

All India Aakash Test Series for Medical - 2021

TEST - I (Code-C)

Test Date : 06/10/2019

ANSWERS

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

HINTS & SOLUTIONS**[PHYSICS]**

1. Answer (3)

Hint & Sol.: The ratio of strength of strong nuclear force to the strength of electromagnetic force is about 100 : 1.

2. Answer (3)

Hint & Sol.: In entire journey sum of kinetic energy and potential energy remains conserved in absence of air.

3. Answer (2)

Hint & Sol.: The statement "science is not just a collection of laws, a catalogue of unrelated facts. It is a creation of human mind, with its freely invented ideas and concepts" was given by Albert Einstein.

4. Answer (3)

Hint: L.C. = 1 MSD – 1 VSD

Sol.: 10 VSD = 8 MSD

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

$$\therefore \text{L.C} = 1 \text{ MSD} - \frac{8}{10} \text{ MSD}$$

$$= \frac{1}{5} \text{ MSD}$$

$$= \frac{1}{5} \text{ mm}$$

$$\text{Side of cube} = 10 \text{ mm} + 2 \times \frac{1}{5}$$

$$= (10 + 0.4) \text{ mm} = 1.04 \text{ cm}$$

$$\text{Volume} = (1.04)^3$$

$$= 1.12 \text{ cm}^3 \text{ (upto 3 significant figure)}$$

5. Answer (2)

Hint: $T = 2\pi\sqrt{\frac{l}{g}}$

Sol.: $T^2 = 4\pi^2 \frac{l}{g}$

$$\therefore g = \frac{4\pi^2 l}{T^2} = \frac{4 \times 10 \times 4}{16} = 10.0 \text{ m/s}^2$$

and, $\frac{\Delta g}{g} = \frac{\Delta l}{l} + \frac{2\Delta T}{T}$

$$\Rightarrow \Delta g = \left(\frac{0.01}{4.00} + 2 \times \frac{0.01}{4.00} \right) \times 10 = 0.075 \approx 0.1$$

Hence $g = (10.0 \pm 0.1) \text{ m/s}^2$

6. Answer (2)

Hint: The power in exponential function must be dimensionless

Sol.: $[Ct] = [M^0 L^0 T^0]$

$$[C] = [T^{-1}]$$

$$\left[\frac{A}{B} \right] = [L]$$

$$\therefore \left[\frac{AC}{B} \right] = [LT^{-1}]$$

7. Answer (3)

Hint & Sol.:

PHYSICAL QUANTITY	Dimensions
Plane angle	$M^0 L^0 T^0$
Solid angle	$M^0 L^0 T^0$
Angular velocity	$M^0 L^0 T^{-1}$
Frequency	$M^0 L^0 T^{-1}$
Relative velocity	$M^0 L T^{-1}$
Relative density	$M^0 L^0 T^0$
Impulse	MLT^{-1}
linear momentum	MLT^{-1}

8. Answer (4)

Hint: Distance can never be negative and decreasing

Sol.: $v = 2t - 6 = 0$ at $t = 3 \text{ s}$

$$x = -9 \text{ m} \quad t = 0 \text{ s}$$

$$x = 0 \text{ m} \quad t = 3 \text{ s}$$

At $t = 3 \text{ s}$,

$$x = -9 \text{ m}$$

At $t = 6 \text{ s}$

$$x = 0 \text{ m}$$

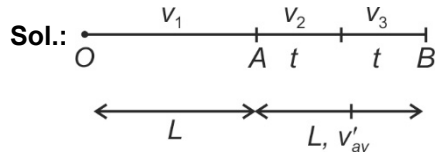
So, distance = $9 + 9 = 18 \text{ m}$

9. Answer (2)

Hint: For equal half distances

$$v_{av} = \frac{2vu}{v+u} \text{ and for equal time interval}$$

$$v_{av} = \frac{u+v}{2}$$



$$v'_{av} = \frac{v_2 + v_3}{2}$$

$$\therefore v_{av} = \frac{2v_1 v'_{av}}{v_1 + v'_{av}}$$

$$v_{av} = \frac{2v_1 \left(\frac{v_2 + v_3}{2} \right)}{v_1 + \frac{v_2 + v_3}{2}}$$

$$v_{av} = \frac{2v_1 v_2 + 2v_1 v_3}{2v_1 + v_2 + v_3}$$

10. Answer (2)

Hint: In multiplication or in division, the number of significant figures in result must be same as that of given number with the least significant figures.

$$\text{Sol.: } \frac{0.301 \times 0.27}{1.149} = 0.071$$

11. Answer (1)

Hint: $[G] = [M^{-1}L^3T^{-2}]$

Sol.: $t \propto R^a M^b G^c$

$$[M^0L^0T^1] = [L]^a [M]^b [M^{-1}L^3T^{-2}]^c$$

$$[M^0L^0T^1] = [M^{b-c}] [L^{3c+a}] [T^{-2c}]$$

$$-2c = 1, \quad b - c = 0, \quad 3c + a = 0$$

$$c = -\frac{1}{2}, \quad b + \frac{1}{2} = 0, \quad -\frac{3}{2} + a = 0$$

$$b = -\frac{1}{2}, \quad a = \frac{3}{2}$$

$$\therefore t \propto \frac{R^{3/2}}{M^{1/2}G^{1/2}}$$

12. Answer (2)

Hint: $n_1 u_1 = n_2 u_2$

$$\text{Sol.: } 10[M_1 L_1^2 T_1^{-2}] = n_2 [M_2 L_2^2 T_2^{-2}]$$

$$\therefore n_2 = 10 \left[\frac{1 \text{ kg}}{1 \text{ kg}} \right]^1 \left[\frac{1 \text{ m}}{10 \text{ cm}} \right]^2 \left[\frac{1 \text{ s}}{30 \text{ s}} \right]^{-2}$$

$$= 10 \times \left[\frac{100 \text{ cm}}{10 \text{ cm}} \right]^2 \times \left[\frac{1}{30} \right]^{-2}$$

$$= 10 \times 100 \times 30 \times 30$$

$$= 9 \times 10^5 \text{ units}$$

13. Answer (1)

Hint: Relative velocity of cars will be zero when their velocity will be equal.

$$\text{Sol.: } v_1 = \frac{dx_p}{dt}$$

$$= 4 - 4t$$

$$v_2 = \frac{dx_Q}{dt}$$

$$= -8 + 2t$$

$$\text{As } v_1 = v_2$$

$$4 - 4t = -8 + 2t$$

$$t = 2 \text{ s}$$

14. Answer (2)

Hint: Use $S = ut + \frac{1}{2}at^2$

$$\text{Sol.: } h_1 = 0 + \frac{1}{2}g \times 4 = 2g$$

$$h_1 + h_2 = \frac{1}{2}g \times 36 = 18g$$

$$\Rightarrow h_2 = 16g$$

$$\therefore \frac{h_1}{h_2} = \frac{1}{8}$$

15. Answer (3)

Hint: $x_{AB} = u_{rel} \times t$ when $a_{rel} = 0$

$$\text{Sol.: } x_{rel} = 10 \times 1 = 10 \text{ m}$$

16. Answer (4)

$$\text{Hint: } t = \frac{2dv}{v^2 - u^2}$$

$$\text{Sol.: } t = \frac{d}{(v+u)} + \frac{d}{(v-u)}$$

$$= \frac{12}{6} + \frac{12}{2} = 8 \text{ s}$$

17. Answer (2)

Hint: Acceleration is slope of velocity-time graph.

$$\text{Sol.: } a = \frac{dv}{dt}$$

$$= -\frac{60}{30} = -2 \text{ m/s}^2$$

18. Answer (2)

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

$$\text{Sol.: } a = 4t$$

$$a \propto t$$

19. Answer (3)

Hint: $t = \frac{S_{rel}}{V_{rel}}$

Sol.: $S_{rel} = 200 \text{ m}$

$v_{rel} = 40 \text{ m/s}$

$t = \frac{200}{40} = 5 \text{ s}$

20. Answer (1)

Hint: For uniform motion, velocity is constant

Sol.: As $v = \text{constant}$

$\therefore x \propto t$

21. Answer (4)

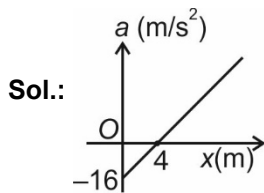
Hint: $v = \frac{dx}{dt}$

Sol.: $\frac{dx}{dt} = 1 - \sin t = 0$

$\sin t = 1 \Rightarrow t = \frac{\pi}{2} = \frac{3.14}{2} = 1.57 \text{ s}$

22. Answer (2)

Hint: $a = v \frac{dv}{dx}$



$v = -2x + 8$

$a = v \frac{dv}{dx}$

$a = (-2x + 8)(-2)$

$a = 4x - 16$

23. Answer (3)

Hint: $s = \frac{1}{2}(u + v)t$

Sol.: $s = \frac{1}{2}(u + v)t$

$400 = \frac{1}{2} \times 40 \times t$

$\Rightarrow t = 20 \text{ s}$

24. Answer (4)

Hint: $s_1 = ut + \frac{1}{2}at^2$

$s_2 = vt$

Sol.: $s_1 = \frac{1}{2} \times 2 \times 25 = 25 \text{ m}$

$v = at$

$= 2 \times 5 = 10 \text{ m/s}$

$s_2 = v \times t$

$= 50 \text{ m}$

$s = s_1 + s_2 = 75 \text{ m}$

25. Answer (2)

Hint: $t = \frac{t_1 t_2}{t_1 + t_2}$

Sol.: $\frac{l}{u} = 3$

And $\frac{l}{v} = 6$

$\Rightarrow u = 2v$

and $l = 6v$

Now,

$t = \frac{l}{v + u} = \frac{6v}{3v} = 2 \text{ s}$

26. Answer (4)

Hint & Sol.: $2^{20} = 2^{10} \times 2^{10} = 1024 \times 1024 \approx 10^6$

Hence order of magnitude = 6

27. Answer (2)

Hint: Distance travelled is same in last second of ascent and its first second of descent.

Sol.: $\frac{1}{2} \times g \times (1)^2 = \frac{g}{2}$

28. Answer (3)

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

Sol.: $s_1 \propto u^2$

$s_2 \propto 4^2 u^2$

$\therefore \frac{s_1}{s_2} = \frac{1}{16}$

29. Answer (4)

Hint: $v_c = \sqrt{\frac{v_1^2 + v_2^2}{2}}$

Sol.: $v_2^2 = v_1^2 + 2al$

or, $al = \frac{v_2^2 - v_1^2}{2} \dots(1)$

$$v_c^2 = v_1^2 + 2a \times \frac{l}{2}$$

$$= v_1^2 + \frac{(v_2^2 - v_1^2)}{2} = \frac{v_1^2 + v_2^2}{2}$$

$$\Rightarrow v_c = \sqrt{\frac{(10)^2 + (20)^2}{2}} = 5\sqrt{10} \text{ m/s}$$

30. Answer (2)

Hint: $v_{av} = \frac{\text{Change in position}}{\text{Time interval}}$

Sol.: $v = \frac{dx}{dt}$

$$\int_0^x dx = \int_0^t (6 + 3t^2) dt$$

$$x = 6t + t^3$$

$$x(0) = 0$$

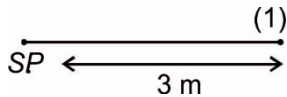
$$x(2) = 6 \times 2 + 8 = 20 \text{ m}$$

$$v_{av} = \frac{20 - 0}{2} = 10 \text{ m/s}$$

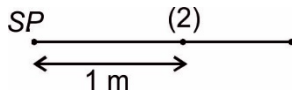
31. Answer (2)

Hint: Concept of displacement and distance

Sol.: After 6 steps



After 10 steps



After 16 steps, He will fall into the pit

$$\therefore t = 16 \times 1 = 16 \text{ s}$$

32. Answer (2)

Hint: $n_1 u_1 = n_2 u_2$

Sol.: $a \times u_1 = b \times u_2$

$$u_1 \text{ for SI unit } \frac{\text{N}}{\text{m}^2}, u_2 \text{ for CGS unit } \frac{\text{dyne}}{\text{cm}^2}$$

$$a \times \frac{\text{N}}{\text{m}^2} = b \times \frac{\text{dyne}}{\text{cm}^2}$$

$$a \times \frac{10^5 \text{ dyne}}{10^4 \text{ cm}^2} = b \times \frac{\text{dyne}}{\text{cm}^2}$$

$$\frac{a}{b} = \frac{1}{10} = 10^{-1}$$

33. Answer (4)

Hint: $d = \frac{m}{V}$

$$\frac{\Delta d}{d} = \frac{\Delta m}{m} + \frac{\Delta V}{V}$$

Sol.: $\% \frac{\Delta d}{d} = \left[\frac{0.01}{23.35} + \frac{0.01}{2.30} \right] \times 100 = 0.5\%$

34. Answer (1)

Hint: If $y = x^n$

then $\frac{dy}{dx} = nx^{n-1}$

Sol.: $y = x^{1/2} - x^{-1/2}$

$$y' = \frac{1}{2}x^{-1/2} + \frac{1}{2}x^{-3/2} = \frac{x+1}{2x^{3/2}}$$

35. Answer (2)

Hint & Sol.: The factor $1 - \frac{1}{c^2}$ must be dimensionless. To make it dimensionless multiply $\frac{1}{c^2}$ with v^2

$$\therefore m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

36. Answer (4)

Hint: $\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

Sol.: $Z = \frac{A}{B}$

$$\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$$

$$\Rightarrow \Delta Z = \left(\frac{\Delta A}{A} + \frac{\Delta B}{B} \right) \times \frac{A}{B}$$

$$\Delta Z = \frac{\Delta A}{B} + \frac{A \Delta B}{B^2}$$

37. Answer (2)

Hint: $T = 2T_1 + 2T_2$

$$\Delta T = 2\Delta T_1 + 2\Delta T_2$$

Sol.: $T = 2 \times 40.3 + 2 \times 70.2$

$$= 80.6 + 140.4 = 221.0$$

$$\Delta T = 2 \times 0.1 + 2 \times 0.2$$

$$= 0.2 + 0.4 = 0.6$$

$$\therefore T \pm \Delta T = (221.0 \pm 0.6)^\circ\text{C}$$

38. Answer (4)

Hint: Principle of homogeneity**Sol.:** $a^2 - x^{1/n}$ should have dimension of (distance)²

$$\therefore x^{1/n} = [L]^{1/n} = L^2$$

$$\therefore \frac{1}{n} = 2$$

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

39. Answer (3)

Hint: Use dimensions of different physical quantities

$$\text{Sol.: } [\text{Torque}] = [\text{ML}^2\text{T}^{-2}]$$

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

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

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

40. Answer (3)

Hint: Differentiation of exponential function.

$$\text{Sol.: } v = \frac{dx}{dt} = -4e^{-2t}, \quad a = \frac{dv}{dt} = 8e^{-2t} = -2v$$

41. Answer (2)

Hint: Power rule of error combination.

$$\text{Sol.: } Z = \frac{P^{1/2}Q^{1/3}}{R}$$

$$\Rightarrow \frac{\Delta Z}{Z} \times 100 = \frac{1}{2} \times \frac{\Delta P}{P} \times 100 + \frac{1}{3} \times \frac{\Delta Q}{Q} \times 100 + \frac{\Delta R}{R} \times 100$$

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

42. Answer (4)

$$\text{Hint \& Sol.: } [PV] = \left[\frac{\text{MLT}^{-2} \cdot \text{L}^3}{\text{L}^2} \right] = [\text{ML}^2\text{T}^{-2}] = [W]$$

43. Answer (3)

Hint: If $|x| < 1$, then $(1+x)^n = 1+nx$

$$\text{Sol.: } (1000+6)^{1/3}$$

$$= 10 \left(1 + \frac{6}{1000} \right)^{1/3}$$

$$= 10 \left(1 + \frac{6}{1000} \times \frac{1}{3} \right)$$

$$= 10(1 + 0.002)$$

$$= 10 \times 1.002 = 10.02$$

44. Answer (3)

$$\text{Hint \& Sol.: } 1 \text{ ly} = 9.46 \times 10^{15} \text{ m}$$

$$1 \text{ parsec} = 3.26 \text{ ly}$$

$$1 \text{ AU} = 1.496 \times 10^{11} \text{ m}$$

45. Answer (1)

$$\text{Hint: } \frac{\Delta V}{V} = 3 \frac{\Delta r}{r}$$

$$\frac{\Delta A}{A} = 2 \frac{\Delta r}{r}$$

$$\text{Sol.: For a given change in } r, \frac{\Delta V}{V} > \frac{\Delta A}{A} > \frac{\Delta r}{r}$$

[CHEMISTRY]

46. Answer (3)

Hint: One mole of H₂O contains 3 mole atoms.**Sol.:** Mole of H₂O molecules = 0.5Mole of atoms of H₂O = 0.5 × 3 = 1.5Number of atoms = 1.5 × 6.0 × 10²³ = 9.0 × 10²³

47. Answer (4)

$$\text{Hint: Mole} = \frac{\text{Given mass}}{\text{Molar mass}}$$

$$\text{Sol.: Mole of H}_2 = \frac{x}{2}$$

$$\text{Mole of CO} = \frac{2x}{28}$$

$$\frac{\text{Mole of H}_2}{\text{Mole of CO}} = \frac{x}{2} \times \frac{28}{2x} = \frac{7}{1}$$

48. Answer (2)

Hint: No. of molecules = mole × N_A

$$\text{Sol.: Molecules of SO}_3 = \frac{40}{80} N_A = 0.5 N_A$$

$$\text{Molecules of CH}_4 = \frac{32}{16} N_A = 2 N_A$$

$$\text{Molecules of H}_2 = \frac{3}{2} N_A = 1.5 N_A$$

$$\text{Molecules of N}_2 = \frac{28}{28} N_A = 1 N_A$$

49. Answer (3)

Hint: Orbital angular momentum (L)

$$= \sqrt{l(l+1)} \hbar$$

Sol.: For f-orbital, l is 3

$$L = \sqrt{3(3+1)} \hbar = \sqrt{12} \hbar$$

50. Answer (3)

$$\text{Hint: } E = h \frac{c}{\lambda}$$

$$\text{Sol.: } E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8 \text{ J}}{300 \times 10^{-9}} \\ = 6.63 \times 10^{-19} \text{ J}$$

51. Answer (3)

Hint: Maximum of two electrons can be accommodated in an orbital.

52. Answer (2)

Hint.: Three dimensional shape of an atomic orbital can be given by using Azimuthal quantum number.

53. Answer (3)

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

$$\text{Sol.: } \lambda = \frac{6.63 \times 10^{-34}}{5 \times 10^{-3} \times 200} \text{ m} = 6.63 \times 10^{-34} \text{ m}$$

54. Answer (2)

$$\text{Hint: Molarity (M)} = \frac{\text{Mole of solute}}{\text{Volume of solution (L)}}$$

$$\text{Sol.: Mole of glucose} = \frac{3.01 \times 10^{21}}{6.02 \times 10^{23}} = 5 \times 10^{-3}$$

$$\text{Molarity} = \frac{5 \times 10^{-3} \times 1000}{500} = 0.01 \text{ M}$$

55. Answer (2)

Hint: The species which does not contain unpaired electron will be diamagnetic

$$\text{Sol.: Cu}^+ : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$$

56. Answer (4)

Hint: Each biomolecule should contain one Fe²⁺ ion.

Sol.: One mole of biomolecule will contain one mole of Fe²⁺ ions.

0.2 g of Fe²⁺ is present in 100 g of biomolecule

$$56 \text{ g of Fe}^{2+} \text{ is present in } \frac{100 \times 56}{0.2} = 28 \times 1000$$

= 28000 g mol⁻¹ of biomolecule.

Molecular mass = 28000 u.

57. Answer (2)

Hint: 1 mol of N₂ occupies 22.4 L at STP.

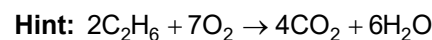
Sol.: 100 L of air contains 78 L of N₂.

$$10 \text{ L of air contains } \frac{78 \times 10}{100} = 7.8 \text{ L N}_2$$

$$\text{Mole of N}_2 \text{ at STP} = \frac{7.8}{22.4} = 0.35$$

Molecules of N₂ = 0.35 N_A

58. Answer (1)



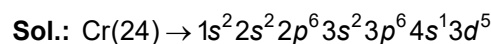
$$\text{Sol.: Mole of ethane} = \frac{3000}{30} = 100$$

$$\text{Mole of O}_2 = \frac{7}{2} \times 100 = 350$$

$$\text{Mass of O}_2 = 350 \times 32 = 11200 \text{ g} = 11.2 \text{ kg}$$

59. Answer (3)

Hint: Write electronic configuration of chromium (Cr).



Number of unpaired electrons = 6

60. Answer (4)

$$\text{Hint: } E = -13.6 \frac{Z^2}{n^2} \text{ eV}$$

$$\text{Sol.: } E = -13.6 \times \frac{(2)^2}{n^2} \text{ eV} = -\frac{54.4}{n^2} \text{ eV}$$

61. Answer (2)

$$\text{Hint: Average atomic mass} = \frac{\sum \% \times M}{100}$$

$$\text{Sol.: Average atomic mass of element X} \\ = \frac{41 \times 30 + 43 \times 70}{100} = \frac{1230 + 3010}{100} = 42.4 \text{ u}$$

62. Answer (4)

Hint: Valence electrons in one oxygen atom is 6.

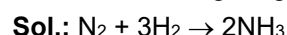
$$\text{Sol.: Mole of oxygen atom} = \frac{6.4}{16} = 0.4$$

Mole of valence electrons = 0.4 × 6 = 2.4

Number of valence electrons = 2.4 N_A

63. Answer (2)

Hint: H₂ is limiting reagent.



$$\text{Mole of N}_2 \text{ taken} = \frac{42}{28} = 1.5$$

$$\text{Mole of H}_2 \text{ taken} = \frac{7.2}{2} = 3.6$$

3.6 mole of H₂ will require 1.2 mole of N₂ for complete reaction.

∴ H₂ is limiting reagent.

$$\text{Mole of NH}_3 \text{ produced} = \frac{2}{3} \times 3.6 = 2.4$$

64. Answer (3)

Hint: 1 mole of NO₂ will occupy 22.4 L at STP.

$$\text{Sol.: Density} = \frac{\text{Molar mass}}{\text{Molar volume}} = \frac{46}{22.4} = 2.05 \text{ g/L}$$

65. Answer (2)

Hint: SI unit of amount of substance is mole.

66. Answer (1)

Hint: Calculate mole of C, H and O.

Elements	Mass percentage	Mole	Mole ratio
C	41.4	3.45	1
H	3.4	3.4	1
O	55.2	3.45	1

Empirical formula of the compound is CHO.

67. Answer (1)

$$\text{Hint: Molality (m)} = \frac{\text{Mole of state solute}}{\text{Mass of solvent (kg)}}$$

$$\text{Sol.: Mass of solute} = 15 \text{ g}$$

$$\text{Mole of solute} = \frac{15}{60} = \frac{1}{4}$$

$$\text{Mass of solvent} = (100 - 15) = 85 \text{ g}$$

$$\text{molality} = \frac{1 \times 1000}{4 \times 85} = 2.94 \text{ m}$$

68. Answer (4)

Hint: Characteristics of cathode rays does not depend upon the material of cathode used.

69. Answer (1)

Hint: For n = 4; l = 0, 1, 2, 3

Sol.: l = 0, 1, 2, 3 respectively represent s, p, d and f orbitals. There are four orbitals, one each in s, p, d and f sub shell having m = 0.

$$\therefore \text{Maximum number of electrons} = 4 \times 2 = 8$$

70. Answer (2)

Hint: P.E. = 2 E_{total}

$$\text{Sol.: } E_{\text{total}} = -13.6 \times \frac{Z^2}{n^2} \text{ eV}$$

$$\text{P.E.} = 2 \times -13.6 \times \frac{(1)^2}{(2)^2} \text{ eV} = -6.8 \text{ eV}$$

71. Answer (4)

Hint: For n = 1, l = 0.

72. Answer (2)

$$\text{Hint: } r_n \propto \frac{n^2}{Z}$$

$$\text{Sol.: } r_2(\text{H}) \propto (2)^2 \dots(1)$$

$$r_3(\text{Li}^{2+}) \propto \frac{(3)^2}{3} \dots(2)$$

$$\therefore \frac{r_2(\text{H})}{r_3(\text{Li}^{2+})} = \frac{4}{3}$$

73. Answer (4)

Hint: The orbital will be filled according to (n + l) rule.

74. Answer (3)

Hint: Number of electrons ejected in photoelectric effect is proportional to the intensity of the light.

75. Answer (1)

Hint: Radial node = n - l - 1

Angular node = l

Sol.: Radial nodes in 5d_{xy} orbital = 5 - 2 - 1 = 2

Angular node = 2

76. Answer (2)

Hint: Hund's rule.

77. Answer (2)

$$\text{Hint: Molarity (M)} = \frac{\text{Mole}}{\text{V(l)}}$$

Sol.: m mol of H₂SO₄ = 200 × 0.5 = 100 m mol

Mass of H₂SO₄ in 200 ml 0.5 M H₂SO₄

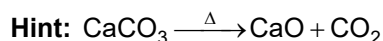
$$= 100 \times 98 \times 10^{-3} = 9.8 \text{ g}$$

50 g H₂SO₄ is present in 100 g of solution.

$$9.8 \text{ g H}_2\text{SO}_4 \text{ is present in } \frac{100}{50} \times 9.8 = 19.6 \text{ g}$$

solution.

78. Answer (4)



$$\text{Sol.: Mole of CO}_2 \text{ produced} = \frac{20}{44} = \frac{10}{22}$$

$$\text{Mole of CaCO}_3 \text{ decomposed} = \frac{10}{22}$$

$$\text{Mass of CaCO}_3 \text{ decomposed} = \frac{10}{22} \times 100 = 45.45 \text{ g}$$

$$\% \text{ purity of CaCO}_3 = \frac{45.45}{50} \times 100 = 90.9\%$$

79. Answer (3)

Hint: Mole fraction of ethanol

$$= \frac{\text{mole of ethanol}}{\text{mole of ethanol} + \text{mole of H}_2\text{O}}$$

Sol.: Mole of ethanol = 4.45

 Mass of H₂O = 1000 g

$$\text{Mole of H}_2\text{O} = \frac{1000}{18} = 55.55$$

$$\begin{aligned} \text{Mole fraction of ethanol} &= \frac{4.45}{4.45 + 55.55} \\ &= \frac{4.45}{60} = 0.074 \end{aligned}$$

80. Answer (2)

Hint: *p*-orbitals, *d*_{x²-y²} and *d*_{z²} orbitals are oriented along the axes.

81. Answer (1)

Hint: Number of orbitals in nth shell is n².

82. Answer (3)

Hint: $E = h \frac{c}{\lambda}$

Sol.: $E_1 \propto \frac{1}{\lambda_1}$

$$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1}$$

$$\text{Or, } \frac{\lambda_1}{\lambda_2} = \frac{E_2}{E_1} = \frac{25}{20} = \frac{5}{4}$$

83. Answer (3)

Hint: $\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$

Sol.: $\Delta x = 2\Delta p$

$$2\Delta p \cdot \Delta p = \frac{h}{4\pi}$$

$$(\Delta p)^2 = \frac{h}{8\pi}$$

$$\Delta p = \frac{1}{2} \sqrt{\frac{h}{2\pi}}$$

$$m\Delta v = \frac{1}{2} \sqrt{\frac{h}{2\pi}}$$

$$\Delta v = \frac{1}{2m} \sqrt{\frac{h}{2\pi}}$$

84. Answer (4)

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

Sol.: For first line in Lyman series.

$$n_1 = 1, n_2 = 2$$

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

$$\text{or, } \frac{1}{\lambda} = R_H \left(\frac{4-1}{4} \right)$$

$$\text{or, } \lambda = \frac{4}{3R_H}$$

85. Answer (2)

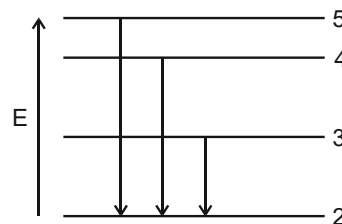
Hint: K(19) → 1s²2s²2p⁶3s²3p⁶4s¹

Sol.: Valence electron is present in 4s orbital.

$$\therefore n = 4, l = 0, m = 0 \text{ \& } s = +\frac{1}{2}$$

86. Answer (2)

Hint: For Balmer series n₁ = 2.

Sol.:


Number of spectral lines obtained = 3.

87. Answer (3)

Hint: Fe : [Ar] 3d⁶4s²

Sol.: Electronic configuration of Fe³⁺ : [Ar] 3d⁵

88. Answer (2)

Hint: $2\pi r = n\lambda$

 λ is de-Broglie wavelength

Sol.: $r = a_0 n^2$

$$r_5 = a_0 5^2 = 25a_0$$

$$\lambda = \frac{2\pi r}{n} = \frac{2\pi \times 25a_0}{5} = 10\pi a_0$$

89. Answer (3)

Hint: Spin quantum number will distinguish two electrons occupying the same orbital.

90. Answer (2)

Hint: Number of degenerate orbitals in a particular shell for one electron system is n².

Sol.: He⁺ is one electron species.

 \therefore Number of degenerate orbitals in the second shell = 2² = 4.

[BIOLOGY]

91. Answer (4)
Sol.: Anton Von Leeuwenhoek first saw and described a living cell.
92. Answer (2)
Sol.: Rudolf Virchow modified cell theory and gave it final shape. Now cell theory is understood as
(i) All living organisms are composed of cells and products of cells.
(ii) All cells arise from pre-existing cells.
93. Answer (4)
Hint : Gas vacuoles are non-membrane bound structures.
Sol.: Gas vacuoles are found in BGA and purple and green photosynthetic bacteria.
94. Answer (3)
Hint : During this phase chromatids move towards the pole.
Sol.: In anaphase of mitosis, centromeres split into two.
95. Answer (1)
Hint : Double metaphasic plate is formed during metaphase I.
Sol.:
- Long lasting diplotene – Dictyotene
 - Appearance of chromosomes – Spireme like a ball of wool stage
 - Reduction of chromosome number – Anaphase I
96. Answer (3)
Hint: This is the phase of meiosis characterised by reduction in number of chromosomes.
Sol.: During anaphase I, homologous chromosomes separate from each other but there is no splitting of centromere.
97. Answer (3)
Hint: A meiocyte has double the number of chromosomes than its meiotic products.
Sol.: Cell A : 32 chromosomes and 60 pg DNA in G₁ phase.
After replication during S-phase
Cell A : 32 chromosomes and 120 pg DNA in G₂ phase.
98. Answer (4)
Hint: Prophase follows interphase during which DNA molecules are not distinct but intertwined.
Sol.: During prophase, condensation of chromosomal material begins.
99. Answer (2)
Hint: RER is the site of protein synthesis.
Sol.: RER is frequently found in cells which are actively involved in protein synthesis and secretion.
100. Answer (3)
Hint: Cell wall protects cell from mechanical injury.
Sol.: Cell growth, formation of intercellular junctions and endocytosis are functions which are related to fluid nature of cell membrane.
101. Answer (3)
Sol.:
- Ribosome is the only cell organelle found in both prokaryotic and eukaryotic cell.
 - Fimbriae are fine bristle like structures of bacteria, which help in attachment with substratum.
102. Answer (4)
Sol.: Outer nuclear membrane is often connected to ER.
103. Answer (1)
Hint: Analogous organelles may differ in origin & structure but are similar in function.
Sol.: Mesosome is analogous to mitochondria because both are involved in respiration.
104. Answer (1)
Sol. : Intrinsic protein – Cell membrane.
- Porin – It is a type of protein found in outer membrane of mitochondria.
- Nexin protein – Found in eukaryotic flagella
- Sedimentation coefficient – Indirect measure of density and size.
105. Answer (3)
Sol.: In plants, Golgi apparatus is made up of unconnected units called dictyosome.
106. Answer (2)
Hint: Chromosomes acquire different shapes during anaphase.
Sol.: Acrocentric chromosome – J shaped
Telocentric chromosome – I shaped
In telocentric chromosomes, position of centromere is terminal.

107. Answer (1)

Sol.: Theodore Schwann was a British zoologist.

108. Answer (1)

Hint: TCA cycle/Krebs cycle which operates in mitochondria is part of aerobic respiration.

Sol.: TCA cycle/Krebs cycle occurs in matrix of mitochondria, therefore mitochondria is site of aerobic respiration.

109. Answer (1)

Hint: Core of flagella is called axoneme which remain surrounded by membrane.

Sol.: Axoneme exhibit 9 + 2 arrangement of microtubules.

110. Answer (2)

Sol.: Cell wall allows materials to pass freely in and out of the cell. Hence cell wall is completely permeable.

111. Answer (4)

Sol.: Ribosomes attach with ER by their larger sub-unit and ribophorin.

Rest of the statements are correct.

112. Answer (4)

Hint : Electron Transport System (ETS) takes place in the inner membrane of mitochondria.

Sol.: Oxysome is related to ATP synthesis, therefore enzymes and electron carriers for formation of ATP are present in the inner membrane of mitochondria.

113. Answer (4)

Hint : Leucoplasts are related to storage of food.

Sol.: Aleuroplast is a type of leucoplast, stores protein not starch.

Rest of the statements are correct.

114. Answer (2)

Hint : It is preparatory phase of cell cycle.

Sol.: Interphase is preparatory phase of cell cycle known as biosynthetic phase because cell duplicates its organelles and replicates its DNA during this phase.

115. Answer (3)

Hint : Mitochondria, chloroplast and Golgi bodies duplicate during gap between S-phase and M-phase.

Sol.: These cell organelles duplicate during G_2 phase of interphase.

116. Answer (2)

Sol.: Genetic material (DNA) duplication takes place during S-phase (synthesis phase).

117. Answer (3)

Hint : Intermediate phase between prophase and metaphase is known as transition phase.

Sol.: Given diagram shows transition to metaphase because chromosomes are going to align at metaphasic plate.

118. Answer (1)

Hint : During cytokinesis in animal cells, cell plate is not formed.

Sol.: In animal cells, cytokinesis is achieved by furrow formation with the help of microfilaments.

119. Answer (1)

Hint : Lysosome is considered as suicidal bag of cell.

Sol.: Lysosomes are rich in hydrolytic enzymes function at acidic pH i.e., acid hydrolases.

120. Answer (2)

Sol.: Sphaerosomes contain hydrolytic enzymes. These are found in abundance in endosperm cells of seeds, thus are believed to be plant lysosome.

121. Answer (3)

Sol.: Nucleolus is the site for r-RNA synthesis.

122. Answer (3)

Hint : Site for attachment of spindle fibre is a proteinaceous disc in centromere region.

Sol.: This proteinaceous disc is called kinetochore.

123. Answer (3)

Hint : A pair of homologous chromosomes is called a bivalent.

Sol.: During pachytene stage bivalent becomes distinct. It consists of 4 chromatids and two centromeres.

124. Answer (4)

Hint : Microtubules form spindle fibres in eukaryotic cells.

Sol.: Microtubules are made up of tubulin protein.

125. Answer (3)

Hint : The final stage of prophase I is marked by terminalisation of chiasmata.

Sol.: Final stage of prophase I is diakinesis.

126. Answer (3)

Sol. : Intrameiotic interphase or interkinesis is a metabolic stage between telophase I and prophase II. During this phase centriole replicates but replication of DNA does not occur.

127. Answer (2)

Hint : Amitosis is direct cell division.

Sol.: In direct cell division, nucleus of cell elongates and gradually splits into two daughter nuclei. Therefore, spindle formation does not occur.

128. Answer (4)

Sol. : Mitosis is helpful in growth, healing and regeneration, repair and maintenance of cell size.

129. Answer (1)

Sol.: Phragmoplast is formed by Golgi complex.

130. Answer (3)

Hint : Number of generations (n) of mitosis = $(2)^n$

Sol.: $128 = (2)^n$

$\Rightarrow n = 7$

131. Answer (2)

Sol.: Pigment chlorophyll remain present in thylakoid not in stroma.

Rest of the statements are correct.

132. Answer (4)

Hint : In eukaryotes, basal body exhibit 9 + 0 arrangement of microtubules like centriole.

Sol.: It is chiefly made up of tubulin proteins. Flagellin is found in flagella of prokaryotes

133. Answer (1)

Hint : In nucleolus, precursor of ribosome are formed.

Sol.: Ribosomes are related to protein synthesis. The cells which are actively involved in protein synthesis, have larger and more numerous nuclei.

134. Answer (1)

Sol.: Lampbrush chromosomes are present in primary oocyte nuclei of vertebrates as well as invertebrates.

135. Answer (1)

Sol.: – Meiosis conserve chromosomes number constant across the generations.

- It increases genetic variability.
- It may occur in zygote or during gamete formation or spore formation.
- It takes place in diploid cells.

136. Answer (3)

Hint: This sugar is abundant in corn and grapes.

Sol.: Fructose is six carbon sugar with keto group. Ribose and deoxyribose are five carbon sugars with aldehyde group.

137. Answer (2)

Hint: These are not strictly biomacromolecules.

Sol.: Lipids are not polymers. Amino acids, monosaccharides and nucleotides are monomers available for proteins, polysaccharides and nucleic acids respectively.

138. Answer (1)

Hint: This bond is a property of molecules constituting genetic material.

Sol.: DNA and RNA both serve as genetic material in organisms. Their nucleotides are linked by phosphodiester bonds.

139. Answer (4)

Hint: Identify an inorganic cofactor.

Sol.: Zinc ions are essential as a cofactor for the proteolytic enzyme carboxypeptidase.

140. Answer (3)

Hint: These enzymes require water for functioning.

Sol.: Hydrolytic enzymes are classified in class III as per IUB *i.e.* hydrolases.

141. Answer (2)

Hint: Holoenzyme is another term for conjugated proteins working as enzymes.

Sol.: Protein part of holoenzyme is called apoenzyme. Tightly bound organic cofactor is prosthetic group.

142. Answer (2)

Hint: Competitive inhibitors resemble the substrate.

Sol.: Succinate is the substrate of enzyme succinic dehydrogenase while oxaloacetate is the product formed.

143. Answer (1)

Hint: Biocatalysts are enzymes.

Sol.: They are mostly proteinaceous. They work optimally at different pH. They alter the rate of the reaction but not the equilibrium constant of the reaction.

144. Answer (3)

Hint: Cellulose is most abundant biomolecule on earth.

Sol.: β -glucose is the monomer of cellulose.

N – acetylglucosamine (NAG) is the monomer of chitin. ATP is energy currency of cell.

145. Answer (4)

Hint: ATP has ribose sugar.

Sol.: Adenosine triphosphate *i.e.* ATP is found in RNA. DNA has deoxyribose.

146. Answer (3)

Hint: Functional group is aldehyde in many sugars.

Sol.: Functional group in glycogen like sugars is aldehyde (carboxyl or carbonyl 'C' atom) and hydroxyl group.

147. Answer (4)

Hint: Elimination of this moiety is seen during formation of glycosidic bond.

Sol.: Water is lost during formation of biomolecules by dehydration.

148. Answer (2)

Hint: 'R' is represented by $-\text{CH}_2\text{OH}$.

Sol.: Serine is classified as alcoholic amino acid. Cysteine is a sulfur containing amino acid.

149. Answer (4)

Hint: Applying Chargaff's rule.

Sol.: $[\text{A}] = [\text{T}] = 30\%$, $\therefore [\text{C}] = [\text{G}] = 20\%$. Total purine and pyrimidine content is 50% each. Sugar and phosphate form the backbone in DNA.

150. Answer (4)

Hint: Identify a sugar obtained from sugarcane.

Sol.: Reducing sugars have free aldehyde or keto group to oxidise cupric ions to cuprous form.

151. Answer (2)

Hint: Identify a polymer of fructose.

Sol.: Inulin is obtained from roots of plants like *Dahlia*.

152. Answer (1)

Hint: Glycogen can be stored in human liver.

Sol.: Chitin is structural homopolysaccharide of N-acetylglucosamine.

153. Answer (2)

Hint: α -carbon of these biomolecules usually have four different substituents.

Sol.: Glycerol is trihydroxypropane.

154. Answer (4)

Hint: T, L, I, V, W, F, K and M are simple alphabetic codes of essential amino acids.

Sol.: Leucine, isoleucine, valine, tryptophan, phenylalanine, lysine and methionine are essential to man.

155. Answer (1)

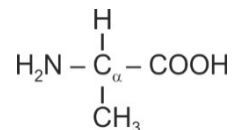
Hint: Identify a nitrogenous base.

Sol.: Uridylic acid is a nucleotide of uracil.

156. Answer (2)

Hint: Its side chain is a 'methyl' group.

Sol.: Tyrosine, tryptophan and phenylalanine are aromatic amino acids. Alanine has the given structure.



157. Answer (2)

Hint: Increased amount of substrate is required to overcome the competitive inhibition.

Sol.: K_m value increases while V_{max} remains unaffected in case of competitive inhibition.

158. Answer (4)

Hint: Feedback inhibition.

Sol.: Product concentration affects activity of allosteric enzyme.

159. Answer (4)

Hint: Primary metabolites have identifiable functions in physiological processes.

Sol.: Lectin such as Concanavalin A is a secondary metabolite.

160. Answer (2)

Hint: They are components of cell membranes.

Sol.: A = water, B = proteins, C = Nucleic acids
D = Carbohydrates, E = Lipids, F = Ions

161. Answer (4)

Hint: It is a polymer of glucose.

Sol.: Proteins (insulin and GLUT 4) are heteropolymers as are nucleic acids.

162. Answer (2)

Hint: Identify a carbohydrate.

Sol.: DNA contains pentose sugar called deoxyribose. Peptide bond is a feature of proteins. Uridine is found in RNA. Thiamine is a vitamin.

163. Answer (3)

Hint: Defense against abrasion.

Sol.: Surfaces requiring protection are lined by multi-layered epithelium/compound epithelium.

164. Answer (2)

Hint: Column like-cells with basal nuclei are present here.

Sol.: Surface lining of stomach is composed of simple columnar epithelium.

165. Answer (3)

Hint: Upon loss of weight, the size of adipocytes decreases.

Sol.: Fat storing cells are called adipocytes. These cells increase/decrease in size depending on fat reserve.

166. Answer (3)

Hint: Cells of a tissue perform similar functions.

Sol.: Cells of a tissue must recognise each other to form a layer of cells.

167. Answer (2)

Hint: Glandular cells are specialised for secretion.

Sol.: Some of the columnar or cuboidal cells get specialised for secretion and form glandular epithelium.

168. Answer (4)

Hint: Tissues are organised in specific proportions and patterns to form an organ.

Sol.: All types of tissues are present in organs such as stomach, heart, lung and kidney.

169. Answer (2)

Hint: Excitability is a property of this tissue.

Sol.: Wall of blood vessels contain a layer of smooth muscle fibres which exhibit excitability and contractility.

170. Answer (1)

Hint: Identify regions where cartilage is found.

Sol.: Elastic cartilage is present in tip of nose and outer ear joints.

171. Answer (3)

Hint: Fusiform fibres.

Sol.: Smooth muscle fibres are involuntary fibres with cell junctions.

172. Answer (2)

Hint: Cardiac muscle fibres.

Sol.: Intercalated discs are fusion points that allow the cells to contract as a unit.

173. Answer (3)

Hint: These are skeletal muscle fibres.

Sol.: Cardiac muscle fibres show branched appearance.

174. Answer (1)

Hint: These constitute more than one half of the volume of neural tissue in our body.

Sol.: Nissl's granules are site of protein synthesis and are absent in axon part of a neuron.

175. Answer (3)

Hint: It belongs to category of specialised connective tissue.

Sol.: Bone helps to support weight.

176. Answer (2)

Hint: These cells are enclosed in cavities called lacunae.

Sol.: Lamellae are found in bone only. Lacunae are common to both bone and cartilage.

177. Answer (2)

Hint: Loose connective tissue.

Sol.: Mast cells of areolar tissue are rich in granules of histamine, serotonin and heparin.

178. Answer (4)

Hint: These are also called Zona occludens.

Sol.: Tight junctions occur in apical part of epithelial tissue and stop substances from leaking across the tissue.

179. Answer (3)

Hint: It is a hormone.

Sol.: Sweat, sebum and saliva are secretions of exocrine glands *i.e.* they have ducts.

180. Answer (4)

Hint: Presence of keratin makes the surface impermeable to water.

Sol.: Skin is lined by dry, keratinized epithelium.



All India Aakash Test Series for Medical - 2021

TEST - I (Code-D)

Test Date : 06/10/2019

ANSWERS

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

HINTS & SOLUTIONS**[PHYSICS]**

1. Answer (1)

$$\text{Hint: } \frac{\Delta V}{V} = 3 \frac{\Delta r}{r}$$

$$\frac{\Delta A}{A} = 2 \frac{\Delta r}{r}$$

$$\text{Sol.: For a given change in } r, \frac{\Delta V}{V} > \frac{\Delta A}{A} > \frac{\Delta r}{r}$$

2. Answer (3)

$$\text{Hint & Sol.: } 1 \text{ ly} = 9.46 \times 10^{15} \text{ m}$$

$$1 \text{ parsec} = 3.26 \text{ ly}$$

$$1 \text{ AU} = 1.496 \times 10^{11} \text{ m}$$

3. Answer (3)

$$\text{Hint: If } |x| \ll 1, \text{ then } (1+x)^n = 1+nx$$

$$\text{Sol.: } (1000+6)^{1/3}$$

$$= 10 \left(1 + \frac{6}{1000} \right)^{1/3}$$

$$= 10 \left(1 + \frac{6}{1000} \times \frac{1}{3} \right)$$

$$= 10(1 + 0.002)$$

$$= 10 \times 1.002 = 10.02$$

4. Answer (4)

$$\text{Hint & Sol.: } [PV] = \left[\frac{\text{MLT}^{-2} \cdot \text{L}^3}{\text{L}^2} \right] = [\text{ML}^2\text{T}^{-2}] = [W]$$

5. Answer (2)

Hint: Power rule of error combination.

$$\text{Sol.: } Z = \frac{P^{1/2}Q^{1/3}}{R}$$

$$\Rightarrow \frac{\Delta Z}{Z} \times 100 = \frac{1}{2} \times \frac{\Delta P}{P} \times 100 + \frac{1}{3} \times \frac{\Delta Q}{Q} \times 100 + \frac{\Delta R}{R} \times 100$$

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

6. Answer (3)

Hint: Differentiation of exponential function.

$$\text{Sol.: } v = \frac{dx}{dt} = -4e^{-2t}, \quad a = \frac{dv}{dt} = 8e^{-2t} = -2v$$

7. Answer (3)

Hint: Use dimensions of different physical quantities

$$\text{Sol.: } [\text{Torque}] = [\text{ML}^2\text{T}^{-2}]$$

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

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

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

8. Answer (4)

Hint: Principle of homogeneity

Sol.: $a^2 - x^{1/n}$ should have dimension of (distance)²

$$\therefore x^{1/n} = [L]^{1/n} = L^2$$

$$\therefore \frac{1}{n} = 2$$

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

9. Answer (2)

$$\text{Hint: } T = 2T_1 + 2T_2$$

$$\Delta T = 2\Delta T_1 + 2\Delta T_2$$

$$\text{Sol.: } T = 2 \times 40.3 + 2 \times 70.2$$

$$= 80.6 + 140.4 = 221.0$$

$$\Delta T = 2 \times 0.1 + 2 \times 0.2$$

$$= 0.2 + 0.4 = 0.6$$

$$\therefore T \pm \Delta T = (221.0 \pm 0.6)^\circ\text{C}$$

10. Answer (4)

$$\text{Hint: } \frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$$

$$\text{Sol.: } Z = \frac{A}{B}$$

$$\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$$

$$\Rightarrow \Delta Z = \left(\frac{\Delta A}{A} + \frac{\Delta B}{B} \right) \times \frac{A}{B}$$

$$\Delta Z = \frac{\Delta A}{B} + \frac{A\Delta B}{B^2}$$

11. Answer (2)

Hint & Sol.: The factor $1 - \frac{1}{c^2}$ must be dimensionless. To make it dimensionless multiply

$$\frac{1}{c^2} \text{ with } v^2$$

$$\therefore m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

12. Answer (1)

Hint: If $y = x^n$

then $\frac{dy}{dx} = nx^{n-1}$

Sol.: $y = x^{1/2} - x^{-1/2}$

$$y' = \frac{1}{2}x^{-1/2} + \frac{1}{2}x^{-3/2} = \frac{x+1}{2x^{3/2}}$$

13. Answer (4)

Hint: $d = \frac{m}{V}$

$$\frac{\Delta d}{d} = \frac{\Delta m}{m} + \frac{\Delta V}{V}$$

Sol.: $\% \frac{\Delta d}{d} = \left[\frac{0.01}{23.35} + \frac{0.01}{2.30} \right] \times 100 \approx 0.5\%$

14. Answer (2)

Hint: $n_1u_1 = n_2u_2$

Sol.: $a \times u_1 = b \times u_2$

u_1 for SI unit $\frac{N}{m^2}$, u_2 for CGS unit $\frac{\text{dyne}}{\text{cm}^2}$

$$a \times \frac{N}{m^2} = b \times \frac{\text{dyne}}{\text{cm}^2}$$

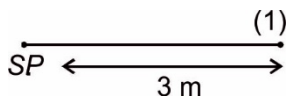
$$a \times \frac{10^5 \text{dyne}}{10^4 \text{cm}^2} = b \times \frac{\text{dyne}}{\text{cm}^2}$$

$$\frac{a}{b} = \frac{1}{10} = 10^{-1}$$

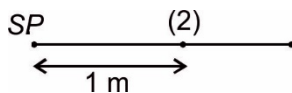
15. Answer (2)

Hint: Concept of displacement and distance

Sol.: After 6 steps



After 10 steps



After 16 steps, He will fall into the pit

$$\therefore t = 16 \times 1 = 16 \text{ s}$$

16. Answer (2)

Hint: $v_{av} = \frac{\text{Change in position}}{\text{Time interval}}$

Sol.: $v = \frac{dx}{dt}$

$$\int_0^x dx = \int_0^t (6 + 3t^2) dt$$

$$x = 6t + t^3$$

$$x(0) = 0$$

$$x(2) = 6 \times 2 + 8 = 20 \text{ m}$$

$$v_{av} = \frac{20 - 0}{2} = 10 \text{ m/s}$$

17. Answer (4)

Hint: $v_c = \sqrt{\frac{v_1^2 + v_2^2}{2}}$

Sol.: $v_2^2 = v_1^2 + 2al$

or, $al = \frac{v_2^2 - v_1^2}{2} \dots(1)$

$$v_c^2 = v_1^2 + 2a \times \frac{l}{2}$$

$$= v_1^2 + \frac{(v_2^2 - v_1^2)}{2} = \frac{v_1^2 + v_2^2}{2}$$

$$\Rightarrow v_c = \sqrt{\frac{(10)^2 + (20)^2}{2}} = 5\sqrt{10} \text{ m/s}$$

18. Answer (3)

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

Sol.: $s_1 \propto u^2$

$$s_2 \propto 4^2 u^2$$

$$\therefore \frac{s_1}{s_2} = \frac{1}{16}$$

19. Answer (2)

Hint: Distance travelled is same in last second of ascent and its first second of descent.

Sol.: $\frac{1}{2} \times g \times (1)^2 = \frac{g}{2}$

20. Answer (4)

Hint & Sol.: $2^{20} = 2^{10} \times 2^{10} = 1024 \times 1024 \approx 10^6$

Hence order of magnitude = 6

21. Answer (2)

Hint: $t = \frac{t_1 t_2}{t_1 + t_2}$

Sol.: $\frac{l}{u} = 3$

And $\frac{l}{v} = 6$

$$\Rightarrow u = 2v$$

$$\text{and } l = 6v$$

Now,

$$t = \frac{l}{v+u} = \frac{6v}{3v} = 2 \text{ s}$$

22. Answer (4)

$$\text{Hint: } s_1 = ut + \frac{1}{2}at^2$$

$$s_2 = vt$$

$$\text{Sol.: } s_1 = \frac{1}{2} \times 2 \times 25 = 25 \text{ m}$$

$$v = at$$

$$= 2 \times 5 = 10 \text{ m/s}$$

$$s_2 = v \times t$$

$$= 50 \text{ m}$$

$$s = s_1 + s_2 = 75 \text{ m}$$

23. Answer (3)

$$\text{Hint: } s = \frac{1}{2}(u+v)t$$

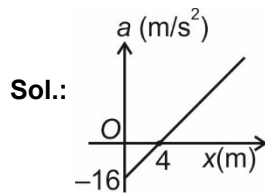
$$\text{Sol.: } s = \frac{1}{2}(u+v)t$$

$$400 = \frac{1}{2} \times 40 \times t$$

$$\Rightarrow t = 20 \text{ s}$$

24. Answer (2)

$$\text{Hint: } a = v \frac{dv}{dx}$$



$$v = -2x + 8$$

$$a = v \frac{dv}{dx}$$

$$a = (-2x + 8)(-2)$$

$$a = 4x - 16$$

25. Answer (4)

$$\text{Hint: } v = \frac{dx}{dt}$$

$$\text{Sol.: } \frac{dx}{dt} = 1 - \sin t = 0$$

$$\sin t = 1 \Rightarrow t = \frac{\pi}{2} = \frac{3.14}{2} = 1.57 \text{ s}$$

26. Answer (1)

Hint: For uniform motion, velocity is constant

Sol.: As $v = \text{constant}$

$$\therefore x \propto t$$

27. Answer (3)

$$\text{Hint: } t = \frac{S_{\text{rel}}}{V_{\text{rel}}}$$

$$\text{Sol.: } S_{\text{rel}} = 200 \text{ m}$$

$$V_{\text{rel}} = 40 \text{ m/s}$$

$$t = \frac{200}{40} = 5 \text{ s}$$

28. Answer (2)

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

$$\text{Sol.: } a = 4t$$

$$a \propto t$$

29. Answer (2)

Hint: Acceleration is slope of velocity-time graph.

$$\text{Sol.: } a = \frac{dv}{dt}$$

$$= -\frac{60}{30} = -2 \text{ m/s}^2$$

30. Answer (4)

$$\text{Hint: } t = \frac{2dv}{v^2 - u^2}$$

$$\text{Sol.: } t = \frac{d}{(v+u)} + \frac{d}{(v-u)}$$

$$= \frac{12}{6} + \frac{12}{2} = 8 \text{ s}$$

31. Answer (3)

Hint: $X_{AB} = u_{\text{rel}} \times t$ when $a_{\text{rel}} = 0$

$$\text{Sol.: } X_{\text{rel}} = 10 \times 1 = 10 \text{ m}$$

32. Answer (2)

$$\text{Hint: Use } S = ut + \frac{1}{2}at^2$$

$$\text{Sol.: } h_1 = 0 + \frac{1}{2}g \times 4 = 2g$$

$$h_1 + h_2 = \frac{1}{2}g \times 36 = 18g$$

$$\Rightarrow h_2 = 16g$$

$$\therefore \frac{h_1}{h_2} = \frac{1}{8}$$

33. Answer (1)

Hint: Relative velocity of cars will be zero when their velocity will be equal.

Sol.: $v_1 = \frac{dx_p}{dt}$

$= 4 - 4t$

$v_2 = \frac{dx_Q}{dt}$

$= -8 + 2t$

As $v_1 = v_2$

$4 - 4t = -8 + 2t$

$t = 2 \text{ s}$

34. Answer (2)

Hint: $n_1u_1 = n_2u_2$

Sol.: $10[M_1L_1^2T_1^{-2}] = n_2[M_2L_2^2T_2^{-2}]$

$\therefore n_2 = 10 \left[\frac{1 \text{ kg}}{1 \text{ kg}} \right]^{-1} \left[\frac{1 \text{ m}}{10 \text{ cm}} \right]^2 \left[\frac{1 \text{ s}}{30 \text{ s}} \right]^{-2}$

$= 10 \times \left[\frac{100 \text{ cm}}{10 \text{ cm}} \right]^2 \times \left[\frac{1}{30} \right]^{-2}$

$= 10 \times 100 \times 30 \times 30$

$= 9 \times 10^5 \text{ units}$

35. Answer (1)

Hint: $[G] = [M^{-1}L^3T^{-2}]$

Sol.: $t \propto R^a M^b G^c$

$[M^0L^0T^1] = [L]^a [M]^b [M^{-1}L^3T^{-2}]^c$

$[M^0L^0T^1] = [M^{b-c}] [L^{3c+a}] [T^{-2c}]$

$-2c = 1, \quad b - c = 0, \quad 3c + a = 0$

$c = -\frac{1}{2}, \quad b + \frac{1}{2} = 0, \quad -\frac{3}{2} + a = 0$

$b = -\frac{1}{2} \quad a = \frac{3}{2}$

$\therefore t \propto \frac{R^{3/2}}{M^{1/2}G^{1/2}}$

36. Answer (2)

Hint: In multiplication or in division, the number of significant figures in result must be same as that of given number with the least significant figures.

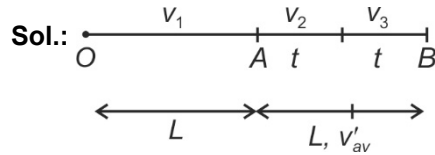
Sol.: $\frac{0.301 \times 0.27}{1.149} = 0.071$

37. Answer (2)

Hint: For equal half distances

$v_{av} = \frac{2vu}{v+u}$ and for equal time interval

$v_{av} = \frac{u+v}{2}$



$v'_{av} = \frac{v_2 + v_3}{2}$

$\therefore v_{av} = \frac{2v_1v'_{av}}{v_1 + v'_{av}}$

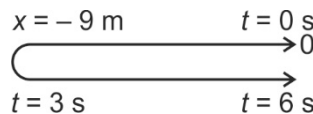
$v_{av} = \frac{2v_1 \left(\frac{v_2 + v_3}{2} \right)}{v_1 + \frac{v_2 + v_3}{2}}$

$v_{av} = \frac{2v_1v_2 + 2v_1v_3}{2v_1 + v_2 + v_3}$

38. Answer (4)

Hint: Distance can never be negative and decreasing

Sol.: $v = 2t - 6 = 0$ at $t = 3 \text{ s}$



At $t = 3 \text{ s}$,

$x = -9 \text{ m}$,

At $t = 6 \text{ s}$

$x = 0 \text{ m}$

So, distance = $9 + 9 = 18 \text{ m}$

39. Answer (3)

Hint & Sol.:

PHYSICAL QUANTITY	Dimensions
Plane angle	$M^0L^0T^0$
Solid angle	$M^0L^0T^0$
Angular velocity	$M^0L^0T^{-1}$
Frequency	$M^0L^0T^{-1}$
Relative velocity	M^0LT^{-1}
Relative density	$M^0L^0T^0$
Impulse	MLT^{-1}
linear momentum	MLT^{-1}

40. Answer (2)

Hint: The power in exponential function must be dimensionless

Sol.: $[Ct] = [M^0L^0T^0]$

$[C] = [T^{-1}]$

$\left[\frac{A}{B}\right] = [L]$

$\therefore \left[\frac{AC}{B}\right] = [LT^{-1}]$

41. Answer (2)

Hint: $T = 2\pi\sqrt{\frac{l}{g}}$

Sol.: $T^2 = 4\pi^2 \frac{l}{g}$

$\therefore g = \frac{4\pi^2 l}{T^2} = \frac{4 \times 10 \times 4}{16} = 10.0 \text{ m/s}^2$

and, $\frac{\Delta g}{g} = \frac{\Delta l}{l} + \frac{2\Delta T}{T}$

$\Rightarrow \Delta g = \left(\frac{0.01}{4.00} + 2 \times \frac{0.01}{4.00}\right) \times 10 = 0.075 \approx 0.1$

Hence $g = (10.0 \pm 0.1) \text{ m/s}^2$

42. Answer (3)

Hint: L.C. = 1 MSD – 1 VSD**Sol.:** 10 VSD = 8 MSD

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

$\therefore \text{L.C} = 1 \text{ MSD} - \frac{8}{10} \text{ MSD}$

$= \frac{1}{5} \text{ MSD}$

$= \frac{1}{5} \text{ mm}$

Side of cube = $10 \text{ mm} + 2 \times \frac{1}{5}$

$= (10 + 0.4) \text{ mm} = 1.04 \text{ cm}$

Volume = $(1.04)^3$

$= 1.12 \text{ cm}^3$ (upto 3 significant figure)

43. Answer (2)

Hint & Sol.: The statement “science is not just a collection of laws, a catalogue of unrelated facts. It is a creation of human mind, with its freely invented ideas and concepts” was given by Albert Einstein.

44. Answer (3)

Hint & Sol.: In entire journey sum of kinetic energy and potential energy remains conserved in absence of air.

45. Answer (3)

Hint & Sol.: The ratio of strength of strong nuclear force to the strength of electromagnetic force is about 100 : 1.

[CHEMISTRY]

46. Answer (2)

Hint: Number of degenerate orbitals in a particular shell for one electron system is n^2 .**Sol.:** He^+ is one electron species. \therefore Number of degenerate orbitals in the second shell = $2^2 = 4$.

47. Answer (3)

Hint: Spin quantum number will distinguish two electrons occupying the same orbital.

48. Answer (2)

Hint: $2\pi r = n\lambda$ λ is de-Broglie wavelength

Sol.: $r = a_0 n^2$

$r_5 = a_0 5^2 = 25a_0$

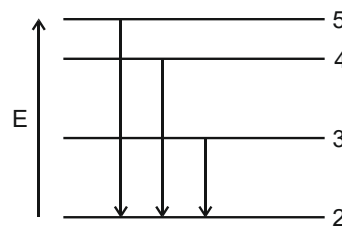
$\lambda = \frac{2\pi r}{n} = \frac{2\pi \times 25a_0}{5} = 10\pi a_0$

49. Answer (3)

Hint: Fe : $[\text{Ar}] 3d^6 4s^2$

Sol.: Electronic configuration of Fe^{3+} : $[\text{Ar}] 3d^5$

50. Answer (2)

Hint: For Balmer series $n_1 = 2$.**Sol.:**

Number of spectral lines obtained = 3.

51. Answer (2)

Hint: $K(19) \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$ **Sol.:** Valence electron is present in 4s orbital.

$$\therefore n = 4, l = 0, m = 0 \text{ \& } s = +\frac{1}{2}$$

52. Answer (4)

Hint: $\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$ **Sol.:** For first line in Lyman series.

$$n_1 = 1, n_2 = 2$$

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

$$\text{or, } \frac{1}{\lambda} = R_H \left(\frac{4-1}{4} \right)$$

$$\text{or, } \lambda = \frac{4}{3 R_H}$$

53. Answer (3)

Hint: $\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$ **Sol.:** $\Delta x = 2\Delta p$

$$2\Delta p \cdot \Delta p = \frac{h}{4\pi}$$

$$(\Delta p)^2 = \frac{h}{8\pi}$$

$$\Delta p = \frac{1}{2} \sqrt{\frac{h}{2\pi}}$$

$$m\Delta v = \frac{1}{2} \sqrt{\frac{h}{2\pi}}$$

$$\Delta v = \frac{1}{2m} \sqrt{\frac{h}{2\pi}}$$

54. Answer (3)

Hint: $E = h \frac{c}{\lambda}$ **Sol.:** $E_1 \propto \frac{1}{\lambda_1}$

$$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1}$$

$$\text{Or, } \frac{\lambda_1}{\lambda_2} = \frac{E_2}{E_1} = \frac{25}{20} = \frac{5}{4}$$

55. Answer (1)

Hint: Number of orbitals in n^{th} shell is n^2 .

56. Answer (2)

Hint: p -orbitals, $d_{x^2-y^2}$ and d_{z^2} orbitals are oriented along the axes.

57. Answer (3)

Hint: Mole fraction of ethanol

$$= \frac{\text{mole of ethanol}}{\text{mole of ethanol} + \text{mole of H}_2\text{O}}$$

Sol.: Mole of ethanol = 4.45Mass of H_2O = 1000 g

$$\text{Mole of H}_2\text{O} = \frac{1000}{18} = 55.55$$

$$\begin{aligned} \text{Mole fraction of ethanol} &= \frac{4.45}{4.45 + 55.55} \\ &= \frac{4.45}{60} = 0.074 \end{aligned}$$

58. Answer (4)

Hint: $\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2$

$$\text{Sol.: Mole of CO_2 produced = $\frac{20}{44} = \frac{10}{22}$$$

$$\text{Mole of CaCO}_3 \text{ decomposed} = \frac{10}{22}$$

$$\begin{aligned} \text{Mass of CaCO}_3 \text{ decomposed} &= \frac{10}{22} \times 100 \\ &= 45.45 \text{ g} \end{aligned}$$

$$\% \text{ purity of CaCO}_3 = \frac{45.45}{50} \times 100 = 90.9\%$$

59. Answer (2)

Hint: Molarity(M) = $\frac{\text{Mole}}{V(l)}$ **Sol.:** m mol of H_2SO_4 = $200 \times 0.5 = 100$ m molMass of H_2SO_4 in 200 ml 0.5 M H_2SO_4

$$= 100 \times 98 \times 10^{-3} = 9.8 \text{ g}$$

50 g H_2SO_4 is present in 100 g of solution.

$$9.8 \text{ g H}_2\text{SO}_4 \text{ is present in } \frac{100}{50} \times 9.8 = 19.6 \text{ g}$$

solution.

60. Answer (2)

Hint: Hund's rule.

61. Answer (1)

Hint: Radial node = $n - l - 1$ Angular node = l **Sol.:** Radial nodes in $5d_{xy}$ orbital = $5 - 2 - 1 = 2$

Angular node = 2

62. Answer (3)

Hint: Number of electrons ejected in photoelectric effect is proportional to the intensity of the light.

63. Answer (4)

Hint: The orbital will be filled according to $(n + l)$ rule.

64. Answer (2)

Hint: $r_n \propto \frac{n^2}{Z}$

Sol.: $r_2(\text{H}) \propto (2)^2 \dots(1)$

$r_3(\text{Li}^{2+}) \propto \frac{(3)^2}{3} \dots(2)$

$$\therefore \frac{r_2(\text{H})}{r_3(\text{Li}^{2+})} = \frac{4}{3}$$

65. Answer (4)

Hint: For $n = 1, l = 0$.

66. Answer (2)

Hint: P.E. = $2 E_{\text{total}}$

Sol.: $E_{\text{total}} = -13.6 \times \frac{Z^2}{n^2} \text{ eV}$

$$\text{P.E.} = 2 \times -13.6 \times \frac{(1)^2}{(2)^2} \text{ eV} = -6.8 \text{ eV}$$

67. Answer (1)

Hint: For $n = 4; l = 0, 1, 2, 3$

Sol.: $l = 0, 1, 2, 3$ respectively represent s, p, d and f orbitals. There are four orbitals, one each in s, p, d and f sub shell having $m = 0$.

\therefore Maximum number of electrons = $4 \times 2 = 8$

68. Answer (4)

Hint: Characteristics of cathode rays does not depend upon the material of cathode used.

69. Answer (1)

Hint: Molality (m) = $\frac{\text{Mole of state solute}}{\text{Mass of solvent (kg)}}$

Sol.: Mass of solute = 15 g

$$\text{Mole of solute} = \frac{15}{60} = \frac{1}{4}$$

Mass of solvent = $(100 - 15) = 85 \text{ g}$

$$\text{molality} = \frac{1 \times 1000}{4 \times 85} = 2.94 \text{ m}$$

70. Answer (1)

Hint: Calculate mole of C, H and O.

Elements	Mass percentage	Mole	Mole ratio
C	41.4	3.45	1
H	3.4	3.4	1
O	55.2	3.45	1

Empirical formula of the compound is CHO.

71. Answer (2)

Hint: SI unit of amount of substance is mole.

72. Answer (3)

Hint: 1 mole of NO_2 will occupy 22.4 L at STP.

$$\text{Sol.: Density = $\frac{\text{Molar mass}}{\text{Molar volume}} = \frac{46}{22.4} = 2.05 \text{ g/L}$$$

73. Answer (2)

Hint: H_2 is limiting reagent.

Sol.: $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

$$\text{Mole of } \text{N}_2 \text{ taken} = \frac{42}{28} = 1.5$$

$$\text{Mole of } \text{H}_2 \text{ taken} = \frac{7.2}{2} = 3.6$$

3.6 mole of H_2 will require 1.2 mole of N_2 for complete reaction.

\therefore H_2 is limiting reagent.

$$\text{Mole of } \text{NH}_3 \text{ produced} = \frac{2}{3} \times 3.6 = 2.4$$

74. Answer (4)

Hint: Valence electrons in one oxygen atom is 6.

$$\text{Sol.: Mole of oxygen atom = $\frac{6.4}{16} = 0.4$$$

Mole of valence electrons = $0.4 \times 6 = 2.4$

Number of valence electrons = $2.4 N_A$

75. Answer (2)

Hint: Average atomic mass = $\frac{\sum \% \times M}{100}$

$$\text{Sol.: Average atomic mass of element X
 $= \frac{41 \times 30 + 43 \times 70}{100} = \frac{1230 + 3010}{100} = 42.4 \text{ u}$$$

76. Answer (4)

Hint: $E = -13.6 \frac{Z^2}{n^2} \text{ eV}$

$$\text{Sol.: $E = -13.6 \times \frac{(2)^2}{n^2} \text{ eV} = -\frac{54.4}{n^2} \text{ eV}$$$

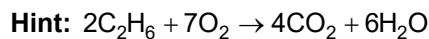
77. Answer (3)

Hint: Write electronic configuration of chromium (Cr).

Sol.: $\text{Cr}(24) \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

Number of unpaired electrons = 6

78. Answer (1)



Sol.: Mole of ethane = $\frac{3000}{30} = 100$

Mole of $O_2 = \frac{7}{2} \times 100 = 350$

Mass of $O_2 = 350 \times 32 = 11200 \text{ g} = 11.2 \text{ kg}$

79. Answer (2)

Hint: 1 mol of N_2 occupies 22.4 L at STP.

Sol.: 100 L of air contains 78 L of N_2 .

10 L of air contains $\frac{78 \times 10}{100} = 7.8 \text{ L } N_2$

Mole of N_2 at STP = $\frac{7.8}{22.4} = 0.35$

Molecules of $N_2 = 0.35 N_A$

80. Answer (4)

Hint: Each biomolecule should contain one Fe^{2+} ion.

Sol.: One mole of biomolecule will contain one mole of Fe^{2+} ions.

0.2 g of Fe^{2+} is present in 100 g of biomolecule

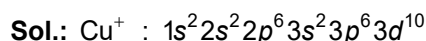
56 g of Fe^{2+} is present in $\frac{100 \times 56}{0.2} = 28 \times 1000$

= 28000 g mol^{-1} of biomolecule.

Molecular mass = 28000 u.

81. Answer (2)

Hint: The species which does not contain unpaired electron will be diamagnetic



82. Answer (2)

Hint: Molarity (M) = $\frac{\text{Mole of solute}}{\text{Volume of solution (L)}}$

Sol.: Mole of glucose = $\frac{3.01 \times 10^{21}}{6.02 \times 10^{23}} = 5 \times 10^{-3}$

Molarity = $\frac{5 \times 10^{-3} \times 1000}{500} = 0.01 \text{ M}$

83. Answer (3)

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

Sol.: $\lambda = \frac{6.63 \times 10^{-34}}{5 \times 10^{-3} \times 200} \text{ m} = 6.63 \times 10^{-34} \text{ m}$

84. Answer (2)

Hint.: Three dimensional shape of an atomic orbital can be given by using Azimuthal quantum number.

85. Answer (3)

Hint: Maximum of two electrons can be accommodated in an orbital.

86. Answer (3)

Hint: $E = h \frac{c}{\lambda}$

Sol.: $E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8 \text{ J}}{300 \times 10^{-9}}$
 $= 6.63 \times 10^{-19} \text{ J}$

87. Answer (3)

Hint: Orbital angular momentum (L)

$= \sqrt{l(l+1)} \hbar$

Sol.: For f-orbital, l is 3

$L = \sqrt{3(3+1)} \hbar = \sqrt{12} \hbar$

88. Answer (2)

Hint: No. of molecules = mole $\times N_A$

Sol.: Molecules of $SO_3 = \frac{40}{80} N_A = 0.5 N_A$

Molecules of $CH_4 = \frac{32}{16} N_A = 2 N_A$

Molecules of $H_2 = \frac{3}{2} N_A = 1.5 N_A$

Molecules of $N_2 = \frac{28}{28} N_A = 1 N_A$

89. Answer (4)

Hint: Mole = $\frac{\text{Given mass}}{\text{Molar mass}}$

Sol.: Mole of $H_2 = \frac{x}{2}$

Mole of $CO = \frac{2x}{28}$

$\frac{\text{Mole of } H_2}{\text{Mole of } CO} = \frac{x}{2} \times \frac{28}{2x} = \frac{7}{1}$

90. Answer (3)

Hint: One mole of H_2O contains 3 mole atoms.

Sol.: Mole of H_2O molecules = 0.5

Mole of atoms of $H_2O = 0.5 \times 3 = 1.5$

Number of atoms = $1.5 \times 6.0 \times 10^{23} = 9.0 \times 10^{23}$

[BIOLOGY]

91. Answer (1)
Sol.: – Meiosis conserve chromosomes number constant across the generations.
 – It increases genetic variability.
 – It may occur in zygote or during gamete formation or spore formation.
 – It takes place in diploid cells.
92. Answer (1)
Sol.: Lampbrush chromosomes are present in primary oocyte nuclei of vertebrates as well as invertebrates.
93. Answer (1)
Hint : In nucleolus, precursor of ribosome are formed.
Sol.: Ribosomes are related to protein synthesis. The cells which are actively involved in protein synthesis, have larger and more numerous nuclei.
94. Answer (4)
Hint : In eukaryotes, basal body exhibit 9 + 0 arrangement of microtubules like centriole.
Sol.: It is chiefly made up of tubulin proteins. Flagellin is found in flagella of prokaryotes
95. Answer (2)
Sol.: Pigment chlorophyll remain present in thylakoid not in stroma.
 Rest of the statements are correct.
96. Answer (3)
Hint : Number of generations (n) of mitosis = $(2)^n$
Sol.: $128 = (2)^n$
 $\Rightarrow n = 7$
97. Answer (1)
Sol.: Phragmoplast is formed by Golgi complex.
98. Answer (4)
Sol. : Mitosis is helpful in growth, healing and regeneration, repair and maintenance of cell size.
99. Answer (2)
Hint : Amitosis is direct cell division.
Sol.: In direct cell division, nucleus of cell elongates and gradually splits into two daughter nuclei. Therefore, spindle formation does not occur.
100. Answer (3)
Sol. : Intrameiotic interphase or interkinesis is a metabolic stage between telophase I and prophase II. During this phase centriole replicates but replication of DNA does not occur.
101. Answer (3)
Hint : The final stage of prophase I is marked by terminalisation of chiasmata.
Sol.: Final stage of prophase I is diakinesis.
102. Answer (4)
Hint : Microtubules form spindle fibres in eukaryotic cells.
Sol.: Microtubules are made up of tubulin protein.
103. Answer (3)
Hint : A pair of homologous chromosomes is called a bivalent.
Sol.: During pachytene stage bivalent becomes distinct. It consists of 4 chromatids and two centromeres.
104. Answer (3)
Hint : Site for attachment of spindle fibre is a proteinaceous disc in centromere region.
Sol.: This proteinaceous disc is called kinetochore.
105. Answer (3)
Sol.: Nucleolus is the site for r-RNA synthesis.
106. Answer (2)
Sol.: Sphaerosomes contain hydrolytic enzymes. These are found in abundance in endosperm cells of seeds, thus are believed to be plant lysosome.
107. Answer (1)
Hint : Lysosome is considered as suicidal bag of cell.
Sol.: Lysosomes are rich in hydrolytic enzymes function at acidic pH i.e., acid hydrolases.
108. Answer (1)
Hint : During cytokinesis in animal cells, cell plate is not formed.
Sol.: In animal cells, cytokinesis is achieved by furrow formation with the help of microfilaments.
109. Answer (3)
Hint : Intermediate phase between prophase and metaphase is known as transition phase.
Sol.: Given diagram shows transition to metaphase because chromosomes are going to align at metaphasic plate.
110. Answer (2)
Sol.: Genetic material (DNA) duplication takes place during S-phase (synthesis phase).

111. Answer (3)

Hint : Mitochondria, chloroplast and Golgi bodies duplicate during gap between S-phase and M-phase.

Sol.: These cell organelles duplicate during G_2 phase of interphase.

112. Answer (2)

Hint : It is preparatory phase of cell cycle.

Sol.: Interphase is preparatory phase of cell cycle known as biosynthetic phase because cell duplicates its organelles and replicates its DNA during this phase.

113. Answer (4)

Hint : Leucoplasts are related to storage of food.

Sol.: Aleuroplast is a type of leucoplast, stores protein not starch.

Rest of the statements are correct.

114. Answer (4)

Hint : Electron Transport System (ETS) takes place in the inner membrane of mitochondria.

Sol.: Oxysome is related to ATP synthesis, therefore enzymes and electron carriers for formation of ATP are present in the inner membrane of mitochondria.

115. Answer (4)

Sol.: Ribosomes attach with ER by their larger sub-unit and ribophorin.

Rest of the statements are correct.

116. Answer (2)

Sol.: Cell wall allows materials to pass freely in and out of the cell. Hence cell wall is completely permeable.

117. Answer (1)

Hint: Core of flagella is called axoneme which remain surrounded by membrane.

Sol.: Axoneme exhibit 9 + 2 arrangement of microtubules.

118. Answer (1)

Hint: TCA cycle/Krebs cycle which operates in mitochondria is part of aerobic respiration.

Sol.: TCA cycle/Krebs cycle occurs in matrix of mitochondria, therefore mitochondria is site of aerobic respiration.

119. Answer (1)

Sol.: Theodore Schwann was a British zoologist.

120. Answer (2)

Hint: Chromosomes acquire different shapes during anaphase.

Sol.: Acrocentric chromosome – J shaped

Telocentric chromosome – I shaped

In telocentric chromosomes, position of centromere is terminal.

121. Answer (3)

Sol.: In plants, Golgi apparatus is made up of unconnected units called dictyosome.

122. Answer (1)

Sol. : Intrinsic protein – Cell membrane.

Porin – It is a type of protein found in outer membrane of mitochondria.

Nexin protein – Found in eukaryotic flagella

Sedimentation – Indirect measure of coefficient density and size.

123. Answer (1)

Hint: Analogous organelles may differ in origin & structure but are similar in function.

Sol.: Mesosome is analogous to mitochondria because both are involved in respiration.

124. Answer (4)

Sol.: Outer nuclear membrane is often connected to ER.

125. Answer (3)

Sol.:

– Ribosome is the only cell organelle found in both prokaryotic and eukaryotic cell.

– Fimbriae are fine bristle like structures of bacteria, which help in attachment with substratum.

126. Answer (3)

Hint: Cell wall protects cell from mechanical injury.

Sol.: Cell growth, formation of intercellular junctions and endocytosis are functions which are related to fluid nature of cell membrane.

127. Answer (2)

Hint: RER is the site of protein synthesis.

Sol.: RER is frequently found in cells which are actively involved in protein synthesis and secretion.

128. Answer (4)

Hint: Prophase follows interphase during which DNA molecules are not distinct but intertwined.

Sol.: During prophase, condensation of chromosomal material begins.

129. Answer (3)

Hint: A meiocyte has double the number of chromosomes than its meiotic products.

Sol.: Cell A : 32 chromosomes and 60 pg DNA in G₁ phase.

After replication during S-phase

Cell A : 32 chromosomes and 120 pg DNA in G₂ phase.

130. Answer (3)

Hint: This is the phase of meiosis characterised by reduction in number of chromosomes.

Sol.: During anaphase I, homologous chromosomes separate from each other but there is no splitting of centromere.

131. Answer (1)

Hint : Double metaphasic plate is formed during metaphase I.

Sol.:

- Long lasting diplotene – Dictyotene
- Appearance of chromosomes – Spireme like a ball of wool stage
- Reduction of chromosome number – Anaphase I

132. Answer (3)

Hint : During this phase chromatids move towards the pole.

Sol.: In anaphase of mitosis, centromeres split into two.

133. Answer (4)

Hint : Gas vacuoles are non-membrane bound structures.

Sol.: Gas vacuoles are found in BGA and purple and green photosynthetic bacteria.

134. Answer (2)

Sol.: Rudolf Virchow modified cell theory and gave it final shape. Now cell theory is understood as

- (i) All living organisms are composed of cells and products of cells.
- (ii) All cells arise from pre-existing cells.

135. Answer (4)

Sol.: Anton Von Leeuwenhoek first saw and described a living cell.

136. Answer (4)

Hint: Presence of keratin makes the surface impermeable to water.

Sol.: Skin is lined by dry, keratinized epithelium.

137. Answer (3)

Hint: It is a hormone.

Sol.: Sweat, sebum and saliva are secretions of exocrine glands *i.e.* they have ducts.

138. Answer (4)

Hint: These are also called Zona occludens.

Sol.: Tight junctions occur in apical part of epithelial tissue and stop substances from leaking across the tissue.

139. Answer (2)

Hint: Loose connective tissue.

Sol.: Mast cells of areolar tissue are rich in granules of histamine, serotonin and heparin.

140. Answer (2)

Hint: These cells are enclosed in cavities called lacunae.

Sol.: Lamellae are found in bone only. Lacunae are common to both bone and cartilage.

141. Answer (3)

Hint: It belongs to category of specialised connective tissue.

Sol.: Bone helps to support weight.

142. Answer (1)

Hint: These constitute more than one half of the volume of neural tissue in our body.

Sol.: Nissl's granules are site of protein synthesis and are absent in axon part of a neuron.

143. Answer (3)

Hint: These are skeletal muscle fibres.

Sol.: Cardiac muscle fibres show branched appearance.

144. Answer (2)

Hint: Cardiac muscle fibres.

Sol.: Intercalated discs are fusion points that allow the cells to contract as a unit.

145. Answer (3)

Hint: Fusiform fibres.

Sol.: Smooth muscle fibres are involuntary fibres with cell junctions.

146. Answer (1)

Hint: Identify regions where cartilage is found.

Sol.: Elastic cartilage is present in tip of nose and outer ear joints.

147. Answer (2)

Hint: Excitability is a property of this tissue.

Sol.: Wall of blood vessels contain a layer of smooth muscle fibres which exhibit excitability and contractility.

148. Answer (4)

Hint: Tissues are organised in specific proportions and patterns to form an organ.

Sol.: All types of tissues are present in organs such as stomach, heart, lung and kidney.

149. Answer (2)

Hint: Glandular cells are specialised for secretion.

Sol.: Some of the columnar or cuboidal cells get specialised for secretion and form glandular epithelium.

150. Answer (3)

Hint: Cells of a tissue perform similar functions.

Sol.: Cells of a tissue must recognise each other to form a layer of cells.

151. Answer (3)

Hint: Upon loss of weight, the size of adipocytes decreases.

Sol.: Fat storing cells are called adipocytes. These cells increase/decrease in size depending on fat reserve.

152. Answer (2)

Hint: Column like-cells with basal nuclei are present here.

Sol.: Surface lining of stomach is composed of simple columnar epithelium.

153. Answer (3)

Hint: Defense against abrasion.

Sol.: Surfaces requiring protection are lined by multi-layered epithelium/compound epithelium.

154. Answer (2)

Hint: Identify a carbohydrate.

Sol.: DNA contains pentose sugar called deoxyribose. Peptide bond is a feature of proteins. Uridine is found in RNA. Thiamine is a vitamin.

155. Answer (4)

Hint: It is a polymer of glucose.

Sol.: Proteins (insulin and GLUT 4) are heteropolymers as are nucleic acids.

156. Answer (2)

Hint: They are components of cell membranes.

Sol.: A = water, B = proteins, C = Nucleic acids
D = Carbohydrates, E = Lipids, F = Ions

157. Answer (4)

Hint: Primary metabolites have identifiable functions in physiological processes.

Sol.: Lectin such as Concanavalin A is a secondary metabolite.

158. Answer (4)

Hint: Feedback inhibition.

Sol.: Product concentration affects activity of allosteric enzyme.

159. Answer (2)

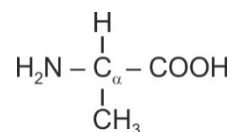
Hint: Increased amount of substrate is required to overcome the competitive inhibition.

Sol.: K_m value increases while V_{max} remains unaffected in case of competitive inhibition.

160. Answer (2)

Hint: Its side chain is a 'methyl' group.

Sol.: Tyrosine, tryptophan and phenylalanine are aromatic amino acids. Alanine has the given structure.



161. Answer (1)

Hint: Identify a nitrogenous base.

Sol.: Uridylic acid is a nucleotide of uracil.

162. Answer (4)

Hint: T, L, I, V, W, F, K and M are simple alphabetic codes of essential amino acids.

Sol.: Leucine, isoleucine, valine, tryptophan, phenylalanine, lysine and methionine are essential to man.

163. Answer (2)

Hint: α -carbon of these biomolecules usually have four different substituents.

Sol.: Glycerol is trihydroxypropane.

164. Answer (1)

Hint: Glycogen can be stored in human liver.

Sol.: Chitin is structural homopolysaccharide of N-acetylglucosamine.

165. Answer (2)

Hint: Identify a polymer of fructose.

Sol.: Inulin is obtained from roots of plants like *Dahlia*.

166. Answer (4)

Hint: Identify a sugar obtained from sugarcane.

Sol.: Reducing sugars have free aldehyde or keto group to oxidise cupric ions to cuprous form.

167. Answer (4)

Hint: Applying Chargaff's rule.

Sol.: $[A] = [T] = 30\%$, $\therefore [C] = [G] = 20\%$. Total purine and pyrimidine content is 50% each. Sugar and phosphate form the backbone in DNA.

168. Answer (2)

Hint: 'R' is represented by $-\text{CH}_2\text{OH}$.

Sol.: Serine is classified as alcoholic amino acid. Cysteine is a sulfur containing amino acid.

169. Answer (4)

Hint: Elimination of this moiety is seen during formation of glycosidic bond.

Sol.: Water is lost during formation of biomolecules by dehydration.

170. Answer (3)

Hint: Functional group is aldehyde in many sugars.

Sol.: Functional group in glycogen like sugars is aldehyde (carboxyl or carbonyl 'C' atom) and hydroxyl group.

171. Answer (4)

Hint: ATP has ribose sugar.

Sol.: Adenosine triphosphate *i.e.* ATP is found in RNA. DNA has deoxyribose.

172. Answer (3)

Hint: Cellulose is most abundant biomolecule on earth.

Sol.: β -glucose is the monomer of cellulose.

N – acetylglucosamine (NAG) is the monomer of chitin. ATP is energy currency of cell.

173. Answer (1)

Hint: Biocatalysts are enzymes.

Sol.: They are mostly proteinaceous. They work optimally at different pH. They alter the rate of the reaction but not the equilibrium constant of the reaction.

174. Answer (2)

Hint: Competitive inhibitors resemble the substrate.

Sol.: Succinate is the substrate of enzyme succinic dehydrogenase while oxaloacetate is the product formed.

175. Answer (2)

Hint: Holoenzyme is another term for conjugated proteins working as enzymes.

Sol.: Protein part of holoenzyme is called apoenzyme. Tightly bound organic cofactor is prosthetic group.

176. Answer (3)

Hint: These enzymes require water for functioning.

Sol.: Hydrolytic enzymes are classified in class III as per IUB *i.e.* hydrolases.

177. Answer (4)

Hint: Identify an inorganic cofactor.

Sol.: Zinc ions are essential as a cofactor for the proteolytic enzyme carboxypeptidase.

178. Answer (1)

Hint: This bond is a property of molecules constituting genetic material.

Sol.: DNA and RNA both serve as genetic material in organisms. Their nucleotides are linked by phosphodiester bonds.

189. Answer (2)

Hint: These are not strictly biomacromolecules.

Sol.: Lipids are not polymers. Amino acids, monosaccharides and nucleotides are monomers available for proteins, polysaccharides and nucleic acids respectively.

180. Answer (3)

Hint: This sugar is abundant in corn and grapes.

Sol.: Fructose is six carbon sugar with keto group. Ribose and deoxyribose are five carbon sugars with aldehyde group.

