All India Aakash Test Series for Medical - 2020

TEST - 3 (Code-E)

Test Date : 15/12/2019

ANSWERS

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

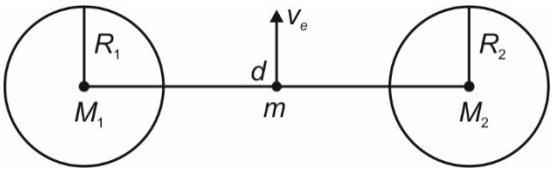
HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint : By conservation of Mechanical energy

Sol. :



$$\frac{-GM_1m}{d/2}-\frac{GM_2m}{d/2}+\frac{1}{2}mv_e^2=0$$

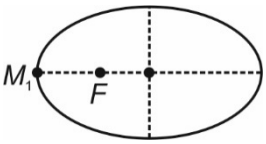
$$v_e^2=\frac{4G(M_1+M_2)}{d}$$

$$v_e=2\sqrt{\frac{G(M_1+M_2)}{d}}$$

2. Answer (2)

Hint : By conservation of mechanical energy

Sol. :



Mechanical energy of the planet = PE + KE

$$= \frac{-GMM_1}{2a}$$

Mechanical energy of the planet remains conserved. So,

$$\frac{1}{2}M_1v^2-\frac{GMM_1}{\frac{2a}{3}}=\frac{-GMM_1}{2a}$$

$$\frac{1}{2}M_1v^2-\frac{3GMM_1}{2a}=\frac{-GMM_1}{2a}$$

$$\frac{1}{2}v^2=\frac{-GM}{2a}+\frac{3GM}{2a}$$

$$v=\sqrt{\frac{2GM}{a}}.$$

3. Answer (4)

Hint & Sol. : Gravitational forces are always attractive in nature.

4. Answer (1)

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

Sol. : $\frac{dA}{dt}=\frac{I\omega}{2m}$

$$\frac{dA}{dt}=\frac{mr^2\omega}{2m}$$

$$\frac{dA}{dt}\propto \omega r^2$$

5. Answer (4)

Hint : Both mass will apply equal and opposite force on each other.

Sol. : $\vec{F}_{12}=-\vec{F}_{21}$

$\Rightarrow \quad \vec{F}_{12}+\vec{F}_{21}=0$

$\Rightarrow \quad \left|\vec{F}_{12}\right|=\left|\vec{F}_{21}\right|$

6. Answer (3)

Hint : $g_d=g\left(1-\frac{d}{R}\right)$

Sol. : $y=x\left(1-\frac{d}{R}\right)$

$$\frac{y}{x}=1-\frac{d}{R}$$

$$\frac{d}{R}=1-\frac{y}{x}$$

$$d=\left(1-\frac{y}{x}\right)R$$

7. Answer (2)

Hint : $V=\frac{-GM}{r}$

Sol. : $V_{net}=\frac{-GM}{r_1}-\frac{GM}{r_2}-\frac{GM}{r_3}+....$

$$V_{net}=\frac{-2G}{1}-\frac{2G}{4}-\frac{2G}{16}+....$$

$$V_{net} = \frac{-2G}{1}\left(\frac{1}{1}+\frac{1}{4}+\frac{1}{16}....\right)$$

$$= -2G\left(\frac{1}{1-\frac{1}{4}}\right)$$

$$= \frac{-8G}{3}\text{ J/kg}$$

8. Answer (3)

Hint : $g_h = g_e$

Sol. : $g_h = g\left(1-2\frac{h}{R}\right)$

$g_e = g - \omega^2 R$

$g\left(1-\frac{2h}{R}\right) = \left(g-\omega^2 R\right)$

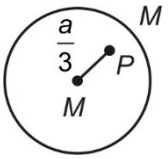
$\frac{2hg}{R} = \omega^2 R$

$h = \frac{\omega^2 R^2}{2g}$

9. Answer (3)

Hint : $V_P = V_1 + V_2$

Sol. :



Potential at P due to mass at centre

$$V_1 = \frac{-GM}{a/3}$$

$$V_1 = \frac{-3GM}{a}$$

Potential due to spherical shell at P

$$V_2 = \frac{-GM}{a}$$

$$V_P = V_1 + V_2$$

$$= \frac{-3GM}{a} - \frac{GM}{a}$$

$$= \frac{-4GM}{a}$$

10. Answer (4)

Hint & Sol. : Gravitation field inside the spherical shell is zero which will be remains zero.

11. Answer (1)

Hint : $T = 2\pi\sqrt{\frac{r^3}{GM}}$

Sol. : $T = 2\pi\sqrt{\frac{(2r)^3}{GM}}$

$T^2 = \frac{4\pi^2 8r^3}{GM}$

$M = \frac{32\pi^2 r^3}{GT^2}$

12. Answer (2)

Hint : $|V| = \frac{GMm}{r}$

Sol. : Force at distance $3r$

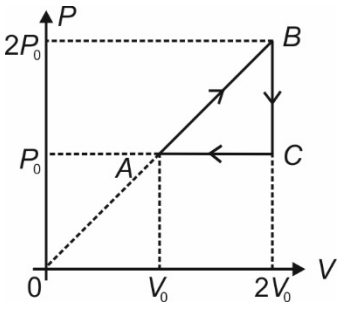
$F = \frac{GMm}{(3r)^2}$

$F = \frac{GMm}{9r^2} = \frac{V}{9r}$

13. Answer (1)

Hint : Work = area of cycle.

Sol. :



Net work $= \frac{1}{2} V_0 \times P_0$

$= \frac{P_0 V_0}{2}$

14. Answer (3)

Hint : $\Delta Q = \Delta U + W$

Sol. : $1 = \frac{\Delta U}{\Delta Q} + \frac{W}{\Delta Q}$

$$\frac{W}{\Delta Q} = 1-\frac{\Delta U}{\Delta Q}$$

$$= 1-\frac{nC_V\Delta T}{nC_P\Delta T}$$

$$= 1-\frac{1}{\gamma}$$

For polyatomic gas, $\gamma = \frac{4}{3}$

$$\frac{W}{\Delta Q} = 1-\frac{1\times 3}{4}$$

$$\frac{W}{\Delta Q} = \frac{1}{4}$$

15. Answer (1)

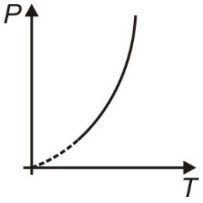
Hint & Sol. : For adiabatic process

$P^{1-\gamma}T^{\gamma}$ = constant

$P^{1-\gamma} \propto T^{-\gamma}$ = constant

$P \propto T^{\left(\frac{\gamma}{\gamma-1}\right)}$ = constant

$\gamma > 1$



16. Answer (3)

Hint : $\eta = 1-\frac{T_2}{T_1}$

Sol. : $1-\frac{T_2}{T_1} = \frac{2}{3}$ ...(1)

and $1-\frac{(T_2-100)}{T_1} = \frac{3}{4}$ ...(2)

$$\frac{1}{4} = \frac{T_2}{T_1}-\frac{100}{T_1}$$

$$\frac{1}{4} = \frac{1}{3}-\frac{100}{T_1}$$

$$\frac{100}{T_1} = \frac{1}{3}-\frac{1}{4}$$

$T_1 = 100 \times 12$

$= 1200$ K

17. Answer (1)

Hint & Sol. : Change in internal energy depends only on initial and final state, hence it is independent of path of thermodynamic process.

18. Answer (3)

Hint & Sol. : Volume of the gas in both process is increasing from $A \rightarrow B$ therefore work will be positive in both process.

19. Answer (2)

Hint : $C = \frac{R}{\gamma-1}+\frac{R}{1-n}$

Sol. : $PV = nRT$

$P = \frac{k}{T}$

P^2V = constant

$PV^{\frac{1}{2}}$ = constant

$C = \frac{R}{\left(\frac{7}{5}-1\right)}+\frac{R}{1-\frac{1}{2}}$

$C = \frac{5R}{2}+2R$

$C = \frac{9R}{2}$

20. Answer (1)

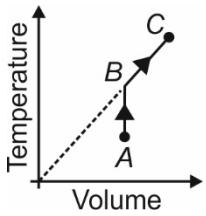
Hint : Isochoric and isobaric process.

Sol. : $A \rightarrow B$ is isochoric process, pressure increases therefore temperature will increase.

In temperature-volume curve line will be parallel to temperature axis

$B \rightarrow C$ is isobaric process, volume is increasing, therefore temperature will also increase by $P_0V = nRT$

$V \propto T$

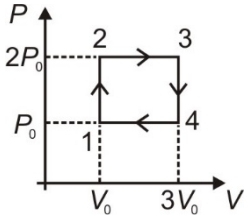


21. Answer (4)

Hint : Heat will be supplied in process

$1 \rightarrow 2$ and $2 \rightarrow 3$

Sol. :



Process 1 → 2 is isochoric process $W = 0$

$Q_{1\to2} = nC_V\Delta T$

$C_V = \frac{R}{\gamma - 1}$

$C_V = \frac{3R}{2}$

$\Delta T = \left(\frac{P_0V_0}{nR}\right)$

$Q_{1\to2} = \frac{n3R}{2} \times \frac{P_0V_0}{nR}$

$= \frac{3P_0V_0}{2}$

Process 2 → 3 is isobaric process

$Q_{2\to3} = nC_P\Delta T$

$C_P = \frac{5R}{2}$

$\Delta T = \frac{4P_0V_0}{nR}$

$Q_{2\to3} = \frac{5}{2}nR \times \frac{4P_0V_0}{nR}$

$= 10P_0V_0$

$Q_{net} = Q_{1\to2} + Q_{2\to3}$

$= \frac{3P_0V_0}{2} + 10P_0V_0$

$= \frac{23P_0V_0}{2}$

22. Answer (3)

Hint : $W = \frac{nR\Delta T}{1-\gamma}$

Sol. : $\gamma = \frac{4}{3}$

$n = 2$

$T_0V^{\gamma-1} = T_1(8V)^{\gamma-1}$

$T_0V^{\frac{4}{3}-1} = T_1(8V)^{\left(\frac{4}{3}-1\right)}$

$T_1 = \frac{T_0}{2} = \frac{300}{2} = 150$ K

$\Delta T = (150 - 300) = -150$ K

$W = \frac{nR\Delta T}{1-\gamma} = \frac{2\times2\times(-150)}{1-\frac{4}{3}}$

$= 1800$ cal

23. Answer (2)

Hint : $\beta = \frac{Q_2}{Q_1 - Q_2} = \frac{T_2}{T_1 - T_2}$

Sol. : $\beta = \frac{T_2}{T_1 - T_2}$

$4 = \frac{250}{T_1 - 250}$

$4T_1 - 4 \times 250 = 250$

$T_1 = \frac{5\times250}{4}$

$T_1 = 312.5$ K

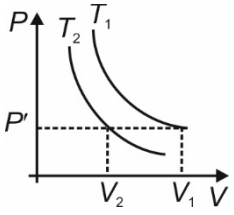
$T_1 = 312.7 - 273$

$= 39.5°C$

24. Answer (1)

Hint : $PV = nRT$

Sol. :



$P' = \frac{nRT}{V_1}$

$V_2 < V_1$

$T_2 < T_1$

25. Answer (3)

Hint & Sol. : In isobaric process $Q = \Delta U + \Delta W$

Therefore $\Delta U \neq \Delta W$

26. Answer (4)

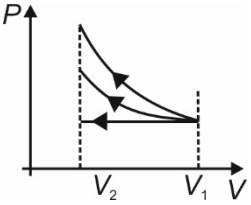
Hint & Sol. : In cyclic process initial and final temperature will be same therefore

$\Delta U = 0$ and $Q = W$

27. Answer (1)

Hint : Area under the P-V curve

Sol. :



In above in dictator diagram area under the *P*-*V* is minimum in isobaric process.

28. Answer (3)

Hint : $\frac{t-0}{100-0}=\left(\frac{P_t-P_0}{P_{100}-P_0}\right)$

Sol. : $\frac{80}{100}=\left(\frac{P_t-60}{80-60}\right)$

$\frac{4}{5}=\left(\frac{P_t-60}{20}\right)$

$P_t - 60 = 16$

$P_t = 76$ cm

29. Answer (1)

Hint : $\frac{K-273}{100}=\frac{F-32}{180}$.

Sol. : $\frac{40}{100}=\frac{x}{180}$

$x=\frac{9\times 40}{5}$

$x = 72$

30. Answer (1)

Hint & Sol. : The mechanical equivalent of heat is dimensionless

31. Answer (4)

Hint : Heat loss = Heat gain

Sol. : $ML_v + Ms\Delta T_1 = M_w s\Delta T_2$

$M \times 540 + M \times 60 = 40 \times 1 \times 20$

$600\ M = 800$

$M = \frac{4}{3}$g

32. Answer (3)

Hint : $H = \frac{dQ}{dt} = KA\frac{\Delta T}{\Delta x}$

Sol. : $\frac{\frac{dQ_1}{dt}}{\frac{dQ_2}{dt_1}}=\frac{K_1A_1}{K_2A_2}$

$=\frac{2}{3}\times\frac{2}{1}$

$H_1 : H_2 = 4 : 3$

33. Answer (2)

Hint : Rate of heat radiated from black body $\frac{E}{t}\propto T^4$.

Sol. : $\frac{E_1/t}{E_2/t}=\left(\frac{T_1}{T_2}\right)^4$

$\frac{E_1/t}{E_2/t}=\left(\frac{500}{1000}\right)^4$

$\frac{E_2}{t}=20\times 16$

$= 320$ W

34. Answer (4)

Hint : $\lambda_m \propto \frac{1}{T}$

Sol. : $\frac{\lambda_{m_1}}{\lambda_{m_2}}=\frac{T_2}{T_1}$

$\lambda_{m_2}=\frac{5000\times 4000}{2000}$

$= 10000$ Å

35. Answer (2)

Hint : $\ln\left(\frac{T-T_0}{T_1-T_0}\right)=-bt$

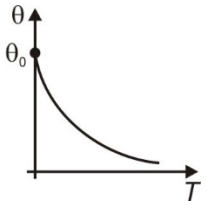
Sol. : $T - T_0 = \theta$

$T_1 - T_0 = \theta_0$

$\ln\left(\frac{\theta}{\theta_0}\right)=-bt$

$\left(\frac{\theta}{\theta_0}\right)=e^{-bt}$

$\theta = \theta_0 e^{-bt}$



36. Answer (3)

Hint : $P - P_0 = \frac{2S}{R}$

Sol. : $P = P_a + P_w + \frac{2S}{R}$

$= 1.01\times10^5 + 0.1\times10^3\times10 + \frac{2\times0.08}{0.1\times10^{-3}}$

$= 1.01 \times 10^5 + 0.01 \times 10^5 + 0.016 \times 10^5$

$= 1.036 \times 10^5 = 103.6$ kPa

≈ 104 kPa

37. Answer (3)

Hint : $R = \frac{\rho vD}{\eta}$

Sol. : $R = \frac{2\times10^3\times\frac{3}{2}\times4\times10^{-2}}{3\times10^{-2}}$

$R = 4 \times 10^3$

$R = 4000$

$R > 2000$ flow will be turbulent

38. Answer (1)

Hint : $R = \sqrt{h(H-h)}$

Sol. : $R_1 = \sqrt{\left(\frac{H}{2}-x_1\right)\left(H-\frac{H}{2}+x_1\right)}$

$R_1 = \sqrt{\left(\frac{H}{2}-x_1\right)\left(\frac{H}{2}+x_1\right)}$

$R_2 = \sqrt{\left(\frac{H}{2}+x_2\right)\left(H-\left(\frac{H}{2}+x_2\right)\right)}$

$= \sqrt{\left(\frac{H}{2}+x_2\right)\left(\frac{H}{2}-x_2\right)}$

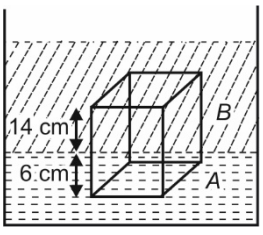
$R_1 = R_2$

$\Rightarrow \quad x_1 = x_2$

39. Answer (2)

Hint : In equilibrium, weight = Buoyant force.

Sol. :



$\rho_A = 700$ kg/m^3

$\rho_B = 300$ kg/m^3

$m = 0.2 \times 0.2 \times 0.06 \times 700 + 0.2 \times 0.2 \times 0.14 \times 300$

$m = 3.36$ kg

40. Answer (3)

Hint : $F_{net} = B - mg$

Sol. : $F = V \times 1000\ g - V \times 400$ g

$F = Vg \times 600$

$a = \frac{Vg\times600}{V\times400}$

$= 15$ m/s^2

41. Answer (4)

Hint & Sol. : $\vec{F} = -6\pi\eta r\vec{v}$ viscous force is independent of the material of the body.

42. Answer (2)

Hint : Use pascal's law.

Sol. : $\frac{F_1}{A_1} = \frac{W}{A_2}$

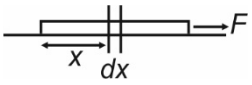
$F_1 = \frac{10000\times20\times10^{-4}}{5}$

$F_1 = 4$ N

43. Answer (4)

Hint : $\Delta L = \frac{(F_1+F_2)L}{2AY}$

Sol. :



$de = \frac{Tdx}{AY}$

Tension at a distance x from free end

$T = \frac{Fx}{L}$

Elongation of rod

$\int de = \int \frac{Fxdx}{LYA}$

$e = \frac{F}{LYA}\int_0^L xdx$

$e = \frac{FL}{2YA}$

44. Answer (3)

Hint & Sol. : Bulk modulus of elasticity of solid greater than liquid and Bulk modulus of elasticity of liquid is greater than gas.

45. Answer (2)

Hint : $\eta = \frac{FL}{A\Delta L}$

Sol. : $F = 12\times10^3$ N

$A = 36\times10^{-4}$ m^2

$\Delta L = 2\times10^{-4}$ m

$L = 6\times10^{-2}$ m

$\eta = \frac{12\times10^3\times6\times10^{-2}}{36\times10^{-4}\times2\times10^{-4}}$

$\eta = 10^9$ N/m^2

[CHEMISTRY]

46. Answer (1)

Hint : Cell constant = $\left(\frac{l}{a}\right)$.

Sol. : Unit of cell constant is cm^{-1} or m^{-1}.

47. Answer (1)

Hint : For strong Electrolyte, $\Lambda_m = \Lambda_m^\circ - Bc^{1/2}$

Sol. : Λ_m linearly related with $c^{1/2}$.

48. Answer (1)

Hint : $ClO_3^- + 6H^+ + 6e^- \longrightarrow Cl^- + 3H_2O$.

Sol. : For every 1 mol ClO_3^-, 6 mole electrons (6F charge) is required to convert into Cl^-.

49. Answer (3)

Hint : Mass deposited = $\frac{Eit}{96500}$

Sol. : Mass of Cu deposited = $\frac{\frac{63.5}{2}\times2\times965}{96500}$

= 0.635 g

50. Answer (2)

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

Sol. : $E^\circ_{cell} = E^\circ_{Hg^{2+}/Hg_2^{2+}} - E^\circ_{Pb^{2+}/Pb}$

= 0.97 – (– 0.13) = 1.1 V

51. Answer (2)

Hint : Cathode : grid of Pb packed with PbO_2

Anode : lead plates

52. Answer (4)

Hint : Corrosion of iron is a cell reaction in which brown layer of $Fe_2O_3.xH_2O$ forms on iron surface

Sol. : Anode : $Fe \longrightarrow Fe^{2+} + 2e^-$

Cathode : $O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O$ (l)

53. Answer (2)

Hint : E = – 0.0591 pH

Sol. : E = – 0.0591 × 3 = – 0.1773 V

54. Answer (3)

Hint : In Cathodic protection iron acts as Cathode.

55. Answer (2)

Hint : Colligative properties depend on number of solute particles.

Sol. : Boiling point is not a colligative property.

56. Answer (3)

Hint : Henry's Law, $p = K_H \cdot x$

Sol. : Smaller is the value of K_H, greater is the solubility of gas.

57. Answer (2)

Hint : For association, i = $1+\left(\frac{1}{n}-1\right)\alpha$

Sol. : i = $1+\left(\frac{1}{2}-1\right)\times0.2 = 1-0.1 = 0.9$

58. Answer (3)

Hint : Ideal solution obeys Raoult's law

Sol. : For Ideal solution,

Δ_{mix} H = 0

Δ_{mix} G < 0

Δ_{mix} S > 0

Δ_{mix} V = 0

59. Answer (1)

Hint : π = iCRT.

Sol. : i = 1 + (3 × 0.9) = 3.7

π = 3.7 × 0.1 × 0.0821 × 300 = 9.1 atm.

60. Answer (3)

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

Sol. : $\Delta T_b = 1 \times 0.52 \times 0.1 = 0.052$

$T_b = 100 + 0.052 = 100.052°C.$

61. Answer (4)

Hint : $\Delta T_f = i K_f m.$

Sol. : $\Delta T_f = 1 \times 1.86 \times 0.5 = 0.93 K$

62. Answer (3)

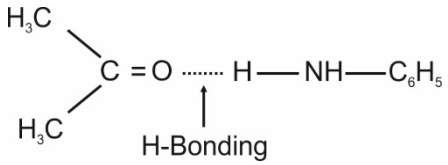
Hint : $Y_A = \frac{P_A^o X_A}{P_A^o X_A + P_B^o X_B}.$

Sol. : $Y_A = \frac{400 \times \frac{3}{8}}{400 \times \frac{3}{8} + 300 \times \frac{5}{8}} = \frac{1200}{1200 + 1500}$

$= \frac{12}{27} = \frac{4}{9}.$

63. Answer (1)

Hint :



64. Answer (3)

Hint : Copper solid is an example of metallic solid.

65. Answer (1)

Hint : Contribution of corner atom in FCC unit cell is $\frac{1}{8}$.

66. Answer (2)

Hint : 1 unit cell of iron will have 2 atoms.

Sol. : 2 atoms are present in 1 unit cell

$\frac{2.8 N_A}{56}$ atoms will be present in $\frac{2.8 N_A}{56 \times 2}$ unit cells $\left(= \frac{N_A}{40} \text{ unit cells}\right)$.

67. Answer (3)

Hint : In FCC unit cell 8 tetrahedral and 4 octahedral voids are present.

Sol. : Number of atoms A in unit cell = 1 + 3 = 4

Number of atoms B in unit cell = 2 + 4 = 6

Formula : $A_4B_6 \Rightarrow A_2B_3$

68. Answer (2)

Hint : Radius ratio of tetrahedral void is from 0.225 to 0.414.

Sol. : Coordination number of tetrahedral void is 4.

69. Answer (3)

Hint : For neutral compound, net charge = 0.

Sol. : $Fe_{0.95}O = Fe_x^{2+} Fe_{0.95-x}^{3+} O_1^{2-}$

$2x + 3(0.95 - x) - 2 = 0$

$3 \times 0.95 - x = 2$

$x = 0.85$

% of $Fe^{3+} = \frac{0.1}{0.95} \times 100 = 10.5\%$

70. Answer (2)

Hint : $r = -\frac{d[H_2O_2]}{dt} = 2\frac{d[O_2]}{dt}$

Sol. : $-\frac{d[H_2O_2]}{dt} = 2\frac{d[O_2]}{dt} \Rightarrow 0.2 = 2\frac{d[O_2]}{dt}$

$\frac{d[O_2]}{dt} = 0.1 \text{ mol } L^{-1}s^{-1}$

71. Answer (1)

Hint : Unit of rate constant of n^{th} order reaction $\left(\frac{\text{mol}}{L}\right)^{1-n} s^{-1}$

Sol. : For first order reaction, n =1

Unit of rate constant = s^{-1}

72. Answer (4)

Hint : Molecularity of a reaction cannot be fraction, zero or any negative number.

73. Answer (2)

Hint : For zero order reaction, $A = A_0 - kt$

Sol. : $A = A_0 - kt$

$\frac{A_0}{4} = A_0 - k \times 10$

$k \times 10 = \frac{3A_0}{4}$

$k = \frac{3A_0}{40} = \frac{3 \times 0.1}{40} = \frac{0.3}{40} = 7.5 \times 10^{-3} \text{ mol } L^{-1}s^{-1}$

74. Answer (3)

Hint : Arrhenius equation :

$\ln k = \ln A - \frac{E_a}{RT}$

Sol. : Compare equation, $\ln k = 2 - \frac{200}{T}$

with Arrhenius equation

$\ln A = 2$ and $\frac{E_a}{R} = 200$

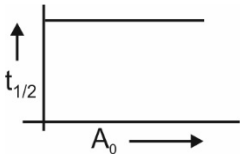
$\Rightarrow A = e^2$ and $E_a = 200\ R$

75. Answer (4)

Hint : For first order reaction

$t_{\frac{1}{2}} = \frac{0.693}{k}$

Sol. :



$\therefore \quad t_{\frac{1}{2}} = \frac{0.693}{k}$

76. Answer (3)

Hint : For first order reaction,

$k = \frac{2.303}{t}\log\left(\frac{A_0}{A}\right)$

Sol. : $t_{1/2} = 10$ sec

$t = \frac{2.303}{k}\log\left(\frac{100}{10}\right) = \frac{2.303}{k}$

$= \frac{2.303}{\frac{0.693}{t_{1/2}}} = \frac{2.303}{0.693} \times t_{1/2} \qquad \left(\because\ t_{½} = \frac{0.693}{k}\right)$

$= 33.23$ sec.

77. Answer (2)

Hint : In Physisorption, enthalpy of Adsorption is 20 – 40 kJ mol^{-1} .

78. Answer (4)

Hint : Catalyst used in Ostwald's process is platinised asbestos to form Nitric acid.

79. Answer (4)

Hint : Colloidal gel contains liquid as dispersed phase and solid as dispersion medium.

80. Answer (2)

Hint : Hydrate metal oxides sols are +ve sols.

Sol. : Congo red sol is a –ve sol.

81. Answer (2)

Hint : Micelles formation takes place above kraft temperature as well as above CMC (critical micelle concentration).

82. Answer (2)

Hint : During Adsorption energy is released.

Sol. : For Adsorption,

$\Delta S < 0,\ \Delta H < 0,\ \Delta G < 0$

83. Answer (2)

Hint : $K_{sp}\ (Al(OH)_3) = [Al^{3+}]\ [OH^-]^3$

And $E = E° - \frac{0.059}{3}\log Q$

Sol. : $Al^{3+} + 3e^- \longrightarrow Al(s)$

$E = -1.67 - \frac{0.059}{3}\log\frac{1}{[Al^{3+}]}$

$= -1.67 + \frac{0.059}{3}\log[Al^{3+}]$

$\left(\because\ pH = 10,\quad pOH = 4,\ [OH^-] = 10^{-4}\right.$
$[Al^{3+}](10^{-4})^3 = 10^{-33},\ [Al^{3+}] = 10^{-33} \times 10^{12}$
$\left. = 10^{-21}\right)$

$E = -1.67 + \frac{0.059}{3}\log\left(10^{-21}\right)$

$= -1.67 - \frac{0.059}{3} \times 21 = -1.67 - 0.059 \times 7$

$= -2.083$ Volt

84. Answer (1)

Hint : Anode: $H_2O(l) \longrightarrow \frac{1}{2}O_2(g) + 2H^+(aq) + 2e^-$

Cathode : $Ag^+(aq) + e^- \longrightarrow Ag(s)$

Sol. : $w = \frac{Eit}{96500} \Rightarrow$ Mole x n-factor $= \frac{it}{96500}$

Mole $(O_2) \times 4 = \frac{9.65 \times 60 \times 60}{96500} = 0.36$

Mol$(O_2) = 0.09$

Volume of O_2 (g) at STP $= 0.09 \times 22.4 = 2.016$ L

85. Answer (3)

Hint : $\Lambda_m^o(NH_4OH) = \Lambda_m^o(NH_4NO_3) + \Lambda_m^o(KOH) - \Lambda_m^o(KNO_3)$

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

Sol. : $\Lambda_m^\circ (NH_4OH) = 128 + 239 - 125$

$= 242\ S\ cm^2\ mol^{-1}$

$\alpha = \frac{14}{242} = 0.0578 \simeq 0.06$

86. Answer (1)

Hint : Density of crystal $\left(d = \frac{ZM}{N_A \times a^3}\right)$ decreases due to Schottky defects.

Sol. : Number of formula units considering Schottky defect

$= 4\left(1 - \frac{5}{100}\right) = 4(1 - 0.05) = 3.8$

density

$= \frac{60 \times 3.8}{6 \times 10^{23} \times \left(5 \times 10^{-8}\ cm\right)^3} = \frac{38}{10^{23} \times 125 \times 10^{-24}}$

$= \frac{38}{12.5} = 3.04\ g/cm^3$

87. Answer (3)

Hint : Invertase catalyzes the conversion of sucrose to glucose and fructose.

88. Answer (2)

Hint : Concentration terms involving volume are temperature dependent.

89. Answer (2)

Hint : Bohr magneton is the unit of magnetic moment.

Sol. : Fe, Co, Ni are ferromagnetic. Magnetite is ferrimagnetic. H_2O, NaCl and C_6H_6 are diamagnetic.

90. Answer (2)

Hint : Dopping of every 1 mol $CaCl_2$ generates 1 mol cation vacancies

Sol. : % of cation vacancies

= % $CaCl_2$ dopped

$= 10^{-5}$ mol%

[BIOLOGY]

91. Answer (1)

Hint : Parenchyma possesses primary walls only.

Sol. : Collenchyma has thick walls at corners. It is mechanical tissue.

92. Answer (2)

Hint : It is secondary in origin.

Sol. : Interfascicular cambium develops between the vascular bundles of dicot stem.

93. Answer (4)

Hint : Sclerenchyma is dead mechanical tissue in a plant.

Sol. : It has lignified thick walls. Parenchyma forms the major component of the plant.

94. Answer (3)

Sol. : Mesophyll tissue of leaves is called ground tissue. Vascular tissue is conducting tissue. Conjunctive tissue is found in roots.

95. Answer (2)

Hint : Bulliform cells are found in some grasses.

Sol. : Bulliform cells are modified adaxial epidermal cells which help to prevent water loss.

96. Answer (2)

Hint : Monocots have isobilateral leaves.

Sol. : Isobilateral leaves possess chloroplast in mesophyll cells and guard cells of stomata.

All cells of epidermis do not possess chloroplast.

97. Answer (2)

Hint : Xylem parenchyma is the only living component of xylem.

Sol. : Vessels, tracheids and xylem fibres are dead elements of xylem.

98. Answer (1)

Hint : Endodermis is called starch sheath as it may store starch grains.

Sol. : In monocot stem, ground tissues is not differentiated into cortical layers, endodermis, pericycle, pith and pith rays. Starch sheath is seen in dicot stem.

99. Answer (2)

Hint : Sapwood is the peripheral region of secondary xylem.

Sol. : Sapwood is actively involved in conduction of water. It is lighter in colour. Both type of wood have lignified cell walls.

100. Answer (4)

Hint : Hypodermis is absent in roots. Monocots do not show secondary growth.

Sol. : Cambium is present in dicots only as they show secondary growth.

101. Answer (1)

Hint : Gymnosperms and some angiosperms show secondary growth.

Sol. : Monocots do not show secondary growth as they lack cambium.

102. Answer (3)

Hint : Stems have conjoint vascular bundles.

Sol. : Roots have radial vascular bundles and exarch xylem. Epidermis is present in both roots and stem.

103. Answer (3)

Hint : Cork cells are redifferentiated tissues.

Sol. : They are formed by cork cambium (phellogen) which is a dedifferentiated tissue.

104. Answer (4)

Sol. : All tissues outside the vascular cambium constitute the bark. Primary xylem is present inside it.

105. Answer (1)

Hint : Tyloses are swellings of xylem parenchyma into the vessels.

Sol. : They are seen in heartwood and make it non functional.

106. Answer (4)

Hint : One vessel member is connected to another.

Sol. : The end walls of vessels are perforated but such type of perforation is not found in the tracheids.

107. Answer (2)

Hint : Cork cambium is extra-stelar cambium.

Sol. : It is usually developed in the cortical region.

108. Answer (3)

Hint : Lenticels are pores on woody stem.

Sol. : Lenticels may serve for the loss of water in the form of vapours and exchange of gases between outer environment and internal tissues.

They are formed due to rupture of stem epidermis.

109. Answer (1)

Hint : Monocot stem has closed vascular bundles.

Sol. : Conjoint vascular bundles can be closed (monocot stem) or open (dicot stem).

110. Answer (3)

Hint : Sieve tube element and vessel elements are living and dead respectively.

Sol. : Both lack nucleus at maturity. Hence they are enucleated.

111. Answer (1)

Hint : Phloem parenchyma is absent in most of the monocots.

Sol. : Phloem parenchyma are cylindrical in shape, have nucleus and cellulosic walls.

112. Answer (2)

Hint : In algae, the most common type of asexual spores are zoospores.

Sol. : Zoospores are planospores and are produced endogenously. They are mitospores and not found in red algae.

113. Answer (4)

Hint : *Marchantia* is a liverwort.

Sol. : Liverworts have completely dependent sporophyte on gametophyte.

114. Answer (3)

Hint : Pteridophytes have sporophyte as main dominant body.

Sol. : Pteridophytes have both sporophyte as well as gametophytic bodies independent.

115. Answer (4)

Hint : *Fucus* is diploid, shows oogamous reproduction.

Sol. : *Polytrichum* is a moss and *Riccia* is a liverwort. In angiosperms, ovules are covered by ovary.

116. Answer (1)

Hint : Bryophytes lack seeds as well as vascular tissues.

Sol. : *Riccia* } Bryophyte

Cedrus, *Cycas* } Gymnosperms

117. Answer (4)

Hint : Green algae lack hydrocolloids.

Sol. : Brown algae have chlorophyll a and c. Hydrocolloid algin covers their cell wall.

118. Answer (3)

Hint : Liverworts have jacketed sex organs.

Sol. : Liverworts produce spores by meiosis in spore mother cells.

119. Answer (2)

Hint : PEN is triploid in most of the angiosperms.

Sol. : PEN is formed by fusion of male gamete with secondary nucleus.

120. Answer (2)

Hint : Organisms which produce gametes by mitosis are haploid.

Sol. : Gametophytic bodies are haploid which is dominant plant body in *Porella.*

Pinus, *Ginkgo* } Gymnosperms

Eucalyptus } Angiosperm

121. Answer (4)

Hint : *Polysiphonia* is a red alga.

Sol. : It lacks motile stages. It reproduces by non-motile gametes and spores.

122. Answer (3)

Hint : *Sphagnum* is a moss.

Sol. : *Sphagnum* is homosporous. It has dependent sporophyte and has great water retaining capacity.

123. Answer (1)

Hint : Stems are usually unbranched in *Cycas.*

Sol. : Stems are branched in *Cedrus* and *Pinus.*

124. Answer (4)

Sol. : Endosperm of gymnosperms is haploid and called female gametophyte.

125. Answer (1)

Hint : *Pinus* and *Salvinia* both are heterosporous and have sporophytic main plant body.

Sol. : Both *Pinus* and *Salvinia* show sporic meiosis.

Pinus being gymnosperm has cambial ring but *Salvinia* does not.

126. Answer (4)

Hint : Pteridophytes include both homosporous as well as heterosporous species.

Sol. : Pteridophytes are vascular amphibians.

127. Answer (3)

Hint : Angiosperms show double fertilisation.

Sol. : Angiosperms can have single cotyledon (monocots) or two cotyledons (dicots). They show diplontic life cycle and have seeds inside fruit.

128. Answer (2)

Sol. : Pollen grains are haploid. Hence, gametes produced by it are haploid.

129. Answer (4)

Sol. : Highly reduced male gametophytes are also present in angiosperms living in different habitats.

130. Answer (1)

Hint : Prothallus is photosynthetic.

Sol. : It is gametophytic, multicellular and inconspicuous structure.

131. Answer (3)

Sol. : *Marchantia* is dioecious. It has male and female sex organs on different plant bodies.

132. Answer (2)

Sol. : Chemotaxonomy includes DNA sequencing to identify or classify organisms.

133. Answer (3)

Hint : Pteridophytes require water for fertilisation.

Sol. : Gametophytes of pteridophytes require cool, damp and shady places to grow.

134. Answer (4)

Sol. : In gymnosperms, the transfer of pollen grains occur by air current.

135. Answer (2)

Hint : *Wolfia* is an angiosperm.

Sol. : *Wolfia* is the smallest angiosperm.

136. Answer (4)

Hint : Identify the maternity hormone.

Sol. : Hypothalamus produces GHRH *i.e.* somatocrinin, GHIH *i.e.* somatostatin and oxytocin. Prolactin is a secretion of anterior pituitary.

137. Answer (1)

Hint : Organ that secretes bile.

Sol. : Organised endocrine glands include pituitary, thyroid, pineal gland etc. Liver performs various functions in addition to release of hormones like IGF-1 and angiotensinogen. It is therefore not exclusively categorized as an endocrine gland.

138. Answer (3)

Hint : This secretion helps maintain diurnal rhythm.

Sol. : Ductless glands are endocrine glands. Melatonin is a secretion of pineal gland. Milk, sweat and sebum are secretions of exocrine mammary glands, sudorific glands and sebaceous glands respectively.

139. Answer (2)

Hint : Gland which lies at the base of diencephalon.

Sol. : Hypothalamus secretes both releasing and inhibitory hormones regulating/influencing secretions of the anterior pituitary.

140. Answer (3)

Hint : Hormone also called adrenaline.

Sol. : Epinephrine/adrenaline is secreted by adrenal medulla under conditions of fear, fight and flight. This hormone has extracellular receptors unlike other given hormones which have intracellular receptors.

141. Answer (1)

Hint : Outermost layer of adrenal cortex.

Sol. : Corticotropin releasing hormone targets anterior pituitary to release ACTH which acts on zona fasciculata and zona reticularis of adrenal cortex. Mineralocorticoids like aldosterone are released under influence of angiotensin II.

142. Answer (4)

Hint : Parathyroid gland is present on dorsal side of thyroid gland.

Sol. : Peptide hormone is PTH *i.e*. parathormone and is released from parathyroid gland. PTH is hypercalcaemic but hypophosphatemic.

143. Answer (3)

Hint : Thymus plays an important role in cell mediated immunity.

Sol. : Thymosin from thymus plays a major role in differentiation of T-lymphocytes. Therefore, with continued degeneration of thymus with age, immunity weakens.

144. Answer (3)

Hint : Select a steroid hormone.

Sol. : Estrogen is responsible for sex drive in women. ACTH is secreted by anterior pituitary gland. ANF is a blood pressure lowering hormone. Progesterone is gestational hormone.

145. Answer (2)

Hint : Endocrine secretion of pancreas.

Sol. : Insulin lowers blood sugar levels to normal and is secreted by β-cells of Islets of Langerhans. Glucagon secreted by α-cells is a hyperglycemic hormone.

146. Answer (2)

Hint : A secretion of pars intermedia.

Sol. : Pars distalis *i.e*. anterior pituitary secretes six hormones, which include GH, PRL, LH, FSH, TSH and ACTH. Melanocyte stimulating hormone is released by pars intermedia which merges with pars distalis eventually.

147. Answer (2)

Hint : Cells of adrenal cortex are damaged in this disorder.

Sol. : Underproduction of hormones by the adrenal cortex alters carbohydrate metabolism causing acute weakness and fatigue leading to Addison's disease. Exophthalmic goitre/Grave's disease is a form of hyperthyroidism while hyperaldosteronism is caused due to excessive secretion of aldosterone.

148. Answer (1)

Hint : Disorder resulting from deficiency of tyrosine derived hormone.

Sol. : Cretinism can result from iodine and thyroxine deficiency since birth or during pregnancy. The afflicted individuals suffer from deaf-mutism, low IQ and low BMR.

149. Answer (3)

Hint : It induces sleep.

Sol. : Pineal gland regulates diurnal rhythm by secreting melatonin.

Light inhibits melatonin production in body. Melatonin levels spike at night.

150. Answer (1)

Hint : It is a secretion of β-cells of pancreas.

Sol. : GH or STH is lipolytic and has glucose sparing effects. Insulin also results in glycogenesis. hCG is produced by trophoblast cells during pregnancy. Thyroxine is not a catecholamine. Cortisol promotes gluconeogenesis.

151. Answer (3)

Hint : Composed of actin protein.

Sol.: Leucocytes *i.e*. macrophages and *Amoeba* show locomotion through pseudopodia formation.

152. Answer (4)

Hint : Bone marrow is a source of blood cells.

Sol. : The original function of the skeleton in the first vertebrates was to provide protection from enemies.

153. Answer (3)

Hint : 'A' comprises 80 bones in humans.

Sol. : Axial skeleton includes cranium, vertebral column, ribcage and facial bones. Appendicular skeleton comprises limb bones and girdles.

154. Answer (4)

Hint : Neurotransmitter of parasympathetic nervous system.

Sol. : Acetylcholine is an excitatory neurotransmitter that binds to its receptors on the sarcolemma.

155. Answer (3)

Hint : Subthreshold stimulus prevents contraction of a muscle cell.

Sol. : Supra and threshold stimulus result in maximal contraction of the muscle fibres *i.e.* leading to contraction of the muscle.

156. Answer (1)

Hint : Bone associated with tongue.

Sol. : Hyoid bone is included in the skull and it does not articulate with any other bone.

157. Answer (3)

Hint. : This is a contractile protein.

Sol. : Actin filaments slide over myosin filaments during muscle contraction.

158. Answer (2)

Hint : Storehouse of calcium.

Sol. : Endoplasmic reticulum *i.e.* sarcoplasmic reticulum of striated muscle fibres store calcium ions which are essential for muscle contraction. Sarcoplasm is cytoplasm of a skeletal muscle cell.

159. Answer (2)

Hint : Decreased levels of estrogen affects mineralization of bones.

Sol. : Osteoporosis results from weak bones due to their demineralisation. Gout occurs due to inflammation of joints caused by accumulation of uric acid crystals. Osteopetrosis makes the bones extremely dense yet prone to fracture.

160. Answer (1)

Hint : Identify the simplest synovial joint.

Sol. : Gliding joints are synovial joints which offer limited mobility in terms of movement in different axes. Elbow joint between humerus and ulna is a hinge joint. Pivot joint exists between atlas and axis of vertebral column. Joint between zygapophyses of different vertebrae are gliding in nature.

161. Answer (2)

Hint : Large triangular flat bone.

Sol. : The dorsal, flat triangular body of scapula has a slightly elevated ridge called the spine which projects as acromion process.

162. Answer (1)

Hint : Hammer shaped bone.

Sol. : Middle ear bones in man are malleus, incus and stapes. Mandible forms lower jaw, maxilla the upper jaw and metacarpals form the palm.

163. Answer (4)

Hint : Identify an odd number.

Sol. : There are '7' tarsals in a single human foot and 8 carpals in a single human hand.

164. Answer (3)

Hint : Myoglobin is red in colour.

Sol. : 12 unpaired thoracic vertebrae are present in man. Myoglobin rich fibres are red in colour. Sternum is present ventrally in man.

165. Answer (4)

Hint : Identify the afferent processes of a neuron.

Sol. : Dendrites receive the impulse and pass them forward to the cell body of a neuron.

Dendrites $\rightarrow$ Cyton $\rightarrow$ Axon hillock $\rightarrow$ Axon.

166. Answer (4)

Hint : External stimuli is the source of energy for impulse.

Sol. : Neurons are structural and functional units of neural tissue. Astrocytes are neuroglial cells but they are not excitable cells. Neither cell of neural tissue can generate threshold stimulus.

167. Answer (3)

Hint : Inhibitory neurotransmitter.

Sol. : Deficiency of dopamine can result in Parkinson's disorder. Schizophrenia can result from excess of dopamine. Alzheimer's disease or senile dementia can be caused due to acetylcholine deficiency.

168. Answer (4)

Hint : Insulation increases the speed of conduction.

Sol. : Increasing diameter of the axon increases the speed of impulse conduction. Cross-sectional area of a nerve fibre $\propto \frac{1}{\text{resistance}}$.

169. Answer (1)

Hint : Chief cation in ECF.

Sol. : Diffusion if permitted would allow Na^+ and K^+ to move into and out of the neuronal cell respectively along their concentration gradients.

170. Answer (2)

Hint : Ions travel across connexons in an electrical synapse.

Sol. : Impulses travel faster across electrical synapses than chemical synapses as cleft size is narrower in case of electrical synapse. Connexons connect pre and post synaptic membranes and permit passage of ions but not neurotransmitters. Bidirectional movement is possible in case of electrical synapses.

171. Answer (4)

Hint : Sympathetic stimulation occurs in fear or flight.

Sol. : Pupils dilate under frightful conditions by effect of sympathetic stimulation. Bronchodilatory impact is observed under effect of adrenaline release.

172. Answer (3)

Hint : It relays impulses to skeletal muscles.

Sol. : Somatic neural system relays impulses from the CNS to skeletal muscles. ANS has two divisions namely sympathetic and para sympathetic.

173. Answer (1)

Hint : Dorsal portion of the midbrain comprises four round swellings.

Sol. : Corpus callosum connects the two cerebral hemispheres.

174. Answer (1)

Hint : This duct connects diocoel to metacoel.

Sol. : Iter or duct of Sylvius is a part of midbrain

175. Answer (1)

Hint : Location of pseudounipolar neurons

Sol. : Sensory neurons bring information here which is processed to brain and motor neurons.

176. Answer (3)

Hint : Neurons can't generate stimulus.

Sol. : Stimuli can be integrated not the response.

177. Answer (1)

Hint : Composed of axons of ganglionic cells.

Sol. : Pupil provides opening for light to enter while lens focusses the light. Fovea transduces blue, green and red light. Ciliary muscles alter shape of the lens.

178. Answer (2)

Hint : Rods and cones are photoreceptor cells.

Sol. : Horizontal cells carry signals from one photoreceptor to another. Rods are responsible for scotopic vision.

179. Answer (2)

Hint : Gustation and olfaction are driven by chemicals.

Sol. : Thermoreceptors measure temperature.

180. Answer (3)

Hint : Connects middle to inner ear.

Sol. : Eustachian tube equalises pressure between middle ear and atmosphere. Round window helps dissipate sound waves. Tympanic membrane assists in converting pressure waves of air into vibrations of bones.

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