All India Aakash Test Series for NEET – 2022

OPEN MOCK TEST - 6 (Code-A)

Test Date : 13/07/2022

ANSWERS

1. (3)	41. (3)	81. (3)	121. (3)	161. (3)
2. (3)	42. (2)	82. (1)	122. (1)	162. (4)
3. (4)	43. (2)	83. (3)	123. (3)	163. (3)
4. (4)	44. (3)	84. (2)	124. (2)	164. (1)
5. (1)	45. (4)	85. (2)	125. (4)	165. (2)
6. (1)	46. (4)	86. (2)	126. (3)	166. (2)
7. (2)	47. (3)	87. (3)	127. (1)	167. (2)
8. (4)	48. (3)	88. (2)	128. (3)	168. (2)
9. (2)	49. (1)	89. (4)	129. (3)	169. (2)
10. (4)	50. (3)	90. (1)	130. (4)	170. (2)
11. (1)	51. (2)	91. (2)	131. (1)	171. (4)
12. (2)	52. (2)	92. (4)	132. (3)	172. (4)
13. (4)	53. (2)	93. (1)	133. (4)	173. (1)
14. (2)	54. (3)	94. (2)	134. (1)	174. (2)
15. (1)	55. (4)	95. (1)	135. (3)	175. (3)
16. (2)	56. (4)	96. (2)	136. (2)	176. (1)
17. (4)	57. (4)	97. (1)	137. (3)	177. (2)
18. (1)	58. (2)	98. (3)	138. (4)	178. (2)
19. (3)	59. (3)	99. (4)	139. (1)	179. (4)
20. (4)	60. (4)	100. (1)	140. (3)	180. (2)
21. (2)	61. (1)	101. (3)	141. (1)	181. (2)
22. (3)	62. (1)	102. (2)	142. (3)	182. (4)
23. (1)	63. (4)	103. (4)	143. (4)	183. (3)
24. (3)	64. (3)	104. (1)	144. (2)	184. (4)
25. (3)	65. (4)	105. (3)	145. (3)	185. (4)
26. (1)	66. (2)	106. (2)	146. (2)	186. (1)
27. (2)	67. (4)	107. (4)	147. (1)	187. (1)
28. (2)	68. (1)	108. (2)	148. (2)	188. (4)
29. (2)	69. (1)	109. (3)	149. (4)	189. (4)
30. (4)	70. (1)	110. (1)	150. (3)	190. (3)
31. (4)	71. (4)	111. (1)	151. (2)	191. (3)
32. (4)	72. (4)	112. (3)	152. (2)	192. (3)
33. (3)	73. (4)	113. (3)	153. (2)	193. (2)
34. (2)	74. (3)	114. (1)	154. (2)	194. (4)
35. (3)	75. (4)	115. (3)	155. (1)	195. (1)
36. (2)	76. (2)	116. (4)	156. (1)	196. (2)
37. (4)	77. (2)	117. (2)	157. (2)	197. (3)
38. (2)	78. (2)	118. (1)	158. (3)	198. (2)
39. (3)	79. (1)	119. (2)	159. (2)	199. (2)
40. (3)	80. (2)	120. (1)	160. (2)	200. (3)


CLICK HERE TO JOIN CHANNEL

HINTS & SOLUTIONS

[PHYSICS]

SECTION-A

1. Answer (3)

Hint & Sol.:

- Faraday gave law of electromagnetic induction.
- Einstein explained general and special theory of relativity
- Universal law of gravitation is given by Newton.
- C.V. Raman explained scattering of light by the molecules.

2. Answer (3)

Hint: $R = \frac{V}{I}$

Sol.: $\frac{\Delta R}{R}(100) = \left(\frac{\Delta V}{V} + \frac{\Delta I}{I}\right) \times 100$

% error in R = 5% + 3%

= 8%

3. Answer (4)

Hint & Sol.:

- Slope of velocity-time graph represents acceleration of the body.
- Area under the graph with time axis represents displacement of the body.

4. Answer (4)

Hint: Equation of trajectory

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$$

Sol.: On comparing above equation with $y = x - \frac{gx^2}{25}$.

$\tan\theta = 1 \Rightarrow \theta = 45°$

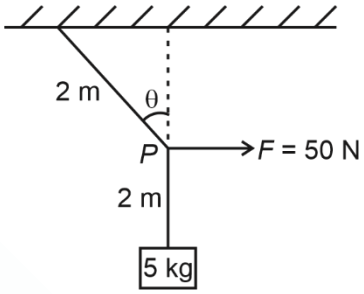
$$\frac{gx^2}{2u^2\cos^2\theta} = \frac{gx^2}{25}$$

$\Rightarrow 2u^2 \times \cos^2 45° = 25$

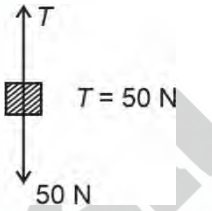
u = 5 m/s

5. Answer (1)

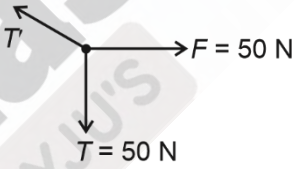
Hint: Use Lami's theorem



Sol.: for block



For point P



$T' = \sqrt{(50)^2 + (50)^2}$

$= 50\sqrt{2}$ N

$\approx$ 70.7 N

6. Answer (1)

Hint: Power $P = \vec{F}.\vec{v}$

$P \propto v \Rightarrow P = kv$

$$mv^2\frac{dv}{dx} = kv$$

$$m\int_0^v v\,dv = k\int_0^x dx$$

$$\frac{mv^2}{2} = kx$$

Hence, $x \propto v^2$

7. Answer (2)

Hint: $x_{cm} = \frac{m_1x_1 + m_2x_2 + m_3x_3 + \ldots}{m_1 + m_2 + m_3 + \ldots.}$

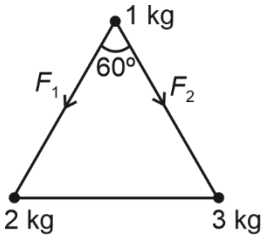
Sol.: $x_{cm} = \dfrac{m(1) + 2m\cdot(2) + 3m\cdot(3) + ...(nm).n}{m + 2m + 3m + ...nm}$

$= \dfrac{m(1^2 + 2^2 + 3^2 + ...n^2)}{m(1 + 2 + 3 + ...n)} = \dfrac{2n+1}{3}$

8. Answer (4)

Hint: $F = \dfrac{Gm_1m_2}{r^2}$

Sol.:



$F_1 = \dfrac{G\times 1\times 2}{(1)^2} = 2G$

$F_2 = \dfrac{G\times 3\times 1}{(1)^2} = 3G$

$F_{net} = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos 60^\circ} = \sqrt{19}\,G$

9. Answer (2)

Hint & Sol.: To change the length of an elastic rod the rod should be under stress.

10. Answer (4)

Hint: In equilibrium condition $mg = F_B$

Sol.: $mg = F_B$

$\Rightarrow \dfrac{4}{3}\pi\left(R^3 - \dfrac{R^3}{27}\right)\rho_s g = \dfrac{4}{3}\pi R^3\cdot\rho_w g$

$\Rightarrow \dfrac{26}{27}\rho_s = \rho_w$

$\Rightarrow \dfrac{\rho_s}{\rho_w} = \dfrac{27}{26} \Rightarrow \rho_s = \dfrac{27}{26}\times 1 = \dfrac{27}{26}$ g/cm^3

11. Answer (1)

Hint: Bulk modulus $B = \dfrac{P}{\Delta V / V}$

and $\gamma = \dfrac{\Delta V}{V.\Delta T}$

Sol.: Change in volume of cube

$\Delta V = \dfrac{PV}{B}$ …(i)

Now, if ΔT is the required increase in temperature

$\Delta V = \gamma V \Delta T$ …(ii)

From (i) and (ii)

$\gamma V\Delta T = \dfrac{VP}{B} \Rightarrow \Delta T = \dfrac{P}{\gamma B}$

12. Answer (2)

Hint: Ideal gas equation $PV = nRT$

Sol.: During an adiabatic process $P \propto T^{5/2}$

$P = KT^{5/2}$; where K is a constant

Now, $P = K\left[\dfrac{PV}{nR}\right]^{5/2}$

$\Rightarrow P^3V^5$ = constant

$\Rightarrow PV^{5/3}$ = constant

Hence, value of $\gamma = \dfrac{C_P}{C_V} = \dfrac{5}{3}$

13. Answer (4)

Hint & Sol.:

$a = -\omega^2 x$, $v = \omega\sqrt{A^2 - x^2}$ and $T = \dfrac{2\pi}{\omega}$

Among the given options, (1) and (2) remains constant with time while (3) will change with time.

14. Answer (2)

Hint & Sol.: The molecules of gas continuously collide elastically with walls of container and with other molecules.

15. Answer (1)

Hint & Sol.:

- In standing wave, amplitude of each point is constant.
- In closed organ pipe, closed end corresponds to a pressure antinode or displacement node.

16. Answer (2)

Hint: Energy stored in capacitor $U = \dfrac{1}{2}CV^2$

Sol.: Initially, $U_1 = \dfrac{1}{2}\times 10^{-2}\times 2^2 = 20$ mJ

Finally, $U_2 = \dfrac{1}{2}\times 10^{-2}\times 4^2 = 80$ mJ

Increase in charge $\Delta Q = 40 - 20 = 20$ mC

So heat produced is difference between work done by battery and change in energy stored in capacitors

So, heat produced, $H = \Delta QV - \Delta U$

$= (20 \times 4 - 60)$ mJ $= 20$ mJ

17. Answer (4)

Hint: Potential due to a point charge $V = \dfrac{KQ}{r}$

Sol.: $V_P = V_{\text{due to } q} + V_{\text{due to induced charges}}$

$\Rightarrow V_P = V_C = \dfrac{Kq}{r'} + V_{\text{induced charges}}$

$\Rightarrow \dfrac{Kq}{r} = \dfrac{Kq}{r'} + V_{\text{induced charges}}$

$\Rightarrow V_{\text{induced charges}} = \dfrac{Kq}{r} - \dfrac{Kq}{r'}$

18. Answer (1)

Hint: Heat produced in any resistor $H = I^2Rt$

Sol.: $R_{AB} = \frac{\rho L}{A} = \frac{\rho L}{4.\pi r^2}$, $R_{BC} = \frac{\rho L}{A'} = \frac{\rho L}{\pi r^2}$

$R_{AB} = \frac{1}{4}R_{BC}$

So, heat developed $H_{AB} = \frac{1}{4}H_{BC}$

$\Rightarrow$ $H_{BC} = 4\ H_{AB}$

19. Answer (3)

Hint: Magnetic force on charged particle $\vec{F} = q(\vec{v} \times \vec{B})$

Sol.: For positive ion, velocity is along positive *x*-direction and hence magnetic force is in negative *y*-direction. For negative ion, velocity is along negative *x*-direction and hence magnetic force is in negative *y*-direction.

So, both ion will deflect along negative y-direction

20. Answer (4)

Sol.: Maximum electric field 300 V/m,

$c = \frac{E_0}{B_0} \Rightarrow B_0 = 10^{-6}\ \text{T}$

$\Rightarrow$ Maximum magnetic force = qvB_0

$= 1.6 \times 10^{-19} \times 2 \times 10^7 \times 10^{-6}$

$= 3.2 \times 10^{-18}$ N

21. Answer (2)

Hint: $\varepsilon = \frac{B\omega l^2}{2}$

Sol.: Induced emf $\varepsilon = \frac{1}{2} \times 40 \times 10^{-6} \times 3 \times 2\pi \times 25$

= 9.4 mV

22. Answer (3)

Hint & Sol.:

$\frac{1}{\varepsilon_0}$ is analogous to μ_0

$\vec{p}$ is analogous to $\vec{M}$

$\vec{p} \times \vec{E}$ is analogous to $\vec{M} \times \vec{B}$

$\frac{2\vec{p}}{4\pi\varepsilon_0 \ell^3}$ is analogous to $\frac{\mu_0 2\vec{M}}{4\pi r^3}$

23. Answer (1)

Hint: Induced electric field at *P* is given by

$\int \vec{E} \cdot d\vec{l} = -\frac{-d\phi}{dt}$

Sol.: At point *P*

$E_{\text{ind}} \cdot 2\pi\left(\frac{R}{2}\right) = -\pi\frac{R^2}{4} \cdot \frac{dB}{dt}$

$E_{\text{ind}}(\pi R) = -\frac{\pi R^2}{4} \cdot 2B_0 t$

$|E_{\text{ind}}| = \frac{R}{2}B_0 t$

$|E_{\text{ind}}| = B_0 t$

So, force $F = qB_0 t$

$= qB_0$ (t = 1 s)

24. Answer (3)

Hint & Sol.: In compound microscope, the intermediate image is real, inverted and magnified.

25. Answer (3)

Hint: Fringe width in YDSE, $\beta = \frac{\lambda D}{d}$

Sol.: Since $\lambda_R > \lambda_Y > \lambda_G > \lambda_B$

Therefore, $\beta_R > \beta_Y > \beta_G > \beta_B$

26. Answer (1)

Hint: $\lambda = \frac{h}{P} = \frac{1.227}{\sqrt{V}}\text{nm}$

Sol.: $\lambda = \frac{1.227}{\sqrt{200}}\text{nm} = 0.08677$ nm

$\lambda = 0.087$ nm

27. Answer (2)

Hint: Intensity $I = \frac{nhf}{tA}$

Sol.: When frequency is doubled for *I* to become doubled *n* should remain the same.

$\therefore$ Saturation current remains the same but maximum kinetic energy becomes more than doubled. ($KE_{\max} = hf - \phi_0$)

28. Answer (2)

Hint: $mvr = \frac{nh}{2\pi}$

Sol.: Since speed reduces to half so, electron would jump to higher energy state with $n = 2$.

So, $mv_0 r = \frac{1 \times h}{2\pi}$ ....(i)

$\frac{mv_0 r'}{2} = \frac{2 \times h}{2\pi}$ ...(ii)

From (i) and (ii)

$r' = 4r$

29. Answer (2)

Hint: Energy of a photon $E = \frac{hc}{\lambda}$

Sol.: $2E - E = \frac{hc}{\lambda}$

$\Rightarrow E = \frac{hc}{\lambda}$

Now, $\frac{4E}{3} - E = \frac{hc}{\lambda'}$

$\Rightarrow \frac{E}{3} = \frac{hc}{\lambda'} \Rightarrow \lambda' = 3\lambda$

30. Answer (4)

Hint: Angular momentum, $L = \frac{nh}{2\pi}$

Sol.: Energy of electron in nth orbit of hydrogen atom $E_n = -\frac{13.6}{n^2}$ eV

$-3.4 \text{ eV} = \frac{-13.6}{n^2}$ eV

$\Rightarrow n = 2$

$L = 2 \times \frac{h}{2\pi} = \frac{h}{\pi}$

31. Answer (4)

Hint & Sol.:

To create a hole

$\frac{hc}{\lambda} \geq 38 \text{ meV}$

Or $\lambda \leq \frac{hc}{38 \text{meV}}$

$= \frac{12400 \text{eV}}{38 \times 10^{-3} \times \text{eV}} \text{Å}$

$= 3.26 \times 10^{-5}$ m

32. Answer (4)

Hint & Sol.: $Y = \overline{A} + \overline{B}$

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

33. Answer (3)

Hint & Sol.: Number of half lives $n = \frac{5}{1.25} = 4$

Fraction decayed $= 1 - \left(\frac{1}{2}\right)^4$

$= 1 - \frac{1}{16} = \frac{15}{16}$

34. Answer (2)

Hint & Sol.: For $i + r$ to be equal to 90°

$\tan i = \mu = \frac{3}{2}$

$\Rightarrow \tan i = \frac{3}{2}$

$\sin i = \frac{3}{\sqrt{13}}$

Hence, $i = 57°$

35. Answer (3)

Hint & Sol.: One internal reflection takes place during the formation of a primary rainbow while two internal reflections takes place during the formation of secondary rainbow.

SECTION-B

36. Answer (2)

Hint: Equation of motion $s = ut + \frac{1}{2}gt^2$

Sol.: In 6 second, velocity gained $v = gt = 10 \times 6$ = 60 m/s

Velocity after passing through the glass sheet $v' = \frac{66.66 \times 60}{100} \approx 40$ m/s

Height of glass sheet above the ground

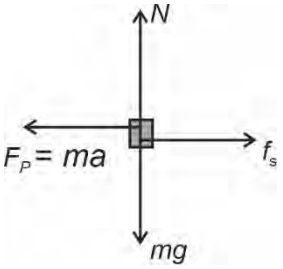
$h = ut + \frac{1}{2}gt^2$

$= 40 \times 3 + \frac{1}{2} \times 10 \times 3^2 = 120 + 45 = 165$ m

37. Answer (4)

Hint: Pseudo force will act on the block from the frame of trolley.

Sol.: From the frame of trolley



Here, $F_P = ma = 24$ N and

$f_{smax} = \mu mg = 0.2 \times 60 = 12$ N

So acceleration of block $a = \frac{24 - 12}{6} = 2 \text{ m/s}^2$

Time taken by box to cover the distance of 8 m

$t = \sqrt{\frac{2s}{a}} = \sqrt{\frac{2 \times 8}{2}} = 2\sqrt{2}$ second

38. Answer (2)

Hint: $\vec{v}_P = \vec{v}_{com} + \vec{v}_{P/com}$

Sol.: $\vec{v}_{com} = v\hat{i}$

$\vec{v}_{P/com} = \frac{v}{R} r\sin\theta\hat{i} - \frac{v}{R} r\cos\theta\hat{j}$

Hence, $\vec{v}_P = \left(v + \frac{v}{R} r\sin\theta\right)\hat{i} - \frac{vr}{R}\cos\theta\hat{j}$

39. Answer (3)

Hint: • Specific heat $C = \frac{\Delta Q}{\Delta T}$

• $\Delta Q = \Delta U + W$

Sol.: $C = \frac{\Delta Q}{\Delta T} = \frac{1}{\Delta T}(\Delta U + W) = C_V + \frac{W}{\Delta T}$

In given process $W = 4V_0 \times \frac{9P_0}{2} = 18P_0V_0$

and $\Delta T = \frac{30P_0V_0}{R} - \frac{3P_0V_0}{R} = \frac{27P_0V_0}{R}$

Hence, $C = C_V + \frac{W}{\Delta T} = \frac{3R}{2} + \frac{18P_0V_0}{\left(27\frac{P_0V_0}{R}\right)} = \frac{13R}{6}$

40. Answer (3)

Hint & Sol.: Natural frequency

$\omega_0 = \sqrt{\frac{k}{m}} = \sqrt{\frac{50}{2}} = 5\ \frac{\text{rad}}{\text{s}}$

Now, $\omega = \sqrt{\omega_0^2 - \left(\frac{b}{2m}\right)^2} = \sqrt{5^2 - \left(\frac{12}{2\times 2}\right)^2}$

$= \sqrt{5^2 - 3^2} = 4$ rad/s

i.e., 'ω' reduces by 20%

41. Answer (3)

Hint: Flux through the enclosed surface $\phi = \frac{Q_{enclosed}}{\varepsilon_0}$

Sol.: Flux of one wire linked with four faces of cube symmetrically.

$\phi_{ABCD} = \phi_{\text{due to wire 1}} + \phi_{\text{due to wire 2}}$

$= \frac{\lambda L}{4\varepsilon_0} + \frac{\lambda L}{4\varepsilon_0} = \frac{\lambda L}{2\varepsilon_0}$

42. Answer (2)

Hint: For balanced Wheatstone bridge

$\frac{P}{Q} = \frac{R}{S}$

Sol.: Using concept of balanced Wheatstone bridge in meter bridge experiment

$\frac{P}{Q} = \frac{R}{S} \Rightarrow \frac{X}{62+1} = \frac{20}{38+2}$

$\Rightarrow x = \frac{20\times 63}{40}$

$x = 31.5\ \Omega$

43. Answer (2)

Hint & Sol.:

For sinusoidal wave

$I_{rms}^2 = \frac{\int_0^T \left(I_0^2 \sin^2\omega t\right)dt}{\int_0^T dt} = \left(\frac{I_0}{\sqrt{2}}\right)^2$

$I_{rms} = \frac{I_0}{\sqrt{2}}$

44. Answer (3)

Hint: Image formed by first lens will act as an image for the second lens.

Sol.:

Image formed by convex lens I_1 will act as a virtual object for concave lens.

For concave lens

$\Rightarrow \frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$= \frac{1}{v} - \frac{1}{4} = \frac{1}{-20} \Rightarrow v = 5$ cm

As size of the image I_1 is 2 cm. Therefore size of image I_2 will be 2 × 1.25 = 2.5 cm.

45. Answer (4)

Hint: $Z_F = \frac{a^2}{\lambda}$

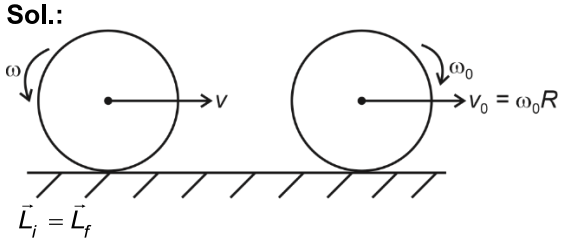
Sol.: $Z_F = \frac{(2.236\times 10^{-3})^2}{800\times 10^{-9}}$

$= \frac{50}{8} = 6.25$ m

46. Answer (4)

Hint: Use conservation of angular momentum

Sol.:



$\vec{L}_i = \vec{L}_f$

$$\Rightarrow mvR-\frac{2}{3}mR^2\omega = mv_0R+\frac{2}{3}mR^2\omega_0$$

$$\Rightarrow mvR-\frac{2}{3}mR^2\left[\frac{v}{R}\right] = mv_0R+\frac{2}{3}mR^2\left[\frac{v_0}{R}\right]$$

$$\Rightarrow \frac{mvR}{3} = \frac{5mv_0R}{3}$$

$$\Rightarrow v_0 = \frac{v}{5}$$

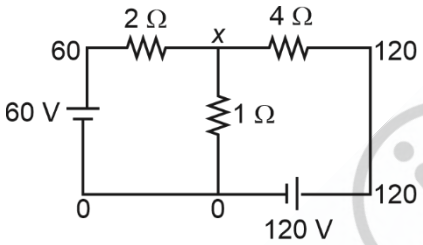
47. Answer (3)

Hint & Sol.: $V_0 = -\frac{1}{2}\frac{\rho R^2}{\varepsilon_0}$

48. Answer (3)

Hint: Use Kirchhoff's law

Sol.:



$$\frac{x-0}{1}+\frac{x-60}{2}+\frac{x-120}{4}=0$$

$\Rightarrow$ $4x + 2x - 120 + x - 120 = 0$

$7x = 240$

$$x = \frac{240}{7}$$

Hence current in 1 Ω, $I = \frac{x-0}{1} = \frac{240}{7}$ A

49. Answer (1)

Hint: For incident and reflected waves in same medium

$$\frac{I_i}{I_r} = \frac{A_i^2}{A_r^2}$$

Sol.: $\frac{I_i}{I_r} = \frac{9}{1}$

$$\Rightarrow I_r = \frac{I_i}{9}$$

So percentage of energy transmitted

$$= \left(1-\frac{1}{9}\right)\times 100$$

$$= \frac{800}{9} = 88.888$$

$\approx$ 89%

50. Answer (3)

Hint: Use law of equipartition of energy

Sol.: K.E due to translational motion of the molecules is

$$K_T = \frac{3}{2}nRT$$

KE due to rotational motion of the molecules in

$$K_R = \frac{2}{2}nRT$$

Total energy $= \frac{5}{2}nRT$

$$\therefore \frac{K_T}{K_{\text{Total}}} = \frac{\frac{3}{2}nRT}{\frac{5}{2}nRT} = \frac{3}{5} = 0.6$$

So, 60% of total energy is due to translational motion.

[CHEMISTRY]

SECTION-A

51. Answer (2)

Hint: $H_2S_2O_8$ contains two peroxy oxygen atoms.

Sol.: No. of peroxy oxygen atoms

= No. of mole of $H_2S_2O_8 \times N_A \times 2$

= $0.1 \times 2 \times N_A = 0.2\ N_A$

52. Answer (2)

Hint: Molarity = $\frac{\text{No. of moles of solute}}{\text{Volume of solution (in L)}}$

Sol.: Molarity = $\frac{40/40}{2} = \frac{1}{2} = 0.5$ M

53. Answer (2)

Hint: Na: $1s^2\ 2s^2\ 2p^6\ 3s^1$

Sol.: For n + l = 3, possible orbitals in sodium are one orbital of 3*s* and three orbitals of 2*p*.

54. Answer (3)

Hint: With increase in number of shells, atomic size of element increases.

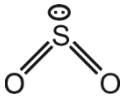
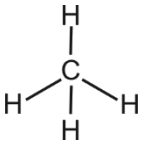
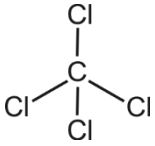
Sol.: Order of atomic size;

Rb > Na > Li > Be

55. Answer (4)

Hint: Sigma bond (σ) and lone pair orbital(s) of central atom involves in hybridization.

Sol.:

	Molecule	Hybridisation
SO_2		sp^2
CO_2	O = C = O	sp
CH_4		sp^3
CCl_4		sp^3

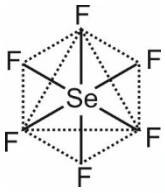
56. Answer (4)

Hint: Second period elements do not have *d* orbitals in their valence shell.

Sol.: Both π bonds present in O = C = O molecule is of $p\pi - p\pi$ type.

57. Answer (4)

Hint: SeF_6 has octahedral geometry.

Sol.: 

$\Rightarrow$ No. of 90° bond angles is 12.

58. Answer (2)

Hint: Molecules of non-zero dipole moment are polar.

Sol.: $H_2O(g)$ is bent in shape with μ_{net} = 1.85D, so it will be polar in nature.

59. Answer (3)

Hint: Lighter gas effuses most easily $\left(\text{rate} \propto \sqrt{\frac{1}{M}}\right)$.

Sol.: Due to minimum molar mass of NH_3 (molar mass 17 g mol^{-1}) among the given gases, it effuses out most easily.

60. Answer (4)

Hint: Isothermal reversible work

$$= -2.303\ nRT \log\left(\frac{V_2}{V_1}\right)$$

Sol.: Work $= -2.303 \times 1 \times R \times 300 \log\left(\frac{1}{10}\right)$

$= 2.303 \times 300\ R$

61. Answer (1)

Hint: For adiabatic process, dQ = 0

Sol.: Molar heat capacity $= \frac{1}{n}\frac{dQ}{dT}$

For adiabatic process, $= \frac{1}{n}\frac{dQ}{dT} = 0$

62. Answer (1)

Hint: During atomisation, one $H_2(g)$ molecule converted into two gaseous atoms.

Sol.: $H_2(g) \rightarrow 2H(g)$, since no. of gaseous moles increases, hence entropy increases.

63. Answer (4)

Hint: Enthalpy of formation is applicable for formation of 1 mol product by using those reactant which are present in its standard state.

Sol.: For reaction, $H_2(g) + I_2(s) \rightarrow 2HI(g)$

Enthalpy of reaction is equal to twice of enthalpy of formation.

64. Answer (3)

Hint: pOH = – log $[OH^-]$

and at 25°C, pH + pOH = 14

Sol.: $[OH^-] = 10^{-2}$ M, pOH = – log (10^{-2}) = 2

then pH = 14 – pOH = 14 – 2 = 12

65. Answer (4)

Hint: Mixture of weak acid and its salt with strong base form an acidic buffer.

Sol.: CH_3COOH and NaOH mixture can form an acidic buffer when CH_3COOH is present in excess.

66. Answer (2)

Hint: Br^- is common ion in the solution.

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

$$\underset{s}{AgBr(s)} \rightleftharpoons \underset{s}{Ag^+(aq)} + \underset{s+0.1\cong 0.1}{Br^-(aq)} \quad [\because 0.1 >>> s]$$

$K_{sp} = s \times 0.1$

$5 \times 10^{-13} = s \times 0.1$

$s = 5 \times 10^{-12}$ M

67. Answer (4)

Hint: Oxidation states of hydrogen and oxygen generally are +1 and –2 respectively.

Sol.: $H\underline{N}O_2 \Rightarrow 1 + x + 2(-2) = 0,\ x = +3$

$H_2\underline{S}O_3 \Rightarrow 2(+1) + x + 3(-2) = 0,\ x = +4$

$H_3\underline{P}O_3 \Rightarrow 3(+1) + x + 3(-2) = 0,\ x = +3$

$H\underline{Cl}O_4 \Rightarrow 1 + x + 4(-2) = 0,\ x = +7$

68. Answer (1)

Hint: *s*-Block elements generally form saline hydrides or ionic hydrides.

Sol.: NaH is a saline hydride.

69. Answer (1)

Hint:

Percentage strength = $\frac{\text{Volume strength}}{11.2} \times 3.4$

Sol.: Percentage strength = $\frac{28}{11.2} \times 3.4 = 8.5\%$

70. Answer (1)

Hint: Higher is the hydration enthalpy, higher is the solubility in water.

Sol.: Due to smaller size of Be^{2+} it has highest hydration enthalpy and has highest solubility.

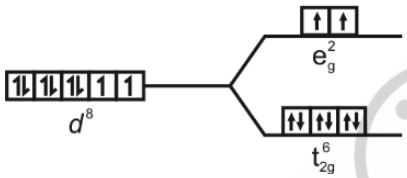
Correct order of solubility :

$BeSO_4 > MgSO_4 > CaSO_4 > BaSO_4$

71. Answer (4)

Hint: Complexes containing symmetrically filled *d*-orbitals do not show Jahn-Teller effect.

Sol.: d^8 is symmetrically filled, so does not show Jahn-Teller effect.



72. Answer (4)

Hint: Aqueous solution of borax is alkaline in nature.

Sol.: $\underset{\text{Borax}}{Na_2B_4O_7} + 7H_2O \longrightarrow 2NaOH + \underset{\text{Orthoboric acid}}{4H_3BO_3}$

73. Answer (4)

Hint: Due to accommodation of six large chloride ions around small sized Si^{4+} ion, $SiCl_6^{2-}$ does not exist.

Sol.:

- Carbon has highest catenation tendency among its group elements.
- Fullerenes are cage like molecules.
- Diamond has three dimensional network involving strong C–C bonds, which are very difficult to break and hence it has high melting point.

74. Answer (3)

Hint: Molar mass of $BaSO_4$ = 233 g mol^{-1}

Sol.:

$\because$ 32 g sulphur is present in 233 g $BaSO_4$ or 233 g $BaSO_4$ contains 32 g sulphur

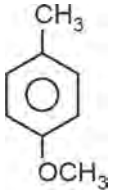
$\therefore$ 0.5 g barium sulphate contains $\frac{32 \times 0.5}{233}$ g sulphur

So, % of sulphur in organic compound

$$= \frac{32 \times 0.5}{233 \times 0.2} \times 100 = 34.33\%$$

75. Answer (4)

Hint: Ring of highest electron density, gives fastest electrophilic aromatic substitution.

Sol.: Due to +R effect of $-OCH_3$ group, electron density on  is highest, hence it will give fastest electrophilic aromatic substitution.

76. Answer (2)

Hint: No. of NaCl units in 1 unit cell of NaCl is 4.

Sol.:

- No. of NaCl units in 29.25 g of NaCl $= \frac{29.25}{58.5} N_A = \frac{N_A}{2}$
- No. of unit cells in 29.25 g of NaCl $= \frac{N_A}{8}$

$= 0.125 \times 6 \times 10^{23}$

$= 0.75 \times 10^{23}$

77. Answer (2)

Hint: $y_A = \frac{P_A^\circ X_A}{P_A^\circ X_A + P_B^\circ X_B}$

Sol.: Mole fraction of A in vapour mixture,

$$y_A = \frac{400 \times \frac{2}{5}}{400 \times \frac{2}{5} + 300 \times \frac{3}{5}}$$

$$= \frac{800}{800 + 900} = \frac{8}{17}$$

78. Answer (2)

Hint: Cell reaction:

$2Ag^+(aq) + H_2(g) \rightarrow 2Ag(s) + 2H^+(aq)$

Sol.: pH = – log$[H^+]$ = 2

$[H^+] = 10^{-2}$ M

$$E_{cell} = E_{cell}^\circ - \frac{0.0591}{2} \log \left[\frac{[H^+]^2}{[Ag^+]^2 [p_{H_2}]} \right]$$

$$= 0.8 - \frac{0.0591}{2} \log \left[\frac{10^{-4}}{10^{-2}} \right]$$

= 0.8 + 0.0591 = 0.8591 V

$\simeq$ 0.86 V

79. Answer (1)

Hint: Conductivity of aqueous solution of weak electrolytes are generally less than that of strong electrolytes.

Sol.:

- Due to presence of highest conductivity ions, H^+ in aq. solution of 0.1 M HCl, it has highest conductivity.
- Correct order of conductivity: 0.1 M HCl > 0.1 M KCl > 0.1 M CH_3COOH > 0.01 M CH_3COOH

80. Answer (2)

Hint:

$$\text{Molar conductivity } (\wedge_m) = \frac{\kappa \times 1000}{C} S\ cm^{-2}\ mol^{-1}$$

Sol.: $$\text{Molar conductivity } (\wedge_m) = \frac{0.01 \times 1000}{0.08}$$

$$= \frac{1000}{8} = 125\ S\ cm^2\ mol^{-1}$$

81. Answer (3)

Hint: For zero order reaction, $A = A_0 - kt$, where A_0 is the initial concentration of reactant and A is its concentration after time. Concentration of product formed = kt

Sol.: Concentration of product (B) formed

= kt

$= 0.3 \times 10^{-3} \times 20 \times 60 = 0.36\ M$

82. Answer (1)

Hint: $PdCl_2$ converts ethene to ethanal through oxidation

Sol.:

- Zeta potential is useful in determining stability of colloidal particles.
- The protecting power of lyophilic colloidal sol. is expressed in terms of gold numbers.
- Coenzymes increases activity of catalyst.

83. Answer (3)

Hint: Nickel is refined by van Arkel process.

Sol.:

- Copper is refined using electrolytic method.
- Tin contains impurities of high melting points so it is refined by liquation process.

84. Answer (2)

Hint: Thermal decomposition of NH_4NO_3 gives N_2O as one of the product.

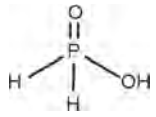
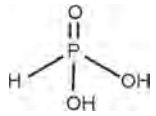
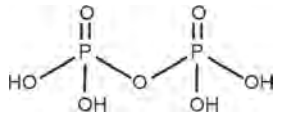
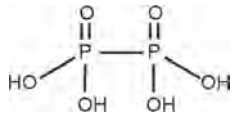
Sol.: • $NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$

- $N_2O : \Rightarrow :N \equiv N - \ddot{O} :$
- Diamagnetic in nature.
- Colourless neutral gas.

85. Answer (2)

Hint: In all oxyacids of phosphorus, at least one 'P=O' bond is present per atom of phosphorus.

Sol.:

H_3PO_2		No. of P-OH bonds = 1
H_3PO_3		No. of P-OH bonds = 2
$H_4P_2O_7$		No. of P-OH bonds = 4
$H_4P_2O_6$		No. of P-OH bonds = 4

SECTION-B

86. Answer (2)

Hint: Thermal decomposition of Ag_2O gives $O_2(g)$ as one of product.

Sol.: $2Ag_2O(s) \rightarrow 4Ag(s) + O_2(g)$

87. Answer (3)

Hint: OF_2 is thermally stable at 298 K.

Sol.:

- I_2O_5 is a very good oxidizing agent and is used for estimation of carbon monoxide.
- Cl_2 water has bleaching action through oxidation.

88. Answer (2)

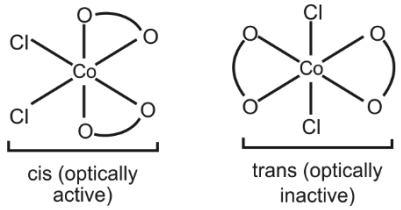
Hint: $KMnO_4$ is an oxidizing agent.

Sol.: $5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \longrightarrow 2Mn^{2+} + 8H_2O + 10CO_2$

89. Answer (4)

Hint: $K_3[Co(ox)_2Cl_2]$ shows both cis and trans form.

Sol.: $K_3[Co(ox)_2Cl_2]$

$\Rightarrow$ 

$\therefore$ trans – $K_3[Co(ox)_2Cl_2]$ can show optical isomerism.

90. Answer (1)

Hint: Smaller the bond length, higher is the bond enthalpy.

Sol.: Order of 'C – X' bond enthalpy

$CH_3 – F > CH_3 – Cl > CH_3 – Br > CH_3 – I$

91. Answer (2)

Hint: More stable the carbocation, faster is the rate of S_N1.

Sol.:

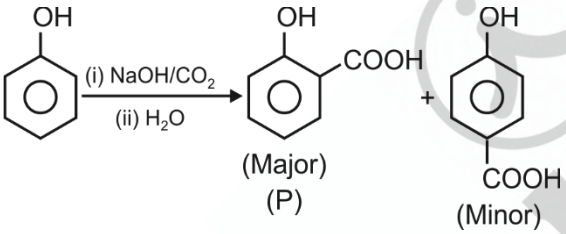
(Aromatic)

So, due to aromatic nature,  is the most stable carbocation.

92. Answer (4)

Hint: In basic medium, phenoxide ion is formed which easily attracts weak electrophile CO_2.

Sol.:



93. Answer (1)

Hint: Compounds containing $CH_3 – \overset{\overset{O}{\|}}{C} –$ and $CH_3 – \overset{\overset{OH}{|}}{CH} –$ groups can give haloform reaction.

Sol.: In the pair of $PhCOCH_3$ and $CH_3CH_2COC_2H_5$, only $PhCOCH_3$ will give haloform reaction. So pair of this compounds can be distinguished.

$$Ph – \overset{\overset{O}{\|}}{C} – CH_3 \xrightarrow{NaOX} Ph – \overset{\overset{O}{\|}}{C} – ONa + \underset{\text{Haloform}}{CHX_3}$$

94. Answer (2)

Hint: Primary aliphatic and aromatic amines respond carbylamine test.

Sol.:

- $PhCH_2NH_2$ is a primary amine so responds carbylamine test.
- $PhCH_2NH_2 + CHCl_3 + 3KOH \xrightarrow{\Delta}$ $PhCH_2NC + 3KCl + 3H_2O$

95. Answer (1)

Hint: Presence of electron withdrawing groups increases the electrophilicity of carbonyl carbon which favours attack of nucleophile.

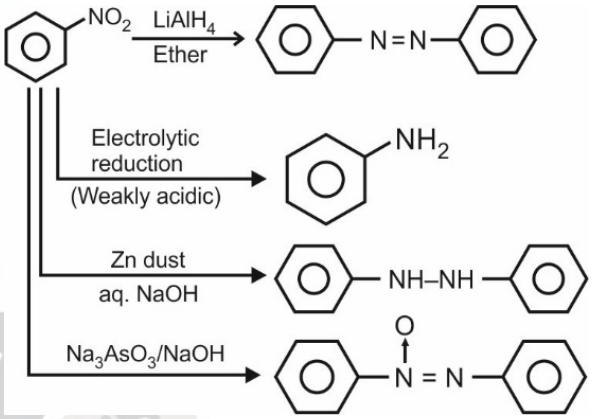
Sol.:

- Order of electron withdrawing nature:
  $–NO_2 > –CHO > –OCH_3$
- So, the correct order of hydrolysis is
  b > d > a > c

96. Answer (2)

Hint: In weakly acidic medium, electrolytic reduction of nitrobenzene gives aniline in the product.

Sol.:



97. Answer (1)

Hint: The human body produces DNA, hormones, enzymes etc. but it does not produce vitamins.

Sol.:

- In a protein molecule, various amino acids are linked together by peptide bond.
- Low level of iodine in the diet may lead to hypothyroidism.

98. Answer (3)

Hint: Monomeric units present in Nylon-2-Nylon-6 are glycine and amino caproic acid.

Sol.:

$$\underset{\text{Glycine}}{nH_2N – CH_2 – COOH} + \underset{\text{Amino caproic acid}}{nH_2N – (CH_2)_5 – COOH}$$

$$\xrightarrow{\Delta} \underset{\text{Nylon–2–Nylon–6}}{\left(NH – CH_2 – \overset{\overset{O}{\|}}{C} – NH – (CH_2)_5 – \overset{\overset{O}{\|}}{C}\right)_n}$$

99. Answer (4)

Hint: 2-3% solution of iodine in alcohol water mixture is known as tincture of iodine which is used as antiseptic.

Sol.:

- Alitame is an artificial sweetener.
- Soframycin and dilute aqueous solution of borax are antiseptic in nature.

100. Answer (1)

Hint: Sodium chlorate is used as herbicide.

Sol.:

- Dieldrin : Pesticide
- *Escherichia coli*: Pathogen causing gastrointestinal disease.
- Polychlorinated biphenyls (PCBs) are used as cleansing solvent.

[BOTANY]

SECTION-A

101. Answer (3)

Hint: Most prokaryotes and some viruses have genetic material in the form of circular DNA.

Sol.: $\phi \times 174$ bacteriophage has circular single stranded DNA as its genetic material.

102. Answer (2)

Hint: Streptokinase is given to patients who have undergone myocardial infarction leading to heart attack.

Sol.: Streptokinase is produced by bacterium *Streptococcus* and is used as 'clot buster' for removing clots from blood vessels of patients.

103. Answer (4)

Hint: At tip of the plants, high concentration of auxins is found and rapid rate of cell division occurs.

Sol.: Pathogen free clones of plants can be obtained through meristem culture due to high concentration of auxins and rapid rate of cell division.

104. Answer (1)

Hint: Dicot plants usually lack endosperm in their seeds.

Sol.: Castor seeds are endospermic seeds.

105. Answer (3)

Hint: Monocot stem do not show secondary growth.

Sol.:

- Presence of water containing cavities which are schizolysigenous in origin is a characteristic feature of monocot stem.
- Vascular bundle is surrounded by bundle sheath in monocot stem.

106. Answer (2)

Hint: Major pigments of brown algae and red algae are fucoxanthin and phycoerythrin respectively.

Sol.:

- *Ulothrix* is a green algae with chlorophyll a and b.
- *Ectocarpus* is a brown alga and *Porphyra* is a red alga, so have fucoxanthin and phycoerythrin respectively.

107. Answer (4)

Hint: In Deuteromycetes or imperfect fungi, only asexual or vegetative phase is known.

Sol.:

- *Aspergillus* is an Ascomycete in which sexual spores are called ascospores and are produced endogenously.
- *Trichoderma* belongs to Deuteromycetes so lack sexual reproduction.

108. Answer (2)

Hint: Water will move from its high water potential to its lower water potential.

$\psi_w = \psi_s + \psi_p$

Sol.: Water potential of cell X

$\psi_w = \psi_s + \psi_p$

$= -54 + 24 = -30$

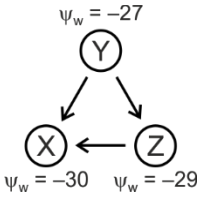
Water potential of cell Y = –27

Water potential of cell Z

$\psi_w = \psi_s + \psi_p$

$\psi_w = -60 + 31 = -29$

$\therefore$ Direction of movement of water will be



109. Answer (3)

Hint: Toxicity of Mn leads to deficiency of Mg, Ca and Fe.

Sol.:

- Toxicity of manganese causes prominent appearance of brown spots surrounded by chlorotic veins.

- Mn^{2+} competes with iron and magnesium for uptake and with magnesium for binding with enzyme.
- Mn^{2+} also inhibits calcium translocation in shoot apex.

110. Answer (1)

Hint: The phenomenon where certain living differentiated cells regain their capacity to divide and form new cells is known as dedifferentiation.

Sol.: Cork is a redifferentiated tissue where the dedifferentiated cells again loose their ability to divide and form permanent cell.

111. Answer (1)

Hint: Sickle cell anaemia can be transmitted from parents to the offsprings when both the partners are carrier for the gene.

Sol.: Sickle cell anaemia is an autosome linked recessive trait and it is controlled by a single pair of allele Hb^A and Hb^s.

112. Answer (3)

Sol:

Type of plant	Pollinating agent
Entomophilous	Insects (bees)
Anemophilous	Wind
Hydrophilous	Water

113. Answer (3)

Hint: When fusion of gametes occur inside the body of the organism, it is called internal fertilisation.

Sol.: In majority of algae, fishes and amphibians, syngamy occur in the external medium and it is called external fertilisation.

114. Answer (1)

Hint: Natality is the number of births during given period of time and mortality is the number of deaths in population in a given area.

Sol.: Natality and immigration contribute to an increase in population density and mortality and emigration will contribute to decrease in population density.

115. Answer (3)

Hint: According to ten percent law, during the transfer of energy, only about 10% of the energy is available for next trophic level.

Sol.: Grass $\rightarrow$ Rabbit $\rightarrow$ Snake $\rightarrow$ Eagle

(50,000 J)

T_1 T_2 T_3 T_4

According to 10% law

At T_2, Rabbit receives, $50{,}000 \times \frac{10}{100} = 5000$ J energy.

At T_3 = 500 J or 0.5 kJ will be available.

116. Answer (4)

Hint: Conservation of ecosystem and natural habitat for the maintenance and recovery of viable organisms in their natural surroundings is called *in-situ* conservation.

Sol.: Biosphere reserve is an example of *in-situ* or on site conservation of biodiversity rich region.

117. Answer (2)

Hint: ABA generally acts as a plant growth inhibitor.

Sol.: Gibberellic acid promotes seed germination and inhibits seed dormancy.

118. Answer (1)

Hint: One molecule of ATP is produced in one cycle of TCA cycle starting with one Acetyl CoA molecule.

Sol.: For 1 molecule of glucose, 2 rounds of Krebs cycle will yield 2 molecules of ATP.

119. Answer (2)

Hint: UUC codon also codes for phenylalanine.

Sol.:

AUG has a dual function. It codes for methionine and also act as initiator codon.

120. Answer (1)

Hint: Number of different types of gametes produced = 2^n.

Sol.: Here n = 3

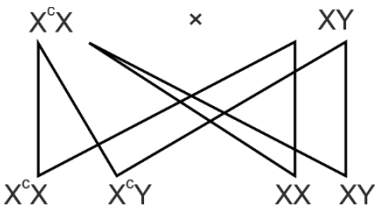
So 2^3 = 8 types of gametes will be produced

121. Answer (3)

Hint: Colour blindness is an X-linked recessive trait.

Sol.: Since, both husband and wife have colourblind father

$\therefore$ Wife will be carrier of the trait.



There is 50% chance that their son would be colourblind.

122. Answer (1)

Hint: Two types of fusions, syngamy and triple fusion take place in an embryo sac of angiosperm during double fertilization.

Sol.: Syngamy – One male gamete fuses with egg cell. This involves two haploid nuclei.

Triple fusion – Other male gamete fuses with two polar nuclei. This involve three haploid nuclei.

Therefore, five nuclei are involved in the double fertilisation event in an angiosperm.

123. Answer (3)

Hint: Lower organism produce or form asexual reproductive structures.

Sol.: Asexual reproductive structures are conidia in *Penicillium*, buds in *Hydra* and zoospores in *Chlamydomonas*.

124. Answer (2)

Hint: Complex-IV contains two copper centres.

Sol.: Complex-IV refers to cytochrome c oxidase complex containing cytochrome *a* and a_3, and two copper centres.

125. Answer (4)

Hint: Perianth is found in the members of Liliaceae.

Sol.: When stamens are attached to the perianth, the condition is called epiphyllous.

126. Answer (3)

Hint: *Penicillium* is a fungus.

Sol.: Ciliated protozoans are aquatic, actively moving organism because of the presence of thousands of cilia, *e.g.*, *Paramoecium*.

127. Answer (1)

Hint: Defining features are those features which are exclusively present in all living beings.

Sol.: Consciousness, cellular organisation and metabolism are defining properties of living organisms.

128. Answer (3)

Hint: Along with endoplasmic reticulum, Golgi apparatus and vacuole, lysosome is a part of endomembrane system.

Sol.: Lysosomes are membrane bound vesicular structures formed by the process of packaging in the Golgi apparatus. Hydrolytic enzymes are optimally active at the acidic pH.

129. Answer (3)

Hint: In the final stage of prophase-I, chiasmata terminates.

Sol.: Diakinesis stage is marked with the terminalisation of chiasmata.

130. Answer (4)

Hint: Reverse transcriptase enzyme is used to generate complementary DNA from RNA template.

Sol.: Polynucleotide phosphorylase or Severo Ochoa enzyme is helpful in polymerising RNA with defined sequence in a template independent manner.

131. Answer (1)

Sol.: Smooth leaved and nectarless cotton varieties do not attract bollworms.

132. Answer (3)

Hint: Recombination frequency is directly proportional to the distance between genes.

Sol.: In first case, the genes are very close to each other and thus show 97.8% of parental type and 1.3% of recombinant type.

In second case, genes are loosely linked or further from each other thus show 62.8% of parental type and 37.2% recombinant type.

133. Answer (4)

Hint: This disease causing agent consists of abnormally folded proteins.

Sol.: The most notable disease caused by prions are bovine spongiform encephalopathy (BSE) commonly called mad cow disease in cattle and its analogous variant Cr-Jacob disease (CJD) in humans.

134. Answer (1)

Hint: Papilionaceous or vexillary aestivation is present in pea and bean.

Sol.:

- Twisted aestivation is found in cotton, lady's finger and china rose.
- Gulmohur and *Cassia* show imbricate aestivation.
- Valvate aestivation is found in *Calotropis*.

135. Answer (3)

Hint: Pteridophytes require water for transfer of antherozoids to the archegonium.

Sol.: Due to specific requirement and the need of water for fertilisation, the spread of living pteridophytes is limited and restricted to narrow geographical region.

SECTION-B

136. Answer (2)

Hint: Root pressure is positive hydrostatic pressure responsible for pushing up water to small heights.

Sol.: Guttation is the loss of water through the special opening and is the effect of root pressure.

137. Answer (3)

Hint: The trichomes are epidermal hairs on the stem.

Sol.:

- The trichomes help in preventing water loss due to transpiration.
- Stomata regulates the process of transpiration and gaseous exchange.

138. Answer (4)

Hint: All organelles involved in endomembrane system are membrane bound.

Sol.: The organelles included in endomembrane system are endoplasmic reticulum, Golgi complex, lysosome and vacuole.

Ribosome is not surrounded by any membrane.

139. Answer (1)

Hint: Flora gives the actual account of habitat and distribution of various plants of a given area.

Sol.: Manual is a book containing complete listing and description of plants growing in a particular area and provide information for identification of names.

140. Answer (3)

Hint: The given figure is of diplontic life cycle pattern.

Sol.: Plant showing diplontic life cycle have gametophytic phase which is few to multi celled.

141. Answer (1)

Hint: Plastocyanin is present near to PS I.

Sol.: Plastocyanin transfers the electrons from cytochrome b_6f to PS I.

Electron transfer from PS II to cytochrome b_6f is by electron carrier plastoquinone.

142. Answer (3)

Hint: In female heterogametic condition, the egg determines the sex of the organism.

Sol.: In butterflies, female individuals produce two different types of gametes, thus the egg determines the sex of the offspring.

143. Answer (4)

Hint: Flocs are formed in secondary treatment of sewage.

Sol.: In settling tank, bacterial flocs are allowed to sediment and is called activated sludge.

144. Answer (2)

Sol.: Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter diapause which is a stage of suspended development.

145. Answer (3)

Sol.: Each trophic level has a certain mass of living material at a particular time called standing crop.

146. Answer (2)

Hint: The coding strand and mRNA sequence are similar but not identical.

Sol.: RNA have uracil instead of thymine.

5′ ATCGTGCGAT 3′ coding strand

↓

5′ AUCGUGCGAU 3′ mRNA sequence

147. Answer (1)

Hint: SAT chromosomes have satellite.

Sol.: The part of chromosome beyond secondary constriction is called satellite. A chromosome having satellite is called SAT chromosome.

148. Answer (2)

Sol.: The mycoplasma are organisms that completely lack cell wall. They are the smallest living cell and can survive without oxygen.

149. Answer (4)

Hint: Air Act was amended to include noise as an air pollutant.

Sol.: Air Act came into force in 1981 but was amended in 1987 to include noise as air pollutant.

150. Answer (3)

Hint: Introduction of Nile perch into the Lake Victoria led to eventually extinction of cichlid fish.

Sol.: Extinction of cichlid fish from Lake Victoria is an example of alien species invasion.

[ZOOLOGY]

SECTION-A

151. Answer (2)

Hint: Contains cnidoblast

Sol.: *Adamsia* belongs to the phylum Coelenterata. *Loligo* (squid) is a mollusc in which digestive system is complete and digestion is extracellular. *Locusta* is a gregarious pest. In *Balanoglossus,* fertilization occurs in the sea water.

152. Answer (2)

Hint: Cells which line the spongocoel

Sol.: Flagellated choanocytes and spongocoel are associated with poriferans. In ctenophores, the reproduction is only by sexual means. Hooks and suckers are present in *Taenia* as their parasitic adaptation.

153. Answer (2)

Hint: Birds and mammals

Sol.: Birds and mammals have the ability to regulate their body temperature. *Scoliodon* and *Pristis* belong to the class Chondrichthyes. *Octopus* is a mollusc; *Salamandra* is an amphibian; *Calotes* is a reptile and *Salpa* is a tunicate.

154. Answer (2)

Hint: Intercellular substance

Sol.: Lamellae and haversian system are present only in bones. Bone marrow of some bones functions as erythropoietic organ *i.e.*, site of production of blood corpuscles (RBCs, WBCs and platelets).

155. Answer (1)

Hint: Tendons connect voluntary striated muscles to bones

Sol.: Neurons in neural tissue are excitable cells. Areolar tissue is the most widely distributed connective tissue in the animal body. It is present beneath the skin. Smooth muscles are present in the wall of blood vessels and skeletal muscles are closely attached to skeletal bones.

156. Answer (1)

Hint: Neck is not the extension of head

Sol.: In male and female cockroach, the genital pouch lies at the hind end of abdomen.

Head of cockroach is connected with thorax by a small and narrow neck, which is supported by chitinous plates *i.e.*, sclerites.

157. Answer (2)

Hint: Part of reproductive and excretory system of cockroach.

Sol.: Labrum or upper lip – Mouth part present in head region.

Spermatheca – Part of reproductive system of female cockroach. It is present in the 6^{th} segment and opens into the genital chamber through spermathecal pore.

Compound eyes – Present in head region, they are the organs of sight.

Phallic gland – Present below ejaculatory duct.

158. Answer (3)

Hint: Present only in RNA

Sol.: The given structure is of a nitrogenous base uracil which is present in nucleotide, uridylic acid. Adenine is present in ATP.

159. Answer (2)

Hint: Precursor of estrogen

Sol.: Cholesterol is a precursor of steroid hormones such as androgen, progesterone etc. Lipids are not strictly considered as biomacromolecules. Cholesterol is not a phospholipid or saturated fatty acid but it is included in lipids because it has fat-like properties.

160. Answer (2)

Hint: Structural analogue

Sol.: In competitive inhibition of enzyme activity, the inhibitor (malonate) closely resembles to the substrate (succinate) in its chemical structure. In it, the value of K_m increases and V_{max} remains same.

161. Answer (3)

Hint: Teeth present in each jaw

Sol.: In humans, all teeth are thecodont *i.e.*, each tooth is embedded in a socket of jaw bone.

In adult, 16 teeth are present in each jaw in the order of incisor, canine, premolar and molar.

162. Answer (4)

Hint: Brush border enzyme

Sol.:

Pepsin	–	Present in gastric juice, which converts proteins into peptones and proteoses
Chymotrypsin, trypsin	–	Present in pancreatic juice and converts peptones and proteoses into dipeptides
Dipeptidase	–	Present in intestinal juice and acts on dipeptides

163. Answer (3)

Hint: Present in aquatic arthropods

Sol.: In land insects like cockroach, tracheal system (network of tubes) is present as respiratory organ. Gills are present in fishes and aquatic amphibians.

Reptiles (e.g. *Alligator*), birds and mammals respire through lungs.

164. Answer (1)

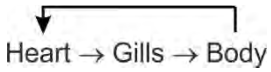
Hint: Negative pressure created inside lungs.

Sol.: Humans have negative pressure breathing because intra-pulmonary pressure is less than atmospheric pressure during inspiration.

165. Answer (2)

Hint: Blood is oxygenated in gills

Sol.: Fishes have single circulation *i.e.*, the heart pumps out deoxygenated blood which undergoes oxygenation in the gills. The oxygenated blood is then suppled to the body parts from where deoxygenated blood is returned to the heart. This can be depicted as follows :-



166. Answer (2)

Hint: More than 70 mL but less than 90 mL

Sol.: Stroke volume = $\frac{\text{Cardiac output}}{\text{Heart rate}}$

$= \frac{5040}{70} = 72$ mL

167. Answer (2)

Hint: Duration of a complete cardiac cycle – Duration of ventricular systole

Sol.: Joint diastole = 0.4 seconds

Atrial systole = 0.1 seconds

So, sum of joint diastole and atrial systole

= 0.4 + 0.1 = 0.5 seconds

168. Answer (2)

Hint: Not present in cortical nephrons

Sol.: Cortical nephrons are majority of nephrons (80%) and the vasa recta is absent or highly reduced in them. In only juxtamedullary nephrons, the vasa recta is present.

169. Answer (2)

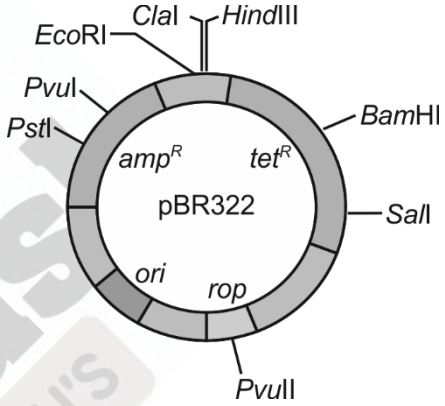
Hint: Associated with podocytes

Sol.: Filtration slits or slit pores are formed by inner epithelial cells of Bowman's capsule or podocytes.

170. Answer (2)

Hint: *Bam*HI and *Eco*RI restriction sites are not present

Sol.: *Pst*I, *Pvu*I, *Sal*I, *Eco*RI, etc. restriction sites are present in the cloning vector pBR322.



171. Answer (4)

Hint: Included in artificial passive immunity

Sol.:

IgA	Present in colostrum, which is very important to a newborn.
IgG	Can cross the placenta and confer immunity to the foetus.
ATS (Anti-Tetanus Serum)	Artificial passive immunity

172. Answer (4)

Hint: Selectable marker in pUC8

Sol.: Disarmed retrovirus can be used as a cloning vector in humans; biolistic method is suitable for transfer of gene in plant cells; *Agrobacterium* is a natural genetic engineer of plants. If insertional inactivation occurs in *lac* Z gene, the colonies of recombinant host cells will give white colour. In the presence of a chromogenic substrate blue-coloured colonies will produce, if the plasmid in the bacteria does not have an insert.

173. Answer (1)

Hint: Can be done in embryonic stage only

Sol.: In gene therapy, correction of the defective gene can be made in embryonic as well as in adult stage. But permanent cure is only possible if correction of defective gene occurs in early embryonic stage.

174. Answer (2)

Hint: Infectious stage of *Entamoeba* is present in faeces of an infected person.

Sol.: **Allergy:** Allergic reactions are due to the release of chemicals like histamine and serotonin from the mast cells.

Typhoid: Diagnosed by Widal test.

Amoebiasis: Caused by a protozoan parasite, *Entamoeba histolytica* in the large intestine of human. Spread by contaminated food and water.

Rheumatoid arthritis: Autoimmune disease

175. Answer (3)

Hint: Obtained from *Erythroxylum*

Sol.: Cocaine interferes with the transport of the neurotransmitter dopamine. It has a potent stimulating action on central nervous system, producing a sense of euphoria (feeling of well being) and increased energy. *Atropa belladona* and *Datura* have hallucinogenic properties.

176. Answer (1)

Hint: Should be carried out in a scientific manner

Sol.: The feeding of cattle should be carried out in a scientific manner with special emphasis on the quality and quantity of fodder. The proportion of balanced feed differs for the young and the adult animals.

177. Answer (2)

Hint: Same breed

Sol.: Group of animals related by descent and similar in most characters like general appearance, size, features, configuration, etc., are said to be belong to same breed.

178. Answer (2)

Hint: p^2 is the frequency of homozygous dominant individuals.

Sol.: AA = 720

So, $p^2 = \frac{720}{2000}$

$p = 0.6$

Since, according to Hardy-Weinberg equation, $p + q = 1$

$\because \quad p = 0.6$

$q = (1 - 0.6) = 0.4$

179. Answer (4)

Hint: Australian marsupials

Sol.: Darwin's finches and Australian marsupials represent the phenomenon of adaptive radiation.

180. Answer (2)

Hint: Early to Permian period

Sol.: Bryophytes were evolved from chlorophyte ancestors (aquatic green algae) in the Carboniferous period of Paleozoic era. Zosterophyllum evolved from tracheophyte ancestors in Silurian period. Psilophyton evolved from Rhynia-type plants.

181. Answer (2)

Hint: Present in cloning vector pBR322

Sol.: *Sal* I – 5′-GTCGAC-3′
3′-CAGCTG-5′
*Eco*RI – ′5′-GAATTC-3′
3′-CTTAAG-5′
*Bam*HI – 5′-GGATCC-3′
3′-CCTAGG-5′

182. Answer (4)

Hint: Contains secondary oocyte

Sol.: In the secretory phase of menstrual cycle the high blood levels of estrogen and progesterone give negative feedback to FSH and LH. Corpus luteum secretes hormone progesterone and estrogen.

FSH and LH attain peak at the end of proliferative phase.

183. Answer (3)

Hint: Identify a viral STI

Sol.: Genital herpes, hepatitis-B and AIDS cannot be cured completely even if they are diagnosed in early stage.

184. Answer (4)

Hint: Includes the transfer of embryo after *in vitro* fertilisation

Sol.: In ZIFT, the embryos with less than 8 blastomeres are transferred into fallopian tube whereas embryos with more than 8 blastomeres are transferred into uterus in the technique named IUT (Intra-Uterine Transfer) to complete its further development. GIFT is gamete intra fallopian transfer in which ovum from a donor is transferred into the fallopian tube of another female who can not produce ovum. ICSI (Intra cytoplasmic sperm injection) is a procedure in which sperm is directly injected into the ovum.

185. Answer (4)

Hint: Formed during fertilization

Sol.: Antrum, secondary oocyte and a polar body are present in tertiary follicle but ootid is formed when sperm enters into the ovum.

SECTION-B

186. Answer (1)

Hint: Filled with perilymph

Sol.: Basilar membrane and tectorial membrane are structural constituents of organ of Corti. Incus is present in middle ear.

187. Answer (1)

Hint: Visual purple

Sol.: The visual pigments for colour vision are:

Erythropsin – erythrolabe (sensitive to the red range to the spectrum)

Chloropsin – chlorolabe (detects green colour)

Cyanopsin – cyanolabe (detects blue colour)

188. Answer (4)

Hint: Connects diocoel to metacoel

Sol.: Cerebrum is the largest part of human brain. Optic lobes are present in midbrain. Midbrain, pons and medulla form the brain stem. Brain stem forms the connection between the brain and spinal cord.

189. Answer (4)

Hint: Function of insulin

Sol.: Pupilary dilation, hypertension, proteolysis and glycogenolysis are associated with catecholamines.

190. Answer (3)

Hint: Hydrophilic in nature

Sol.: Hydrophilic hormones such as adrenaline, glucagon, secretin, FSH etc. interact with receptors present on plasma membrane.

191. Answer (3)

Hint: Includes neurohypophysis hormones

Sol.: Hormones like LH, ACTH, TSH, oxytocin, ADH and PRL are released from pituitary gland, whereas GHIH is released from hypothalamus.

192. Answer (3)

Hint: The myoglobin structure gives a 3-D view of protein.

Sol.: Myoglobin (protein found in muscle cell) have tertiary structure of protein and haemoglobin have quaternary structure of protein. It has four helical polypeptide chains, 2α-chains and 2β-chains.

193. Answer (2)

Hint: Chargaff's rule

Sol.: According to Chargaff's rule, the amount of adenine is always equal to that of thymine and amount of guanine is always equal to that of cytosine (*i.e.*, A = T and G = C).

Thus, if A = 25, then T = 25

C = 30, then G = 30

So, deoxyguanylic acid = 30

And if, deoxyadenylic acid is 25

then, deoxythymidylic acid is 25

Thus, total amount of nucleotides

= 30 + 30 + 25 + 25 = 110

194. Answer (4)

Hint: Total volume of air present in the lungs after forceful inspiration.

Sol.: TLC = TV + IRV + ERV + RV

= IC + ERV + RV

= EC + IRV + RV

195. Answer (1)

Hint: Acts on the genetic material

Sol.: Nucleases – Nucleic acid

Nucleotidases – Nucleotides

Nucleosidases – Nucleosides

196. Answer (2)

Hint: Conjugated lipid are found in cell membrane

Sol.: Palmitic acid is a simple lipid. Cholesterol is a derived lipid. Hexacosyl palmitate is bees wax and lecithin is an example of conjugated lipid. Lecithin contains choline.

197. Answer (3)

Hint: Helps in formation and secretion of milk

Sol.: Prolactin blood level becomes high during intense lactation which gives negative feedback to FSH and LH. Low levels of FSH and LH are responsible for lactational amenorrhea.

198. Answer (2)

Hint: RY13

Sol.: In *Eco*RI, the letter R represents the strain RY13 of bacteria.

199. Answer (2)

Hint: They are 14 in number

Sol.: Digits of one hand have 14 bones and so does facial region.

Cranium has 8 bones.

Vertebral column has 26 bones.

Carpals are 8 in number in one hand.

200. Answer (3)

Hint: Identify non-primate mammal.

Sol.: In non-primates like cows, sheep, rats, deers, dogs, tiger etc. cyclical changes during reproduction are called oestrous cycle, while in primates (monkeys, apes and humans) it is called menstrual cycle.

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