

All India Aakash Test Series for Medical - 2022

TEST - I (Code-C)

Test Date : 01/11/2020

ANSWERS

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

HINTS & SOLUTIONS**[PHYSICS]**

1. Answer (1)

Hint : On addition and subtraction absolute errors are added.**Sol. :**

$$\Delta T = (31.0 - 41.2) \pm (0.1 + 0.3)$$

$$= [(-10.2) \pm 0.4]^{\circ}\text{C}$$

2. Answer (2)

Hint and Sol. :

$$\frac{\Delta P}{P} = \frac{1}{2}\% \frac{\Delta a}{a} + 1\% \frac{\Delta b}{b} + \frac{4}{5}\% \frac{\Delta c}{c}$$

$$= \frac{1}{2} \times 1 + 0.5 + \frac{4}{5} \times 2.5 = 3\%$$

3. Answer (4)

Hint and Sol. : For a set to act as base quantities, none of the quantity could be derived completely from other quantities.

4. Answer (2)

Hint and Sol. :

Dimensionless quantities may have unit. e.g. angle.

Unitless quantities do not have dimensions e.g. refractive index.

5. Answer (3)

Hint : Least count = $\frac{\text{Pitch}}{\text{Divisions of circular scale}}$

Sol. : Least count = $\frac{0.2}{150} = 1.33 \times 10^{-4} \text{ cm}$

6. Answer (2)

Hint and Sol. : The mediating particle of electromagnetic force are photons.

7. Answer (3)

Hint : $n_1 u_1 = n_2 u_2$

[Pressure] = $[\text{ML}^{-1}\text{T}^{-2}]$

Sol. : $n_1 [\text{ML}^{-1}\text{T}^{-2}]_1 = n_2 [\text{ML}^{-1}\text{T}^{-2}]_2$

$$\left[\frac{M_1}{M_2} \right] \left[\frac{L_1^{-1}}{L_2^{-2}} \right] \left[\frac{T_1^{-2}}{T_2^{-2}} \right] = n_2$$

$$n_2 = \left[\frac{\text{kg}}{10 \text{ kg}} \right] \left[\frac{\text{s}}{0.25 \text{ s}} \right]^{-2} \left[\frac{\text{m}}{1 \text{ km}} \right]^{-1}$$

$$= 6.25$$

8. Answer (3)

Hint : Reading = MSD + VSD \times LC

Sol. : 8MSD = 10 VSD

1 VSD = $\frac{8}{10}$ MSD

LC = 1 MSD - 1 VSD

LC = 1 MSD - $\frac{8}{10}$ MSD

LC = $\frac{2}{10}$ MSD = 0.2 \times 1mm

LC = 0.2 mm

Edge = 11 mm + 3 \times 0.2 = 11.6 mm

Volume = (Edge)³ = (11.6)³
= 15.6 \times 10²

9. Answer (1)

Hint : [Force] = [A]^x [V]^y [ρ]^z

Sol. : [Force] = $[\text{MLT}^{-2}]$

$\Rightarrow [\text{MLT}^{-2}] = [\text{L}^2]^x [\text{LT}^{-1}]^y [\text{ML}^{-3}]^z$

2x + y - 3z = 1

z = 1

-y = -2

$\Rightarrow x = z = 1$

y = 2

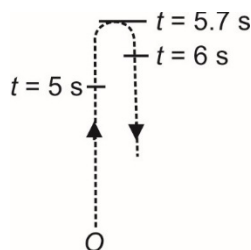
[F] = [ρ] [A] [V]²

10. Answer (2)

Hint and Sol. :

|Average velocity| \leq average speed

11. Answer (2)

Hint : In the time duration, the particle changes direction of its motion.**Sol. :**

Displacement = $\frac{1}{2}g(0.7)^2 - \frac{1}{2}g(0.3)^2 = 2 \text{ m}$

12. Answer (3)

$$\text{Hint : } T_2 = \frac{t_1 \times t_3}{(t_1 - t_3)}$$

Sol. : Time taken on stationary escalator

$$= t_1 = \frac{d}{u}$$

Time taken while standing on moving escalator

$$= t_2 = \frac{d}{v}$$

Time taken to move on a moving escalator

$$= \frac{d}{u+v} = t_3$$

$$\Rightarrow \frac{1}{t_3} = \frac{1}{t_1} + \frac{1}{t_2}$$

$$\Rightarrow t_2 = \frac{t_1 t_3}{t_1 - t_3} = \frac{10 \times 20}{20 - 10} = 20 \text{ s}$$

13. Answer (2)

Hint : Distance = \int speed dt

Sol. : Distance = \int_0^6 speed $\times dt$

Particle direction changes at $t = 4$ sec

$$\text{distance} = \int_0^4 (4t - t^2) dt + \int_4^6 (t^2 - 4t) dt$$

$$= \int_0^4 (4t - t^2) dt + \int_4^6 (t^2 - 4t) dt$$

$$= \left(2t^2 - \frac{t^3}{3} \right)_0^4 + \left(\frac{t^3}{3} - 2t^2 \right)_4^6$$

$$= \frac{32}{3} + \frac{32}{3} = 21.33 \text{ (m)}$$

14. Answer (1)

$$\text{Hint : } t = \sqrt{\frac{2h}{g}}$$

$$\text{Sol. : } t_1 = \sqrt{\frac{2h}{g}}$$

$$t_2 = \sqrt{\frac{2(3h)}{g}} - \sqrt{\frac{2h}{g}}$$

$$= (\sqrt{3} - 1)t_1$$

$$= (\sqrt{3} - 1) \times 4$$

15. Answer (4)

Hint : Use concept of relative motion.

Sol. : $a_A = 0$

$$a_B = \frac{3}{5} = 0.6 \text{ m/s}^2$$

$$u_A = 3 \text{ m/s}$$

$$u_B = 0$$

$$a_{A/B} = -0.6 \text{ m/s}^2$$

$$u_{A/B} = 3 \text{ m/s}$$

$$t = \frac{2u_{A/B}}{a_{A/B}} = \frac{2 \times 3}{0.6} = 10 \text{ s}$$

16. Answer (3)

Hint and Sol. :

$$v_{avg} = \frac{3}{\frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}}$$

$$= \frac{3}{\frac{1}{10} + \frac{1}{20} + \frac{1}{40}} = 17.14 \text{ m/s}$$

17. Answer (4)

Hint : $a = \frac{dv}{dt} \Rightarrow \int dv = \int a dt$

Sol. : $a = 4e^{-3t}$

$$\int_2^v dv = \int_0^\infty 4 \cdot e^{-3t} dt$$

$$v - 2 = -\frac{4}{3} e^{-3t} \Big|_0^\infty$$

$$v = 2 + \frac{4}{3} = \frac{10}{3} \text{ m/s}$$

18. Answer (4)

Hint: $\vec{v} = \vec{u} + \vec{g}t$

Sol. : $2 - gt = \pm 1$

$$\Rightarrow t = 0.1 \text{ s}, 0.3 \text{ s}$$

19. Answer (1)

Hint and Sol. :

Between O and A, velocity is positive and acceleration is negative.

20. Answer (1)

Hint and Sol. :

Systematic error is independent of number of observations.

21. Answer (4)

Hint : Use dimensional analysis.

$$\text{Sol. : } [\text{Energy}] = [M L^2 T^{-2}]$$

$$[\text{Force}] = [\text{M L T}^{-2}]$$

$$[\text{Angle}] = [\text{M}^0 \text{L}^0 \text{T}^0]$$

$$[\text{Impulse}] = [\text{M L T}^{-1}]$$

22. Answer (2)

Hint and Sol. :

The instrument with smallest least count, has highest precision.

23. Answer (4)

Hint : Using rules of significant figures.

$$\text{Sol. : } \frac{62.24}{2.0} = 31.12$$

$$= 31 \text{ (two significant figures)}$$

24. Answer (4)

Hint and Sol. :

erg is a unit of energy. Gauss is a unit of magnetic field.

25. Answer (1)

Hint : Dimensional analysis.

$$\text{Sol. : } [A] = [x] = [\text{M}^0 \text{L T}^0]$$

$$[Bt] = [Ct^2] = [\text{M}^0 \text{L}^0 \text{T}^0]$$

$$[B] = [\text{M}^0 \text{L}^0 \text{T}^{-1}]$$

$$[C] = [\text{M}^0 \text{L}^0 \text{T}^{-2}]$$

$$\left[\frac{AB}{C} \right] = \frac{[\text{M}^0 \text{L T}^0][\text{M}^0 \text{L}^0 \text{T}^{-1}]}{[\text{M}^0 \text{L}^0 \text{T}^{-2}]} = [\text{M}^0 \text{L T}]$$

26. Answer (3)

Hint and Sol. :

Maxwell unified electromagnetism and optics.

27. Answer (1)

$$\text{Hint : } v = \frac{4}{3} \pi R^3$$

$$\text{Sol. : } \% \frac{\Delta v}{v} = 3\% \frac{\Delta R}{R}$$

$$= 3 \times 0.2 = 0.6\%$$

28. Answer (2)

$$\text{Hint : } R_{net} = R_1 + R_2$$

$$\text{Sol. : } R_{net} = R_1 + R_2$$

$$\Delta R_{net} = \Delta R_1 + \Delta R_2$$

$$\Rightarrow R_{net} = (20 + 40) \pm (0.2 + 0.2)$$

$$= (60 \pm 0.4) \Omega$$

29. Answer (2)

Hint and Sol. : Trailing zeroes in a number with a decimal are significant.

30. Answer (1)

Hint and Sol. :

$$2.645 = 2.6 \text{ (One decimal place)}$$

31. Answer (4)

Hint and Sol. :

Equations with dimensionless constants and additions cannot be derived using dimensional analysis.

32. Answer (2)

Hint and Sol. :

$$\% \text{ error} = \frac{0.01}{0.80} \times 100 = 1.25\%$$

33. Answer (2)

Hint and Sol. :

Electron microscope is based upon principle of wave nature of matter.

34. Answer (2)

Hint : Galileo law of odd numbers.

Sol. : Ratio of height in successive five second intervals = 1 : 3 : 5 : 7

$$\therefore \text{Ratio} = 3 : 7$$

35. Answer (3)

Hint and Sol. :

In 12 hours, the hour hand has a zero displacement.

36. Answer (4)

Hint : Distance = Path length

Displacement = Shortest path length

$$\text{Sol. : } a + 2r + b + 4r$$

$$= 1 + 14 + 6 + 28$$

$$= 49 \text{ m}$$

$$\text{Distance} = a + \pi r + b + 2\pi r = 73 \text{ m}$$

$$\text{Ratio} = \frac{73}{49}$$

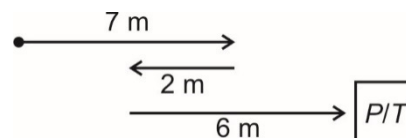
37. Answer (2)

Hint : Displacement = Body diagonal

$$\text{Sol. : } \text{Displacement} = \sqrt{4^2 + 3^2 + 5^2} = 5\sqrt{2} \text{ m}$$

38. Answer (3)

Hint and Sol. :



Total steps = 7 + 2 + 6 = 15

Forward steps = 7 + 6 = 13

Backward steps = 2

$$\text{Time} = \frac{13}{2} + \frac{2}{4} = 6.5 + 0.5 = 7 \text{ sec.}$$

39. Answer (2)

$$\text{Hint : } a = \frac{v^2 - u^2}{2s}$$

$$\text{Sol. : } a = \frac{|100^2 - 50^2|}{2 \times 50} = 75 \text{ m/s}^2$$

40. Answer (1)

$$\text{Hint : } \int dv = \int a dt$$

$$\text{Displacement} = \int v dt$$

$$\text{Sol. : } v = \int 12t^2 dt$$

$$v = 4t^3 \Big|_0^t = 4t^3$$

$$\text{Displacement} = \int_0^2 4t^3 dt$$

$$= t^4 \Big|_0^2 = 16 \text{ m}$$

41. Answer (3)

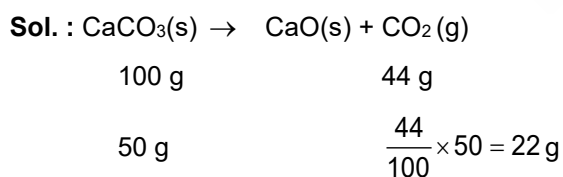
Hint : Distance = area under speed-time graph.

$$\text{Sol. : Area} = \frac{1}{2} \times 3 \times 6 + 6 \times 1 + \frac{1}{2} \times 3 \times 6 + \frac{1}{2} \times 1 \times 2 + 2 \times 2 = 29 \text{ m}$$

[CHEMISTRY]

46. Answer (3)

$$\text{Hint : } \% \text{ purity} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$$



$$\therefore \% \text{ purity} = \frac{20}{22} \times 100 = 90.9\% \approx 91\%$$

47. Answer (3)

Hint : Moles \propto Volume (at constant T and P)

$$\text{Sol. : } \frac{n_{\text{H}_2}}{n_{\text{N}_2}} = \frac{V_{\text{H}_2}/22.4}{V_{\text{N}_2}/22.4} = \frac{1}{2}$$

42. Answer (4)

Hint and Sol. : In graph (1) and (3), acceleration and velocity are respectively infinite.

In graph (2), particle has two velocities at same time.

All of these are not possible.

43. Answer (1)

Hint and Sol. :

When acceleration and velocity are in opposite direction, then speed decreases.

44. Answer (2)

Hint and Sol. :

$$H = \frac{u^2}{2g}$$

$$T = \frac{2u}{g}, u \text{ is variable so } T \text{ is variable}$$

$$\Rightarrow H = \frac{1}{2g} \times \left(\frac{gT}{2}\right)^2 = \frac{1}{8} \times g \times (T)^2$$

This is equation of Parabola.

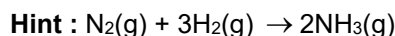
45. Answer (1)

Hint and Sol. :

$$2.01 \times 4.06 = 8.1606 = 8.16 \text{ (3 significant figures)}$$

$$8.16 + 1.6 = 9.76 = 9.8 \text{ (One decimal place)}$$

48. Answer (3)



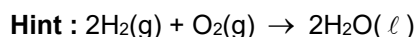
Sol. : 6 g of H₂ reacts with 28 g of N₂

$$\therefore 9 \text{ g of H}_2 \text{ will reacts with } \frac{28}{6} \times 9 \text{ g of N}_2 = 42 \text{ g of N}_2$$

\therefore N₂ is left in excess

$$\text{Amount of N}_2 \text{ left} = 56 - 42 = 14 \text{ g}$$

49. Answer (3)



Also, H₂ is the limiting reagent.

Sol. : 44.8 L of H₂ forms 2 moles of H₂O

$$134.4 \text{ L of H}_2 \text{ will form } 2 \times \frac{134.4}{44.8} \text{ moles of H}_2\text{O} = 6 \text{ moles of H}_2\text{O}$$

50. Answer (4)

$$\text{Hint : Molarity} = \frac{\text{Number of moles of solute}}{\text{Volume of solution in L}}$$

$$\text{Sol. : } 2 = \frac{w \times 1000}{40 \times 500}$$

$$w = \frac{2 \times 40 \times 500}{1000} = 40 \text{ g}$$

51. Answer (1)

Hint : Number of moles of gas at STP

$$= \frac{\text{Volume of gas}}{\text{Molar volume}}$$

Sol. :

- 32 g of $\text{O}_2 = 1 \text{ mole} = 2 N_A \text{ atoms}$
- 33.6 L of CO_2 at STP = $\frac{33.6}{22.4}$ moles
= 1.5 moles = $4.5 N_A \text{ atoms}$
- 3 moles of $\text{H}_2 = 3 \times 2 N_A \text{ atoms} = 6 N_A \text{ atoms}$
- 2 moles of $\text{SO}_2 = 3 \times 2 N_A \text{ atoms}$
= $6 N_A \text{ atoms}$

52. Answer (2)

Hint : Zero preceding to first non-zero digit are non-significant.

Sol. : Number of significant figures in 0.06 is 1.

Number of significant figures in 2.005 is 4

Number of significant figures in 4.0×10^4 is 2

53. Answer (1)

$$\text{Hint : } x_A = \frac{n_A}{n_A + n_B}$$

$$\text{Sol. : } x_{\text{H}_2\text{O}} = \frac{n_{\text{H}_2\text{O}}}{n_{\text{H}_2\text{O}} + n_{\text{glucose}}}$$

$$= \frac{\frac{90}{18}}{\frac{90}{18} + \frac{10}{180}} = 0.99$$

54. Answer (4)

Hint : $2\text{C}_4\text{H}_{10}(\text{g}) + 13\text{O}_2(\text{g}) \rightarrow 8\text{CO}_2(\text{g}) + 10\text{H}_2\text{O}(\text{l})$

Sol. : 116 g of butane requires 13×22.4 L of O_2 gas at STP.

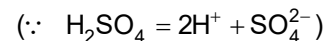
$$29 \text{ g of butane will require} \Rightarrow \frac{13 \times 22.4}{116} \times 29 \text{ L of } \text{O}_2$$

$$= 72.8 \text{ L of } \text{O}_2 \text{ gas}$$

55. Answer (2)

$$\text{Hint : Molarity} = \frac{\text{Number of moles of solute}}{\text{Volume of solution in L}}$$

$$\text{Sol. : } M_{\text{H}_2\text{SO}_4} = \frac{9.8 \times 1000}{98 \times 500} = 0.2 \text{ M}$$



$$M_{[\text{H}^+]} = 2 \times M_{\text{H}_2\text{SO}_4} = 2 \times 0.2 = 0.4 \text{ M}$$

$$\text{Also } M_{[\text{SO}_4^{2-}]} = 0.2 \text{ M}$$

56. Answer (1)

Hint : Valence electron in 1 mole (60 g) of $\text{CO}_3^{2-} = 24 N_A$

Sol. : Valence electrons in 6 g of $\text{CO}_3^{2-} = 2.4 N_A$

57. Answer (1)

Hint : One Fe atom should be present in one molecule.

$$\text{Sol. : } \% \text{ of Fe} = \frac{\text{Weight of Fe}}{\text{Weight of biomolecule}} \times 100$$

$$0.2 = \frac{56}{\text{Weight of biomolecule}} \times 100$$

$$\therefore \text{Minimum molecular weight of biomolecule} = \frac{56 \times 100}{0.2} = 28000 \text{ u}$$

58. Answer (2)

$$\text{Hint : Number of Particles} = \frac{\text{Given mass}}{\text{Molar mass}} \times N_A$$

$$\text{Sol. : Number of molecules of urea in 150 g}$$

$$\frac{150}{60} \times N_A = 2.5 \times 6.022 \times 10^{23} = 15.055 \times 10^{23}$$

Number of molecules of urea left

$$= 15.055 \times 10^{23} - 3 \times 10^{23} = 12.055 \times 10^{23}$$

Number of moles of urea left

$$= \frac{12.055 \times 10^{23}}{6.022 \times 10^{23}} = 2 \text{ moles}$$

59. Answer (3)

Hint : Equivalent weight of oxygen = 8

Sol. : Equivalent weight of metal oxide

$$= E_M + E_O$$

$$= 12 + 8 = 20$$

60. Answer (4)

Hint : Calculate simple mole ratio of each element.

Sol. :

Element	%	Atomic mass	No. of moles	Simple Ratio
C	40	12	40/12 = 3.33	3.33 / 3.33 = 1
H	6.67	1	6.67/1 = 6.67	6.67 / 3.33 = 2
O	53.33	16	53.33/16 = 3.33	3.33 / 3.33 = 1

∴ Empirical formula is CH₂O.

61. Answer (3)

Hint : NH₃ is the limiting reagent.**Sol. :** 4 moles of NH₃ produce 6 moles of H₂O

∴ 2 moles of NH₃ will produce $\frac{6}{4} \times 2$ moles of H₂O

= 3 moles of H₂O

62. Answer (4)

Hint : n = 4, l = 2 represents 4d**Sol. :** Maximum number of electrons in 4d orbitals is 10.

63. Answer (2)

Hint : Orbital angular momentum = $\sqrt{\ell(\ell+1)} \hbar$ **Sol. :** For 'p' orbital, $\ell = 1$

∴ Orbital angular momentum = $\sqrt{1(1+1)} \hbar = \sqrt{2} \hbar$

64. Answer (2)

Hint : Azimuthal quantum number (ℓ) determines the shape of an atomic orbital.

65. Answer (3)

Hint : Na (Z = 11) : 1s²2s²2p⁶3s¹**Sol. :** For 3s¹,

$$n = 3, \ell = 0, m = 0, s = +\frac{1}{2} \text{ or } -\frac{1}{2}$$

66. Answer (2)

$$\text{Hint : } E = \frac{hc}{\lambda}$$

$$\text{Sol. : } \frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = \frac{10000}{2500} = \frac{4}{1}$$

$$\therefore E_1 = 4E_2$$

67. Answer (3)

Hint : Isoelectronic species have same number of electrons.**Sol. :** Al³⁺ and K⁺ both have 10 electrons.

68. Answer (4)

Hint : Zinc (Z = 30) : [Ar] 4s² 3d¹⁰

69. Answer (2)

Hint : Angular nodes = ℓ **Sol. :** For 2p, $\ell = 1$

∴ Number of angular nodes in 2p = 1

For 3d, $\ell = 2$

∴ Number of angular nodes in 3d = 2

70. Answer (4)

Hint : For H-atom, energy of atomic orbitals depends upon the value of n only.**Sol. :** Order of energy

$$4s = 4p > 3s = 3p = 3d$$

71. Answer (3)

Hint : P has maximum number of unpaired electrons

$$P(15) = 1s^2 2s^2 2p^6 3s^2 3p^3$$

1	1	1
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3 unpaired electrons

72. Answer (3)

$$\text{Hint : } \bar{v} = \frac{1}{\lambda} = \frac{v}{c}$$

$$\text{Sol. : } \bar{v} = \frac{1.5 \times 10^9}{3 \times 10^8} = 5 \text{ m}^{-1}$$

73. Answer (4)

Hint : Number of waves in n orbit = n**Sol. :** Number of waves in 4th orbit of H-atom = 4.

74. Answer (4)

Hint : Number of atomic orbitals in nth energy level = n²**Sol. :** ∴ In third energy level, number of atomic orbitals = (3)² = 9

75. Answer (3)

$$\text{Hint : } \Delta E = 2.18 \times 10^{-18} \left(\frac{1}{n_i^2} - \frac{1}{n_f^2} \right)$$

76. Answer (1)

Hint : According to Heisenberg uncertainty principle

$$\Delta v \cdot \Delta x = \frac{h}{4\pi m}$$

$$\text{Sol. : Uncertainty in speed} = \frac{1}{100} \times 20 = 0.2 \text{ m/s}$$

$$\Delta x = \frac{h}{4\pi m \Delta v}$$

$$= \frac{6.6 \times 10^{-34}}{4 \times 3.14 \times 10 \times 10^{-3} \times 0.2} = 2.6 \times 10^{-32} \text{ m}$$

77. Answer (3)

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

Sol. : For first excited state of He^+ ion, $Z = 2$,
 $n = 2$

$$r_n = 52.9 \times \frac{(2)^2}{2} = 105.8 \text{ pm}$$

78. Answer (3)

$$\text{Hint : Total number of spectral lines} = \frac{n(n-1)}{2}$$

Sol. : 4th excited states means fifth state

$$\therefore \text{No. of spectral lines} = \frac{5(5-1)}{2} = 10$$

79. Answer (2)

$$\text{Hint : } \lambda = \frac{h}{mv}$$

$$\text{Sol. : } m = \frac{h}{\lambda v} = \frac{6.6 \times 10^{-34}}{0.1 \times 10^{-9} \times 3 \times 10^8} \\ = 2.2 \times 10^{-32} \text{ kg}$$

80. Answer (2)

Hint : The order of $\left(\frac{\text{Charge}}{\text{Mass}}\right)$ ratio for different particles is

Electron > Proton > Alpha particles > Neutron

81. Answer (2)

Hint : Isosters have same number of atoms as well as same number of valence electrons.

Sol. :

	N_2	CO
No. of atoms	2	2
No. of electrons	14	14

82. Answer (4)

$$\text{Hint : K.E.} = h\nu - h\nu_0$$

$$\text{Sol. : K.E.} = h(\nu - \nu_0)$$

$$= 6.6 \times 10^{-34} (1.1 \times 10^{12} - 1 \times 10^{11})$$

$$= 6.6 \times 10^{-34} \times 1 \times 10^{12}$$

$$= 6.6 \times 10^{-22} \text{ J}$$

83. Answer (2)

$$\text{Hint : } E = \frac{nhc}{\lambda}$$

$$\text{Sol. : } n = \frac{E\lambda}{hc} = \frac{100 \times 450 \times 10^{-9}}{6.6 \times 10^{-34} \times 3 \times 10^8} = 2.3 \times 10^{20}$$

84. Answer (4)

Hint : In $\begin{array}{|c|} \hline \uparrow\downarrow \\ \hline 4s \end{array}$ $\begin{array}{|c|c|c|} \hline \uparrow\downarrow & \uparrow & \uparrow \\ \hline 4p \end{array}$ Pauli exclusion

principle is violated.

Sol. : In $\begin{array}{|c|} \hline \uparrow\downarrow \\ \hline 4s \end{array}$ $\begin{array}{|c|c|} \hline \uparrow\downarrow & \uparrow \\ \hline 4p \end{array}$ Hund's rule is violated.

85. Answer (4)

Hint : Bohr's model account for the stability and line spectra of hydrogen atoms and hydrogen like ions (He^+ , Li^{2+} , etc.)

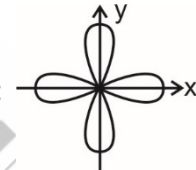
Sol. : Bohr's model failed to explain Zeeman as well as Stark effect.


86. Answer (3)

Hint : The value of ℓ varies from 0 to $n - 1$.

Sol. : For $n = 3$, ℓ can be 0, 1, 2

87. Answer (2)

Hint : $d_{x^2-y^2}$: 

p_x : 

88. Answer (3)

$$\text{Hint : } \frac{1}{\lambda} = R_H \times Z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

Sol. : For Balmer series, $n_1 = 2$
and for minimum wavelength, $n_2 = \infty$

$$\therefore \frac{1}{\lambda} = R_H \times 1^2 \left(\frac{1}{(2)^2} - \frac{1}{\infty} \right)$$

$$\text{So, } \lambda = \frac{4}{R_H}$$

89. Answer (3)

Hint : Angular momentum of an electron in an orbit is quantised.

Sol. : The energy of an electron in the orbit does not change with time.

90. Answer (2)

Hint : % by mass of H_2O

$$= \frac{\text{Mass of } \text{H}_2\text{O}}{\text{Mass of compound}} \times 100$$

$$\text{Sol. : } 63 = \frac{x \times 18}{18x + 106} \times 100$$

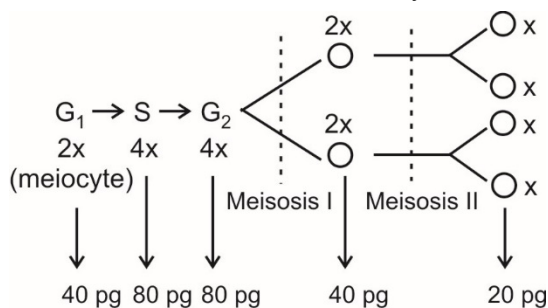
$$\therefore \boxed{x = 10}$$

[BIOLOGY]

91. Answer (4)
Sol. : Anton van Leeuwenhoek first saw and described a living cell.
92. Answer (3)
Hint : In cell envelope of bacteria capsule is a rigid protective layer
Sol. : Glycocalyx in form of a loose sheath called slime layer. Cell envelope is a three layered structure and all layers act as a single protective layer.
93. Answer (2)
Hint : Cyanobacteria are prokaryotes and in prokaryotes membrane bounded cell organelles are absent.
Sol. : In BGA, chromatophores are pigment containing membranous extensions.
94. Answer (2)
Hint : In prokaryotes pili are elongated tubular structures, involved in mating process.
Sol. : Fimbriae help in attachment of bacteria to host or surface of rocks. Both pili and fimbriae do not help in motility.
95. Answer (4)
Hint : ER, Golgi complex, lysosome and vacuole constitute endomembrane system of an eukaryotic cell.
Sol. : Peroxisome is a microbody.
96. Answer (3)
Hint : Glycosylation of proteins and glycosidation of lipids are carried out by Golgi complex.
Sol. : Glycosylation and glycosidation are formation of glycoproteins and glycolipids respectively. Packaging of material, cell secretion and formation of plasma membrane during cytokinesis are another roles of Golgi complex.
97. Answer (3)
Sol. : In bacteria capsule hide it from host's immune system.
98. Answer (4)
Sol. : In cells of parenchyma tissue and meristematic tissue, cell wall consists of only primary cell wall.
99. Answer (2)
Hint : Fungal cell wall is made up of chitin which is polymer of nitrogenous polysaccharide.
- Sol.** : (a) Fungal cell wall – polymer of N-acetylglucosamine
 (b) Na^+/K^+ pump in animal cells – uphill movement
 (c) Middle lamella – Calcium and magnesium pectate
 (d) Plasmamembrane – Quasi fluid nature
100. Answer (3)
Hint : Photosynthetic product is stored in form of starch in plants in site of its synthesis.
Sol. : Storage of starch takes place in chloroplast not in mitochondria.
101. Answer (4)
Hint : During separation of chromatids, centromere splits.
Sol. : In meiosis during anaphase II, centromeres split and chromatids separate. During anaphase I homologous chromosomes separate, hence there is no splitting of centromere.
102. Answer (3)
Hint : In primary constriction region proteinaceous discs provide site for attachment of spindle fibres.
Sol. : These proteinaceous discs are called kinetochore
103. Answer (3)
Hint : Synapsis is pairing of homologous chromosomes.
Sol. : Pairing of homologous chromosomes take place during zygotene stage.
104. Answer (1)
Sol. : If diplotene lasts for months or years, known as dictyotene eg. oocyte of some vertebrates.
105. Answer (1)
Hint : Equatorial plates are formed during metaphase-I of meiosis where alignment of bivalents occur.
Sol. : During prophase I, diplotene is recognised by appearance of chiasmata and dissolution of synaptonemal complex.
106. Answer (2)
Hint : Terminalisation of chiasmata occurs during diakinesis which is final stage of meiotic prophase I.
Sol. : Due to meiosis reduction in chromosome number in gametes take place but it is required to maintain constant chromosome number in next generation by fusion of such gametes.

107. Answer (2)

Sol. : Here amount of DNA is denoted by x.



108. Answer (3)

Sol. : Haploid cells never undergo meiosis. These cells divide by mitosis. Rest of the statements are correct.

109. Answer (1)

Sol. : Given figure represents metaphase stage because chromosomes are aligned at metaphasic plate.

110. Answer (3)

Hint : Separation of homologous chromosomes or chromatids always take place during anaphase of meiosis or mitosis.

Sol. : During anaphase I of meiosis chromosome pairs get separated but chromatids still remain attached at their centromere.

111. Answer (4)

Hint : Colchicine treatment in a cell inhibits microtubules formation.

Sol. : As a result of inhibition of microtubule polymerization spindle apparatus is not formed during metaphase, hence cell division stops.

112. Answer (2)

Sol. : During G_0 phase cells remain metabolically active and can divide occasionally just to replace the cells lost due to injury.

113. Answer (3)

Hint : Amitosis is called direct cell division.

Sol. : In amitosis, there is no spindle formation.

114. Answer (1)

Sol. : $G_1 \rightarrow S$ transition is major check point.

115. Answer (3)

Sol. : Specific concentration of Mg^{++} ions is required for association of ribosome sub-units.

116. Answer (4)

Hint : Microfilaments help in pseudopodia formation and cleavage furrow formation during cell division.

Sol. : Microtubules form cytoskeleton of cilia and help in cell plate formation during cytokinesis in plant cells.

117. Answer (2)

Hint : Chromosomes having one shorter arm and one longer arm exhibit L-shape during anaphase.

Sol. : Such chromosomes are called sub metacentric.

118. Answer (3)

Hint : Nucleolus is not bound by any membrane.

Sol. : Nucleolus is site for rRNA synthesis in nucleoplasm. These may occur in more number in cells which are actively involved in protein synthesis.

119. Answer (2)

Sol. : During anaphase centromeres split, chromatids separate and move to opposite pole.

120. Answer (1)

Sol. : Elaioplast – Castor

Amyloplast – Potato

Aleuroplast – Maize

121. Answer (2)

Hint : The cell organelle, which has hydrolytic enzymes is known as suicidal bag of the cell.

Sol. : This cell organelle is lysosome.

122. Answer (4)

Sol. : In plant cells Golgi apparatus is known as dictyosome.

123. Answer (3)

Hint : Eukaryotic flagella is mainly made up of tubulin protein whereas prokaryotic flagella is made up of flagellin protein.

Sol. : Microtubules are made up of tubulin protein. Eukaryotic flagella show 9 + 2 arrangement of microtubules.

In prokaryotic flagella basal body consists of rings.

124. Answer (3)

Hint : In 80S ribosomes rRNA are of 4 types 18S, 5.8S, 5S and 28S.

Sol. : 18S rRNA – Small sub unit.

5S, 5.8S and 28S rRNA – Large sub unit.

125. Answer (4)

Hint : Eukaryotes which do not produce flagellated cells, lack centriole.

Sol. : In higher plants centrioles are absent.

126. Answer (1)

Sol. : Ribosome were discovered by George Palade.

127. Answer (3)

Hint : For staining of DNA basic dyes like acetocarmine or fuelgen are used.

Sol. : Chromatin is mainly made up of DNA with histone and non histone proteins.

128. Answer (3)

Hint : The chromosomes which have one extremely short and one very long arm show J-shape during anaphase.

Sol. : Such chromosomes are known as acrocentric.

129. Answer (2)

Hint : NOR (Nucleolar organizer region) or secondary constriction is an additional constriction in few chromosomes.

Sol. : The part of chromosome beyond secondary constriction is called satellite. Telomere is end of chromosome.

130. Answer (1)

Hint : Double metaphasic plate is formed during meiosis I for alignment of homologous chromosome pairs.

Sol. : The phase during which double metaphasic plate formed is metaphase I.

131. Answer (3)

Sol. : Synepionemal complex dissolves during diplotene stage.

132. Answer (4)

Sol. : Majority of the enzymes required in TCA cycle are found in matrix except succinic acid dehydrogenase, which occurs in inner membrane of mitochondria.

133. Answer (3)

Hint : Fungal cell wall is generally composed of a nitrogenous polysaccharide i.e. chitin.

Sol. : Chitin is a polymer of N-acetylglucosamine.

134. Answer (1)

Sol. : In human beings cell membrane of RBCs has approximately 52% of protein and 40% lipids. Cell wall protects cell from mechanical injury.

135. Answer (2)

Hint : Gas vacuoles are membraneless, found in prokaryotes.

Sol. : In BGA (cyanobacteria) gas vacuoles are found.

136. Answer (1)

Hint : It is present in air sacs of human lungs

Sol. : Squamous epithelium forms diffusion boundary. Cuboidal epithelium consists of single layer of cube like cells.

Columnar epithelium contains single layer of tall and slender cells.

Ciliated epithelium is characterised by presence of cilia.

137. Answer (2)

Hint : Its example is epithelium

Sol. : Cell is the smallest, structural and functional unit of an organism.

An organ comprises a group of tissues.

An organism is an individual animal.

138. Answer (3)

Hint : They are present on free surface

Sol. : The presence of microvilli increases the surface area of absorption giving brush bordered appearance.

Cilia are present in ciliated epithelium.

139. Answer (3)

Hint : They perform cementing between cells

Sol. : Adhering junctions are also called macula adherens. They possess intercellular proteins and tonofibrils which keep the neighbouring cells together.

140. Answer (3)

Hint : Secretion of endocrine glands

Sol. : Endocrine glands are ductless glands and their products are called hormones which are secreted directly into fluid bathing the gland.

141. Answer (2)

Hint : They are absent in blood.

Sol. : Fibres are absent in blood. Nucleated cells like WBCs are present in blood. Proteins like collagen, elastin, fibrinogen and albumin are components of connective tissues.

142. Answer (3)

Hint : Identify non excitable tissues.

Sol. : Areolar and adipose are loose connective tissues. Muscular and neural tissues are not connective tissues.

143. Answer (2)

Hint : Ligaments connect bone to bone

Sol. : Tendons attach skeletal muscles to bone whereas ligaments attach one bone to another bone.

144. Answer (3)

Hint : Bones contain calcium salts.

Sol. : The intercellular material of cartilage is solid and pliable and resists compression whereas bones have hard and non-pliable ground substance rich in calcium salts and collagen fibres which give bone its strength. Lamellae are present in bones.

145. Answer (4)

Hint : Ciliated epithelium moves particles in one direction.

Sol. : Compound epithelium is made of more than one layer of cells. Cuboidal and columnar epithelium play role in secretion and absorption.

146. Answer (3)

Hint : Wall of intestine contains smooth muscles

Sol. : Presence of striations and structural syncytium is a characteristic of skeletal muscle fibres. Branched appearance is seen in cardiac muscle fibres. Smooth muscle fibres are fusiform or spindle shaped and are uninucleated.

147. Answer (2)

Hint : Blood cell production

Sol. : The bone marrow in some bones is the site of production of blood cells. All bones do not contain red bone marrow. Active marrow is found in bones forming spine, hip, shoulder bones, ribs, breast bone and skull.

148. Answer (3)

Hint : Muscle fibres are anatomical units of muscle

Sol. : Each muscle is made of many long cylindrical fibres arranged parallelly. These fibres are composed of numerous fine fibrils called myofibrils.

149. Answer (4)

Hint : It is present in cartilage

Sol. : Fibroblasts are cells that produce and secrete fibres. Mast cells secrete inflammatory mediators. Macrophages are phagocytic cells. Chondrocytes are cells present in cartilage.

150. Answer (3)

Hint : It is called axolemma

Sol. : The presence of dendrites, axon and Nissl's granules are characteristic of neurons whereas plasma membrane is present around all cells.

151. Answer (2)

Hint : It is bathed in saliva

Sol. : Compound epithelium covers dry surface of skin, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts. Alveoli of lungs are lined by squamous epithelium.

Inner surface of fallopian tubes is lined by ciliated epithelium.

Inner surface of intestine is lined by columnar epithelium.

152. Answer (4)

Hint : It is a feature of skeletal muscle fibres.

Sol. : Many nuclei (syncytium) present at the periphery is a characteristic feature of skeletal muscle fibres. Cardiac muscle fibres possess single, centrally placed nucleus.

153. Answer (4)

Hint : Neuroglial cell

Sol. : Muscle cells and neurons are excitable cells. Astrocytes are neuroglial cells that form the blood-brain barrier. Neuroglial cells are not excitable.

154. Answer (3)

Hint : It is without water.

Sol. : Living tissue gives wet weight. When it is dried, all the water evaporates and dry weight is obtained. When the tissue is fully burnt, all the carbon compounds are oxidized to gaseous form and ash remains.

155. Answer (4)

Hint : R is variable

Sol. : There are four substituent groups occupying the four valency positions. These are hydrogen, carboxyl group, amino group and a variable R group. Based on the nature of R group, there are many types of amino acids.

156. Answer (2)

Hint : Neutral amino acid

Sol. : Aromatic amino acids contain aromatic ring. Valine is a neutral amino acid containing equal number of carboxylic and amino groups.

157. Answer (2)

Hint : The structure represents adenine

Sol. : Adenine is a purine type of nitrogenous base which is a component of both RNA and DNA. When found attached with sugar it forms adenosine which is a nucleoside. If a phosphate group is also found esterified to sugar it forms adenylic acid which is a nucleotide.

158. Answer (3)

Hint : Arachidic acid has 20 carbons

Sol. : Arachidonic acid has 20 carbon atoms including the carboxyl carbon. Stearic acid has 18 carbon atoms and Palmitic acid has 16 carbon atoms.

159. Answer (1)

Hint : Trihydroxypropane is glycerol

Sol. : Glycerol is a simple lipid. Many lipids have both glycerol and fatty acids where fatty acids are esterified with glycerol. They can be monoglycerides, diglycerides and triglycerides.

160. Answer (2)

Hint : Purines are dicyclic

Sol. : Pyrimidines are cytosine, uracil and thymine which are heterocyclic but not dicyclic. Purines are heterocyclic and dicyclic and include adenine and guanine. Neurons and RBCs don't divide.

161. Answer (4)

Hint : Phospholipids are compound lipids

Sol. : A fatty acid molecule comprises a carboxylic group attached to an R group. The R group could be methyl or ethyl or higher number of $-CH_2$ groups.

162. Answer (2)

Hint : It is a lectin

Sol. : Examples of some drugs are vinblastin and curcumin.

Concanavalin A is a lectin which is a protein that can bind to sugar.

163. Answer (3)

Hint : They make up 1% of total cellular mass

Sol. :

Component	% of total cellular mass
Water	70-90
Proteins	10-15

Lipids	2
Ions	1

164. Answer (2)

Hint : Secreted by fibroblasts

Sol. : RuBisCO is the most abundant protein in the whole of biosphere. Albumin is a plasma protein. Elastin is a component of connective tissue.

165. Answer (4)

Hint : Identify a protein

Sol. : Proteins are considered as heteropolymers containing linked amino acids. Insulin is a protein while starch, chitin and inulin are homopolymers of glucose, N-acetyl glucosamine and fructose respectively.

166. Answer (4)

Hint : Glucose is hexose sugar

Sol. : A nucleic acid containing deoxyribose is called deoxyribonucleic acid (DNA) while that which contains ribose is called ribonucleic acid (RNA). Hexose sugars are not found in nucleic acids.

167. Answer (3)

Hint : Conversion of Fe^{3+} to Fe^{2+}

Sol. : In a polysaccharide chain the right end is called reducing end while the left is called non-reducing end.

168. Answer (2)

Hint : They release energy

Sol. : Anabolic pathways are biosynthetic pathways. They consume energy whereas catabolic pathways are degradation pathways and release energy. Catabolic pathway is exemplified by degradation of glucose into lactic acid.

169. Answer (1)

Hint : Antibodies fight infectious agents

Sol. :

Protein	Functions
Collagen	Intercellular ground substance
Trypsin	Enzyme
Insulin	Hormone
Antibody	Fight infectious agents

Receptor	Sensory reception (smell, taste, hormone, etc.)
GLUT-4	Enables glucose transport into cells

170. Answer (4)

Hint : They are not synthesized in the body

Sol. : Essential amino acids are called so because they have to be supplied through diet. A polypeptide may contain essential or non essential amino acids.

171. Answer (1)

Hint : Component of polypeptide

Sol. : Primary structure gives positional information in a protein. When protein thread is folded into other forms, it is called secondary structure. When long protein chain is folded upon itself like a hollow woollen ball, it forms tertiary structure.

172. Answer (2)

Hint : Connects adjacent nucleotides

Sol. : In nucleic acids, one ester bond is present on each side of phosphate group therefore it is called phosphodiester bond. Peptide bond links amino acids in a polypeptide. Glycosidic bond links individual monosaccharides in a polysaccharide. Hydrogen bonds stabilize the tertiary structure of proteins.

173. Answer (4)

Hint : Living organisms work continuously

Sol. : Living process is a constant effort to prevent falling in equilibrium.

The turn over of molecules involves continuous making and breaking through chemical reactions.

174. Answer (2)

Hint : A pitch in B-DNA contains 10 base pairs

Sol. : At each step of ascent the strand turns 36°

The rise per base pair is 3.4 \AA i.e., 0.34 nm

175. Answer (3)

Hint : Class I of enzymes

Sol. : Lyases catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

Hydrolases catalyse hydrolysis of ester peptide bonds etc.

Isomerases catalyse interconversion of isomers.

176. Answer (2)

Hint : Holoenzyme = Apoenzyme + Cofactor

Sol. : Cofactors can be prosthetic groups, co-enzymes and metal ions.

177. Answer (4)

Hint : K_m indicates substrate concentration

Sol. : A competitive inhibitor increases the apparent K_m for a given substrate. This means that in the presence of a competitive inhibitor more substrate is needed to achieve $\frac{1}{2} V_{max}$

178. Answer (2)

Hint : Transition state

Sol. : An obligatory formation of E-S complex occurs which is a transient phenomenon. When substrate is bound to enzyme active site, a new structure of substrate called transition state structure is formed.

179. Answer (2)

Hint : Action of heat on proteins

Sol. : Since most enzymes are proteins, exposure to higher temperature destroys enzymatic activity because proteins are denatured by heat. Low temperature preserves the enzyme in a temporarily inactive state.

180. Answer (2)

Hint : Peroxidase and catalase

Sol. : Zn^{2+} is a cofactor of carboxypeptidase. Niacin is a component of coenzyme nicotinamide adenine dinucleotide. Mg^{2+} is an cofactor of hexokinase.



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