will be 10 chromosomes and 50 pg of DNA.

93. Answer (3)

Hint: $\text{NADH} + \text{H}^+$ is a product of this oxidative decarboxylation reaction.

Sol.: The complete reaction is as follows:



In this reaction several coenzymes, including NAD^+ and CoA are required for oxidative decarboxylation.

94. Answer (3)

Hint: Mitochondrial matrix possesses single circular DNA molecule.

Sol.: Nucleus has linear dsDNA molecule. Nucleoid and chloroplast have single circular DNA molecule.

95. Answer (3)

Hint: The given floral formula is of Solanaceae family.

Sol.: The floral formula $\text{K}_{(5)} \text{C}_{(5)} \text{A}_5 \underline{\text{G}}_{(2)}$ is commonly seen in the 'potato family'

(Solanaceae). Members of this family have solitary, axillary or cymose inflorescence.

96. Answer (2)

Hint: These organisms are also called "Jokers of the plant kingdom".

Sol.: Mycoplasma are the smallest living cell known and they are pathogenic to animals and plants.

97. Answer (1)

Hint: Phycoerythrin is red pigment found in red algae.

Sol.: Members of Rhodophyceae, commonly called Red algae, have chlorophyll *a* and *d* along with phycoerythrin. *Polysiphonia* is a red algae.

98. Answer (4)

Hint: The trait shown in the pedigree can be autosomal recessive or autosomal dominant.

Sol.: The genotype of the female in generation II can be *Aa* or *aa*. This pedigree is not true for X-linked dominant and X-linked recessive traits.

99. Answer (2)

Hint: RNA has higher rate of mutation as compared to DNA due to the presence of an additional OH group at 2'-position of ribose.

Sol.: The packaging of chromatin at higher level requires additional set of proteins that collectively are referred as non-histone chromosomal (NHC) proteins.

100. Answer (3)

Hint: Dissolution of synaptonemal complex occurs during the diplotene stage.

Sol.: Crossing over takes place in the pachytene stage of prophase I.

101. Answer (2)

Hint: This hormone is responsible for hastening the malting process in brewing industry.

Sol.: Gibberellins are growth promoting hormones, which are known to cause quicker early growth in juvenile conifers.

102. Answer (4)

Hint: Sickle cell anaemia is an example of transversion mutation.

Sol.: Sickle cell anemia is an autosomal recessive disorder which is developed due to the substitution of adenine (purine base) by thymine (pyrimidine base) in the coding strand of DNA of responsible gene. This mutation leads to change of glutamic acid to valine of the β globin chain, resulting in a qualitative disorder of haemoglobin molecules.

103. Answer (2)

Hint: In this interaction, both the partners are benefitted but they can live equally well without the association.

Sol.: A plover bird enters the mouth of crocodile to feed on parasitic leeches. This type of interaction is called proto-cooperation.

104. Answer (3)

Sol.: Cyclosporin A is used as an immunosuppressive agent in organ transplant patients. These are produced by a fungus *Trichoderma polysporum*.

105. Answer (3)

Hint: Gynoecium in Solanaceae family shows axile placentation.

Sol.: Tomato, tobacco, chilli, china rose, petunia and lemon show axile placentation.

106. Answer (3)

Hint: Exclude the exclusive feature of male frogs

Sol.: In female frogs, ovaries are situated near kidneys but there is no functional connection with them. A pair of oviducts arising from the ovaries opens into cloaca separately. A mature female frog can lay 2500-3000 ova at a time.

107. Answer (3)

Hint: Causes vasodilation of blood vessels

Sol.: ADH can affect the kidney functions by its constrictory effect on blood vessels. This causes an increase in blood pressure. Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thereby GFR. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the renal tubule which also leads to an increase in blood pressure and GFR.

ANF can cause vasodilation (dilation of blood vessels) and thereby, decreases the blood pressure.

108. Answer (2)

Hint: Made up of a layer of flattened cells.

Sol.: Simple squamous epithelium is present in the inner lining of blood vessels and air sacs of lungs.

Simple cuboidal and columnar epithelial tissues are involved in secretion and absorption of substances.

109. Answer (4)

Hint: Exclude coelenterates and platyhelminths

Sol.: Starting from the members of the phylum Platyhelminthes, animals are triploblastic. Aschelminths are pseudocoelomates and from annelids onwards, animals are coelomates.

In members of the phylum Annelida, Arthropoda and Chordata, true segmentation is present.

Hirudinaria – Annelid

Culex and *Laccifer* – Arthropods

110. Answer (4)

Hint: Farmer's friend

Sol.: *Nereis*, an aquatic annelid, is dioecious but (*Pheretima*) earthworm and (*Hirudinaria*) leech are monoecious (Bisexual / Hermaphrodite).

Ascaris, *Anopheles* and *Trygon* are unisexual organisms (Dioecious).

111. Answer (3)

Hint: Part of forebrain

Sol.: In human brain, the cerebral cortex contains motor areas, sensory areas and large regions that are neither clearly sensory nor motor in function. These regions known as the association areas are responsible for complex functions like intersensory associations, memory and communication.

Corpora quadrigemina is a part of midbrain; cerebellum is a part of hindbrain. Brain stem is made up of midbrain, pons and medulla oblongata.

112. Answer (3)

Hint: During resting state, inner surface of an axon is negatively charged.

Sol.: When a neuron is not conducting any impulse, i.e., resting, the axonal membrane is comparatively more permeable to K^+ and nearly impermeable to Na^+ .

Consequently, the axoplasm inside the axon contains high concentration of K^+ and negatively charged proteins and low concentration of Na^+ .

In contrast, the fluid outside the axon contains a low concentration of K^+ , a high concentration of Na^+ and thus, forms a concentration gradient.

113. Answer (2)

Hint: Voluntary muscle fibres are multi-nucleated.

Sol.: The skeletal muscle fibres are cylindrical in shape, voluntary in nature, striated, multi-nucleated and unbranched.

Smooth muscle fibres are fusiform, involuntary in nature, non-striated, uninucleated and unbranched.

114. Answer (3)

Hint: Caused by HSV

Sol.: Except for hepatitis-B, genital herpes and HIV infections, other sexually transmitted diseases are completely curable if detected early and treated properly.

115. Answer (4)

Hint: Thyroxine binds to intracellular receptors.

Sol.: Hormones which interact with membrane-bound receptors do not enter the target cell but generate second messengers which in turn regulate the cellular metabolism. *E.g.*, secretin and CCK.

Hormones which interact with intracellular receptors (*e.g.*, steroid hormones, iodothyronines, etc) mostly regulate gene expression by the interaction of hormone-receptor complex with the genome.

116. Answer (1)

Hint: Mesosomes are infoldings of membrane, involved in bacterial respiration.

Sol.: Pili are surface structures found in bacteria. These are involved in the mating process.

117. Answer (1)

Hint: In monocot stem, pericycle is absent.

Sol.: In dicot stem, pericycle is in the form of semi-lunar patches, made up of sclerenchymatous cells.

118. Answer (2)

Hint: In monocot seeds, outer protein layer of the endosperm is the aleurone layer.

Sol.: A single, shield shaped cotyledon is present in the monocot seeds.

119. Answer (3)

Hint: Diatoms are chief producers in oceans.

Sol.:

(i) In *Aspergillus*, sexual spores are called ascospores.

(ii) *Altenaria* is an imperfect fungus, in which only the asexual or vegetative phases are known.

(iii) *Gonyaulax* is a dinoflagellate responsible for red tide of sea.

120. Answer (4)

Hint: Direct synthesis of ATP from metabolites is called substrate level phosphorylation.

Sol.: In glycolysis, fructose-1,6-bisphosphate will give rise to 2 molecules of glyceraldehyde-3-phosphate. Each molecule of glyceraldehyde-3-phosphate will produce 2ATP from substrate level phosphorylation. So, there will be 4 ATP from substrate level phosphorylation in glycolysis.

121. Answer (4)

Hint: This effect is due to a plant hormone that helps in cell division.

Sol.: Cytokinins delay the senescence of leaves and other organs by mobilization of resources. This effect is called Richmond Lang effect.

122. Answer (2)

Hint: The first embryophytes are also called amphibians of the plant kingdom.

Sol.: Bryophytes are the first embryophytes in the plant kingdom.

123. Answer (2)

Hint: The transcription and translation can be coupled in bacteria.

Sol.: Tailing process in hnRNA is template independent.

The genetic code is nearly universal, with some exceptions.

124. Answer (4)

Hint: Mendelian dihybrid cross shows the phenotypic ratio of 9 : 3 : 3 : 1.

Sol.: In the dihybrid cross, only one progeny out of 16 has the genotype aabb. Therefore the number of seeds that show recessive traits will be

$$\frac{1}{16} \times 480 = 30 \text{ seeds.}$$

125. Answer (4)

Hint: Exponential growth curves have a J-shape.

Sol.: An exponentially growing population has a growth curve represented by $\frac{dN}{dt} = rN$.

126. Answer (4)

Hint: Pyramid of number is generally upright in an aquatic ecosystem.

Sol.: In case of tree ecosystem, pyramid of number can be inverted or spindle shaped.

127. Answer (1)

Hint: Standing state is the amount of inorganic substance present in an ecosystem per unit area at a given time.

Sol.: Standing crop is the amount of biomass in different trophic levels at a given time.

128. Answer (4)

Hint: *Rhizobium* is a symbiotic N_2 fixing bacterium.

Sol.: In India, *Aulosira* is the most active, non-symbiotic N_2 fixing microbe in rice fields.

129. Answer (1)

Hint: Two copper centres are present in the complex IV of ETS.

Sol.: F_0 is an integral membrane protein, which forms a channel through which protons cross the inner membrane of mitochondria.

130. Answer (3)

Hint: Senescence of leaves is promoted by a gaseous hormone.

Sol.: Senescence in plants is prevented by cytokinins and it is promoted by ethylene.

131. Answer (2)

Hint: Secreted by parathyroid glands

Sol.: The parathyroid hormone is a peptide hormone. PTH increases the Ca^{2+} levels in the blood. It acts on the bones and stimulates the process of bone resorption. TCT secreted by thyroid gland is hypocalcemic in nature. Insulin is a hypoglycemic hormone.

132. Answer (4)

Hint: Include cartilaginous fishes

Sol.: In urochordates, notochord is present only in the larval tail, while in cephalochordates, it extends from head to tail region and is persistent throughout their life.

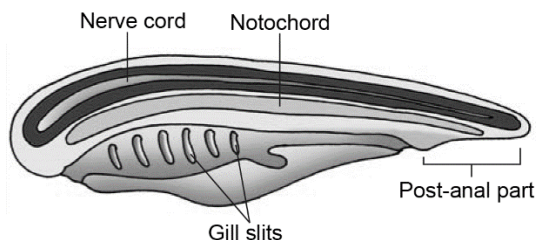
In the members of the class Chondrichthyes, notochord is persistent throughout the life.

In vertebrates, notochord is replaced by a cartilaginous or bony vertebral column in the adults.

133. Answer (3)

Hint: Nerve cord is dorsally located

Sol.:



In members of the phylum Chordata, notochord is ventral to nerve cord and dorsal to gut.

134. Answer (1)

Hint: Lower most part of the brain stem.

Sol.: A specialised centre present in the medulla region of the brain called respiratory rhythm centre is primarily responsible for the regulation of respiration.

A chemosensitive area is situated adjacent to the respiratory rhythm centre, which is highly sensitive to pCO_2 and concentration of hydrogen ions.

135. Answer (1)

Hint: Number of eyes in human

Sol.: In the tissues, where low pO_2 , high pCO_2 , high H^+ concentration and higher temperature exist, the conditions are favourable for dissociation of oxygen from the oxyhaemoglobin. In alveoli, high pO_2 , low pCO_2 , lesser H^+ concentration and lower temperature, all are the factors that favour the formation of oxyhaemoglobin.

136. Answer (1)

Hint: Exists between forebrain and hindbrain

Sol.: Frogs excrete urea and thus, are ureotelic animals. Frog has nucleated RBCs which contain red-coloured pigment, namely haemoglobin.

Copulatory pad is present in male frogs. Midbrain is characterised by a pair of optic lobes.

137. Answer (3)

Hint: Three ganglia lie in the thorax and six in the abdomen

Sol.: If the head of a cockroach is cut off, it will still live for as long as one week as its nervous system is spread throughout the body. The head holds a bit of nervous system while the rest is situated along the ventral (belly-side) part of its body.

138. Answer (3)

Hint: Female sex hormone

Sol.: Osteoporosis is an age-related disorder characterised by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is a common cause of osteoporosis in aged women.

Testosterone is a male sex hormone. Aldosterone is the main mineralocorticoid in human body and prolactin regulates the growth of the mammary glands and formation of milk in them.

139. Answer (4)

Hint: Present in triglyceride

Sol.: In a nucleotide, a phosphate moiety links with the carbon of one sugar. The bond between the phosphate and hydroxyl group of sugar is an ester bond.

140. Answer (4)

Hint: Presence of rapidly dividing cells

Sol.: Tissue culture means that the whole plant could be regenerated from explants, *i.e.*, any part of a plant taken out and grown in a test tube, under sterile conditions in special nutrient media.

The method of producing thousands of plants through tissue culture is called micro-propagation. Even if the plant is infected with a virus, the meristem (apical and axillary) is free of virus. Hence, one can remove the meristem and grow it *in vitro* to obtain virus-free plants.

141. Answer (3)

Hint: Immunoglobulin

Sol.: Antibody functions by fighting infectious agents. It is secreted by B-lymphocytes. Antibodies provide humoral immunity.

Insulin – A peptide hormone

Trypsin – An enzyme

GLUT-4 – Enables glucose transport into the cells

142. Answer (4)

Hint: Opioids are obtained from this plant

Sol.: Excessive dosage of cocaine causes hallucinations. Cocaine is obtained from *Erythroxylum coca*.

Other well-known plants with hallucinogenic properties are *Atropa belladonna* and *Datura*.

Papaver somniferum produces morphine, which is a depressant.

143. Answer (2)

Hint: Less than 8

Sol.: The 8th, 9th and 10th pairs of ribs do not articulate directly with the sternum but join the seventh rib with the help of hyaline cartilage. These are called vertebrochondral ribs.

144. Answer (3)

Hint: Silences *via* dsRNA

Sol.: The source of the complementary RNA used in RNAi could be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate *via* an RNA intermediate.

PCR involves amplification of DNA. Gene therapy involves correction of a genetic defect. ELISA is based on the principle of antigen-antibody interaction.

145. Answer (4)

Hint: Second step of PCR in chronology

Sol.: Primers anneal to its complementary template DNA during the annealing step of PCR.

Hence, if the primers designed are not complementary to target template DNA, then, it would affect the first step of PCR, *i.e.*, annealing.

PCR involves 3 steps:

(i) Denaturation

(ii) Annealing

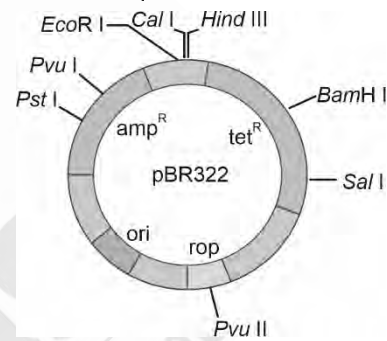
(iii) Extension/Polymerisation

146. Answer (4)

Hint: Exclude the sites of restriction endonucleases present in the antibiotic resistant genes

Sol.: The restriction site of restriction enzyme *Pvu* II is present within *rop*.

rop codes for the proteins involved in the replication of the plasmid.



147. Answer (4)

Hint: Fluid connective tissue

Sol.: Tendons and ligaments are examples of dense regular connective tissues.

Tendons ⇒ Attach skeletal muscles to bones

Ligaments ⇒ Attach one bone to another bone

Bone has a hard and non-pliable ground substance.

Blood is fibreless as fibroblasts are absent in it.

148. Answer (4)

Hint: Initiates the ventricular contraction

Sol.: Each peak in the ECG is identified with a letter from P to T that corresponds to a specific electrical activity of the heart.

P-wave	–	Depolarisation (excitation) of the atria
QRS-complex	–	Depolarisation of the ventricles
T-wave	–	Repolarisation of the ventricles
End of T- wave	–	End of the ventricular systole

149. Answer (3)

Hint: Releases energy during the course of reaction

Sol.: All intermediate structural states in an enzyme catalysed reaction are unstable and possess high energy.

Also, if 'P' is at a lower level than 'S', the reaction is an exothermic reaction. One need not supply energy (by heating) in order to form the product.

Here, 'X' represents activation energy without enzyme whereas 'Y' represents activation energy in the presence of enzyme.

150. Answer (3)

Hint: Component of PNS

Sol.: A special neural centre in the medulla oblongata can moderate the cardiac functions through ANS. Neural signals through sympathetic nerves can increase the rate of heart beat, the strength of ventricular contractions and thereby the cardiac output.

On the other hand, parasympathetic neural signals decrease the rate of heart beat, speed of conduction of action potentials and thereby the cardiac output.

151. Answer (4)

Hint: Aromatic amino acid

Sol.: Aromatic amino acids (tyrosine, tryptophan and phenylalanine) contain a ring-like structure in their side chain.

Based on the number of amino and carboxyl groups, there are acidic (e.g. glutamic acid), basic (lysine) and neutral (valine) amino acids.

152. Answer (4)

Hint: Contains 23 chromosomes

Sol.: In human testis, spermatogonium is diploid and contains 46 chromosomes.

Primary and secondary spermatocytes undergo meiosis.

Primary spermatocytes and primary oocytes are diploid whereas secondary spermatocytes are haploid.

153. Answer (1)

Hint: Leads to an increase in blood pressure

Sol.: JGA is a special sensitive region formed by the cellular modifications in the DCT and the afferent arteriole at the location of their contact. A fall in GFR, decrease in blood volume and pressure can activate the JG cells to release renin, which stimulates the glomerular blood flow and thereby restores the GFR back to normal.

154. Answer (2)

Hint: Duration of cardiac cycle = $\frac{60 \text{ seconds}}{\text{Heart rate}}$

Sol.: We know,

Cardiac output = Heart rate \times Stroke volume

5250 mL = HR \times 70 mL

$$\therefore \text{HR} = \frac{5250}{70} = 75 \text{ beats min}^{-1}$$

$$\text{Duration of cardiac cycle} = \frac{60}{75} = 0.80 \text{ sec}$$

155. Answer (4)

Hint: Lipid bilayer arrangement

Sol.: Lipids are indeed small molecular weight compounds and are arranged into structures like cell membrane. Upon grinding of a living tissue, cell membranes are broken into pieces, and they form vesicles which are not water-soluble. Therefore, these membrane fragments in the form of vesicles get separated along with the acid-insoluble pool and hence in the macromolecular fraction. Though, they are not strictly macromolecules.

156. Answer (3)

Hint: In chemiosmosis, breakdown of proton gradient leads to the release of energy.

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

157. Answer (4)

Hint: Z scheme of light reaction involves both PS I and PS II.

Sol.: When only PS I is functional, the electron is circulated within the photosystem and the phosphorylation occurs due to cyclic flow of electrons.

158. Answer (3)

Hint: In bryophytes, water is required for sexual reproduction.

Sol.: Liverworts show asexual reproduction by means of fragmentation and gemmae. Gemmae are green, multicellular asexual buds. Vegetative reproduction in mosses occur by fragmentation and budding in the secondary protonema.

159. Answer (3)

Hint: Nectaries attract insects and other animals.

Sol.: Wind pollinated flowers, generally have flowers packed in inflorescence, well exposed stamens, non-sticky pollen and feathery stigma.

160. Answer (3)

Hint: *Ex-situ* conservation involves taking threatened animals and plants out from their natural habitat and placing them in special setting.

Sol.: Cryopreservation, wildlife safari parks and botanical garden are *ex-situ* conservation strategies. Wildlife sanctuaries are the places where animals are protected *in-situ*.

161. Answer (4)

Hint: $G_1 \rightarrow S$ transition, the major check point in the cell cycle, is carried out by G_1 cyclin + cdc 2 kinase.

Sol.: G_2 to M transition is triggered by maturation promoting factor formed by mitotic cyclin + cdc 2 kinase.

162. Answer (3)

Hint: Synapsis occurs during the 2nd sub-stage of prophase I.

Sol.: Pairing of homologous chromosomes is known as synapsis and this event occurs during zygotene. Chromosomal synapsis is accompanied by a structure called synaptonemal complex.

163. Answer (4)

Hint: Phenylketonuria is an autosomal recessive disorder.

Sol.: Phenylketonuria is caused due to the lack of enzyme, phenylalanine hydroxylase that converts phenylalanine into tyrosine.

164. Answer (3)

Hint: Interkinesis is a metabolic stage between telophase I and prophase II.

Sol.: There is no DNA replication during interkinesis, but there is duplication of centrosome in animal cells.

165. Answer (4)

Sol.: The term linkage was coined by T.H. Morgan.

166. Answer (3)

Hint: Sigma (σ) factor is required by RNA polymerase (core enzyme) for transcription initiation.

Sol.: In prokaryotes RNA polymerase (core enzyme) can only catalyse the elongation process.

167. Answer (3)

Hint: This technique is used to make millions of copies of a specific DNA sample.

Sol.: Polymerase chain reaction is a technique, which can be used to replicate the isolated DNA from a single cell.

168. Answer (3)

Hint: Systematics includes taxonomy and evolutionary relationships.

Sol.: The word systematics is derived from a Latin word "Systema".

169. Answer (1)

Hint: Superior ovary is found in hypogynous flowers.

Sol.: Petunia is an ornamental plant of solanaceae. It is an example of hypogynous flower.

170. Answer (3)

Hint: Diatomite or diatomaceous earth is used in brewing industry, sugarcane refineries and in polishing of metal.

Sol.: Euglenoids, such as *Euglena* can also survive in absence of sunlight, as they can show both phototrophic and heterotrophic mode of nutrition.

171. Answer (3)

Hint: Shown by Bobcat and Tasmanian tiger cat.

Sol.: When more than one adaptive radiation appeared to have occurred in an isolated geographical area (representing different habitats), one can call this convergent evolution.

Placental mammals in Australia also exhibit adaptive radiation in evolving into varieties of such placental mammals, each of which appears to be 'similar' to a corresponding marsupial (e.g., Placental wolf and Tasmanian wolf-marsupial).

The similar development of a trait in two distinct species that share a similar original trait in response to similar evolutionary challenge or pressure is called parallel evolution. Cyclical evolution refers to the idea that evolutionary processes repeat themselves over time within an ecosystem.

172. Answer (4)

Hint: Have life span of about two weeks to several months.

Sol.: As a first step towards gene therapy for ADA deficiency, lymphocytes from the blood of the patient are grown in a culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.

173. Answer (3)

Hint: Came before *Homo erectus*.

Sol.: The first human like being, the hominid was called *Homo habilis*. The brain capacities was in between 650-800 cc. They probably did not eat meat.

Fossils discovered in Java in 1891 revealed the next stage, *i.e.*, *Homo erectus* about 1.5 mya. They had a large brain of about 900 cc. They probably ate meat.

The Neanderthal man had a brain size of 1400 cc.

174. Answer (2)

Hint: DNA fragments of equal size appear as a single band in agarose gel.

Sol.: Restriction enzyme 'X' cuts at two positions in the given linear DNA of 15 kb and three fragments (each of 5 kb) would be obtained after complete restriction digestion.

As each of three fragments would be of the same size, they will appear as a single band in an agarose gel after electrophoresis.

175. Answer (2)

Hint: Computed tomography uses the same radiations as that used in radiography.

Sol.: Ionising radiations like X-rays and gamma rays and non-ionising radiations like UV rays cause DNA damage leading to neoplastic transformation of normal cells.

Techniques like radiography (use of X-rays), CT (Computed Tomography) and MRI are very useful to detect cancers of the internal organs.

176. Answer (2)

Hint: Tetracycline resistance would not be lost

Sol.: In the above-mentioned condition, non-transformants would be sensitive to both ampicillin and tetracycline as naturally *E.coli* does not contain any antibiotic resistant gene.

Recombinant transformants would be sensitive to tetracycline but resistant to ampicillin whereas

non-recombinant transformants would be resistant to both ampicillin and tetracycline.

177. Answer (2)

Hint: PMNLs are phagocytic cells.

Sol.: Most abundant cells of the total WBCs are neutrophils.

An agranulocyte that forms 6-8% of the total WBCs is monocyte. Neutrophils and monocytes are phagocytes. These are categorized under cellular barrier of innate immunity.

178. Answer (4)

Hint: Silencing of RNA of nematode

Sol.: Using *Agrobacterium* vectors, nematode specific genes are introduced into the host plant. The introduction of DNA is such that it produces both sense and anti-sense RNA in the host cells. These two RNAs being complementary to each other forms dsRNA that initiates RNAi and thus, silences the specific mRNA of nematode. The consequence is that the parasite will not survive in a transgenic host expressing specific interfering RNA.

179. Answer (2)

Hint: Given by deVries

Sol.: Hugo deVries believed that it is mutation that causes evolution and not the minor variations (heritable) that Darwin talked about. Mutations are random and directionless while Darwinian variations are small and directional.

180. Answer (2)

Hint: Assists in blocking polyspermy

Sol.: Receptors for sperm binding in humans are present on zona pellucida, which is an acellular layer.

During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that blocks the entry of additional sperms. Thus, it ensures that only one sperm can fertilise an ovum.



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Test Date : 06/04/2025

ANSWERS

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

HINTS & SOLUTIONS**[PHYSICS]**

1. Answer (4)

Hint & Sol.: Bulk modulus defined for all solids, liquids and gases.

2. Answer (3)

Hint & Sol.:

For perfectly elastic collision $e = 1$

For perfectly inelastic collision $e = 0$

For partially elastic collision $0 < e < 1$

3. Answer (4)

Hint: Total time of flight = $t_1 + t_2$

Sol.: Time of flight = $\frac{2u \sin \theta}{g}$

$$t_1 + t_2 = \frac{2u \sin \theta}{g}$$

$$3 + 1 = \frac{2 \times 40 \sin \theta}{10}$$

$$\sin \theta = \frac{1}{2}$$

$$\theta = 30^\circ$$

4. Answer (2)

Hint: In SHM, $v_{\max} = A\omega$

Sol.: $\omega = \frac{v_{\max}}{A}$

From graph

$$v_{\max} = 0.3 \text{ m/s}, A = \frac{10}{100} \text{ m}$$

$$\omega = \frac{0.3}{10 \times 10^{-2}}$$

$$= 3 \text{ rad/s}$$

5. Answer (1)

Hint: Process A \rightarrow B is isochoric

Sol.: $\Delta U = n C_v \Delta T$

$$= \frac{R}{\left(\frac{7}{5} - 1\right)} \times \frac{2 P_0 V_0}{R}$$

$$= 5 P_0 V_0$$

6. Answer (3)

Hint: According to Stoke's law $F_{\text{drag}} = 6\pi\eta r v$

Sol.: $v = \frac{F_{\text{drag}}}{6\pi\eta r}$

$$= \frac{18 \times 10^{-3}}{6 \times 3.14 \times 0.5 \times 1 \times 10^{-3}}$$

$$\approx 2 \text{ m/s}$$

7. Answer (3)

Hint: Net electric dipole moment $\vec{P} = \vec{P}_1 + \vec{P}_2$

Sol.: $\vec{P}_1 = \sqrt{2} qa \hat{i}$

$\vec{P}_2 = \sqrt{2} qa \hat{j}$

$\vec{P} = \sqrt{2} aq \hat{i} + \sqrt{2} aq \hat{j}$

$$|\vec{P}| = 2qa$$

8. Answer (4)

Hint & Sol.: Electric flux passing through a closed surface in uniform electric field is zero.

9. Answer (3)

Hint: Work done by external force = Change in potential energy

Sol.: $U = -PE \cos \theta$

$$U_i = -PE$$

$$U_f = -PE \cos\theta$$

$$W = -PE \cos\theta + PE$$

$$\frac{3PE}{2} = PE(1 - \cos\theta)$$

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

$$\theta = 120^\circ$$

10. Answer (3)

Hint: Maximum number of lines in emission spectrum can be calculated using formula

$$N = \frac{n(n-1)}{2}$$

Sol.: $n = 4$

$$N = \frac{4(4-1)}{2} = 6$$

11. Answer (2)

Hint: $P = \frac{1}{f}$

Sol.: $P = P_1 + P_2$

$$= 2 + \left(\frac{-1}{20 \times 10^{-2}} \right)$$

$$= 2 - 5$$

$$= -3 \text{ D}$$

12. Answer (3)

Hint: Resonant frequency, $f = \frac{1}{2\pi\sqrt{LC}}$

Sol.: $f_1 = \frac{1}{2\pi\sqrt{L_1 \times 3C}}$

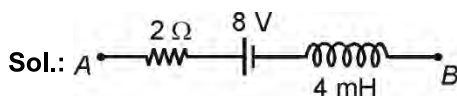
$$f_1 = f$$

$$\frac{1}{2\pi\sqrt{L_1 \times 3C}} = \frac{1}{2\pi\sqrt{LC}}$$

$$L_1 = \frac{L}{3}$$

13. Answer (1)

Hint: Potential drop across an inductor $V_L = -L \frac{di}{dt}$



$$V_A - V_B = 6 + 8 - 4 = 10 \text{ V}$$

14. Answer (3)

Hint: Shift = $t \left(1 - \frac{1}{\mu} \right)$

Sol.: Shift = $4 \left(1 - \frac{1}{\frac{3}{2}} \right)$

$$= \frac{4}{3} \text{ cm}$$

15. Answer (3)

Hint: Magnification through a spherical mirror,

$$m = -\frac{v}{u}$$

Sol.: $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{v} - \frac{1}{3f} = -\frac{1}{f}$$

$$\frac{1}{v} - \frac{2}{3f} = -\frac{1}{f}$$

$$\frac{1}{v} = -\frac{1}{f} + \frac{2}{3f}$$

$$\frac{1}{v} = \frac{-3+2}{3f}$$

$$v = -3f$$

$$m = -\frac{3f}{\frac{3f}{2}} = -2$$

16. Answer (1)

Hint & Sol.: Speed of light in vacuum is

$$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

$$c\sqrt{\mu_0 \epsilon_0} = 1$$

17. Answer (2)

Hint: Charge flowing through a coil is given by

$$Q = \frac{\Delta\phi}{R}$$

Sol.: $\phi_i = 5 + 3 + 16 = 24$

$$\phi_f = 20 + 6 + 16 = 42$$

$$Q = \frac{\phi_f - \phi_i}{R}$$

$$= \frac{42 - 24}{6} = 3 \text{ C}$$

18. Answer (2)

Hint: Use Boolean formula $\overline{\overline{A}} = A$

Sol.: $y = \overline{\overline{A} + \overline{B}}$

$= \overline{\overline{A}} \cdot \overline{\overline{B}}$

$= A \cdot B$

AND gate.

19. Answer (4)

Hint & Sol.: Electrons on n-side and holes on p-side will move towards the junction.

20. Answer (4)

Hint & Sol.: ${}_1\text{H}^2 + {}_1\text{H}^2 \rightarrow {}_1\text{H}^3 + \text{proton}$

21. Answer (1)

Hint: Energy of a photon $E = hv$

Sol.: $\frac{hc}{\lambda} = E$

$\left(\frac{hc}{\lambda} = hv\right)$

$\frac{h}{\lambda} = P$

$Pc = hv$

$v = \frac{Pc}{h}$

22. Answer (1)

Hint & Sol.: Intensity of bright fringe decrease on going away from central bright. In diffraction, light energy is redistributed.

23. Answer (3)

Hint: For bright fringe, phase difference $\Delta\phi = 2n\pi$

Sol.: For central fringe $n = 0$

$\phi = 0$

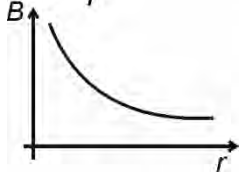
For 2nd bright $n = 2$

$(\Delta\phi)_{2-B} = 4\pi$

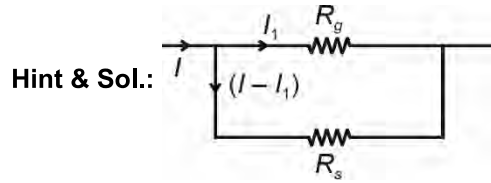
24. Answer (3)

Hint: Magnetic field due to a long straight current carrying wire is given by $B = \left(\frac{\mu_0 i}{2\pi r}\right)$

Sol.: $B \propto \frac{1}{r}$



25. Answer (1)



Hint & Sol.:

$I_1 R_g = (I - I_1) R_s$

$I_1 (R_g + R_s) = I R_s$

$\frac{I_1}{I} = \left(\frac{R_s}{R_g + R_s}\right)$

$= \frac{0.3}{60.3}$

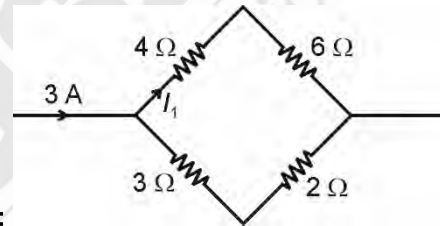
$= \left(\frac{1}{201}\right)$

26. Answer (4)

Hint & Sol.: By Curie's law for paramagnetic material $\chi \propto \frac{1}{T}$.

27. Answer (1)

Hint: $P = I^2 R$



Sol.:

$I_1 = \frac{3 \times 5}{10 + 5}$

$= 1 \text{ A}$

$P = I_1^2 R$

$= 1^2 \times 4$

$= 4 \text{ W}$

28. Answer (3)

Hint & Sol.: Drift velocity is dependent on electric field and current flows in a conductor when electric field is applied.

29. Answer (4)

Hint: Use conduction formula: $\frac{dQ}{dt} = kA \frac{dT}{dx}$

Sol.: $\frac{dT}{dx} = \left(\frac{dQ}{dt}\right) / kA$

$\left(\frac{dQ}{dt}\right)$ and k is constant but $\frac{dT}{dx}$ change with area of cross-section.

30. Answer (2)

Hint: Work done = $\int P dV$

Sol.: $W = (2V_0 - V_0)\left(\frac{P_0}{2}\right) + (2V_0 - V_0)\left(P_0 - \frac{P_0}{2}\right) \times \frac{1}{2}$
 $= \frac{P_0 V_0}{2} + \frac{P_0 V_0}{4}$
 $= \frac{3P_0 V_0}{4}$

31. Answer (3)

Hint: Average kinetic energy per molecule per degree of freedom = $\frac{1}{2} k_B T$

Sol.: Rotational degree of freedom of diatomic gas is 2

Average rotational kinetic energy = $2\left(\frac{1}{2} k_B T\right)$
 $= k_B T$

32. Answer (3)

Hint & Sol.: Beat frequency = $f_1 - f_2$

Time taken in two consecutive maxima = $\frac{1}{f_1 - f_2}$

Time taken in two consecutive maxima and minima = $\frac{1}{2(f_1 - f_2)}$.

33. Answer (1)

Hint: Fundamental frequency of a string fixed at both the ends, $f = \frac{1}{2\ell} \sqrt{\frac{T}{\mu}}$

Sol.: $f \propto \sqrt{T}$

$$\frac{f}{f_1} = \frac{\sqrt{T}}{\sqrt{\frac{144}{100} T}}$$

$f_1 = 1.2f$

$$\left(\frac{f_1 - f}{f}\right) = \left(\frac{1.2f - f}{f}\right) \times 100$$

= 20%

34. Answer (4)

Hint: Time period of spring-mass system

$$T = 2\pi \sqrt{\frac{m}{k_{\text{eff}}}}$$

Sol.: For parallel combination

$$k_{\text{eff}} = \frac{k}{2} + k = \left(\frac{3k}{2}\right)$$

$$T = 2\pi \sqrt{\frac{m}{\frac{3k}{2}}}$$

$$= 2\pi \sqrt{\frac{2m}{3k}}$$

35. Answer (3)

Hint: Force is variable, therefore use $W = \int \vec{F} \cdot d\vec{r}$

Sol.: $W = \int \vec{F} \cdot d\vec{r}$
 $= \int (2x\hat{i} + \hat{j})(dx\hat{i} + dy\hat{j})$
 $= \int_2^3 2x dx + \int_1^2 dy$
 $= \left[x^2\right]_2^3 + (2-1)$
 $= 9 - 4 + 1$
 $= 6 \text{ J}$

36. Answer (2)

Hint & Sol.: $W = \vec{F} \cdot \vec{d}$
 $= Fd \cos\theta$

Dot product of two vectors is scalar

37. Answer (1)

Hint: $\Delta P = \rho gh$

Sol.: $B = \frac{-\Delta P}{\left(\frac{\Delta V}{V}\right)}$

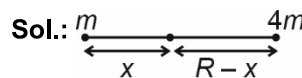
$P = 10^3 \times 10 \times 2 \times 10^3$
 $= 2 \times 10^7$

$$B = \frac{2 \times 10^7}{10^{-3}}$$

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

38. Answer (3)

Hint: Use equation $E = \frac{Gm}{r^2}$ and $V = -\frac{Gm}{r}$



$$\frac{Gm}{x^2} = \frac{4mG}{(R-x)^2}$$

$R - x = 2x$

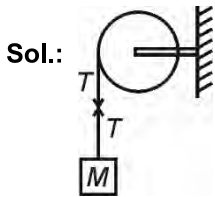
$$x = \frac{R}{3}$$

$$V = \frac{-Gm}{\frac{R}{3}} - \frac{4Gm}{\frac{2R}{3}}$$

$$V = \frac{-3Gm}{R} - \frac{6Gm}{R} = \frac{-9Gm}{R}$$

39. Answer (4)

Hint: There is no slipping of string on disc, hence use equation $a = R\alpha$



$$Mg - T = Ma \quad \dots(1)$$

$$T \times R = I\alpha$$

$$a = R\alpha$$

$$TR = \frac{MR^2}{2} \times \frac{a}{R}$$

$$T = \frac{Ma}{2} \quad \dots(2)$$

$$(1) + (2)$$

$$Mg = \frac{3Ma}{2}$$

$$a = \frac{2g}{3}$$

40. Answer (2)

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

Sol.: $\omega = \omega_0 + \alpha t$

$$12 = \alpha \times 4$$

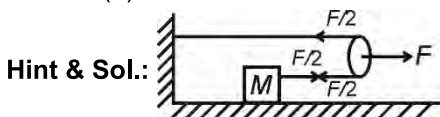
$$\alpha = 3 \text{ rad/s}^2$$

$$\tau = I\alpha$$

$$300 = I \times 3$$

$$I = 100 \text{ kg m}^2$$

41. Answer (2)



$$\frac{F}{2} = Ma$$

$$a = \frac{F}{2M}$$

42. Answer (2)

Hint: Kinetic energy at highest point

$$K = \frac{1}{2} M u^2 \cos^2 \theta$$

Sol.: $K = 2 \text{ P.E}$

$$\frac{1}{2} M u^2 \cos^2 \theta = 2 MgH$$

$$\frac{1}{2} M u^2 \cos^2 \theta = 2Mg \frac{u^2 \sin^2 \theta}{2g}$$

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

$$\theta = \tan^{-1} \left(\frac{1}{\sqrt{2}} \right)$$

43. Answer (4)

Hint & Sol.: Two vectors of same physical quantity are unequal if they have different magnitude as well as different direction, same magnitude but different direction and same direction but different magnitude.

44. Answer (3)

Hint: $a = \frac{d^2x}{dt^2}$

Sol.: $x = 2 - 3t + 4t^3$

$$v = \frac{dx}{dt}$$

$$v = -3 + 12t^2$$

For, $v = 0$

$$\Rightarrow -3 + 12t^2 = 0$$

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

Now, $a = \frac{dv}{dt}$

$$a = 24t$$

$$a = 24 \times \frac{1}{2}$$

$$= 12 \text{ m/s}^2$$

45. Answer (2)

Hint: Dimension of E is $[ML^2T^{-2}]$

Sol.: $\frac{E}{g} = \frac{[ML^2T^{-2}]}{[LT^{-2}]}$

$$= [MLT^0]$$

[CHEMISTRY]

46. Answer (1)

Hint: Empirical formula is the simplest whole number ratio of elements present in a compound.

Sol.:

Element	%	Atomic mass	No. of moles	Simplest whole number ratio
C	38.71	12	$\frac{38.71}{12} = 3.22$	1
H	9.67	1	$\frac{9.67}{1} = 9.67$	3
O	51.62	16	$\frac{51.62}{16} = 3.22$	1

∴ The empirical formula is CH₃O.

47. Answer (2)

Hint: Number of angular nodes = ℓ

Number of radial nodes = $n - \ell - 1$

Sol.: For $4d_{x^2-y^2}$ subshell, $n = 4$, $\ell = 2$

Number of radial nodes = $4 - 2 - 1 = 1$

Number of angular nodes = $\ell = 2$

48. Answer (3)

Hint: IUPAC official name of element with atomic number 101 is Mendelevium.

Sol.:

Column I	Column II
101	Mendelevium
103	Lawrencium
104	Rutherfordium
108	Hassium

49. Answer (4)

Hint: Dipole moment (μ) = charge (Q) × bond length (l)

Sol.:

Molecules	Dipole moment μ (D)
H ₂ O	1.85
NH ₃	1.47
HI	0.38
CCl ₄	0

50. Answer (3)

Hint: Bond order (B.O.) = $\frac{1}{2} [N_b - N_a]$ where N_b is the number of electrons in bonding molecular orbital and N_a is the number of electrons in antibonding molecular orbital

Sol.: Bond order of $N_2 = \frac{10-4}{2} = 3$

Bond order of $N_2^+ = \frac{9-4}{2} = 2.5$

Bond order of $N_2^- = \frac{10-5}{2} = 2.5$

Bond order of $O_2 = \frac{10-6}{2} = 2$

Bond order $O_2^+ = \frac{10-5}{2} = 2.5$

Bond order $O_2^- = \frac{10-7}{2} = 1.5$

51. Answer (1)

Hint: For enthalpy change $\Delta H = nC_P\Delta T$

Sol.: For isothermal process temperature remains constant therefore $\Delta T = 0$

∴ $\Delta H = nC_P\Delta T = 0$

52. Answer (3)

Hint: The solubility of AgCl decreases because of common ion effect.

Sol.: $CaCl_2 \rightarrow Ca^{+2} + 2Cl^-$
 $0.1 \quad 2 \times 0.1 = 0.2$

Let the solubility of AgCl in 0.1 M CaCl₂ be S.

$AgCl \rightleftharpoons Ag^{\oplus} + Cl^{\ominus}$
 $S \quad S + 0.2$

$K_{sp}(AgCl) = [Ag^+][Cl^-]$

$1.8 \times 10^{-10} = S \times 0.2$ [$S \ll 0.2$, $S + 0.2 \approx 0.2$]

$S = \frac{1.8 \times 10^{-10}}{0.2}$

$= 9 \times 10^{-10} \text{ mol L}^{-1}$

53. Answer (2)

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

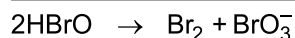
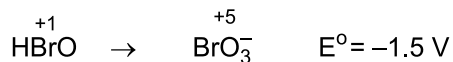
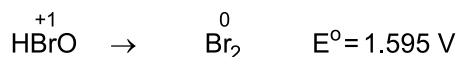
Sol.: Correct order of reducing power is

Na > Al > Fe > Sn

64. Answer (4)

Hint: If E_{cell}° value is +ve then disproportionation reaction will take place.

Sol.:



$$E_{\text{cell}}^{\circ} = 1.595 \text{ V} - 1.5 \text{ V} = 0.095 \text{ V}$$

65. Answer (3)

Hint: Crystal field splitting energy (Δ_0) depends on strength of ligand. $\left(\Delta_0 \propto \frac{1}{\lambda_{\text{absorb}}} \right)$

Sol.

(Coordination entity)	Wavelength of light absorbed (in nm)
$[\text{CoCl}(\text{NH}_3)_5]^{2+}$	535
$[\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{3+}$	500
$[\text{Co}(\text{NH}_3)_6]^{3+}$	475
$[\text{Co}(\text{CN})_6]^{3-}$	310

66. Answer (1)

Hint: Deficiency of vitamin C (Ascorbic acid) causes scurvy.

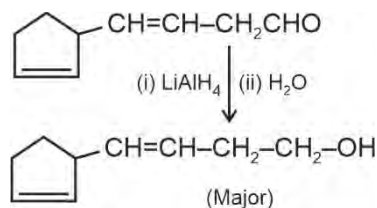
Sol.:

	Name of vitamins	Deficiency diseases
(a)	Thiamine	Beriberi
(b)	Riboflavin	Digestive disorder and burning sensation of the skin
(c)	Pyridoxine	Convulsions
(d)	Ascorbic acid	Bleeding gums

67. Answer (3)

Hint: LiAlH_4 reduces aldehyde into 1° alcohol.

Sol.: LiAlH_4 cannot reduce double bond.



68. Answer (4)

Hint & Sol.: On addition of dil. H_2SO_4 in CO_3^{2-} solution, CO_2 gas will be evolved that will turn lime water milky.

69. Answer (1)

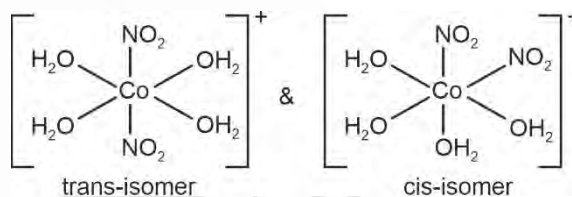
Hint: Complex will not exhibit coordination isomerism as there are no cationic and anionic coordination spheres separately

Sol.: It will exhibit linkage isomerism as ambidentate ligand (NO_2^-) can have different linkages with central metal atom.

Complex will exhibit ionization isomerism by giving different ions in solution or in molten state as



Complex will exhibit geometrical isomerism as cis/trans



No enantiomeric pairs possible, as the molecule is not chiral.

70. Answer (4)

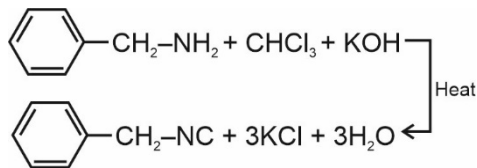
Hint: For aldol condensation reaction, at least two α hydrogen atoms should be present in carbonyl compound.

Sol.:

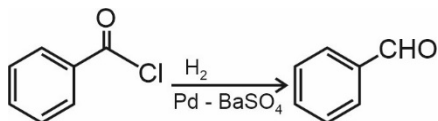
	No- α -hydrogen
	3 α -hydrogen atoms
	No α -hydrogen
	1 α hydrogen is present so aldol condensation will not occur.

71. Answer (1)

Hint: Aliphatic and aromatic primary amines on heating with chloroform and ethanolic potassium hydroxide solution form isocyanides or carbylamines.

Sol.:

Above reaction is known as carbylamine reaction.



Reaction is known as Rosenmund reaction.

72. Answer (1)

Hint: $[H^+] = c\alpha$ **Sol.:** $\alpha = 10\% = 0.01$

$$[H^+] = c\alpha = 0.2 \times 0.01 = 2 \times 10^{-3}$$

$$pH = -\log[H^+] = -\log 2 \times 10^{-3}$$

$$= 3 - \log 2 = 3 - 0.3$$

$$= 2.7$$

73. Answer (4)

Hint: Group reagent is used to identify a group of radicals or cations in a salt.

Sol.:

Group of Basic radicals	Group reagent
Group-I	Dilute HCl
Group-II	H ₂ S gas in presence of dil. HCl
Group-III	NH ₄ OH in presence of NH ₄ Cl
Group-IV	H ₂ S in presence of NH ₄ OH

74. Answer (1)

$$\text{Hint: } r_n = 52.9 \times \frac{n^2}{z} \text{ pm and } n\lambda = 2\pi r_n$$

$$\text{Sol.: } r_n = 52.9 \times \frac{16}{4} = 211.6 \text{ pm}$$

$$\lambda = \frac{2\pi r_n}{n}$$

$$= \frac{2\pi \times 211.6}{4} = 105.8\pi \text{ pm}$$

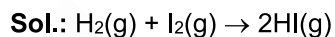
75. Answer (3)

Hint: Exothermic reactions are favoured at low temperature.

Sol.: Addition of inert gas at constant volume has no effect on equilibrium state.

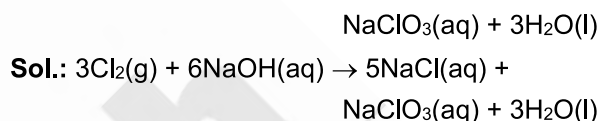
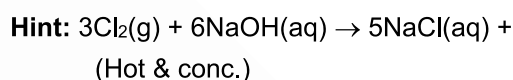
When we decrease the pressure, reaction will shift towards that side which has higher number of gaseous moles.

76. Answer (2)

Hint: $\Delta H^\circ = \Sigma BE \text{ of reactants} - \Sigma BE \text{ of products}$ 

$$\Delta H^\circ = (x + y - 2z) \text{ kJ mol}^{-1}$$

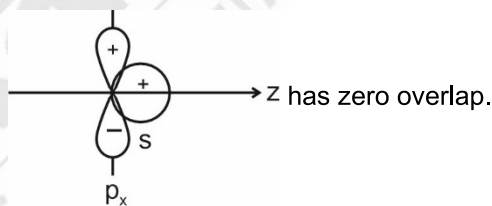
77. Answer (4)



3 moles Cl₂(gas) react with = 6 moles of NaOH

4 moles of Cl₂(gas) will react with = 8 moles of NaOH

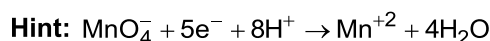
78. Answer (4)

Hint & Sol.:

79. Answer (1)

Hint & Sol.: Two components A and B show negative deviations from Raoult's law when A-B interaction is stronger than A-A and B-B interaction.

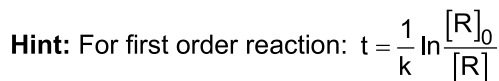
80. Answer (4)



Sol.: One mole MnO₄⁻ required five moles of electron to change into Mn⁺².

Therefore 0.6 mole MnO₄⁻ required three moles of electrons to change into Mn⁺².

81. Answer (2)



$$\text{Sol.: } t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$$

$$= \frac{2.303}{2.303 \times 10^{-3}} \log \frac{2}{0.2}$$

$$= 10^3 \log 10$$

$$= 1000 \text{ s}$$

82. Answer (3)

Hint: Steam distillation is used to separate substances which are steam volatile and are immiscible with water.

Sol.: Paper chromatography is a type of partition chromatography.

Glycerol can be separated from spent-lye in soap industry by using distillation under reduced pressure technique.

83. Answer (3)

Hint: Basic amino acids have more number of amino groups than the carboxyl groups.

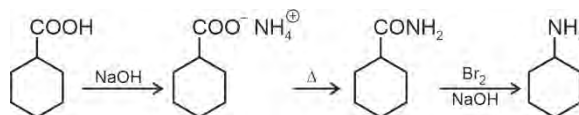
Sol.:

Amino acid	Structure
Lysine	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ (\text{CH}_2)_4 \\ \\ \text{NH}_2 \end{array}$
Leucine	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{CH}_2 \\ \\ \text{CH}-\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$
Valine	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{CH}-\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$
Phenylalanine	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{CH}_2 \\ \\ \text{C}_6\text{H}_5 \end{array}$

84. Answer (1)

Hint: Hoffmann method is used for the preparation of primary amines by treating an amide with bromine in an aqueous solution of sodium hydroxide.

Sol.:



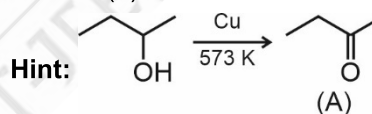
85. Answer (4)

Hint: Lesser the pK_a value more will be the acidic strength.

Sol.:

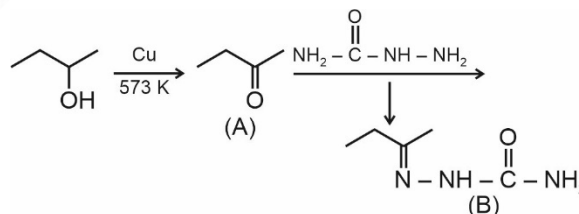
Compound	pK_a
	4.19
	4.46
	3.41
HCOOH	3.75

86. Answer (2)



Hint:

Sol.:

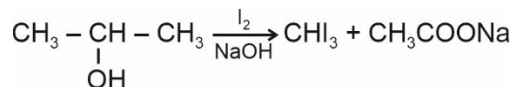
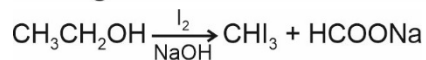
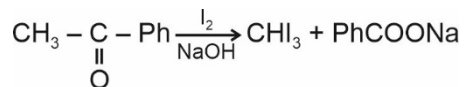


87. Answer (2)

Hint & Sol.: Boiling point of alcohol is more than the ether and hydrocarbon of similar molecular mass due to the presence of hydrogen bonding.

88. Answer (4)

Hint: Compounds containing $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-$ group or $\text{CH}_3-\underset{\text{OH}}{\text{CH}}-$ group will give positive iodoform test.

Sol.:

89. Answer (1)

Hint: Both Ce^{4+} and Yb^{2+} do not have unpaired electrons.**Sol.:** • $\text{Ce}^{4+} \Rightarrow [\text{Xe}] 4f^0$ $\text{Yb}^{2+} \Rightarrow [\text{Xe}] 4f^{14}$

• Absorption band of lanthanoid ions are narrow because of the excitation within f level.

90. Answer (1)

Hint: Paramagnetic species contain unpaired electron.**Sol.:** MnO_4^{2-} , $\text{Mn}^{6+} \Rightarrow [\text{Ar}] 4s^0 3d^1$

It contains one unpaired electron so behaves as paramagnetic species.

[BIOLOGY]

91. Answer (3)

Hint: Gynoecium in Solanaceae family shows axile placentation.**Sol.:** Tomato, tobacco, chilli, china rose, petunia and lemon show axile placentation.

92. Answer (3)

Sol.: Cyclosporin A is used as an immunosuppressive agent in organ transplant patients. These are produced by a fungus *Trichoderma polysporum*.

93. Answer (2)

Hint: In this interaction, both the partners are benefitted but they can live equally well without the association.**Sol.:** A plover bird enters the mouth of crocodile to feed on parasitic leeches. This type of interaction is called proto-cooperation.

94. Answer (4)

Hint: Sickle cell anaemia is an example of transversion mutation.**Sol.:** Sickle cell anemia is an autosomal recessive disorder which is developed due to the substitution of adenine (purine base) by thymine (pyrimidine base) in the coding strand of DNA of responsible gene. This mutation leads to change of glutamic acid to valine of the β globin chain, resulting in a qualitative disorder of haemoglobin molecules.

95. Answer (2)

Hint: This hormone is responsible for hastening the malting process in brewing industry.**Sol.:** Gibberellins are growth promoting hormones, which are known to cause quicker early growth in juvenile conifers.

96. Answer (3)

Hint: Dissolution of synaptonemal complex occurs during the diplotene stage.**Sol.:** Crossing over takes place in the pachytene stage of prophase I.

97. Answer (2)

Hint: RNA has higher rate of mutation as compared to DNA due to the presence of an additional OH group at 2'-position of ribose.**Sol.:** The packaging of chromatin at higher level requires additional set of proteins that collectively are referred as non-histone chromosomal (NHC) proteins.

98. Answer (4)

Hint: The trait shown in the pedigree can be autosomal recessive or autosomal dominant.**Sol.:** The genotype of the female in generation II can be Aa or aa. This pedigree is not true for X-linked dominant and X-linked recessive traits.

99. Answer (1)

Hint: Phycoerythrin is red pigment found in red algae.**Sol.:** Members of Rhodophyceae, commonly called Red algae, have chlorophyll a and d along with phycoerythrin. *Polysiphonia* is a red algae.

100. Answer (2)

Hint: These organisms are also called "Jokers of the plant kingdom".**Sol.:** Mycoplasma are the smallest living cell known and they are pathogenic to animals and plants.

101. Answer (3)

Hint: The given floral formula is of Solanaceae family.**Sol.:** The floral formula $\oplus \overset{\text{♂}}{\text{K}}_{(5)} \overset{\text{♀}}{\text{C}}_{(5)} \overset{\text{A}}{\text{A}_5} \overset{\text{G}}{\text{G}_{(2)}}$ is commonly seen in the 'potato family' (Solanaceae). Members of this family have solitary, axillary or cymose inflorescence.

102. Answer (3)

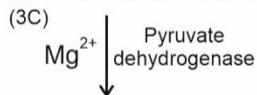
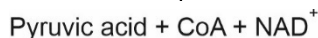
Hint: Mitochondrial matrix possesses single circular DNA molecule.

Sol.: Nucleus has linear dsDNA molecule. Nucleoid and chloroplast have single circular DNA molecule.

103. Answer (3)

Hint: $\text{NADH} + \text{H}^+$ is a product of this oxidative decarboxylation reaction.

Sol.: The complete reaction is as follows:



In this reaction several coenzymes, including NAD^+ and CoA are required for oxidative decarboxylation.

104. Answer (4)

Hint: DNA duplication occurs during S phase.

Sol.: After S phase, chromosome number will remain the same but amount of DNA will be doubled. Therefore, there will be 10 chromosomes and 50 pg of DNA.

105. Answer (3)

Hint: In water hyacinth and water lily, the flowers emerge above the level of water.

Sol.: In majority of aquatic plants, the flowers emerge above the water level and they are pollinated by either insect or wind. Water hyacinth and water lily are pollinated by insects.

106. Answer (4)

Hint: Thyroxine binds to intracellular receptors.

Sol.: Hormones which interact with membrane-bound receptors do not enter the target cell but generate second messengers which in turn regulate the cellular metabolism. *E.g.*, secretin and CCK.

Hormones which interact with intracellular receptors (*e.g.*, steroid hormones, iodothyronines, etc) mostly regulate gene expression by the interaction of hormone-receptor complex with the genome.

107. Answer (3)

Hint: Caused by HSV

Sol.: Except for hepatitis-B, genital herpes and HIV infections, other sexually transmitted diseases are completely curable if detected early and treated properly.

108. Answer (2)

Hint: Voluntary muscle fibres are multi-nucleated.

Sol.: The skeletal muscle fibres are cylindrical in shape, voluntary in nature, striated, multi-nucleated and unbranched.

Smooth muscle fibres are fusiform, involuntary in nature, non-striated, uninucleated and unbranched.

109. Answer (3)

Hint: During resting state, inner surface of an axon is negatively charged.

Sol.: When a neuron is not conducting any impulse, *i.e.*, resting, the axonal membrane is comparatively more permeable to K^+ and nearly impermeable to Na^+ .

Consequently, the axoplasm inside the axon contains high concentration of K^+ and negatively charged proteins and low concentration of Na^+ .

In contrast, the fluid outside the axon contains a low concentration of K^+ , a high concentration of Na^+ and thus, forms a concentration gradient.

110. Answer (3)

Hint: Part of forebrain

Sol.: In human brain, the cerebral cortex contains motor areas, sensory areas and large regions that are neither clearly sensory nor motor in function. These regions known as the association areas are responsible for complex functions like intersensory associations, memory and communication.

Corpora quadrigemina is a part of midbrain; cerebellum is a part of hindbrain. Brain stem is made up of midbrain, pons and medulla oblongata.

111. Answer (4)

Hint: Farmer's friend

Sol.: *Nereis*, an aquatic annelid, is dioecious but (*Pheretima*) earthworm and (*Hirudinaria*) leech are monoecious (Bisexual / Hermaphrodite).

Ascaris, *Anopheles* and *Trygon* are unisexual organisms (Dioecious).

112. Answer (4)

Hint: Exclude coelenterates and platyhelminths

Sol.: Starting from the members of the phylum Platyhelminthes, animals are triploblastic. Aschelminths are pseudocoelomates and from annelids onwards, animals are coelomates.

In members of the phylum Annelida, Arthropoda and Chordata, true segmentation is present.

Hirudinaria – Annelid

Culex and *Laccifer* – Arthropods

113. Answer (2)

Hint: Made up of a layer of flattened cells.

Sol.: Simple squamous epithelium is present in the inner lining of blood vessels and air sacs of lungs.

Simple cuboidal and columnar epithelial tissues are involved in secretion and absorption of substances.

114. Answer (3)

Hint: Causes vasodilation of blood vessels

Sol.: ADH can affect the kidney functions by its constrictory effect on blood vessels. This causes an increase in blood pressure. Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thereby GFR. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the renal tubule which also leads to an increase in blood pressure and GFR.

ANF can cause vasodilation (dilation of blood vessels) and thereby, decreases the blood pressure.

115. Answer (3)

Hint: Exclude the exclusive feature of male frogs

Sol.: In female frogs, ovaries are situated near kidneys but there is no functional connection with them. A pair of oviducts arising from the ovaries opens into cloaca separately. A mature female frog can lay 2500-3000 ova at a time.

116. Answer (3)

Hint: Senescence of leaves is promoted by a gaseous hormone.

Sol.: Senescence in plants is prevented by cytokinins and it is promoted by ethylene.

117. Answer (1)

Hint: Two copper centres are present in the complex IV of ETS.

Sol.: F_0 is an integral membrane protein, which forms a channel through which protons cross the inner membrane of mitochondria.

118. Answer (4)

Hint: *Rhizobium* is a symbiotic N_2 fixing bacterium.

Sol.: In India, *Aulosira* is the most active, non-symbiotic N_2 fixing microbe in rice fields.

119. Answer (1)

Hint: Standing state is the amount of inorganic substance present in an ecosystem per unit area at a given time.

Sol.: Standing crop is the amount of biomass in different trophic levels at a given time.

120. Answer (4)

Hint: Pyramid of number is generally upright in an aquatic ecosystem.

Sol.: In case of tree ecosystem, pyramid of number can be inverted or spindle shaped.

121. Answer (4)

Hint: Exponential growth curves have a J-shape.

Sol.: An exponentially growing population has a growth curve represented by $\frac{dN}{dt} = rN$.

122. Answer (4)

Hint: Mendelian dihybrid cross shows the phenotypic ratio of 9 : 3 : 3 : 1.

Sol.: In the dihybrid cross, only one progeny out of 16 has the genotype aabb. Therefore the number of seeds that show recessive traits will be $\frac{1}{16} \times 480 = 30$ seeds.

123. Answer (2)

Hint: The transcription and translation can be coupled in bacteria.

Sol.: Tailing process in hnRNA is template independent.

The genetic code is nearly universal, with some exceptions.

124. Answer (2)

Hint: The first embryophytes are also called amphibians of the plant kingdom.

Sol.: Bryophytes are the first embryophytes in the plant kingdom.

125. Answer (4)

Hint: This effect is due to a plant hormone that helps in cell division.

Sol.: Cytokinins delay the senescence of leaves and other organs by mobilization of resources. This effect is called Richmond Lang effect.

126. Answer (4)

Hint: Direct synthesis of ATP from metabolites is called substrate level phosphorylation.

Sol.: In glycolysis, fructose-1,6-bisphosphate will give rise to 2 molecules of glyceraldehyde-3-phosphate. Each molecule of glyceraldehyde-3-phosphate will produce 2ATP from substrate level phosphorylation. So, there will be 4 ATP from substrate level phosphorylation in glycolysis.

127. Answer (3)

Hint: Diatoms are chief producers in oceans.

Sol.:

- (i) In *Aspergillus*, sexual spores are called ascospores.
- (ii) *Altenaria* is an imperfect fungus, in which only the asexual or vegetative phases are known.
- (iii) *Gonyaulax* is a dinoflagellate responsible for red tide of sea.

128. Answer (2)

Hint: In monocot seeds, outer protein layer of the endosperm is the aleurone layer.

Sol.: A single, shield shaped cotyledon is present in the monocot seeds.

129. Answer (1)

Hint: In monocot stem, pericycle is absent.

Sol.: In dicot stem, pericycle is in the form of semi-lunar patches, made up of sclerenchymatous cells.

130. Answer (1)

Hint: Mesosomes are infoldings of membrane, involved in bacterial respiration.

Sol.: Pili are surface structures found in bacteria. These are involved in the mating process.

131. Answer (4)

Hint: Lipid bilayer arrangement

Sol.: Lipids are indeed small molecular weight compounds and are arranged into structures like cell membrane. Upon grinding of a living tissue, cell membranes are broken into pieces, and they form vesicles which are not water-soluble. Therefore, these membrane fragments in the form of vesicles get separated along with the acid-insoluble pool and hence in the macromolecular fraction. Though, they are not strictly macromolecules.

132. Answer (2)

Hint: Duration of cardiac cycle = $\frac{60 \text{ seconds}}{\text{Heart rate}}$

Sol.: We know,

Cardiac output = Heart rate \times Stroke volume
5250 mL = HR \times 70 mL

$$\therefore \text{HR} = \frac{5250}{70} = 75 \text{ beats min}^{-1}$$

$$\text{Duration of cardiac cycle} = \frac{60}{75} = 0.80 \text{ sec}$$

133. Answer (1)

Hint: Leads to an increase in blood pressure

Sol.: JGA is a special sensitive region formed by the cellular modifications in the DCT and the afferent arteriole at the location of their contact. A fall in GFR, decrease in blood volume and pressure can activate the JG cells to release renin, which stimulates the glomerular blood flow and thereby restores the GFR back to normal.

134. Answer (4)

Hint: Contains 23 chromosomes

Sol.: In human testis, spermatogonium is diploid and contains 46 chromosomes.

Primary and secondary spermatocytes undergo meiosis.

Primary spermatocytes and primary oocytes are diploid whereas secondary spermatocytes are haploid.

135. Answer (4)

Hint: Aromatic amino acid

Sol.: Aromatic amino acids (tyrosine, tryptophan and phenylalanine) contain a ring-like structure in their side chain.

Based on the number of amino and carboxyl groups, there are acidic (e.g. glutamic acid), basic (lysine) and neutral (valine) amino acids.

136. Answer (3)

Hint: Component of PNS

Sol.: A special neural centre in the medulla oblongata can moderate the cardiac functions through ANS. Neural signals through sympathetic nerves can increase the rate of heart beat, the strength of ventricular contractions and thereby the cardiac output.

On the other hand, parasympathetic neural signals decrease the rate of heart beat, speed of conduction of action potentials and thereby the cardiac output.

137. Answer (3)

Hint: Releases energy during the course of reaction

Sol.: All intermediate structural states in an enzyme catalysed reaction are unstable and possess high energy.

Also, if 'P' is at a lower level than 'S', the reaction is an exothermic reaction. One need not supply energy (by heating) in order to form the product.

Here, 'X' represents activation energy without enzyme whereas 'Y' represents activation energy in the presence of enzyme.

138. Answer (4)

Hint: Initiates the ventricular contraction

Sol.: Each peak in the ECG is identified with a letter from P to T that corresponds to a specific electrical activity of the heart.

P-wave	–	Depolarisation (excitation) of the atria
QRS-complex	–	Depolarisation of the ventricles
T-wave	–	Repolarisation of the ventricles
End of T- wave	–	End of the ventricular systole

139. Answer (4)

Hint: Fluid connective tissue

Sol.: Tendons and ligaments are examples of dense regular connective tissues.

Tendons ⇒ Attach skeletal muscles to bones

Ligaments ⇒ Attach one bone to another bone

Bone has a hard and non-pliable ground substance.

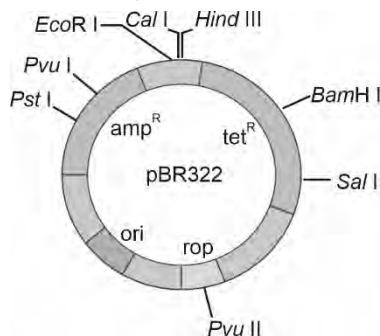
Blood is fibreless as fibroblasts are absent in it.

140. Answer (4)

Hint: Exclude the sites of restriction endonucleases present in the antibiotic resistant genes

Sol.: The restriction site of restriction enzyme *Pvu* II is present within *rop*.

rop codes for the proteins involved in the replication of the plasmid.



141. Answer (4)

Hint: Second step of PCR in chronology

Sol.: Primers anneal to its complementary template DNA during the annealing step of PCR. Hence, if the primers designed are not complementary to target template DNA, then, it would affect the first step of PCR, *i.e.*, annealing.

PCR involves 3 steps:

- (i) Denaturation
- (ii) Annealing
- (iii) Extension/Polymerisation

142. Answer (3)

Hint: Silences *via* dsRNA

Sol.: The source of the complementary RNA used in RNAi could be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate *via* an RNA intermediate.

PCR involves amplification of DNA. Gene therapy involves correction of a genetic defect. ELISA is based on the principle of antigen-antibody interaction.

143. Answer (2)

Hint: Less than 8

Sol.: The 8th, 9th and 10th pairs of ribs do not articulate directly with the sternum but join the seventh rib with the help of hyaline cartilage. These are called vertebrochondral ribs.

144. Answer (4)

Hint: Opioids are obtained from this plant

Sol.: Excessive dosage of cocaine causes hallucinations. Cocaine is obtained from *Erythroxylum coca*.

Other well-known plants with hallucinogenic properties are *Atropa belladonna* and *Datura*.

Papaver somniferum produces morphine, which is a depressant.

145. Answer (3)

Hint: Immunoglobulin

Sol.: Antibody functions by fighting infectious agents. It is secreted by B-lymphocytes. Antibodies provide humoral immunity.

Insulin – A peptide hormone

Trypsin – An enzyme

GLUT-4 – Enables glucose transport into the cells

146. Answer (4)

Hint: Presence of rapidly dividing cells

Sol.: Tissue culture means that the whole plant could be regenerated from explants, *i.e.*, any part of a plant taken out and grown in a test tube, under sterile conditions in special nutrient media.

The method of producing thousands of plants through tissue culture is called micro-propagation. Even if the plant is infected with a virus, the meristem (apical and axillary) is free of virus. Hence, one can remove the meristem and grow it *in vitro* to obtain virus-free plants.

147. Answer (4)

Hint: Present in triglyceride

Sol.: In a nucleotide, a phosphate moiety links with the carbon of one sugar. The bond between the phosphate and hydroxyl group of sugar is an ester bond.

148. Answer (3)

Hint: Female sex hormone

Sol.: Osteoporosis is an age-related disorder characterised by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is a common cause of osteoporosis in aged women.

Testosterone is a male sex hormone. Aldosterone is the main mineralocorticoid in human body and prolactin regulates the growth of the mammary glands and formation of milk in them.

149. Answer (3)

Hint: Three ganglia lie in the thorax and six in the abdomen

Sol.: If the head of a cockroach is cut off, it will still live for as long as one week as its nervous system is spread throughout the body. The head holds a bit of nervous system while the rest is situated along the ventral (belly-side) part of its body.

150. Answer (1)

Hint: Exists between forebrain and hindbrain

Sol.: Frogs excrete urea and thus, are ureotelic animals. Frog has nucleated RBCs which contain red-coloured pigment, namely haemoglobin.

Copulatory pad is present in male frogs. Midbrain is characterised by a pair of optic lobes.

151. Answer (1)

Hint: Number of eyes in human

Sol.: In the tissues, where low pO_2 , high pCO_2 , high H^+ concentration and higher temperature exist, the conditions are favourable for dissociation of oxygen from the oxyhaemoglobin. In alveoli, high pO_2 , low pCO_2 , lesser H^+ concentration and lower temperature, all are the factors that favour the formation of oxyhaemoglobin.

152. Answer (1)

Hint: Lower most part of the brain stem.

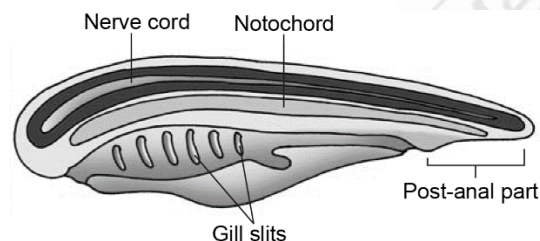
Sol.: A specialised centre present in the medulla region of the brain called respiratory rhythm centre is primarily responsible for the regulation of respiration.

A chemosensitive area is situated adjacent to the respiratory rhythm centre, which is highly sensitive to pCO_2 and concentration of hydrogen ions.

153. Answer (3)

Hint: Nerve cord is dorsally located

Sol.:



In members of the phylum Chordata, notochord is ventral to nerve cord and dorsal to gut.

154. Answer (4)

Hint: Include cartilaginous fishes

Sol.: In urochordates, notochord is present only in the larval tail, while in cephalochordates, it extends from head to tail region and is persistent throughout their life.

In the members of the class Chondrichthyes, notochord is persistent throughout the life.

In vertebrates, notochord is replaced by a cartilaginous or bony vertebral column in the adults.

155. Answer (2)

Hint: Secreted by parathyroid glands

Sol.: The parathyroid hormone is a peptide hormone. PTH increases the Ca^{2+} levels in the blood. It acts on the bones and stimulates the process of bone resorption. TCT secreted by thyroid gland is hypocalcemic in nature. Insulin is a hypoglycemic hormone.

156. Answer (3)

Hint: Diatomite or diatomaceous earth is used in brewing industry, sugarcane refineries and in polishing of metal.

Sol.: Euglenoids, such as *Euglena* can also survive in absence of sunlight, as they can show both phototrophic and heterotrophic mode of nutrition.

157. Answer (1)

Hint: Superior ovary is found in hypogynous flowers.

Sol.: Petunia is an ornamental plant of solanaceae. It is an example of hypogynous flower.

158. Answer (3)

Hint: Systematics includes taxonomy and evolutionary relationships.

Sol.: The word systematics is derived from a Latin word "Systema".

159. Answer (3)

Hint: This technique is used to make millions of copies of a specific DNA sample.

Sol.: Polymerase chain reaction is a technique, which can be used to replicate the isolated DNA from a single cell.

160. Answer (3)

Hint: Sigma (σ) factor is required by RNA polymerase (core enzyme) for transcription initiation.

Sol.: In prokaryotes RNA polymerase (core enzyme) can only catalyse the elongation process.

161. Answer (4)

Sol.: The term linkage was coined by T.H. Morgan.

162. Answer (3)

Hint: Interkinesis is a metabolic stage between telophase I and prophase II.

Sol.: There is no DNA replication during interkinesis, but there is duplication of centrosome in animal cells.

163. Answer (4)

Hint: Phenylketonuria is an autosomal recessive disorder.

Sol.: Phenylketonuria is caused due to the lack of enzyme, phenylalanine hydroxylase that converts phenylalanine into tyrosine.

164. Answer (3)

Hint: Synapsis occurs during the 2nd sub-stage of prophase I.

Sol.: Pairing of homologous chromosomes is known as synapsis and this event occurs during zygotene. Chromosomal synapsis is accompanied by a structure called synaptonemal complex.

165. Answer (4)

Hint: G₁ → S transition, the major check point in the cell cycle, is carried out by G₁ cyclin + cdc 2 kinase.

Sol.: G₂ to M transition is triggered by maturation promoting factor formed by mitotic cyclin + cdc 2 kinase.

166. Answer (3)

Hint: *Ex-situ* conservation involves taking threatened animals and plants out from their natural habitat and placing them in special setting.

Sol.: Cryopreservation, wildlife safari parks and botanical garden are *ex-situ* conservation strategies. Wildlife sanctuaries are the places where animals are protected *in-situ*.

167. Answer (3)

Hint: Nectaries attract insects and other animals.

Sol.: Wind pollinated flowers, generally have flowers packed in inflorescence, well exposed stamens, non-sticky pollen and feathery stigma.

168. Answer (3)

Hint: In bryophytes, water is required for sexual reproduction.

Sol.: Liverworts show asexual reproduction by means of fragmentation and gemmae. Gemmae are green, multicellular asexual buds. Vegetative reproduction in mosses occur by fragmentation and budding in the secondary protonema.

169. Answer (4)

Hint: Z scheme of light reaction involves both PS I and PS II.

Sol.: When only PS I is functional, the electron is circulated within the photosystem and the phosphorylation occurs due to cyclic flow of electrons.

170. Answer (3)

Hint: In chemiosmosis, breakdown of proton gradient leads to the release of energy.

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

171. Answer (2)

Hint: Assists in blocking polyspermy

Sol.: Receptors for sperm binding in humans are present on zona pellucida, which is an acellular layer.

During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that blocks the entry of additional sperms. Thus, it ensures that only one sperm can fertilise an ovum.

172. Answer (2)

Hint: Given by deVries

Sol.: Hugo deVries believed that it is mutation that causes evolution and not the minor variations (heritable) that Darwin talked about. Mutations are random and directionless while Darwinian variations are small and directional.

173. Answer (4)

Hint: Silencing of RNA of nematode

Sol.: Using *Agrobacterium* vectors, nematode specific genes are introduced into the host plant. The introduction of DNA is such that it produces both sense and anti-sense RNA in the host cells. These two RNAs being complementary to each other forms dsRNA that initiates RNAi and thus, silences the specific mRNA of nematode. The consequence is that the parasite will not survive in a transgenic host expressing specific interfering RNA.

174. Answer (2)

Hint: PMNLs are phagocytic cells.

Sol.: Most abundant cells of the total WBCs are neutrophils.

An agranulocyte that forms 6-8% of the total WBCs is monocyte. Neutrophils and monocytes are phagocytes. These are categorized under cellular barrier of innate immunity.

175. Answer (2)

Hint: Tetracycline resistance would not be lost

Sol.: In the above-mentioned condition, non-transformants would be sensitive to both ampicillin and tetracycline as naturally *E.coli* does not contain any antibiotic resistant gene.

Recombinant transformants would be sensitive to tetracycline but resistant to ampicillin whereas non-recombinant transformants would be resistant to both ampicillin and tetracycline.

176. Answer (2)

Hint: Computed tomography uses the same radiations as that used in radiography.

Sol.: Ionising radiations like X-rays and gamma rays and non-ionising radiations like UV rays cause DNA damage leading to neoplastic transformation of normal cells.

Techniques like radiography (use of X-rays), CT (Computed Tomography) and MRI are very useful to detect cancers of the internal organs.

177. Answer (2)

Hint: DNA fragments of equal size appear as a single band in agarose gel.

Sol.: Restriction enzyme 'X' cuts at two positions in the given linear DNA of 15 kb and three fragments (each of 5 kb) would be obtained after complete restriction digestion.

As each of three fragments would be of the same size, they will appear as a single band in an agarose gel after electrophoresis.

178. Answer (3)

Hint: Came before *Homo erectus*.

Sol.: The first human like being, the hominid was called *Homo habilis*. The brain capacities was in between 650-800 cc. They probably did not eat meat.

Fossils discovered in Java in 1891 revealed the next stage, *i.e.*, *Homo erectus* about 1.5 mya. They had a large brain of about 900 cc. They probably ate meat.

The Neanderthal man had a brain size of 1400 cc.

179. Answer (4)

Hint: Have life span of about two weeks to several months.

Sol.: As a first step towards gene therapy for ADA deficiency, lymphocytes from the blood of the patient are grown in a culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.

180. Answer (3)

Hint: Shown by Bobcat and Tasmanian tiger cat.

Sol.: When more than one adaptive radiation appeared to have occurred in an isolated geographical area (representing different habitats), one can call this convergent evolution.

Placental mammals in Australia also exhibit adaptive radiation in evolving into varieties of such placental mammals, each of which appears to be 'similar' to a corresponding marsupial (*e.g.*, Placental wolf and Tasmanian wolf-marsupial).

The similar development of a trait in two distinct species that share a similar original trait in response to similar evolutionary challenge or pressure is called parallel evolution. Cyclical evolution refers to the idea that evolutionary processes repeat themselves over time within an ecosystem.

