All India Aakash Test Series for NEET - 2026

TEST - 1 (Code - C)

For Code-D Answers Click Here

Test Date : 25/08/2024

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

SECTION-A

1. Answer (2)

Hint: $[A]=\left[\frac{B}{\lambda^2}\right]=\left[M^0L^0T^0\right]$

Sol.: $\left[\frac{AB}{\lambda^2}\right]=\left[M^0L^0T^0\right]$

$[AB] = [M^0L^2T^0]$

2. Answer (3)

Hint & Sol.: A correct equation is both dimensionally and numerically correct.

3. Answer (3)

Hint: $\omega=\frac{d\theta}{dt}$

Sol.: $[\omega]=\left[\frac{2\pi}{T}\right]=[M^0L^0T^{-1}]$

4. Answer (2)

Hint: $[\lambda] = [L]$ and $[g] = [LT^{-2}]$

Sol.: $[LT^{-1}] = [L]^a[LT^{-2}]^b$

$LT^{-1} = L^{a+b}T^{-2b}$

Comparing power,

$b=\frac{1}{2}$ and $a=\frac{1}{2}$

5. Answer (3)

Hint: Kinetic energy = $\frac{1}{2}mv^2$

Sol.: $\frac{\Delta K}{K}=\frac{\Delta m}{m}+\frac{2\Delta v}{v}$

= 1% + 2(2%)

= 5%

6. Answer (4)

Hint & Sol.: Two different physical quantities cannot be added.

7. Answer (3)

Hint: Use principle of homogeneity

Sol.: Assertion is true but reason is false. We can check only dimensional consistency but cannot find the value of proportionality constants.

8. Answer (1)

Hint & Sol.: Trailing zero(s) in a number with a decimal point are significant.

9. Answer (3)

Hint & Sol.: The measurement taken by the instrument with minimum least count are most precise.

10. Answer (3)

Hint: $\sin(\omega t + bx)$ is dimensionless quantity

Sol.: $[b] = [L^{-1}]$

$\left[\frac{a}{b}\right]=[M^0L^0T^0]$

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

11. Answer (2)

Hint: Wavelength has same dimensions as length

Sol.: $[\lambda]=\frac{[h]}{[mv]}$

$[h] = [MLT^{-1}]\,[L]$

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

12. Answer (1)

Hint: Time to move up = time to come down = t

Sol.: The particle will be at highest point at

$t=\frac{7+3}{2}=5$ s

$v = u - gt = 0 \Rightarrow u = 10 \times 5 = 50$ m s^{-1}

13. Answer (1)

Hint: $v_{avg}=\frac{\text{total distance}}{\text{total time}}$

Sol.: $\frac{d}{\frac{d}{2\times30}+\frac{d}{2\times v}}=48$ km h^{-1}

$\frac{2\times30\times v}{v+30}=48$

$\frac{5v}{v+30}=4$

$5v = 4v + 120$

$v = 120$ km h^{-1}

14. Answer (2)

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

Sol.: $x = (t-3)^2$

$\frac{dx}{dt} = 2(t-3)$

$a = \frac{d^2x}{dt^2} = 2 \text{ m s}^{-2}$

15. Answer (3)

Hint & Sol.: At point of return, velocity should be zero and acceleration should be non-zero.

16. Answer (4)

Hint: Total time of flight $T = 2\sqrt{\frac{2H}{g}} = \sqrt{\frac{8H}{g}}$

Sol.: $\Delta T = \sqrt{\frac{8(H-h)}{g}} = \sqrt{\frac{8(40-20)}{10}} = \sqrt{\frac{8\times 20}{10}}$

= 4 second

17. Answer (3)

Hint: $H = \frac{1}{2}gt^2$

Sol.: The ball will be at maximum height at t = 2 second. The ball will hit near the base at

$20 - 10t = -40$

t = 6 second

Time to fall = (6 – 2) = 4 s

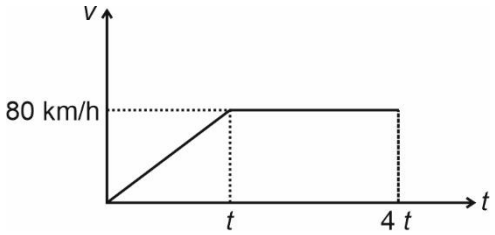
$H = \frac{1}{2}\times 10 \times 4 \times 4$

= 80 m

18. Answer (2)

Hint: $v_{avg} = \frac{\text{Total displacement}}{\text{Total time}}$

Sol.:



$v_{avg} = \frac{\frac{1}{2}\times(t)80 + 80\times 3t}{4t}$

$= \frac{40t + 240t}{4t} = \frac{280}{4}$ km/h = 70 km/h.

19. Answer (4)

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

Sol.: $100 = \frac{1}{2}\times a \times 100$

a = 2 m s^{-2}

$S_{12} = \frac{1}{2}(2)(12)^2 = 144$ m

ΔS = (144 – 100) m

= 44 m

20. Answer (2)

Hint: Both move equal distance before stopping.

Sol.: $v^2 - u^2 = 2as$

$0 - (20 \times 20) = 2 \times a \times 200$

$a = -\frac{400}{400}$

a = 1 m s^{-2}

21. Answer (4)

Hint: While calculating the distance avoid taking negative sign of area

Sol.: Displacement = (4 × 2 – 3 × 2 + 2 × 2 – 1 × 2) m

Distance = (4 × 2 + 3 × 2 + 2 × 2 + 1 × 2) m

$= \frac{\text{Displacement}}{\text{Distance}} = \frac{4}{20} = \frac{1}{5}$

22. Answer (4)

Hint: Use $v^2 - u^2 = 2as$

Sol.: $v^2 - u^2 = \frac{2as}{2}$

$v_1^2 - u^2 = 2as$

$v_1^2 - u^2 = 2(v^2 - u^2)$

$v_1^2 = 2v^2 - 2u^2 + u^2$

$v_1^2 = 2v^2 - u^2$

$v_1 = \sqrt{2v^2 - u^2}$

23. Answer (4)

Hint: Slope of position – time graph is velocity

Sol.: Velocity is negative and constant till 0 to mid of t_1 and t_2. Velocity is positive from mid of t_1 and t_2 to t_3.

24. Answer (4)

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

Sol.: $\frac{dx}{dt} = 2t - 8 = 0$

$t = 4$ s

$x = (4^2 - 8 \times 4 + 8)$ m

$= (16 - 32 + 8)$ m

$= -8$ m

25. Answer (3)

Hint: At both times t_1 and t_2 the velocity is in opposite direction.

Sol.: $v = u - gt_1$ ....(1)

$-v = u - gt_2$ ...(2)

From (1) and (2),

$u - gt_1 = -u + gt_2$

$2u = gt_1 + gt_2$

$\frac{2u}{g} - t_1 = t_2$

26. Answer (2)

Hint: Use $v^2 - u^2 = 2as$

Sol.: $v^2 = 2g(H - h)$ is a parabola

$v^2 = 2gH - 2gh$

27. Answer (4)

Hint & Sol.: Average velocity $(\bar{v}) = \frac{\text{Total displacement}}{\text{Total time}}$

Average speed $(v_{avg}) = \frac{\text{Total distance}}{\text{Total time}}$

$v_{avg} \geq \bar{v}$, as total distance $\geq$ total displacement

28. Answer (3)

Hint & Sol.: $\vec{a} = \frac{d\vec{v}}{dt}$ = slope of velocity-time graph

29. Answer (2)

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

Sol.: $t = \frac{u}{a}$

$= \frac{10}{2}$

$= 5$ s

$d_1 = 10 \times 5 - \frac{1}{2} \times 2 \times 5^2$

$= 50 - 25 = 25$

$d_2 = 10 \times 4 - \frac{1}{2} \times 2 \times 4^2$

$= 24$ m

$d = d_1 - d_2$

$= 25 - 24 = 1$ m

30. Answer (3)

Hint: Solve it from the frame of car

Sol.: $l = \frac{1}{2}(g + a)t^2$

$3 = \frac{1}{2} \times 15t^2$

$\frac{6}{15} = t^2$

$0.4 = t^2$

$t = \sqrt{0.4}$ s

31. Answer (3)

Hint: Least count of screw gauge is pitch divided by number of division on circular scale

Sol.: Reading = main scale reading + n(L.C)

$= 1$ mm $+ 52\ (0.01)$ mm

$= 1.52$ mm

$= 0.152$ cm

32. Answer (2)

Hint: Use principle of homogeneity

Sol.: $[B] = [L]^{\frac{1}{2}}$

$[A] = \left[\frac{ML^2T^{-2}}{[L]^{\frac{1}{2}}}\right]$

$\left[\frac{A}{B^2}\right] = \left[\frac{ML^2T^{-2}}{L^{\frac{1}{2}}L}\right]$

$\left[\frac{A}{B^2}\right] = \left[ML^{\frac{1}{2}}T^{-2}\right]$

33. Answer (2)

Hint: Angular displacement is a dimensionless quantity

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

34. Answer (3)

Hint: Use $n_1u_1 = n_2u_2$

Sol.: 1.5 g cm$^{-3} = n_2\ (100$ g$)\ (10$ cm$)^{-3}$

1.5 g cm$^{-3} = n_2\ 100 \times 10^{-3}$ g cm^{-3}

$15 = n_2$

35. Answer (4)

Hint: Slope of position-time graph is equal to velocity

Sol.: $\frac{v_B}{v_A}=\frac{\tan\theta_B}{\tan\theta_A}=\frac{\tan 60^\circ}{\tan 30^\circ}=3$

SECTION - B

36. Answer (3)

Hint: Use concept of relative velocity

Sol.: $v_p=\frac{d}{6}$, where d is distance

$v_e=\frac{d}{8}$

Time taken by Preeti to walk down on escalator moving up

$t=\frac{d}{v_p-v_e}=\frac{d}{\frac{d}{6}-\frac{d}{8}}$

$=\frac{d\times 48}{8d-6d}=24$ s

37. Answer (3)

Hint & Sol.: The free fall is a case of uniform acceleration (g = 9.8 m s^{-2})

38. Answer (3)

Hint: The speed of person in train is his velocity with respect to train

Sol.: $|\vec{v}_{P\cdot A}|=|\vec{V}_P-\vec{V}_A|=3.6$ km/h = 1 m s^{-1}

$|\vec{v}_A|=36$ km/h $=\frac{36\times 5}{18}=10$ m s^{-1}

$|\vec{v}_B|=54$ km/h $=\frac{54\times 5}{18}=15$ m s^{-1}

$\vec{V}_{P\cdot A}=|\vec{V}_P-\vec{V}_A|=1$ m s^{-1}

$|\vec{V}_P|=|\vec{V}_{PA}+\vec{V}_A|=9$ m s^{-1}

$|\vec{V}_{PB}|=|\vec{V}_P-\vec{V}_B|=(9+15)$ m s^{-1}

= 24 m s^{-1}

$|\vec{V}_{AB}|=|\vec{V}_A-\vec{V}_B|=25$ m s^{-1}

39. Answer (3)

Hint: Slope of position-time graph gives velocity

Sol.: The slope of $x-t$ graph decreases with time that means velocity decreases hence acceleration is negative.

40. Answer (1)

Hint : L.C. = 1 MSD – 1 VSD

Sol.: 12 VSD = 8 MSD

1 VSD $=\frac{8}{12}$ MSD

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

L.C. = 1 MSD $-\frac{2}{3}$ MSD

$=\frac{1}{3}$ MSD

$=\frac{1}{3}$ mm

41. Answer (2)

Hint: Use $L\propto (F)^a(v)^b(M)^c$

Sol.: [F] = [MLT^{-2}]

[v] = [LT^{-1}]

[M] = [M]

[L] = [MLT^{-2}]^a [LT^{-1}]^b [M]^c

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

$a+c=0\Rightarrow a=-c$

$a+b=1$ …(i)

$-2a-b=0$

$b=-2a$ …(ii)

From (i) and (ii),

$a=-1$

$c=1$

$b=+2$

$L\propto [F^{-1}v^2M^1]$

42. Answer (1)

Hint: Pascal is a unit of pressure

Sol.: $\left[\frac{\text{pascal second}}{\text{meter}^3}\right]=\left[\frac{MLT^{-2}}{L^2}\times\frac{T}{L^3}\right]$

= [ML^{-4}T^{-1}]

43. Answer (2)

Hint: Density $=\frac{\text{Mass}}{\text{Volume}}=\frac{m}{\pi r^2 L}$

Sol.: $\frac{\Delta d}{d}=\frac{\Delta m}{m}+\frac{2\Delta r}{r}+\frac{\Delta L}{L}$

$\left(\frac{\Delta d}{d}\%\right)=\left[\frac{0.003}{0.6}+\frac{0.005\times 2}{0.5}+\frac{0.04}{4}\right]\times 100$

$=\left[\frac{1}{2}+2+1\right]=3.5\%$

44. Answer (1)

Hint: Use $n_1u_1=n_2u_2$

Sol.: 1 N m = n_1 dyne cm

$1\times 10^5\times 10^2$ dyne cm = n_1 dyne cm

$10^7=n_1$

45. Answer (3)

Hint: Dimensions of Planck's constant (h) are $[ML^2T^{-1}]$

Sol.: $h = p^a q^b$

$[ML^2T^{-1}] = [MLT^{-1}]^a [L]^b$

$\Rightarrow a = 1, a + b = 2 \Rightarrow b = 1$

$[h] = [pq]$

46. Answer (3)

Hint: Use relationship between different physical quantities

Sol.: $[G] = \frac{[MLT^{-2}][L^2]}{[M^{+2}]} = [M^{-1}L^3T^{-2}]$

$[\Delta P] = [MLT^{-1}]$

$[\text{Power}] = \left[\frac{\text{Work}}{\text{Time}}\right] = \left[\frac{ML^2T^{-2}}{T}\right] = [ML^2T^{-3}]$

$\left[\begin{matrix}\text{Electrical}\\ \text{resistance}\end{matrix}\right] = \frac{[\text{Power}]}{[\text{Current}]^2} = [ML^2T^{-3}A^{-2}]$

47. Answer (4)

Hint: $\frac{\Delta KE}{KE} = \pm\left(\frac{\Delta m}{m} + \frac{2\Delta v}{v}\right)$

Sol.: $\frac{\Delta KE}{KE} = \pm\left[\frac{0.2}{2} + \frac{0.2}{10} \times 2\right]$

$= \pm [0.1 + 0.04]$

$= \pm [0.14]$

$KE = \frac{1}{2} \times 2 \times 10 \times 10 = 100 \text{ J}$

$\Delta KE = \pm 14 \text{ J}$

$KE = [100 \pm 14] \text{ J}$

48. Answer (4)

Hint: $x = \frac{dv}{dt}$

Sol.: $v = (x)^{\frac{1}{4}}$

$\frac{dx}{dt} = (x)^{\frac{1}{4}}$

$\int_0^x \frac{dx}{x^{\left(\frac{1}{4}\right)}} = \int_0^t dt$

$\frac{(x)^{-\frac{1}{4}+1}}{-\frac{1}{4}+1} = t$

$\frac{(x)^{+\frac{3}{4}}}{\frac{3}{4}} = t$

$\frac{4}{3}(x)^{\frac{3}{4}} = t \Rightarrow x \propto t^{\frac{4}{3}}$

49. Answer (2)

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

Sol.: $\frac{v}{50} = \frac{50}{100} \Rightarrow v = 25 \text{ m s}^{-1}$

$a = (25)\left(\frac{50}{100}\right) = 12.5 \text{ m s}^{-2}$

50. Answer (3)

Hint & Sol.: Total time $20 = \frac{1}{2} \times 10 \times t^2$

$t = 2$ second

Time taken to cover first half

$10 = \frac{1}{2} \times 10 t_1^2$

$t_1 = \sqrt{2}$ s

Time taken to cover second half

$t_2 = \left(2 - \sqrt{2}\right)$ s

Ratio = $= \frac{\sqrt{2}}{2 - \sqrt{2}}$

$= \frac{1}{\sqrt{2} - 1}$

[CHEMISTRY]

SECTION - A

51. Answer (3)

Hint: ${}_{19}K = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

Sol.: For $4s^1 \Rightarrow$

$n = 4, l = 0, m = 0 \ \ s = +\frac{1}{2} / -\frac{1}{2}$

52. Answer (1)

Hint: Orbital angular momentum = $\sqrt{l(l+1)}\frac{h}{2\pi}$

Sol.: For $3p$ orbital, $l = 1$

$\therefore \sqrt{l(l+1)}\frac{h}{2\pi} = \sqrt{1(1+1)}\frac{h}{2\pi} = \frac{h}{\sqrt{2}\pi}$

53. Answer (2)

Hint: For multielectronic species, higher the (n + l) value, higher is the energy of orbital. If (n + l) value is same for two orbitals then orbital with higher n value will have high energy.

Sol.: $4d = 4 + 2 = 6$

$5s = 5 + 0 = 5$

$5p = 5 + 1 = 6$

$4f = 4 + 3 = 7$

So, increasing order of energy is

$5s < 4d < 5p < 4f$

54. Answer (3)

Hint: Radial node = n – l – 1

Angular node = l

Sol.:

Orbital	Angular node	Radial node
3*s*	0	3 – 0 – 1 = 2
3*p*	1	3 – 1 – 1 = 1
2*p*	1	2 – 1 – 1 = 0
1*s*	0	1 – 0 – 1 = 0

55. Answer (2)

Hint: $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$

Sol.: 1 mol of C_4H_8 produces 4 mol of CO_2

$\therefore \frac{5.6\times10^3}{56}$ mol of $C_4H_8 \equiv 4\times\frac{5.6}{56}\times10^3$

= 400 mol of CO_2

$\therefore$ Volume of CO_2 = 400 × 22.4

= 8960 L

56. Answer (4)

Hint: Empirical formula represents the ratio of the elements present in the compound.

Sol.:

Element	% by mass	Mole	Minimum ratio
C	75	75/12 = 6.25	6.25/6.25 = 1
H	25	25/1 = 25	25/6.25 = 4

$\therefore$ Empirical formula = CH_4

57. Answer (2)

Hint: 1 mol of $CaCO_3$ is neutralised by 2 mol of HCl

Sol.: Moles of HCl = M × V

$= \frac{0.1\times100}{1000} = 0.01\,\text{mol}$

Moles of $CaCO_3$ (100% pure) required = $\frac{0.01}{2}$ mol

Mass of $CaCO_3$ (100% pure) required = $\left(\frac{0.01}{2}\times100\right)$ g

$\Rightarrow$ 0.5 g

Mass of 80% pure $CaCO_3$ required = $\frac{100\times0.5}{80} = 0.625$ g

58. Answer (4)

Hint: Number of atoms = Moles × N_A × atomicity

Sol.: 7 g of nitrogen gas = $\frac{7}{28}\times N_A\times2$

$\Rightarrow 0.5\ N_A$

34 g of ammonia gas = $\frac{34}{17}\times N_A\times4$

$= 8\ N_A$

1.6 g of oxygen gas = $\frac{1.6}{32}\times N_A\times2$

$\Rightarrow 0.1\ N_A$

2 g of hydrogen gas = $\frac{2}{2}\times N_A\times2$

$= 2\ N_A$

59. Answer (3)

Hint: Total number of neutrons in a heavy water molecule and in a water molecule are 10 and 8 respectively.

Total number of neutrons = moles × N_A × number of neutrons in one molecule

Sol.: Number of neutrons in D_2O : Number of neutrons in H_2O

$= \frac{4}{20}\times N_A\times10 : \frac{3.6}{18}\times N_A\times8$

= 5 : 4

60. Answer (3)

Hint: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

2 mol of hydrogen gas reacts with 1 mol of oxygen

Sol.: 4 g of hydrogen $\equiv$ 32 g of oxygen

$\therefore$ 8 g of hydrogen $\equiv$ 64 g of oxygen

Available oxygen = 32 g

So, oxygen is the limiting reagent.

Left amount of hydrogen = Available H_2 – consumed H_2

$\Rightarrow$ 8 – 4 = 4 g

$= \frac{4}{2} = 2$ mol hydrogen

= 44.8 L at STP

61. Answer (3)

Hint: Zeros at the end or right of a number are significant provided they are on right side of the decimal point.

Sol.:

- Avogadro number (6.022×10^{23}) has four significant figures.
- All non-zero digits are significant.
- Zeros between two non-zero digits are significant.
- Exact numbers of objects have infinite significant figures.

62. Answer (2)

Hint: Molarity = $\frac{\text{moles of solute}}{\text{volume of solution (L)}}$

Sol.: Moles of solute = Molarity × Volume

$= \frac{1 \times 250}{1000} \Rightarrow 0.25$ mol.

Mass of solute $\Rightarrow 0.25 \times 60 \Rightarrow 15.0$ g

63. Answer (4)

Hint:

$$\chi_{solvent} = \frac{\text{Moles of solvent}}{\text{Total number of moles of solution}}$$

Sol.: For 1 molal aqueous solution,

1 mol of solute is present in 1 kg of solvent (water)

$$\chi_{solvent} = \frac{1000/18}{\frac{1000}{18}+1} \Rightarrow \frac{55.56}{56.56} = 0.98$$

64. Answer (4)

Hint: Number of atoms in a given gas depends on its moles as well as atomicity.

Sol.:

- Number of atoms in a gas = Moles × N_A × atomicity

  So, equal number of moles of different gases contain same number of atoms if their atomicities are also same.
- According to Avogadro's law, "under same conditions to temperature and pressure, equal volumes of different gases contain equal number of molecules.

65. Answer (1)

Hint: Volume changes with change in temperature.

Sol.: Mole fraction is the ratio of moles of a given component of the mixture to the total number of moles of mixture. So, it is a unitless quantity and does not depend on temperature.

Molality is the number of moles of solute present in 1 kg of solvent. So, it does not depend on temperature.

66. Answer (2)

Hint & Sol.:

	Series	Spectral region
1.	Lyman	Ultraviolet
2.	Paschen	Infrared
3.	Brackett	Infrared
4.	Pfund	Infrared

67. Answer (4)

Hint: % of Fe in haemoglobin molecule = $\frac{\text{Mass of iron is one molecule}}{\text{Molecular mass of haemoglobin}}$

Sol.: Atomic mass of iron = 56 u

$\therefore$ Mass of 4 atoms of iron = (56 × 4) u

% of Fe in haemoglobin molecule = 0.334

$$= \frac{56 \times 4}{\text{Molecular mass of haemoglobin}} \times 100$$

$\therefore$ Molecular mass of haemoglobin = $\frac{56 \times 4 \times 100}{0.334}$

= 67065.8 u

68. Answer (1)

Hint: According to law of conservation of mass, mass can neither be created nor be destroyed in a chemical reaction.

Sol.: $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$

100 g = 56 g + 44 g

69. Answer (4)

Hint: As per law of definite proportions, a given compound always contains exactly the same proportion of elements by weight.

Sol.: If two elements combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element are in the ratio of small whole number as per law of multiple proportions so, CO_2 and CS_2 do not follow law of multiple proportions.

- $2H_2(g) + O_2(g) \rightarrow 2H_2O$
  $2\,L \quad 1\,L$

According to Gay Lussac' s law of combining volume, 2 volume of H_2 combines with 1 volume of O_2 to give 2 volume of water.

70. Answer (3)

Hint: Principal quantum number tells about energy and size of orbital.

Sol.:

1. Principal quantum number – Size and energy of orbital
2. Azimuthal quantum number – Shape of orbital
3. Magnetic quantum number – Total number of orbitals in subshell
4. Spin quantum number – Spin of an electron

71. Answer (2)

Hint: Volume = $\frac{\text{Mass}}{\text{Density}}$

Sol.: Mass of 6×10^{23} molecules of water = Molar mass

= 18 g/mole

$\therefore$ Mass of 1 molecule of water = $\frac{18}{6\times10^{23}}$

$= 3 \times 10^{-23}$ g

Volume = $\frac{3\times10^{-23}}{1} = 3\times10^{-23}$ cm^3

72. Answer (4)

Hint: Chromium and copper have exceptional electronic configuration.

Sol.: $_{29}Cu = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$

$_{24}Cr = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

$_{25}Mn = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^2$

$_{26}Fe = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$

Element	Unpaired electron(s)
Cu	1
Mn	5
Cr	6
Fe	4

73. Answer (3)

Hint: Formula mass term is used for ionic compounds like NaCl.

Sol.:

- Mass of one hydrogen atom = $\frac{1.008}{6.022\times10^{23}}$

  $= 1.67 \times 10^{-24}$ g

- CCl_4 is a covalent compound and formula unit mass term is not applicable for it.

74. Answer (4)

Hint: Number of atoms = Moles × N_A × Atomicity

Sol.: Let mass of each of S_2 and S_8 taken be x g

S_2	S_8
Moles = $\frac{x}{32\times2}$	$\frac{x}{32\times8}$
Molecules = $\frac{x}{32\times2}\times N_A$	$\frac{x}{32\times8}\times N_A$

Let mass of each O_2 and O_3 taken be x g

Number of atoms in O_2 molecule $= \frac{x}{16\times2}N_A\times2 = \frac{x}{16}N_A$

Number of atoms in O_3 molecule $= \frac{x}{16\times3}N_A\times3 = \frac{x}{16}N_A$

75. Answer (2)

Hint: $E = nh\nu$

Sol.: $E = 6.02 \times 10^{23} \times 6.6 \times 10^{-34} \times 2 \times 10^{12}$

$= 79.5 \times 10 = 795$ J $= 0.795$ kJ

$= 0.8$ kJ

76. Answer (4)

Hint & Sol.: Wave nature of light does not justify

i. Black body radiation

ii. Photoelectric effect

iii. Variation of heat capacity of solids as a function of temperature

iv. Line spectra of hydrogen atoms.

77. Answer (3)

Hint: Angular momentum of electron = $m_e vr$

Sol.: $m_e vr = n\cdot\frac{h}{2\pi}$

Angular momentum of an electron is quantised

78. Answer (1)

Hint: The species which have same number of electrons are known as isoelectronic species

Sol.:

Species	Number of electrons
O^{2-}	10
Ne	10
Na^{+}	10
S^{2-}	18
Ar	18
Ca^{2+}	18
Sc^{3+}	18
K^{+}	18
Cl^{-}	18
P^{3-}	18
Mg^{2+}	10

79. Answer (4)

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

Sol.: $\lambda = \frac{6.6\times10^{-34}}{0.33\times5\times10^{3}} = 4\times10^{-37}$ m

80. Answer (4)

Hint:

Orbital	l value
s	0
p	1
d	2
f	3

Sol.:

	Orbitals	(n + l) value
a.	4*f*	4 + 3 = 7
b.	5*p*	5 + 1 = 6
c.	3*d*	3 + 2 = 5
d.	4*s*	4 + 0 = 4

81. Answer (3)

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

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

$\Delta v = \frac{0.010\times2\times10^{3}}{100} = 0.2$

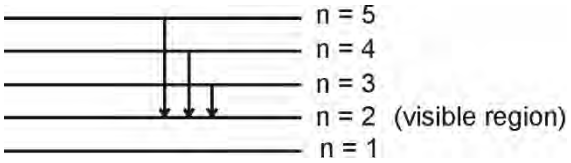
$\therefore \Delta x = \frac{6.6\times10^{-34}}{4\times3.14\times9\times10^{-31}\times0.2}$

3×10^{-4} m

82. Answer (3)

Hint: For visible region, n $\Rightarrow$ 2

Sol.:



83. Answer (3)

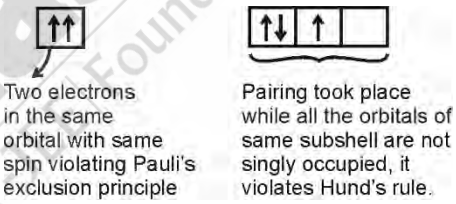
Hint & Sol.: Maximum number of orbitals in a subshell = (2l + 1)

- It ranges from $-\ell$ to $+\ell$.
- Number of orbitals in n^{th} shell = n^2

84. Answer (3)

Hint: According to Pauli's exclusion principle, in an orbital no two electrons can have the same set of all four quantum numbers.

Sol.: As per Hunds rule, pairing of electrons occurs in a subshell when all the orbitals are singly occupied.



85. Answer (2)

Hint: $\lambda = \frac{h}{\sqrt{2m\,KE}}$

Sol.: $\lambda_1 = \frac{h}{\sqrt{2m_1\,KE_1}} = \frac{h}{\sqrt{2\times2\times1}}$

$\lambda_2 = \frac{h}{\sqrt{2m_2KE_2}} = \frac{h}{\sqrt{2\times1\times9}}$

$\therefore \frac{\lambda_1}{\lambda_2} = \sqrt{\frac{2\times9}{2\times2}} = \frac{3}{\sqrt{2}}$

SECTION - B

86. Answer (2)

Hint: Precision refers to the closeness to various measurements for the same quantity.

Sol.: Accuracy is the agreement of a particular value to the true value of the results.

87. Answer (3)

Hint: Average atomic mass

$= \frac{(\text{Abundance proportion of } {}_{10}E \times 10) + (\text{Abundance proportion of } {}_{11}E \times 11)}{\text{Sum of proportion}}$

Sol.: Average atomic mass = $\frac{(1\times 10)+(4\times 11)}{1+4}$

$= \frac{54}{5} \Rightarrow 10.8$ u

88. Answer (2)

Hint: Molarity = $\frac{\text{moles of solute}}{\text{volume of solution}(L)}$

Sol.: Moles of ethanol required = 0.5 × 2

= 1 mol

Mass of ethanol = 1 × 46 = 46 g

Density = $\frac{\text{mass}}{\text{volume}}$

$\therefore$ Volume = $\frac{\text{mass}}{\text{density}} = \frac{46\text{ g}}{(0.46\times 10^3)\text{g/L}}$

= 0.1 L $\Rightarrow$ 100 mL

89. Answer (4)

Hint: NaOH + HCl $\rightarrow$ NaCl + H_2O

Sol.: Moles of HCl = $\left(\frac{50\times 0.25}{1000}\right) = 0.0125$ mol

$\Rightarrow$ 1 mol of HCl (36.5 g) reacts with 1 mol of NaOH (40 g)

$\therefore$ 0.0125 mol of HCl will react with = 40 × 0.0125

= 0.5 g

Remaining amount of NaOH = 2.0 – 0.5

= 1.5 g

90. Answer (3)

Hint: Molality = $\frac{\text{moles of solute}}{\text{mass of solvent}(kg)}$

Sol.: 18 g glucose in 180 g water

$\frac{18/180}{180}\times 1000 = \frac{5}{9}$ m

34.2 g sucrose in 360 g water

$\frac{34.2/342}{360}\times 1000 = \frac{5}{18}$ m

5.85 g NaCl in 18 g water

$\frac{5.85/58.5}{18}\times 1000 = \frac{50}{9}$ m

5.6 g CaO in 36 g water

$\frac{5.6/56}{36}\times 1000 \Rightarrow \frac{25}{9}$ m

91. Answer (2)

Hint: No. of molecules = $\frac{\text{Given mass}}{\text{Molar mass}}\times N_A$

Sol.: Molecules of CO_2 in 440 g = $\frac{440}{44}\times N_A$

$\Rightarrow 10\ N_A$

Molecules of CO_2 in 4 moles = $4N_A$ (left)

As per the question,

$10\ N_A - x = 4\ N_A$

$\therefore x = 6\ N_A$ molecules

1 CO_2 molecule $\equiv$ 2 oxygen atoms

$\therefore$ 6 N_A CO_2 molecules $\equiv$ 12 N_A molecules = 12 × 6 × 10^{23}

= 7.2 × 10^{24} oxygen atoms

92. Answer (1)

Hint: Moles of gas = $\frac{\text{Given mass}}{\text{Molar mass}}$

Sol.: Let the masses of He and O_2 be x g and 8 x g respectively

Moles of He = $\frac{x}{4}$

Moles of O_2 = $\frac{8x}{32} = \frac{x}{4}$

Molar ratio = $\frac{x}{4} : \frac{x}{4} = 1:1$

93. Answer (3)

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

Sol.: Let the mass of solvent be 1 kg

$0.2 = \frac{n_{(\text{urea})}}{1}$

$\therefore$ moles of urea = 0.2

& mass of urea = 0.2 × 60 = 12 g

If mass of solvent is 1 kg (1000 g) & mass of solute is 12 g then mass of solution = 1012 g.

1012 g urea solution contains 12 g urea

$\therefore$ 2000 g urea (2 kg) solution contains =

= $\frac{12}{1012}\times 2000$

= 23.71 g urea

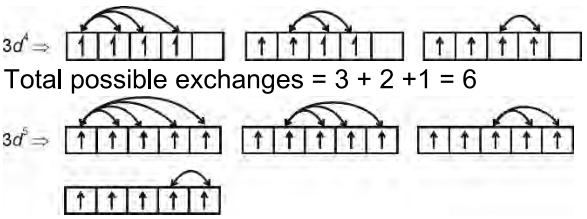
94. Answer (3)

Hint: For electromagnetic radiations, $E \propto \frac{1}{\lambda}$

Sol.: The energy of γ-rays is higher than that of X-rays and hence wavelength of γ-rays is less than that of X-rays.

95. Answer (2)

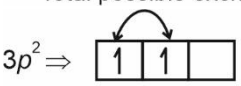
Hint & Sol.:



Total possible exchanges = 3 + 2 +1 = 6

Total possible exchanges $\Rightarrow$ 4 + 3 + 2 + 1 =10

Total possible exchanges = 3



Total possible exchanges = 1

96. Answer (2)

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

Sol.: For 1st line in Lyman series,

$$\frac{1}{\lambda_1} = R_H\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = \frac{3R_H}{4}$$

$$\lambda_1 = \frac{4}{3R_H}$$

For 2nd line of Balmer series,

$$\frac{1}{\lambda_2} = R_H\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = R_H\left(\frac{1}{4} - \frac{1}{16}\right) \Rightarrow \frac{3R_H}{16}$$

$$\lambda_2 = \frac{16}{3R_H}$$

$$\therefore \frac{\lambda_1}{\lambda_2} = \frac{4}{3R_H} \times \frac{3R_H}{16} \Rightarrow \frac{1}{4}$$

97. Answer (2)

Hint & Sol.: The splitting of spectral lines in the presence of magnetic field is called 'Zeeman effect'.

The splitting of spectral lines in the presence of electric field is called 'Stark effect'.

98. Answer (4)

Hint: For hydrogen atom, energy of orbital depends only on the value of n.

Sol.: The order of energy of the given transition is

$5p \rightarrow 1s > 5s \rightarrow 2p > 5d \rightarrow 3p = 5f \rightarrow 3d$

99. Answer (4)

Hint: $h\nu = h\nu_0 + \frac{1}{2}m_e v^2$

Sol.:

- There is no time lag between striking of light and ejection of photoelectrons.
- Number of photoelectrons ejected depends on intensity of light.
- Kinetic energy of photoelectrons ejected depends on frequency of light.

$\therefore$ 4 = 2 + K.E $\Rightarrow \therefore$ KE = 2 eV = 2 × 1.6 × 10^{-19} J

100. Answer (4)

Hint & Sol.: d-orbitals have double dumb-bell shape except d_{z^2} which has baby soother like shape.

[BOTANY]

SECTION-A

101. Answer (2)

Hint: '*Omnis cellula-e cellula*' means new cells are formed from pre-existing cells.

Sol.: Rudolf Virchow modified the hypothesis of Schleiden and Schwann to give the cell theory a final shape by adding the statement '*Omnis cellula-e cellula*'. The cell theory is applicable for living cells only.

102. Answer (4)

Hint: Mitochondria are involved in the production of ATP through oxidative phosphorylation. Stroma of chloroplast is the site of dark reaction.

Sol.: Like mitochondria, the chloroplasts are also double membrane bound. Out of the two, the inner chloroplast membrane is relatively less permeable than the outer membrane.

103. Answer (1)

Hint: Cells perform the essential functions of life.

Sol.: Anything less than a complete structure of a cell does not ensure independent living. Hence, cell is the fundamental structural and functional unit of all living organisms.

104. Answer (1)

Hint: DNA replication occurs in the nucleus. Protein synthesis occurs in the cytoplasm.

Sol.: The nuclear envelope consists of two parallel membranes with a space between, called the perinuclear space.

105. Answer (2)

Hint: The scientist who proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells was a British Zoologist.

Sol.: Schwann proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells.

106. Answer (4)

Hint: The given diagram represents the internal structure of eukaryotic flagella.

Sol.: In the given diagram, the labelled parts I, II, III and IV are Peripheral microtubule, Central microtubule, Radial spoke and Central sheath respectively.

107. Answer (4)

Hint: Cytoplasm is the main arena of cellular activities.

Sol.: Chromosomes contain the genetic material, DNA. Centrioles are non-membrane bound structures. Vacuoles contain water, sap, excretory product and other materials not useful for the cell.

108. Answer (1)

Hint: The centrioles form the basal body of cilia or flagella.

Sol.: The central part of the proximal region of the centriole is proteinaceous and called the hub, which is connected with tubules of the peripheral triplets by radial spokes made of protein.

109. Answer (1)

Hint: Mycoplasma, a prokaryote, is the smallest cell known.

Sol.: Cell wall is absent in mycoplasma. They have 70S ribosomes and DNA as genetic material. They have the machinery to synthesize the ATP.

110. Answer (2)

Hint: The two arms of submetacentric chromosome and acrocentric chromosome are said to be p arm and q arm.

Sol.: p and q arms of a chromosome are differentiated on the basis of their difference in the lengths.

111. Answer (2)

Hint: Nerve cells are long and branched.

Sol.: Human red blood cells are round and biconcave. Mesophyll cells are round and oval. White blood cells are amoeboid.

112. Answer (3)

Hint: Light reaction of photosynthesis occurs in thylakoids of chloroplast.

Sol.: The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrates and proteins.

113. Answer (3)

Hint: Mycoplasma is a prokaryotic organism.

Sol.: Mycoplasma lacks cell wall. Since it is prokaryotic organism, its genetic material remains free in the cytoplasm, *i.e.*, not enveloped by nuclear membrane. Mycoplasma has 70S ribosomes in cytoplasm and animal cell has 70S ribosomes in mitochondria. The subunits of these ribosomes are 50S and 30S.

114. Answer (3)

Hint: Glycocalyx differs in the composition and thickness among different bacteria.

Sol.: The outermost layer of cell envelope in bacteria, *i.e.*, glycocalyx could be a loose sheath called the slime layer in some, while in others, it may be thick and tough, called the capsule.

115. Answer (4)

Hint: Mesosomes increase the surface area of the plasma membrane and help in cell wall formation, DNA replication and distribution to daughter cells.

Sol.: Mesosomes also help in respiration. These are found in prokaryotes and in prokaryotes, except for ribosomes, other cell organelles are absent.

116. Answer (2)

Hint: The cell organelle that can occupy upto 90 percent of the volume of the cell in plants is bound by tonoplast.

Sol.: In plant cells, vacuole can occupy upto 90 percent of the volume of the cell. The concentration of ions and other materials is significantly higher than in the cytoplasm.

117. Answer (3)

Hint: Bacterial flagella have three parts – filament, hook and basal body.

Sol.: Pili are involved in the mating process. Eukaryotic flagella are membrane-bound extensions of plasma membrane. Fimbriae are small bristle like fibres help to attach with host tissues.

118. Answer (3)

Hint: Prokaryotes have 70S ribosomes.

Sol.: In prokaryotes, ribosomes are associated with the plasma membrane of the cell and the ribosomes are the site of protein synthesis. The subunits of the ribosomes found in prokaryotes are 50S and 30S.

119. Answer (4)

Hint: Some cell organelles are not coordinated with the components of endomembrane system,

and thus they are not considered as a part of this system.

Sol.: The endomembrane system includes endoplasmic reticulum, Golgi complex, lysosomes and vacuoles. Peroxisomes are not included in this system.

120. Answer (3)

Hint: Several ribosomes may attach to a single mRNA and form a chain called polyribosomes or polysome.

Sol.: Ribosomes are made up of ribosomal RNA and proteins. Therefore, a polysome is said to have mRNA, ribosomal RNA and proteins.

121. Answer (3)

Hint: The lipids are arranged within the cell membrane with the polar head towards the outer sides and the hydrophobic tails towards the inner part.

Sol.: The ratio of protein and lipid varies considerably in different cell types. In human beings, the membrane of the erythrocyte has approximately 52 percent protein and 40 percent lipids.

In addition to phospholipids, membrane also contains cholesterol.

122. Answer (1)

Hint: Microtubules are cytoskeleton and centromere hold the two chromatids of a chromosome together.

Sol.: Animal cells have centrioles which are absent in almost all plant cells. Spindle fibres are formed during cell division in animal cells as well as plant cells.

123. Answer (3)

Hint: The middle lamella is a layer mainly of calcium pectate present between cell walls of two neibhouring plant cells.

Sol.: The middle lamella in plants holds or glues the different neighbouring cells together.

124. Answer (3)

Hint: In the given diagram, the labelled structures A, B, C and D, respectively are RER, nucleolus, Golgi complex and mitochondrion.

Sol.: Ribosomes on RER translate mRNA into proteins. Nucleolus is a site for active ribosomal RNA (rRNA) synthesis.

125. Answer (4)

Hint: The major lipids in the cell membrane are complex lipids.

Sol.: The major lipids in the cell membrane are phospholipids that are arranged in a bilayer.

126. Answer (2)

Hint: Chromatophores are membranous extensions into the cell of some prokaryotes.

Sol.: Chromatophores have photosynthetic pigments and the membrane has lipids and proteins similar to that of plasma membrane. These are found in photosynthetic prokaryotes, like cyanobacteria and purple bacteria.

127. Answer (3)

Hint: The ability of movement of proteins within the membrane is measured as its fluidity.

Sol.: An improved model of the structure of cell membrane was proposed by Singer and Nicolson widely accepted as fluid mosaic model. According to this, the quasi-fluid nature of lipid enables lateral movement of proteins within the overall bilayer.

128. Answer (4)

Hint: Cell wall gives shape to the cell and protects the cell from mechanical damage and infection. It also helps in cell-to-cell interaction and provides barrier to undesirable macromolecules.

Sol.: In a young plant cell, the primary cell wall is capable of growth, which gradually diminishes as the cell matures.

129. Answer (1)

Hint: Inclusion bodies in prokaryotes are reserve materials stored in the cytoplasm.

Sol.: Ribosomes are the granular structures first observed under the electron microscope as dense particles by George Palade. These structures are also called Palade particles. These are not the inclusion bodies.

130. Answer (2)

Hint: The cell wall and middle lamellae in plants are traversed by a living component of the cell.

Sol.: The cell wall and middle lamellae may be traversed by plasmodesmata which connect the cytoplasm of neighbouring cells.

131. Answer (4)

Hint: Centrosome is a non-membrane bound cell organelle found in cytoplasm of animal cells and some lower plant cells.

Sol.: Centrosome is an organelle usually containing two cylindrical structures called centrioles. Both the centrioles in a centrosome lie perpendicular to each other.

132. Answer (4)

Hint: Rough endoplasmic reticulum is extensive and continuous with the outer membrane of the nucleus.

Sol.: Rough endoplasmic reticulum bears ribosomes on its surface. They give rise to smooth

endoplasmic reticulum which is responsible for detoxification of drugs.

Golgi complex is involved in the formation of plasma membrane during cytokinesis.

133. Answer (2)

Hint: Animals have an outer membrane as the delimiting structure of the cell.

Sol.: The outer membrane as the delimiting structure of the animal cell is plasma membrane and it has phospholipids as the major constituent.

134. Answer (2)

Hint: Smooth endoplasmic reticulum synthesises lipid-like steroidal hormones.

Sol.: The *cis* and the *trans* faces of Golgi complex are entirely different, but interconnected. Lysosome is very rich in almost all types of hydrolytic enzymes. Contractile vacuole is important for osmoregulation and excretion processes.

135. Answer (1)

Hint: In bacteria, the special membranous structure formed by the extensions of plasma membrane into the cell is mesosome.

Sol.: Mesosomes in bacteria are in the forms of vesicles, tubules and lamellae. Cristae are infoldings of inner membrane of mitochondria into the matrix.

SECTION-B

136. Answer (4)

Hint: The inner compartment of mitochondria is filled with a dense homogeneous substance called the matrix.

Sol.: The matrix of mitochondria possesses single circular DNA molecule, a few RNA molecules, ribosomes (70S) and the components required for the synthesis of proteins.

137. Answer (3)

Hint: The plasmid DNA confers certain unique phenotypic characters, such as resistance to antibiotics, to some bacteria.

Sol.: Bacteria are prokaryotes and prokaryotes have double stranded circular DNA as genetic material.

138. Answer (2)

Hint: Mitochondria are the sites of aerobic respiration in eukaryotic cells.

Sol.: Mitochondria produce cellular energy in the form of ATP, hence they are called 'power houses' of the cell.

139. Answer (3)

Hint: Nucleolus is a site for active ribosomal RNA synthesis.

Sol.: Mitochondria and chloroplasts have 70S ribosomes that is made up of rRNA. Along with DNA and proteins, chromosomes have RNA too.

140. Answer (1)

Hint: Coccus and Spirillum bacteria are spherical and spiral respectively.

Sol.: Vibrio is comma-shaped bacterium. Bacillus is rod-shaped bacterium.

141. Answer (3)

Hint: For ribosomes, 'S' in 80S and 70S stands for the sedimentation coefficient.

Sol.: 'S' in 80S and 70S regarding ribosomes, is Svedberg's Unit that represents sedimentation coefficient. It is indirectly a measure of density and size.

142. Answer (1)

Hint: Neutral solutes may move across the membrane by the process of simple diffusion along the concentration gradient, *i.e.*, from higher concentration to the lower.

Sol.: Transport of ions across the cell membrane is an energy dependent process, in which energy of ATP is utilised and is called active transport. Na^+/K^+ pump is an example of such type of transport.

143. Answer (3)

Hint: Grana are found in chloroplast and kinetochore is a part of chromosome.

Sol.: The axoneme in eukaryotic flagella and cilia usually has nine doublets of radially arranged peripheral microtubules, and a pair of centrally located microtubules. Such an arrangement of axonemal microtubules is referred to as the 9+2 array.

144. Answer (3)

Hint: Amyloplasts store carbohydrates (starch) and elaioplasts store oils and fats.

Sol.: Aleuroplasts are a type of leucoplast. These are colourless plastids. Chromoplasts have fat soluble pigments like carotene and xanthophylls.

145. Answer (3)

Hint: Chromosomes are made up of nucleoprotein fibres that was stained by Flemming with the help of basic dyes.

Sol.: The material of the nucleus stained by the basic dyes was given the name chromatin by Flemming.

146. Answer (3)

Hint: Microbodies are single membrane bound minute vesicles.

Sol.: Microbodies contain various enzymes, are present in both plant and animal cells. These are in the form of minute vesicles.

147. Answer (4)

Hint: Along with animal cells, Theodore Schwann also studied plant cells.

Sol.: Schwann (1839), a British Zoologist, studied different types of animal cells and reported that cells had a thin outer layer which is today known as the 'plasma membrane'. He also concluded, based on his studies on plant tissues, that the presence of cell wall is a unique character of the plant cells.

148. Answer (3)

Hint: Anton von Leeuwenhoek used simple self-made light microscope to see the cells.

Sol.: Anton von Leeuwenhoek first saw and described a live cell.

The invention of the microscope and its improvement leading to the electron microscope revealed all the structural details of the cell.

149. Answer (4)

Hint: Cell wall of cyanobacteria is made up of peptidoglycan, whereas plant cell wall is made up of cellulose.

Sol.: In eukaryotes, cytoplasm is divided in many compartments by membranous structures. In cyanobacteria, photosynthetic pigments are contained by the chromatophores that are membranous extensions into the cytoplasm.

150. Answer (1)

Hint: The structure that divides the intracellular space into two distinct compartments are present in the form of a network or reticulum of tiny tubular structures scattered in the cytoplasm.

Sol.: Endoplasmic reticulum divides the intracellular space into two distinct compartments, *i.e.*, luminal (inside ER) and extra luminal (cytoplasm) compartments.

[ZOOLOGY]

SECTION-A

151. Answer (3)

Hint: A H_2O molecule is lost

Sol.: Upon dehydration reaction, a molecule of H_2O is lost. When two molecules of glucose ($C_6H_{12}O_6$) are linked by a glycosidic bond, a molecule of H_2O is removed and maltose is formed.

The molecular formula of maltose is $C_{12}H_{22}O_{11}$.

152. Answer (2)

Hint: Morphine is also an alkaloid.

Sol.: Alkaloid – Codeine

Polymeric substance – Gum

Lectin – Concanavalin A

Toxin – Ricin

153. Answer (3)

Hint: Lipids are not polymeric in nature.

Sol.: Gingelly oil is not polymeric. RuBisCO is a protein which is a heteropolymer. DNA is the polymer of nucleotides. Starch is a homopolysaccharide.

154. Answer (1)

Hint: Denaturation of enzymes

Sol.: Mostly proteinaceous enzymes (except thermostable enzymes) get damaged at high temperatures as the tertiary structure is lost upon heating due to breakage of most of the bonds. Tertiary structure is necessary for biological activities of the enzymes. Decrease in temperature preserves the enzyme in their temporarily inactive state.

155. Answer (1)

Hint: Pyrimidine = [T + C] in dsDNA

Sol.: As per Chargaff's rule,

Amount of guanine = amount of cytosine

$\because$ Amount of guanine = 25%

Thus, amount of cytosine = 25%

So, A = T = 25%

Hence, amount of pyrimidine = C + T = 25 + 25 = 50%

156. Answer (1)

Hint: Insect belongs to the phylum Arthropoda.

Sol.: Chitin is found in the exoskeleton of arthropods.

The 1st amino acid in a protein (*eg.*, insulin) is N-terminal amino acid. In polysaccharides (*e.g.*, glycogen) the right end is called the reducing end and the left end in called the non-reducing end.

157. Answer (2)

Hint: Skeletal muscle fibres are not branched.

Sol.: Skeletal muscle fibres are striated, multinucleated, unbranched, cylindrical and voluntary.

Cardiac muscle fibres are branched and involuntary.

158. Answer (4)

Hint: Plasma is the matrix of blood.

Sol.: Blood is the main circulating fluid of the body. It transports nutrients, gases, hormones, *etc*.

159. Answer (4)

Hint: Every enzyme works at an optimum temperature and pH.

Sol.: Enzymes lower the activation energy in a chemical reaction and therefore, increase the rate of reaction. Temperature, pH, concentration of the substrate as well as the product and presence of the inhibitor affect the enzyme activity.

160. Answer (1)

Hint: Most of the enzymes are proteinaceous.

Sol.: An enzyme like any other protein has all the structures namely primary, secondary and tertiary.

Tertiary structure is required for many biological activities of the protein. The protein chain folds upon itself and forms the active sites into which substrate fits.

161. Answer (2)

Hint: Enzymes are divided into six classes.

Sol.: Class III – Hydrolases are the enzymes that catalyse hydrolysis of ester, ether, peptide, glycosidic, C – C, C-halide or P-N bonds.

Class II – Transferases

Class IV – Lyases

Class V – Isomerases

162. Answer (3)

Hint: Fats and oils are glycerides.

Sol.: Rate of a physical or chemical reaction refers to the amount of product formed per unit time.

Rate of reaction increases by double or decreases by half for every 10°C rise or fall in temperature respectively.

Inorganic catalyst works efficiently at high temperatures and pressures where enzymes get damaged at high temperatures (say above 40°C).

163. Answer (2)

Hint: Co-factor = Prosthetic groups, co-enzymes and metal ions

Sol.: Haem is the prosthetic group of enzymes 'peroxidase' and 'catalase'.

A prosthetic group is an organic compound and is always tightly bound to an enzyme.

164. Answer (4)

Hint: Malonate is the competitive inhibitor of succinic dehydrogenase.

Sol.: When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as competitive inhibitor. Due to its close structural similarity with the substrate, the inhibitor competes with the substrate for the substrate binding site of the enzyme. Consequently, the substrate cannot bind and as a result, the enzyme action declines, *e.g*., inhibition of succinic dehydrogenase by malonate which closely resembles the substrate 'succinate' in structure.

165. Answer (3)

Hint: Metal ions act as co-factor.

Sol.: Zinc acts as the co-factor for the enzyme 'carboxypeptidase'.

Apoenzyme is the protein part of an enzyme.

Co-enzymes and prosthetic groups are different types of co-factors.

166. Answer (3)

Hint: Exclude the simplest amino acid

Sol.: The 'R' group in amino acids could be a hydrogen (glycine), a methyl group (alanine), hydroxy methyl (serine), *etc*. Cysteine is a sulphur containing amino acid.

167. Answer (3)

Hint: Phenylalanine is an aromatic amino acid.

Sol.: The chemical and physical properties of amino acids are essentially of the amino, carboxyl and the R functional groups. Based on number of amino and carboxyl groups, there are acidic (glutamic acid), basic (lysine) and neutral (valine) amino acids. Similarly, there are aromatic amino acids (*e.g*., tyrosine, phenylalanine, tryptophan).

168. Answer (2)

Hint: Each amino acid has its own unique pH in which it exist in its zwitterionic form.

Sol.: A zwitterionic form of amino acid has equal number of positively and negatively charged groups and therefore, overall charge on it becomes zero.

169. Answer (4)

Hint: CCl_3COOH is used in chemical analysis of a living tissue.

Sol.: All elements present in a sample of Earth's crust are also present in a sample of living tissue. Also, the relative abundance of carbon and oxygen w.r.t. other elements is higher in any living organism than in Earth's crust.

Amino acids that occur in proteins are only of 20 types. The molecular formula of trichloroacetic acid is CCl_3COOH.

170. Answer (4)

Hint: Collagen

Sol.: Collagen is the most abundant protein in the animal world. It also acts as an intercellular ground substance.

171. Answer (4)

Hint: Palmitic acid belongs to this category.

Sol.: Upon chemical analysis of a living tissue, two fractions are observed. One is called the filtrate or more technically, the acid-soluble fraction and the second, the retentate or the acid-insoluble fraction. The acid-insoluble fraction has only four types of organic compounds *i.e.*, proteins, nucleic acids, polysaccharides and lipids.

172. Answer (4)

Hint: K_m is related to substrate concentration.

Sol.: K_m in an enzyme catalysed reaction is defined as the concentration of substrate at which the velocity of the reaction is half the maximum velocity.

173. Answer (3)

Hint: It is a monosaccharide.

Sol.: Inulin is a polymer of fructose whereas cellulose is a polymer of glucose.

Glycogen and starch are homopolymers.

174. Answer (4)

Hint: These cells are absent in blood.

Sol.: Fibroblasts secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the connective tissue. These cells also secrete modified polysaccharides, which accumulate between cells and fibres and act as matrix (ground substance).

175. Answer (1)

Hint: Ciliated epithelium helps in the movement of particles in a specific direction.

Sol.: Ductless glands are also called endocrine glands. Compound epithelium covers the dry surface of the skin as it is involved in protection.

Connective tissue is the most abundant tissue in the body of complex animals.

176. Answer (3)

Hint: Neurons are excitable cells of neural system.

Sol.: The neuroglial cells protect and support neurons. Neuroglia make up more than one half the volume of neural tissue in our body. Neurons, the structural and functional units of neural tissue, are excitable cells.

177. Answer (1)

Hint: It may be simple or compound based on the number of layers of cells.

Sol.: Epithelial tissue has a free surface, which faces either a body fluid or the outside environment and thus provides a covering or a lining for some parts of the body.

The cells are compactly packed with little intercellular matrix.

178. Answer (2)

Hint: Collagen fibres provide strength to bones.

Sol.: Bones have hard and non-pliable ground substance, rich in calcium salts and collagen fibres which give strength to bones. The intercellular material of cartilage is solid and pliable and resists compression.

179. Answer (4)

Hint: Present in bones as well

Sol.: The intercellular material of cartilage is solid and pliable and resists compression. It is a type of specialised connective tissue.

Bone is the main tissue that provides structural frame to the body. Osteocytes (bone cells) and chondrocytes are present in spaces called lacunae.

Lamellae are absent in cartilage.

180. Answer (1)

Hint: Flattened cells are involved in diffusion.

Sol.: Some of the columnar or cuboidal cells get specialised for secretion and are called glandular epithelium. Flattened cells are components of squamous epithelium.

181. Answer (3)

Hint: This epithelium is made of a single layer of flattened cells.

Sol.: In human respiratory system, the diffusion membrane is made of three layers namely, the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance present between them.

Also, it is known that simple squamous epithelium is involved in forming a diffusion boundary.

182. Answer (2)

Hint: It is also absent in lymph.

Sol.: Fibroblasts are absent in blood. In all connective tissues except blood and lymph, the cells secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the connective tissue.

183. Answer (4)

Hint: Bone marrow is a hematopoietic structure.

Sol.: The bone marrow in some bones is the site of production of blood cells, so if it gets damaged, then production of blood cells will also get hampered.

Limb bones, such as long bones of the legs, serve weight bearing functions.

Dense irregular connective tissue has fibroblasts and many fibres (mostly collagen) that are oriented differently. This tissue is present in the skin.

184. Answer (1)

Hint: Feature of skeletal muscle fibres

Sol.: Smooth muscle fibres are involuntary in action. These are fusiform in shape (tapered from both the ends) and are unstriated.

Cell junctions hold them together and they are bundled together in a connective tissue sheath.

Smooth muscle fibre has a centrally located nucleus.

185. Answer (4)

Hint: Smooth muscle fibres do not have striations.

Sol.: All involuntary muscle fibres are not striped; cardiac muscle fibres are striped.

The walls of stomach and intestine contain smooth muscle fibres that are involuntary in action.

Intercalated discs are present in cardiac muscle fibres.

SECTION-B

186. Answer (2)

Hint: Type of a specialised connective tissue

Sol.: Neural tissue exerts the greatest control over the body's responsiveness to changing conditions.

Tendons which attach skeletal muscles to bones and ligaments which attach one bone to another are examples of dense regular connective tissue.

Bone is the main tissue that provides structural frame to the body. Bones support and protect softer tissues and organs.

187. Answer (3)

Hint: Constituents of areolar connective tissue

Sol.: A – Macrophage

B – Fibroblast

C – Collagen fibres

D – Mast cell

Areolar tissue serves as a support framework for epithelium. It contains fibroblasts (cells that produce and secrete fibres), macrophages and mast cells.

188. Answer (1)

Hint: Made of many layers of cells

Sol.: Compound epithelium provides protection against chemical and mechanical stresses. It has limited role in secretion and absorption.

This epithelium covers the dry surface of the skin, the moist surface of buccal cavity, pharynx, *etc*.

189. Answer (3)

Hint: Cells of this tissue bear cilia and form ciliated epithelium.

Sol.: The columnar epithelium is composed of a single layer of tall and slender cells. Their nuclei are located at the base. Free surface may have microvilli. They are found in the lining of stomach and intestine and help in secretion and absorption.

Endothelium of alveolar capillaries consists of simple squamous epithelial tissue.

Compound epithelial tissue is present in the moist surface of buccal cavity.

Cuboidal epithelium is commonly found in the ducts of glands.

190. Answer (2)

Hint: Transition state structure is not a permanent structure.

Sol.: During the state where substrate is bound to the enzyme active site, a new structure of the substrate called transition state structure is formed which is transient and unstable state.

191. Answer (1)

Hint: Hormones are the secretions of ductless glands.

Sol.: On the basis of the mode of pouring of their secretions, glands are divided into two categories namely exocrine and endocrine glands.

Exocrine glands secrete mucus, saliva, earwax, oil, milk, digestive enzymes and other cell products. These products are released through ducts or tubes. In contrast, endocrine glands do not have ducts. Their products called hormones are secreted directly into the fluid bathing the gland.

Insulin is a proteinaceous hormone. Trypsin is a digestive enzyme.

192. Answer (3)

Hint: Compound epithelium has a limited role in secretion and absorption.

Sol.: Compound epithelium is made of more than one layer of cells and thus has a limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses. They cover the dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts.

Ciliated epithelium is mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes.

193. Answer (3)

Hint: Also known as gap junction

Sol.: Three types of cell junctions are found in the epithelium and other tissues. These are called as tight, adhering and gap junctions. Tight junctions help to stop substances from leaking across a tissue. Adhering junctions perform cementing to keep neighbouring cells together. Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small molecules and sometimes big molecules.

194. Answer (3)

Hint: Depends on the type of neurotransmitters released

Sol.: When a neuron is suitably stimulated, an electrical disturbance is generated which swiftly travels along its plasma membrane. Arrival of the disturbance at the neuron's endings, or output zone, triggers events that may cause stimulation or inhibition of adjacent neurons and other cells.

Chemical nature of a receptor can never change. Receptors are mostly proteinaceous in nature.

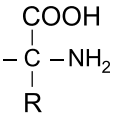
195. Answer (2)

Hint: Contraction leads to shortening

Sol.: Muscle fibres contract (shorten) in response to stimulation, then relax (lengthen) and return to their uncontracted state in a coordinated fashion.

196. Answer (4)

Hint:



Sol.: Amino acids are substituted methanes. There are four substituent groups occupying the four valency positions. These are hydrogen, carboxyl group, amino group and a variable group designated as R group.

197. Answer (4)

Hint: Constituent of genetic material

Sol.: Nucleotide = Nitrogenous base + Ribose sugar + Phosphate group. Glycerol is trihydroxy propane and is a simple lipid. Arachidonic acid has 20 carbon atoms including the carboxyl carbon. Cytosine is a nitrogenous base while cytidine is a nucleoside.

198. Answer (2)

Hint: Fibres are present in both the tissues.

Sol.: Fibres and fibroblasts are compactly packed in the dense connective tissue. Orientation of fibres show a regular and irregular pattern and are called dense regular and dense irregular tissues respectively. In the dense regular connective tissues, the collagen fibres are present in rows between many parallel bundles of fibres.

Dense irregular connective tissue has fibroblasts and many fibres (mostly collagen) that are oriented differently.

199. Answer (4)

Hint: Haemoglobin exhibits quaternary structure of protein.

Sol.: Some proteins are an assembly of more than one polypeptide or subunits. The manner in which these individual polypeptides or subunits are arranged w.r.t. each other is the architecture of proteins called quaternary structure of a protein. Adult human haemoglobin consists of 4 subunits. Two of these are identical to each other.

200. Answer (2)

Hint: $E + S \rightleftharpoons ES \rightarrow EP \rightarrow E + P$

Sol.: The catalytic cycle of an enzyme action can be described in the following steps:

(1) The substrate binds to the active site of the enzyme.

(2) The binding of the substrate induces the enzyme to alter its shape, fitting more tightly around the substrate.

(3) The active site of the enzyme, now in close proximity of the substrate breaks the chemical bonds of the substrate and the new enzyme product complex is formed.

(4) The enzyme releases the products of the reaction and the free enzyme is ready to bind to another molecule of the substrate.

❑ ❑ ❑

All India Aakash Test Series for NEET - 2026

TEST - 1 (Code - D)

For Code-C Answers Click Here

Test Date : 25/08/2024

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

SECTION-A

1. Answer (2)

Hint: $[A]=\left[\frac{B}{\lambda^2}\right]=\left[M^0L^0T^0\right]$

Sol.: $\left[\frac{AB}{\lambda^2}\right]=\left[M^0L^0T^0\right]$

$[AB] = [M^0L^2T^0]$

2. Answer (3)

Hint & Sol.: A correct equation is both dimensionally and numerically correct.

3. Answer (3)

Hint: $\omega=\frac{d\theta}{dt}$

Sol.: $[\omega]=\left[\frac{2\pi}{T}\right]=[M^0L^0T^{-1}]$

4. Answer (2)

Hint: $[\lambda] = [L]$ and $[g] = [LT^{-2}]$

Sol.: $[LT^{-1}] = [L]^a[LT^{-2}]^b$

$LT^{-1} = L^{a+b}T^{-2b}$

Comparing power,

$b=\frac{1}{2}$ and $a=\frac{1}{2}$

5. Answer (3)

Hint: Kinetic energy = $\frac{1}{2}mv^2$

Sol.: $\frac{\Delta K}{K}=\frac{\Delta m}{m}+\frac{2\Delta v}{v}$

= 1% + 2(2%)

= 5%

6. Answer (4)

Hint & Sol.: Two different physical quantities cannot be added.

7. Answer (3)

Hint: Use principle of homogeneity

Sol.: Assertion is true but reason is false. We can check only dimensional consistency but cannot find the value of proportionality constants.

8. Answer (1)

Hint & Sol.: Trailing zero(s) in a number with a decimal point are significant.

9. Answer (3)

Hint & Sol.: The measurement taken by the instrument with minimum least count are most precise.

10. Answer (3)

Hint: $\sin(\omega t + bx)$ is dimensionless quantity

Sol.: $[b] = [L^{-1}]$

$\left[\frac{a}{b}\right]=[M^0L^0T^0]$

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

11. Answer (2)

Hint: Wavelength has same dimensions as length

Sol.: $[\lambda]=\frac{[h]}{[mv]}$

$[h] = [MLT^{-1}][L]$

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

12. Answer (1)

Hint: Time to move up = time to come down = t

Sol.: The particle will be at highest point at

$t=\frac{7+3}{2}=5$ s

$v = u - gt = 0 \Rightarrow u = 10 \times 5 = 50$ m s^{-1}

13. Answer (1)

Hint: $v_{avg}=\frac{\text{total distance}}{\text{total time}}$

Sol.: $\frac{d}{\frac{d}{2\times30}+\frac{d}{2\times v}}=48$ km h^{-1}

$\frac{2\times30\times v}{v+30}=48$

$\frac{5v}{v+30}=4$

$5v = 4v + 120$

$v = 120$ km h^{-1}

14. Answer (2)

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

Sol.: $x = (t-3)^2$

$\frac{dx}{dt} = 2(t-3)$

$a = \frac{d^2x}{dt^2} = 2 \text{ m s}^{-2}$

15. Answer (3)

Hint & Sol.: At point of return, velocity should be zero and acceleration should be non-zero.

16. Answer (4)

Hint: Total time of flight $T = 2\sqrt{\frac{2H}{g}} = \sqrt{\frac{8H}{g}}$

Sol.: $\Delta T = \sqrt{\frac{8(H-h)}{g}} = \sqrt{\frac{8(40-20)}{10}} = \sqrt{\frac{8\times 20}{10}}$

= 4 second

17. Answer (3)

Hint: $H = \frac{1}{2}gt^2$

Sol.: The ball will be at maximum height at t = 2 second. The ball will hit near the base at

$20 - 10t = -40$

t = 6 second

Time to fall = (6 – 2) = 4 s

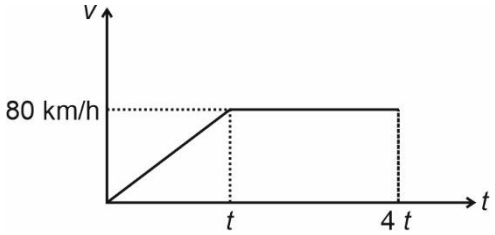
$H = \frac{1}{2}\times 10 \times 4 \times 4$

= 80 m

18. Answer (2)

Hint: $v_{avg} = \frac{\text{Total displacement}}{\text{Total time}}$

Sol.:



$v_{avg} = \frac{\frac{1}{2}\times(t)80 + 80\times 3t}{4t}$

$= \frac{40t + 240t}{4t} = \frac{280}{4}$ km/h = 70 km/h.

19. Answer (4)

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

Sol.: $100 = \frac{1}{2}\times a \times 100$

a = 2 m s^{-2}

$S_{12} = \frac{1}{2}(2)(12)^2 = 144$ m

ΔS = (144 – 100) m

= 44 m

20. Answer (2)

Hint: Both move equal distance before stopping.

Sol.: $v^2 - u^2 = 2as$

$0 - (20 \times 20) = 2 \times a \times 200$

$a = -\frac{400}{400}$

a = 1 m s^{-2}

21. Answer (4)

Hint: Slope of position-time graph is equal to velocity

Sol.: $\frac{v_B}{v_A} = \frac{\tan\theta_B}{\tan\theta_A} = \frac{\tan 60^\circ}{\tan 30^\circ} = 3$

22. Answer (3)

Hint: Use $n_1u_1 = n_2u_2$

Sol.: 1.5 g cm^{-3} = n_2 (100 g) (10 cm)$^{-3}$

1.5 g cm^{-3} = n_2 100 × 10^{-3} g cm^{-3}

15 = n_2

23. Answer (2)

Hint: Angular displacement is a dimensionless quantity

Sol.: [Relative density] = [M^{0}L^{0}T^0]

24. Answer (2)

Hint: Use principle of homogeneity

Sol.: $[B] = [\text{L}]^{\frac{1}{2}}$

$[A] = \left[\frac{\text{ML}^2\text{T}^{-2}}{[\text{L}]^{\frac{1}{2}}}\right]$

$\left[\frac{A}{B^2}\right] = \left[\frac{\text{ML}^2\text{T}^{-2}}{\text{L}^{\frac{1}{2}}\,\text{L}}\right]$

$\left[\frac{A}{B^2}\right] = \left[\text{ML}^{\frac{1}{2}}\,\text{T}^{-2}\right]$

25. Answer (3)

Hint: Least count of screw gauge is pitch divided by number of division on circular scale

Sol.: Reading = main scale reading + n(L.C)

= 1 mm + 52 (0.01) mm

= 1.52 mm

= 0.152 cm

26. Answer (3)

Hint: Solve it from the frame of car

Sol.: $l = \frac{1}{2}(g+a)t^2$

$3 = \frac{1}{2} \times 15t^2$

$\frac{6}{15} = t^2$

$0.4 = t^2$

$t = \sqrt{0.4}$ s

27. Answer (2)

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

Sol.: $t = \frac{u}{a}$

$= \frac{10}{2}$

= 5 s

$d_1 = 10 \times 5 - \frac{1}{2} \times 2 \times 5^2$

= 50 – 25 = 25

$d_2 = 10 \times 4 - \frac{1}{2} \times 2 \times 4^2$

= 24 m

$d = d_1 - d_2$

= 25 – 24 = 1 m

28. Answer (3)

Hint & Sol.: $\vec{a} = \frac{d\vec{v}}{dt}$ = slope of velocity-time graph

29. Answer (4)

Hint & Sol.: Average velocity $(\bar{v}) = \frac{\text{Total displacement}}{\text{Total time}}$

Average speed $(v_{avg}) = \frac{\text{Total distance}}{\text{Total time}}$

$v_{avg} \geq \bar{v}$, as total distance ≥ total displacement

30. Answer (2)

Hint: Use $v^2 - u^2 = 2as$

Sol.: $v^2 = 2g(H - h)$ is a parabola

$v^2 = 2gH - 2gh$

31. Answer (3)

Hint: At both times t_1 and t_2 the velocity is in opposite direction.

Sol.: $v = u - gt_1$ ....(1)

$-v = u - gt_2$ ...(2)

From (1) and (2),

$u - gt_1 = -u + gt_2$

$2u = gt_1 + gt_2$

$\frac{2u}{g} - t_1 = t_2$

32. Answer (4)

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

Sol.: $\frac{dx}{dt} = 2t - 8 = 0$

t = 4 s

$x = (4^2 - 8 \times 4 + 8)$ m

$= (16 - 32 + 8)$ m

$= -8$ m

33. Answer (4)

Hint: Slope of position – time graph is velocity

Sol.: Velocity is negative and constant till 0 to mid of t_1 and t_2. Velocity is positive from mid of t_1 and t_2 to t_3.

34. Answer (4)

Hint: Use $v^2 - u^2 = 2as$

Sol.: $v^2 - u^2 = \frac{2as}{2}$

$v_1^2 - u^2 = 2as$

$v_1^2 - u^2 = 2(v^2 - u^2)$

$v_1^2 = 2v^2 - 2u^2 + u^2$

$v_1^2 = 2v^2 - u^2$

$v_1 = \sqrt{2v^2 - u^2}$

35. Answer (4)

Hint: While calculating the distance avoid taking negative sign of area

Sol.: Displacement = (4 × 2 – 3 × 2 + 2 × 2 – 1 × 2) m

Distance = (4 × 2 + 3 × 2 + 2 × 2 + 1 × 2) m

$= \frac{\text{Displacement}}{\text{Distance}} = \frac{4}{20} = \frac{1}{5}$

SECTION - B

36. Answer (3)

Hint & Sol.: Total time $20 = \frac{1}{2} \times 10 \times t^2$

t = 2 second

Time taken to cover first half

$10 = \frac{1}{2} \times 10 t_1^2$

$t_1 = \sqrt{2}$ s

Time taken to cover second half

$t_2 = \left(2 - \sqrt{2}\right)$ s

Ratio = $= \frac{\sqrt{2}}{2 - \sqrt{2}}$

$= \frac{1}{\sqrt{2} - 1}$

37. Answer (2)

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

Sol.: $\frac{v}{50} = \frac{50}{100} \Rightarrow v = 25 \text{ m s}^{-1}$

$a = (25)\left(\frac{50}{100}\right) = 12.5 \text{ m s}^{-2}$

38. Answer (4)

Hint: $x = \frac{dv}{dt}$

Sol.: $v = (x)^{\frac{1}{4}}$

$\frac{dx}{dt} = (x)^{\frac{1}{4}}$

$\int_0^x \frac{dx}{x^{\left(\frac{1}{4}\right)}} = \int_0^t dt$

$\frac{(x)^{-\frac{1}{4}+1}}{-\frac{1}{4}+1} = t$

$\frac{(x)^{+\frac{3}{4}}}{\frac{3}{4}} = t$

$\frac{4}{3}(x)^{\frac{3}{4}} = t \Rightarrow x \propto t^{\frac{4}{3}}$

39. Answer (4)

Hint: $\frac{\Delta KE}{KE} = \pm\left(\frac{\Delta m}{m} + \frac{2\Delta v}{v}\right)$

Sol.: $\frac{\Delta KE}{KE} = \pm\left[\frac{0.2}{2} + \frac{0.2}{10} \times 2\right]$

= ± [0.1 + 0.04]

= ± [0.14]

$KE = \frac{1}{2} \times 2 \times 10 \times 10 = 100$ J

ΔKE = ± 14 J

KE = [100 ± 14] J

40. Answer (3)

Hint: Use relationship between different physical quantities

Sol.: $[G] = \frac{[MLT^{-2}][L^2]}{[M^{+2}]} = [M^{-1}L^3T^{-2}]$

$[\Delta P] = [MLT^{-1}]$

$[\text{Power}] = \left[\frac{\text{Work}}{\text{Time}}\right] = \left[\frac{ML^2T^{-2}}{T}\right] = [ML^2T^{-3}]$

$\left[\begin{matrix}\text{Electrical} \\ \text{resistance}\end{matrix}\right] = \frac{[\text{Power}]}{[\text{Current}]^2} = [ML^2T^{-3}A^{-2}]$

41. Answer (3)

Hint: Dimensions of Planck's constant (h) are $[ML^2T^{-1}]$

Sol.: $h = p^a q^b$

$[ML^2T^{-1}] = [MLT^{-1}]^a [L]^b$

$\Rightarrow$ $a = 1$, $a + b = 2 \Rightarrow b = 1$

$[h] = [pq]$

42. Answer (1)

Hint: Use $n_1u_1 = n_2u_2$

Sol.: 1 N m = n_1 dyne cm

$1 \times 10^5 \times 10^2$ dyne cm = n_1 dyne cm

$10^7 = n_1$

43. Answer (2)

Hint: Density $= \frac{\text{Mass}}{\text{Volume}} = \frac{m}{\pi r^2 L}$

Sol.: $\frac{\Delta d}{d} = \frac{\Delta m}{m} + \frac{2\Delta r}{r} + \frac{\Delta L}{L}$

$\left(\frac{\Delta d}{d}\%\right) = \left[\frac{0.003}{0.6} + \frac{0.005 \times 2}{0.5} + \frac{0.04}{4}\right] \times 100$

$= \left[\frac{1}{2} + 2 + 1\right] = 3.5\%$

44. Answer (1)
Hint: Pascal is a unit of pressure
Sol.: $\left[\frac{\text{pascal second}}{\text{meter}^3}\right]=\left[\frac{MLT^{-2}}{L^2}\times\frac{T}{L^3}\right]$
$= [ML^{-4}T^{-1}]$

45. Answer (2)
Hint: Use $L \propto (F)^a(v)^b(M)^c$
Sol.: $[F] = [MLT^{-2}]$
$[v] = [LT^{-1}]$
$[M] = [M]$
$[L] = [MLT^{-2}]^a [LT^{-1}]^b [M]^c$
$[L] = [M]^{a+c} [L]^{a+b} [T]^{-2a-b}$
$a + c = 0 \Rightarrow a = -c$
$a + b = 1$ …(i)
$-2a - b = 0$
$b = -2a$ …(ii)
From (i) and (ii),
$a = -1$
$c = 1$
$b = +2$
$L \propto [F^{-1}v^2M^1]$

46. Answer (1)
Hint : L.C. = 1 MSD – 1 VSD
Sol.: 12 VSD = 8 MSD
$1 \text{ VSD} = \frac{8}{12} \text{ MSD}$
$= \frac{2}{3} \text{ MSD}$
$\text{L.C.} = 1 \text{ MSD} - \frac{2}{3} \text{ MSD}$
$= \frac{1}{3} \text{ MSD}$
$= \frac{1}{3} \text{ mm}$

47. Answer (3)
Hint: Slope of position-time graph gives velocity
Sol.: The slope of $x - t$ graph decreases with time that means velocity decreases hence acceleration is negative.

48. Answer (3)
Hint: The speed of person in train is his velocity with respect to train
Sol.: $|\vec{v}_{P\cdot A}| = |\vec{V}_P - \vec{V}_A| = 3.6 \text{ km/h} = 1 \text{ m s}^{-1}$
$|\vec{v}_A| = 36 \text{ km/h} = \frac{36\times5}{18} = 10 \text{ m s}^{-1}$
$|\vec{v}_B| = 54 \text{ km/h} = \frac{54\times5}{18} = 15 \text{ m s}^{-1}$
$\vec{V}_{P\cdot A} = |\vec{V}_P - \vec{V}_A| = 1 \text{ m s}^{-1}$
$|\vec{V}_P| = |\vec{V}_{PA} + \vec{V}_A| = 9 \text{ m s}^{-1}$
$|\vec{V}_{PB}| = |\vec{V}_P - \vec{V}_B| = (9+15) \text{ m s}^{-1}$
$= 24 \text{ m s}^{-1}$
$|\vec{V}_{AB}| = |\vec{V}_A - \vec{V}_B| = 25 \text{ m s}^{-1}$

49. Answer (3)
Hint & Sol.: The free fall is a case of uniform acceleration ($g = 9.8 \text{ m s}^{-2}$)

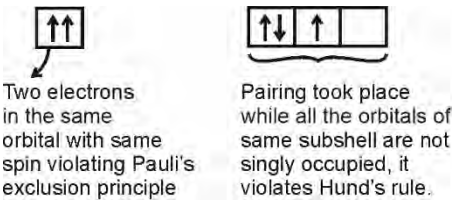
50. Answer (3)
Hint: Use concept of relative velocity
Sol.: $v_p = \frac{d}{6}$, where d is distance
$v_e = \frac{d}{8}$
Time taken by Preeti to walk down on escalator moving up
$t = \frac{d}{v_p - v_e} = \frac{d}{\frac{d}{6} - \frac{d}{8}}$
$= \frac{d\times48}{8d - 6d} = 24 \text{ s}$

[CHEMISTRY]

SECTION - A

51. Answer (2)
Hint: $\lambda = \frac{h}{\sqrt{2m\,KE}}$
Sol.: $\lambda_1 = \frac{h}{\sqrt{2m_1\,KE_1}} = \frac{h}{\sqrt{2\times2\times1}}$
$\lambda_2 = \frac{h}{\sqrt{2m_2KE_2}} = \frac{h}{\sqrt{2\times1\times9}}$
$\therefore \frac{\lambda_1}{\lambda_2} = \sqrt{\frac{2\times9}{2\times2}} = \frac{3}{\sqrt{2}}$

52. Answer (3)
Hint: According to Pauli's exclusion principle, in an orbital no two electrons can have the same set of all four quantum numbers.
Sol.: As per Hunds rule, pairing of electrons occurs in a subshell when all the orbitals are singly occupied.



53. Answer (3)

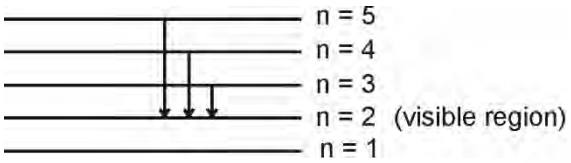
Hint & Sol.: Maximum number of orbitals in a subshell = (2l + 1)

- It ranges from $-\ell$ to $+\ell$.
- Number of orbitals in n^{th} shell = n^2

54. Answer (3)

Hint: For visible region, n $\Rightarrow$ 2

Sol.:



55. Answer (3)

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

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

$$\Delta v = \frac{0.010 \times 2 \times 10^3}{100} = 0.2$$

$$\therefore \Delta x = \frac{6.6 \times 10^{-34}}{4 \times 3.14 \times 9 \times 10^{-31} \times 0.2}$$

3×10^{-4} m

56. Answer (4)

Hint:

Orbital	l value
s	0
p	1
d	2
f	3

Sol.:

	Orbitals	(n + l) value
a.	4*f*	4 + 3 = 7
b.	5*p*	5 + 1 = 6
c.	3*d*	3 + 2 = 5
d.	4*s*	4 + 0 = 4

57. Answer (4)

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

Sol.: $\lambda = \frac{6.6 \times 10^{-34}}{0.33 \times 5 \times 10^3} = 4 \times 10^{-37}$ m

58. Answer (1)

Hint: The species which have same number of electrons are known as isoelectronic species

Sol.:

Species	Number of electrons
O^{2-}	10
Ne	10
Na^+	10
S^{2-}	18
Ar	18
Ca^{2+}	18
Sc^{3+}	18
K^+	18
Cl^-	18
P^{3-}	18
Mg^{2+}	10

59. Answer (3)

Hint: Angular momentum of electron = $m_e vr$

Sol.: $m_e vr = n \cdot \frac{h}{2\pi}$

Angular momentum of an electron is quantised

60. Answer (4)

Hint & Sol.: Wave nature of light does not justify

i. Black body radiation

ii. Photoelectric effect

iii. Variation of heat capacity of solids as a function of temperature

iv. Line spectra of hydrogen atoms.

61. Answer (2)

Hint: E = nhν

Sol.: E = 6.02 × 10^{23} × 6.6 × 10^{-34} × 2 × 10^{12}

= 79.5 ×10 = 795 J = 0.795 kJ

= 0.8 kJ

62. Answer (4)

Hint: Number of atoms = Moles × N_A × Atomicity

Sol.: Let mass of each of S_2 and S_8 taken be x g

S_2	S_8
Moles = $\frac{x}{32\times2}$	$\frac{x}{32\times8}$
Molecules = $\frac{x}{32\times2}\times N_A$	$\frac{x}{32\times8}\times N_A$

Let mass of each O_2 and O_3 taken be x g

Number of atoms in O_2 molecule $= \frac{x}{16\times2}N_A\times2 = \frac{x}{16}N_A$

Number of atoms in O_3 molecule $= \frac{x}{16\times3}N_A\times3 = \frac{x}{16}N_A$

63. Answer (3)

Hint: Formula mass term is used for ionic compounds like NaCl.

Sol.:

- Mass of one hydrogen atom = $\frac{1.008}{6.022\times10^{23}}$

  $= 1.67 \times 10^{-24}$ g
- CCl_4 is a covalent compound and formula unit mass term is not applicable for it.

64. Answer (4)

Hint: Chromium and copper have exceptional electronic configuration.

Sol.: $_{29}Cu = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$

$_{24}Cr = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

$_{25}Mn = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^2$

$_{26}Fe = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$

Element	Unpaired electron(s)
Cu	1
Mn	5
Cr	6
Fe	4

65. Answer (2)

Hint: Volume = $\frac{\text{Mass}}{\text{Density}}$

Sol.: Mass of 6×10^{23} molecules of water = Molar mass

= 18 g/mole

$\therefore$ Mass of 1 molecule of water = $\frac{18}{6\times10^{23}}$

$= 3 \times 10^{-23}$ g

Volume = $\frac{3\times10^{-23}}{1} = 3\times10^{-23}$ cm^3

66. Answer (3)

Hint: Principal quantum number tells about energy and size of orbital.

Sol.:

1. Principal quantum number – Size and energy of orbital
2. Azimuthal quantum number – Shape of orbital
3. Magnetic quantum number – Total number of orbitals in subshell
4. Spin quantum number – Spin of an electron

67. Answer (4)

Hint: As per law of definite proportions, a given compound always contains exactly the same proportion of elements by weight.

Sol.: If two elements combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element are in the ratio of small whole number as per law of multiple proportions so, CO_2 and CS_2 do not follow law of multiple proportions.

- $2H_2(g) + O_2(g) \rightarrow 2H_2O$

  2 L 1 L

According to Gay Lussac' s law of combining volume, 2 volume of H_2 combines with 1 volume of O_2 to give 2 volume of water.

68. Answer (1)

Hint: According to law of conservation of mass, mass can neither be created nor be destroyed in a chemical reaction.

Sol.: $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$

100 g = 56 g + 44 g

69. Answer (4)

Hint: % of Fe in haemoglobin molecule = $\frac{\text{Mass of iron is one molecule}}{\text{Molecular mass of haemoglobin}}$

Sol.: Atomic mass of iron = 56 u

$\therefore$ Mass of 4 atoms of iron = (56 × 4) u

% of Fe in haemoglobin molecule = 0.334

$= \frac{56\times4}{\text{Molecular mass of haemoglobin}}\times100$

$\therefore$ Molecular mass of haemoglobin = $\frac{56\times4\times100}{0.334}$

= 67065.8 u

70. Answer (2)

Hint & Sol.:

	Series	Spectral region
1.	Lyman	Ultraviolet
2.	Paschen	Infrared
3.	Brackett	Infrared
4.	Pfund	Infrared

71. Answer (1)

Hint: Volume changes with change in temperature.

Sol.: Mole fraction is the ratio of moles of a given component of the mixture to the total number of moles of mixture. So, it is a unitless quantity and does not depend on temperature.

Molality is the number of moles of solute present in 1 kg of solvent. So, it does not depend on temperature.

72. Answer (4)

Hint: Number of atoms in a given gas depends on its moles as well as atomicity.

Sol.:

- Number of atoms in a gas = Moles × N_A × atomicity

  So, equal number of moles of different gases contain same number of atoms if their atomicities are also same.
- According to Avogadro's law, "under same conditions to temperature and pressure, equal volumes of different gases contain equal number of molecules.

73. Answer (4)

Hint:

$$\chi_{solvent} = \frac{\text{Moles of solvent}}{\text{Total number of moles of solution}}$$

Sol.: For 1 molal aqueous solution,

1 mol of solute is present in 1 kg of solvent (water)

$$\chi_{solvent} = \frac{1000/18}{\frac{1000}{18}+1} \Rightarrow \frac{55.56}{56.56} = 0.98$$

74. Answer (2)

Hint: Molarity = $\frac{\text{moles of solute}}{\text{volume of solution (L)}}$

Sol.: Moles of solute = Molarity × Volume

$= \frac{1\times 250}{1000} \Rightarrow 0.25$ mol.

Mass of solute $\Rightarrow 0.25 \times 60 \Rightarrow 15.0$ g

75. Answer (3)

Hint: Zeros at the end or right of a number are significant provided they are on right side of the decimal point.

Sol.:

- Avogadro number (6.022×10^{23}) has four significant figures.
- All non-zero digits are significant.
- Zeros between two non-zero digits are significant.
- Exact numbers of objects have infinite significant figures.

76. Answer (3)

Hint: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

2 mol of hydrogen gas reacts with 1 mol of oxygen

Sol.: 4 g of hydrogen ≡ 32 g of oxygen

$\therefore$ 8 g of hydrogen ≡ 64 g of oxygen

Available oxygen = 32 g

So, oxygen is the limiting reagent.

Left amount of hydrogen = Available H_2 – consumed H_2

$\Rightarrow 8 - 4 = 4$ g

$= \frac{4}{2} = 2$ mol hydrogen

= 44.8 L at STP

77. Answer (3)

Hint: Total number of neutrons in a heavy water molecule and in a water molecule are 10 and 8 respectively.

Total number of neutrons = moles × N_A × number of neutrons in one molecule

Sol.: Number of neutrons in D_2O : Number of neutrons in H_2O

$= \frac{4}{20}\times N_A \times 10 : \frac{3.6}{18}\times N_A \times 8$

= 5 : 4

78. Answer (4)

Hint: Number of atoms = Moles × N_A × atomicity

Sol.: 7 g of nitrogen gas = $\frac{7}{28}\times N_A \times 2$

$\Rightarrow 0.5\ N_A$

34 g of ammonia gas = $\frac{34}{17}\times N_A \times 4$

$= 8\ N_A$

1.6 g of oxygen gas = $\frac{1.6}{32}\times N_A \times 2$

$\Rightarrow 0.1\ N_A$

2 g of hydrogen gas = $\frac{2}{2} \times N_A \times 2$

$= 2\ N_A$

79. Answer (2)

Hint: 1 mol of $CaCO_3$ is neutralised by 2 mol of HCl

Sol.: Moles of HCl = M × V

$= \frac{0.1 \times 100}{1000} = 0.01\,\text{mol}$

Moles of $CaCO_3$ (100% pure) required = $\frac{0.01}{2}$ mol

Mass of $CaCO_3$ (100% pure) required = $\left(\frac{0.01}{2} \times 100\right)$ g

$\Rightarrow 0.5$ g

Mass of 80% pure $CaCO_3$ required = $\frac{100 \times 0.5}{80} = 0.625$ g

80. Answer (4)

Hint: Empirical formula represents the ratio of the elements present in the compound.

Sol.:

Element	% by mass	Mole	Minimum ratio
C	75	75/12 = 6.25	6.25/6.25 = 1
H	25	25/1 = 25	25/6.25 = 4

$\therefore$ Empirical formula = CH_4

81. Answer (2)

Hint: $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$

Sol.: 1 mol of C_4H_8 produces 4 mol of CO_2

$\therefore \frac{5.6 \times 10^3}{56}$ mol of $C_4H_8 \equiv 4 \times \frac{5.6}{56} \times 10^3$

= 400 mol of CO_2

$\therefore$ Volume of CO_2 = 400 × 22.4

= 8960 L

82. Answer (3)

Hint: Radial node = n – l – 1

Angular node = l

Sol.:

Orbital	Angular node	Radial node
3*s*	0	3 – 0 – 1 = 2
3*p*	1	3 – 1 – 1 = 1
2*p*	1	2 – 1 – 1 = 0
1*s*	0	1 – 0 – 1 = 0

83. Answer (2)

Hint: For multielectronic species, higher the (n + l) value, higher is the energy of orbital. If (n + l) value is same for two orbitals then orbital with higher n value will have high energy.

Sol.: 4*d* = 4 + 2 = 6

5*s* = 5 + 0 = 5

5*p* = 5 + 1 = 6

4*f* = 4 + 3 = 7

So, increasing order of energy is

5*s* < 4*d* < 5*p* < 4*f*

84. Answer (1)

Hint: Orbital angular momentum = $\sqrt{l(l+1)}\frac{h}{2\pi}$

Sol.: For 3*p* orbital, l = 1

$\therefore \sqrt{l(l+1)}\frac{h}{2\pi} = \sqrt{1(1+1)}\frac{h}{2\pi} = \frac{h}{\sqrt{2}\pi}$

85. Answer (3)

Hint: $_{19}K = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

Sol.: For $4s^1 \Rightarrow$

n = 4, l = 0, m = 0 $s = +\frac{1}{2} / -\frac{1}{2}$

SECTION - B

86. Answer (4)

Hint & Sol.: d-orbitals have double dumb-bell shape except d_{z^2} which has baby soother like shape.

87. Answer (4)

Hint: $h\nu = h\nu_0 + \frac{1}{2}m_e v^2$

Sol.:

- There is no time lag between striking of light and ejection of photoelectrons.
- Number of photoelectrons ejected depends on intensity of light.
- Kinetic energy of photoelectrons ejected depends on frequency of light.

$\therefore 4 = 2 + \text{K.E} \Rightarrow \therefore$ KE = 2 eV = $2 \times 1.6 \times 10^{-19}$ J

88. Answer (4)

Hint: For hydrogen atom, energy of orbital depends only on the value of n.

Sol.: The order of energy of the given transition is

$5p \rightarrow 1s > 5s \rightarrow 2p > 5d \rightarrow 3p = 5f \rightarrow 3d$

89. Answer (2)

Hint & Sol.: The splitting of spectral lines in the presence of magnetic field is called 'Zeeman effect'.

The splitting of spectral lines in the presence of electric field is called 'Stark effect'.

90. Answer (2)

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

Sol.: For 1st line in Lyman series,

$$\frac{1}{\lambda_1} = R_H\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = \frac{3R_H}{4}$$

$$\lambda_1 = \frac{4}{3R_H}$$

For 2nd line of Balmer series,

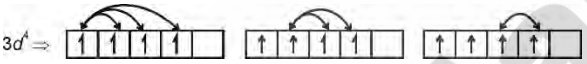
$$\frac{1}{\lambda_2} = R_H\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = R_H\left(\frac{1}{4} - \frac{1}{16}\right) \Rightarrow \frac{3R_H}{16}$$

$$\lambda_2 = \frac{16}{3R_H}$$

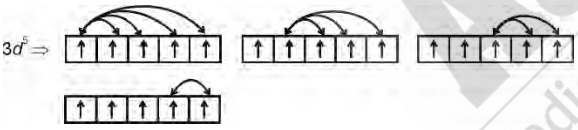
$$\therefore \frac{\lambda_1}{\lambda_2} = \frac{4}{3R_H} \times \frac{3R_H}{16} \Rightarrow \frac{1}{4}$$

91. Answer (2)

Hint & Sol.:

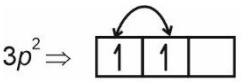


Total possible exchanges = 3 + 2 +1 = 6



Total possible exchanges ⇒ 4 + 3 + 2 + 1 =10

Total possible exchanges = 3



Total possible exchanges = 1

92. Answer (3)

Hint: For electromagnetic radiations, $E \propto \frac{1}{\lambda}$

Sol.: The energy of γ-rays is higher than that of X-rays and hence wavelength of γ-rays is less than that of X-rays.

93. Answer (3)

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

Sol.: Let the mass of solvent be 1 kg

$$0.2 = \frac{n_{(urea)}}{1}$$

$\therefore$ moles of urea = 0.2

& mass of urea = 0.2 × 60 = 12 g

If mass of solvent is 1 kg (1000 g) & mass of solute is 12 g then mass of solution = 1012 g.

1012 g urea solution contains 12 g urea

$\therefore$ 2000 g urea (2 kg) solution contains =

$$= \frac{12}{1012} \times 2000$$

= 23.71 g urea

94. Answer (1)

Hint: Moles of gas = $\frac{\text{Given mass}}{\text{Molar mass}}$

Sol.: Let the masses of He and O_2 be x g and 8 x g respectively

Moles of He = $\frac{x}{4}$

Moles of O_2 = $\frac{8x}{32} = \frac{x}{4}$

Molar ratio = $\frac{x}{4} : \frac{x}{4} = 1:1$

95. Answer (2)

Hint: No. of molecules = $\frac{\text{Given mass}}{\text{Molar mass}} \times N_A$

Sol.: Molecules of CO_2 in 440 g = $\frac{440}{44} \times N_A$

$\Rightarrow 10\ N_A$

Molecules of CO_2 in 4 moles = $4N_A$ (left)

As per the question,

$10\ N_A - x = 4\ N_A$

$\therefore x = 6\ N_A$ molecules

1 CO_2 molecule $\equiv$ 2 oxygen atoms

$\therefore$ 6 N_A CO_2 molecules $\equiv$ 12 N_A molecules = $12 \times 6 \times 10^{23}$

= 7.2×10^{24} oxygen atoms

96. Answer (3)

Hint: Molality = $\frac{\text{moles of solute}}{\text{mass of solvent (kg)}}$

Sol.: 18 g glucose in 180 g water

$\frac{18/180}{180}\times1000=\frac{5}{9}$ m

34.2 g sucrose in 360 g water

$\frac{34.2/342}{360}\times1000=\frac{5}{18}$ m

5.85 g NaCl in 18 g water

$\frac{5.85/58.5}{18}\times1000=\frac{50}{9}$ m

5.6 g CaO in 36 g water

$\frac{5.6/56}{36}\times1000\Rightarrow\frac{25}{9}$ m

97. Answer (4)

Hint: $NaOH + HCl \rightarrow NaCl + H_2O$

Sol.: Moles of HCl = $\left(\frac{50\times0.25}{1000}\right)=0.0125$ mol

$\Rightarrow$ 1 mol of HCl (36.5 g) reacts with 1 mol of NaOH (40 g)

$\therefore$ 0.0125 mol of HCl will react with = 40 × 0.0125 = 0.5 g

Remaining amount of NaOH = 2.0 – 0.5 = 1.5 g

98. Answer (2)

Hint: Molarity = $\frac{\text{moles of solute}}{\text{volume of solution(L)}}$

Sol.: Moles of ethanol required = 0.5 × 2 = 1 mol

Mass of ethanol = 1 × 46 = 46 g

Density = $\frac{\text{mass}}{\text{volume}}$

$\therefore$ Volume = $\frac{\text{mass}}{\text{density}}=\frac{46\text{ g}}{\left(0.46\times10^3\right)\text{g/L}}$

= 0.1 L $\Rightarrow$ 100 mL

99. Answer (3)

Hint: Average atomic mass

$=\frac{(\text{Abundance proportion of }{}_{10}\text{E}\times10)+(\text{Abundance proportion of }{}_{11}\text{E}\times11)}{\text{Sum of proportion}}$

Sol.: Average atomic mass = $\frac{(1\times10)+(4\times11)}{1+4}$

$=\frac{54}{5}\Rightarrow10.8$ u

100. Answer (2)

Hint: Precision refers to the closeness to various measurements for the same quantity.

Sol.: Accuracy is the agreement of a particular value to the true value of the results.

[BOTANY]

SECTION-A

101. Answer (1)

Hint: In bacteria, the special membranous structure formed by the extensions of plasma membrane into the cell is mesosome.

Sol.: Mesosomes in bacteria are in the forms of vesicles, tubules and lamellae. Cristae are infoldings of inner membrane of mitochondria into the matrix.

102. Answer (2)

Hint: Smooth endoplasmic reticulum synthesises lipid-like steroidal hormones.

Sol.: The *cis* and the *trans* faces of Golgi complex are entirely different, but interconnected. Lysosome is very rich in almost all types of hydrolytic enzymes. Contractile vacuole is important for osmoregulation and excretion processes.

103. Answer (2)

Hint: Animals have an outer membrane as the delimiting structure of the cell.

Sol.: The outer membrane as the delimiting structure of the animal cell is plasma membrane and it has phospholipids as the major constituent.

104. Answer (4)

Hint: Rough endoplasmic reticulum is extensive and continuous with the outer membrane of the nucleus.

Sol.: Rough endoplasmic reticulum bears ribosomes on its surface. They give rise to smooth endoplasmic reticulum which is responsible for detoxification of drugs.

Golgi complex is involved in the formation of plasma membrane during cytokinesis.

105. Answer (4)

Hint: Centrosome is a non-membrane bound cell organelle found in cytoplasm of animal cells and some lower plant cells.

Sol.: Centrosome is an organelle usually containing two cylindrical structures called centrioles. Both the centrioles in a centrosome lie perpendicular to each other.

106. Answer (2)

Hint: The cell wall and middle lamellae in plants are traversed by a living component of the cell.

Sol.: The cell wall and middle lamellae may be traversed by plasmodesmata which connect the cytoplasm of neighbouring cells.

107. Answer (1)

Hint: Inclusion bodies in prokaryotes are reserve materials stored in the cytoplasm.

Sol.: Ribosomes are the granular structures first observed under the electron microscope as dense particles by George Palade. These structures are also called Palade particles. These are not the inclusion bodies.

108. Answer (4)

Hint: Cell wall gives shape to the cell and protects the cell from mechanical damage and infection. It also helps in cell-to-cell interaction and provides barrier to undesirable macromolecules.

Sol.: In a young plant cell, the primary cell wall is capable of growth, which gradually diminishes as the cell matures.

109. Answer (3)

Hint: The ability of movement of proteins within the membrane is measured as its fluidity.

Sol.: An improved model of the structure of cell membrane was proposed by Singer and Nicolson widely accepted as fluid mosaic model. According to this, the quasi-fluid nature of lipid enables lateral movement of proteins within the overall bilayer.

110. Answer (2)

Hint: Chromatophores are membranous extensions into the cell of some prokaryotes.

Sol.: Chromatophores have photosynthetic pigments and the membrane has lipids and proteins similar to that of plasma membrane. These are found in photosynthetic prokaryotes, like cyanobacteria and purple bacteria.

111. Answer (4)

Hint: The major lipids in the cell membrane are complex lipids.

Sol.: The major lipids in the cell membrane are phospholipids that are arranged in a bilayer.

112. Answer (3)

Hint: In the given diagram, the labelled structures A, B, C and D, respectively are RER, nucleolus, Golgi complex and mitochondrion.

Sol.: Ribosomes on RER translate mRNA into proteins. Nucleolus is a site for active ribosomal RNA (rRNA) synthesis.

113. Answer (3)

Hint: The middle lamella is a layer mainly of calcium pectate present between cell walls of two neibhouring plant cells.

Sol.: The middle lamella in plants holds or glues the different neighbouring cells together.

114. Answer (1)

Hint: Microtubules are cytoskeleton and centromere hold the two chromatids of a chromosome together.

Sol.: Animal cells have centrioles which are absent in almost all plant cells. Spindle fibres are formed during cell division in animal cells as well as plant cells.

115. Answer (3)

Hint: The lipids are arranged within the cell membrane with the polar head towards the outer sides and the hydrophobic tails towards the inner part.

Sol.: The ratio of protein and lipid varies considerably in different cell types. In human beings, the membrane of the erythrocyte has approximately 52 percent protein and 40 percent lipids.

In addition to phospholipids, membrane also contains cholesterol.

116. Answer (3)

Hint: Several ribosomes may attach to a single mRNA and form a chain called polyribosomes or polysome.

Sol.: Ribosomes are made up of ribosomal RNA and proteins. Therefore, a polysome is said to have mRNA, ribosomal RNA and proteins.

117. Answer (4)

Hint: Some cell organelles are not coordinated with the components of endomembrane system, and thus they are not considered as a part of this system.

Sol.: The endomembrane system includes endoplasmic reticulum, Golgi complex, lysosomes and vacuoles. Peroxisomes are not included in this system.

118. Answer (3)

Hint: Prokaryotes have 70S ribosomes.

Sol.: In prokaryotes, ribosomes are associated with the plasma membrane of the cell and the ribosomes are the site of protein synthesis. The subunits of the ribosomes found in prokaryotes are 50S and 30S.

119. Answer (3)

Hint: Bacterial flagella have three parts – filament, hook and basal body.

Sol.: Pili are involved in the mating process. Eukaryotic flagella are membrane-bound extensions of plasma membrane. Fimbriae are small bristle like fibres help to attach with host tissues.

120. Answer (2)

Hint: The cell organelle that can occupy upto 90 percent of the volume of the cell in plants is bound by tonoplast.

Sol.: In plant cells, vacuole can occupy upto 90 percent of the volume of the cell. The concentration of ions and other materials is significantly higher than in the cytoplasm.

121. Answer (4)

Hint: Mesosomes increase the surface area of the plasma membrane and help in cell wall formation, DNA replication and distribution to daughter cells.

Sol.: Mesosomes also help in respiration. These are found in prokaryotes and in prokaryotes, except for ribosomes, other cell organelles are absent.

122. Answer (3)

Hint: Glycocalyx differs in the composition and thickness among different bacteria.

Sol.: The outermost layer of cell envelope in bacteria, *i.e.*, glycocalyx could be a loose sheath called the slime layer in some, while in others, it may be thick and tough, called the capsule.

123. Answer (3)

Hint: Mycoplasma is a prokaryotic organism.

Sol.: Mycoplasma lacks cell wall. Since it is prokaryotic organism, its genetic material remains free in the cytoplasm, *i.e.*, not enveloped by nuclear membrane. Mycoplasma has 70S ribosomes in cytoplasm and animal cell has 70S ribosomes in mitochondria. The subunits of these ribosomes are 50S and 30S.

124. Answer (3)

Hint: Light reaction of photosynthesis occurs in thylakoids of chloroplast.

Sol.: The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrates and proteins.

125. Answer (2)

Hint: Nerve cells are long and branched.

Sol.: Human red blood cells are round and biconcave. Mesophyll cells are round and oval. White blood cells are amoeboid.

126. Answer (2)

Hint: The two arms of submetacentric chromosome and acrocentric chromosome are said to be p arm and q arm.

Sol.: p and q arms of a chromosome are differentiated on the basis of their difference in the lengths.

127. Answer (1)

Hint: Mycoplasma, a prokaryote, is the smallest cell known.

Sol.: Cell wall is absent in mycoplasma. They have 70S ribosomes and DNA as genetic material. They have the machinery to synthesize the ATP.

128. Answer (1)

Hint: The centrioles form the basal body of cilia or flagella.

Sol.: The central part of the proximal region of the centriole is proteinaceous and called the hub, which is connected with tubules of the peripheral triplets by radial spokes made of protein.

129. Answer (4)

Hint: Cytoplasm is the main arena of cellular activities.

Sol.: Chromosomes contain the genetic material, DNA. Centrioles are non-membrane bound structures. Vacuoles contain water, sap, excretory product and other materials not useful for the cell.

130. Answer (4)

Hint: The given diagram represents the internal structure of eukaryotic flagella.

Sol.: In the given diagram, the labelled parts I, II, III and IV are Peripheral microtubule, Central microtubule, Radial spoke and Central sheath respectively.

131. Answer (2)

Hint: The scientist who proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells was a British Zoologist.

Sol.: Schwann proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells.

132. Answer (1)

Hint: DNA replication occurs in the nucleus. Protein synthesis occurs in the cytoplasm.

Sol.: The nuclear envelope consists of two parallel membranes with a space between, called the perinuclear space.

133. Answer (1)

Hint: Cells perform the essential functions of life.

Sol.: Anything less than a complete structure of a cell does not ensure independent living. Hence,

cell is the fundamental structural and functional unit of all living organisms.

134. Answer (4)

Hint: Mitochondria are involved in the production of ATP through oxidative phosphorylation. Stroma of chloroplast is the site of dark reaction.

Sol.: Like mitochondria, the chloroplasts are also double membrane bound. Out of the two, the inner chloroplast membrane is relatively less permeable than the outer membrane.

135. Answer (2)

Hint: '*Omnis cellula-e cellula*' means new cells are formed from pre-existing cells.

Sol.: Rudolf Virchow modified the hypothesis of Schleiden and Schwann to give the cell theory a final shape by adding the statement '*Omnis cellula-e cellula*'. The cell theory is applicable for living cells only.

SECTION-B

136. Answer (1)

Hint: The structure that divides the intracellular space into two distinct compartments are present in the form of a network or reticulum of tiny tubular structures scattered in the cytoplasm.

Sol.: Endoplasmic reticulum divides the intracellular space into two distinct compartments, *i.e.*, luminal (inside ER) and extra luminal (cytoplasm) compartments.

137. Answer (4)

Hint: Cell wall of cyanobacteria is made up of peptidoglycan, whereas plant cell wall is made up of cellulose.

Sol.: In eukaryotes, cytoplasm is divided in many compartments by membranous structures. In cyanobacteria, photosynthetic pigments are contained by the chromatophores that are membranous extensions into the cytoplasm.

138. Answer (3)

Hint: Anton von Leeuwenhoek used simple self-made light microscope to see the cells.

Sol.: Anton von Leeuwenhoek first saw and described a live cell.

The invention of the microscope and its improvement leading to the electron microscope revealed all the structural details of the cell.

139. Answer (4)

Hint: Along with animal cells, Theodore Schwann also studied plant cells.

Sol.: Schwann (1839), a British Zoologist, studied different types of animal cells and reported that cells had a thin outer layer which is today known as the 'plasma membrane'. He also concluded, based on his studies on plant tissues, that the presence of cell wall is a unique character of the plant cells.

140. Answer (3)

Hint: Microbodies are single membrane bound minute vesicles.

Sol.: Microbodies contain various enzymes, are present in both plant and animal cells. These are in the form of minute vesicles.

141. Answer (3)

Hint: Chromosomes are made up of nucleoprotein fibres that was stained by Flemming with the help of basic dyes.

Sol.: The material of the nucleus stained by the basic dyes was given the name chromatin by Flemming.

142. Answer (3)

Hint: Amyloplasts store carbohydrates (starch) and elaioplasts store oils and fats.

Sol.: Aleuroplasts are a type of leucoplast. These are colourless plastids. Chromoplasts have fat soluble pigments like carotene and xanthophylls.

143. Answer (3)

Hint: Grana are found in chloroplast and kinetochore is a part of chromosome.

Sol.: The axoneme in eukaryotic flagella and cilia usually has nine doublets of radially arranged peripheral microtubules, and a pair of centrally located microtubules. Such an arrangement of axonemal microtubules is referred to as the 9+2 array.

144. Answer (1)

Hint: Neutral solutes may move across the membrane by the process of simple diffusion along the concentration gradient, *i.e.*, from higher concentration to the lower.

Sol.: Transport of ions across the cell membrane is an energy dependent process, in which energy of ATP is utilised and is called active transport. Na^+/K^+ pump is an example of such type of transport.

145. Answer (3)

Hint: For ribosomes, 'S' in 80S and 70S stands for the sedimentation coefficient.

Sol.: 'S' in 80S and 70S regarding ribosomes, is Svedberg's Unit that represents sedimentation coefficient. It is indirectly a measure of density and size.

146. Answer (1)

Hint: Coccus and Spirillum bacteria are spherical and spiral respectively.

Sol.: Vibrio is comma-shaped bacterium. Bacillus is rod-shaped bacterium.

147. Answer (3)

Hint: Nucleolus is a site for active ribosomal RNA synthesis.

Sol.: Mitochondria and chloroplasts have 70S ribosomes that is made up of rRNA. Along with DNA and proteins, chromosomes have RNA too.

148. Answer (2)

Hint: Mitochondria are the sites of aerobic respiration in eukaryotic cells.

Sol.: Mitochondria produce cellular energy in the form of ATP, hence they are called 'power houses' of the cell.

149. Answer (3)

Hint: The plasmid DNA confers certain unique phenotypic characters, such as resistance to antibiotics, to some bacteria.

Sol.: Bacteria are prokaryotes and prokaryotes have double stranded circular DNA as genetic material.

150. Answer (4)

Hint: The inner compartment of mitochondria is filled with a dense homogeneous substance called the matrix.

Sol.: The matrix of mitochondria possesses single circular DNA molecule, a few RNA molecules, ribosomes (70S) and the components required for the synthesis of proteins.

[ZOOLOGY]

SECTION-A

151. Answer (4)

Hint: Smooth muscle fibres do not have striations.

Sol.: All involuntary muscle fibres are not striped; cardiac muscle fibres are striped.

The walls of stomach and intestine contain smooth muscle fibres that are involuntary in action.

Intercalated discs are present in cardiac muscle fibres.

152. Answer (1)

Hint: Feature of skeletal muscle fibres

Sol.: Smooth muscle fibres are involuntary in action. These are fusiform in shape (tapered from both the ends) and are unstriated.

Cell junctions hold them together and they are bundled together in a connective tissue sheath.

Smooth muscle fibre has a centrally located nucleus.

153. Answer (4)

Hint: Bone marrow is a hematopoietic structure.

Sol.: The bone marrow in some bones is the site of production of blood cells, so if it gets damaged, then production of blood cells will also get hampered.

Limb bones, such as long bones of the legs, serve weight bearing functions.

Dense irregular connective tissue has fibroblasts and many fibres (mostly collagen) that are oriented differently. This tissue is present in the skin.

154. Answer (2)

Hint: It is also absent in lymph.

Sol.: Fibroblasts are absent in blood. In all connective tissues except blood and lymph, the cells secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the connective tissue.

155. Answer (3)

Hint: This epithelium is made of a single layer of flattened cells.

Sol.: In human respiratory system, the diffusion membrane is made of three layers namely, the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance present between them.

Also, it is known that simple squamous epithelium is involved in forming a diffusion boundary.

156. Answer (1)

Hint: Flattened cells are involved in diffusion.

Sol.: Some of the columnar or cuboidal cells get specialised for secretion and are called glandular epithelium. Flattened cells are components of squamous epithelium.

157. Answer (4)

Hint: Present in bones as well

Sol.: The intercellular material of cartilage is solid and pliable and resists compression. It is a type of specialised connective tissue.

Bone is the main tissue that provides structural frame to the body. Osteocytes (bone cells) and chondrocytes are present in spaces called lacunae.

Lamellae are absent in cartilage.

158. Answer (2)

Hint: Collagen fibres provide strength to bones.

Sol.: Bones have hard and non-pliable ground substance, rich in calcium salts and collagen fibres which give strength to bones. The intercellular material of cartilage is solid and pliable and resists compression.

159. Answer (1)

Hint: It may be simple or compound based on the number of layers of cells.

Sol.: Epithelial tissue has a free surface, which faces either a body fluid or the outside environment and thus provides a covering or a lining for some parts of the body.

The cells are compactly packed with little intercellular matrix.

160. Answer (3)

Hint: Neurons are excitable cells of neural system.

Sol.: The neuroglial cells protect and support neurons. Neuroglia make up more than one half the volume of neural tissue in our body. Neurons, the structural and functional units of neural tissue, are excitable cells.

161. Answer (1)

Hint: Ciliated epithelium helps in the movement of particles in a specific direction.

Sol.: Ductless glands are also called endocrine glands. Compound epithelium covers the dry surface of the skin as it is involved in protection.

Connective tissue is the most abundant tissue in the body of complex animals.

162. Answer (4)

Hint: These cells are absent in blood.

Sol.: Fibroblasts secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the connective tissue. These cells also secrete modified polysaccharides, which accumulate between cells and fibres and act as matrix (ground substance).

163. Answer (3)

Hint: It is a monosaccharide.

Sol.: Inulin is a polymer of fructose whereas cellulose is a polymer of glucose.

Glycogen and starch are homopolymers.

164. Answer (4)

Hint: K_m is related to substrate concentration.

Sol.: K_m in an enzyme catalysed reaction is defined as the concentration of substrate at which the velocity of the reaction is half the maximum velocity.

165. Answer (4)

Hint: Palmitic acid belongs to this category.

Sol.: Upon chemical analysis of a living tissue, two fractions are observed. One is called the filtrate or more technically, the acid-soluble fraction and the second, the retentate or the acid-insoluble fraction. The acid-insoluble fraction has only four types of organic compounds *i.e.*, proteins, nucleic acids, polysaccharides and lipids.

166. Answer (4)

Hint: Collagen

Sol.: Collagen is the most abundant protein in the animal world. It also acts as an intercellular ground substance.

167. Answer (4)

Hint: CCl_3COOH is used in chemical analysis of a living tissue.

Sol.: All elements present in a sample of Earth's crust are also present in a sample of living tissue. Also, the relative abundance of carbon and oxygen w.r.t. other elements is higher in any living organism than in Earth's crust.

Amino acids that occur in proteins are only of 20 types. The molecular formula of trichloroacetic acid is CCl_3COOH.

168. Answer (2)

Hint: Each amino acid has its own unique pH in which it exist in its zwitterionic form.

Sol.: A zwitterionic form of amino acid has equal number of positively and negatively charged groups and therefore, overall charge on it becomes zero.

169. Answer (3)

Hint: Phenylalanine is an aromatic amino acid.

Sol.: The chemical and physical properties of amino acids are essentially of the amino, carboxyl and the R functional groups. Based on number of amino and carboxyl groups, there are acidic (glutamic acid), basic (lysine) and neutral (valine) amino acids. Similarly, there are aromatic amino acids (*e.g.*, tyrosine, phenylalanine, tryptophan).

170. Answer (3)

Hint: Exclude the simplest amino acid

Sol.: The 'R' group in amino acids could be a hydrogen (glycine), a methyl group (alanine), hydroxy methyl (serine), *etc*. Cysteine is a sulphur containing amino acid.

171. Answer (3)

Hint: Metal ions act as co-factor.

Sol.: Zinc acts as the co-factor for the enzyme 'carboxypeptidase'.

Apoenzyme is the protein part of an enzyme.

Co-enzymes and prosthetic groups are different types of co-factors.

172. Answer (4)

Hint: Malonate is the competitive inhibitor of succinic dehydrogenase.

Sol.: When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as competitive inhibitor. Due to its close structural similarity with the substrate, the inhibitor competes with the substrate for the substrate binding site of the enzyme. Consequently, the substrate cannot bind and as a result, the enzyme action declines, *e.g.*, inhibition of succinic dehydrogenase by malonate which closely resembles the substrate 'succinate' in structure.

173. Answer (2)

Hint: Co-factor = Prosthetic groups, co-enzymes and metal ions

Sol.: Haem is the prosthetic group of enzymes 'peroxidase' and 'catalase'.

A prosthetic group is an organic compound and is always tightly bound to an enzyme.

174. Answer (3)

Hint: Fats and oils are glycerides.

Sol.: Rate of a physical or chemical reaction refers to the amount of product formed per unit time.

Rate of reaction increases by double or decreases by half for every 10°C rise or fall in temperature respectively.

Inorganic catalyst works efficiently at high temperatures and pressures where enzymes get damaged at high temperatures (say above 40°C).

175. Answer (2)

Hint: Enzymes are divided into six classes.

Sol.: Class III – Hydrolases are the enzymes that catalyse hydrolysis of ester, ether, peptide, glycosidic, C – C, C-halide or P-N bonds.

Class II – Transferases

Class IV – Lyases

Class V – Isomerases

176. Answer (1)

Hint: Most of the enzymes are proteinaceous.

Sol.: An enzyme like any other protein has all the structures namely primary, secondary and tertiary.

Tertiary structure is required for many biological activities of the protein. The protein chain folds upon itself and forms the active sites into which substrate fits.

177. Answer (4)

Hint: Every enzyme works at an optimum temperature and pH.

Sol.: Enzymes lower the activation energy in a chemical reaction and therefore, increase the rate of reaction. Temperature, pH, concentration of the substrate as well as the product and presence of the inhibitor affect the enzyme activity.

178. Answer (4)

Hint: Plasma is the matrix of blood.

Sol.: Blood is the main circulating fluid of the body. It transports nutrients, gases, hormones, *etc*.

179. Answer (2)

Hint: Skeletal muscle fibres are not branched.

Sol.: Skeletal muscle fibres are striated, multinucleated, unbranched, cylindrical and voluntary.

Cardiac muscle fibres are branched and involuntary.

180. Answer (1)

Hint: Insect belongs to the phylum Arthropoda.

Sol.: Chitin is found in the exoskeleton of arthropods.

The 1st amino acid in a protein (*eg.*, insulin) is N-terminal amino acid. In polysaccharides (*e.g.*, glycogen) the right end is called the reducing end and the left end in called the non-reducing end.

181. Answer (1)

Hint: Pyrimidine = [T + C] in dsDNA

Sol.: As per Chargaff's rule,

Amount of guanine = amount of cytosine

$\because$ Amount of guanine = 25%

Thus, amount of cytosine = 25%

So, A = T = 25%

Hence, amount of pyrimidine = C + T = 25 + 25 = 50%

182. Answer (1)

Hint: Denaturation of enzymes

Sol.: Mostly proteinaceous enzymes (except thermostable enzymes) get damaged at high temperatures as the tertiary structure is lost upon heating due to breakage of most of the bonds.

Tertiary structure is necessary for biological activities of the enzymes. Decrease in temperature preserves the enzyme in their temporarily inactive state.

183. Answer (3)

Hint: Lipids are not polymeric in nature.

Sol.: Gingelly oil is not polymeric. RuBisCO is a protein which is a heteropolymer. DNA is the polymer of nucleotides. Starch is a homopolysaccharide.

184. Answer (2)

Hint: Morphine is also an alkaloid.

Sol.: Alkaloid – Codeine

Polymeric substance – Gum

Lectin – Concanavalin A

Toxin – Ricin

185. Answer (3)

Hint: A H_2O molecule is lost

Sol.: Upon dehydration reaction, a molecule of H_2O is lost. When two molecules of glucose ($C_6H_{12}O_6$) are linked by a glycosidic bond, a molecule of H_2O is removed and maltose is formed.

The molecular formula of maltose is $C_{12}H_{22}O_{11}$.

SECTION-B

186. Answer (2)

Hint: $E + S \rightleftharpoons ES \rightarrow EP \rightarrow E + P$

Sol.: The catalytic cycle of an enzyme action can be described in the following steps:

(1) The substrate binds to the active site of the enzyme.

(2) The binding of the substrate induces the enzyme to alter its shape, fitting more tightly around the substrate.

(3) The active site of the enzyme, now in close proximity of the substrate breaks the chemical bonds of the substrate and the new enzyme product complex is formed.

(4) The enzyme releases the products of the reaction and the free enzyme is ready to bind to another molecule of the substrate.

187. Answer (4)

Hint: Haemoglobin exhibits quaternary structure of protein.

Sol.: Some proteins are an assembly of more than one polypeptide or subunits. The manner in which these individual polypeptides or subunits are arranged w.r.t. each other is the architecture of proteins called quaternary structure of a protein. Adult human haemoglobin consists of 4 subunits. Two of these are identical to each other.

188. Answer (2)

Hint: Fibres are present in both the tissues.

Sol.: Fibres and fibroblasts are compactly packed in the dense connective tissue. Orientation of fibres show a regular and irregular pattern and are called dense regular and dense irregular tissues respectively. In the dense regular connective tissues, the collagen fibres are present in rows between many parallel bundles of fibres.

Dense irregular connective tissue has fibroblasts and many fibres (mostly collagen) that are oriented differently.

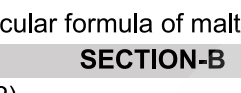
189. Answer (4)

Hint: Constituent of genetic material

Sol.: Nucleotide = Nitrogenous base + Ribose sugar + Phosphate group. Glycerol is trihydroxy propane and is a simple lipid. Arachidonic acid has 20 carbon atoms including the carboxyl carbon. Cytosine is a nitrogenous base while cytidine is a nucleoside.

190. Answer (4)

Hint:



Sol.: Amino acids are substituted methanes. There are four substituent groups occupying the four valency positions. These are hydrogen, carboxyl group, amino group and a variable group designated as R group.

191. Answer (2)

Hint: Contraction leads to shortening

Sol.: Muscle fibres contract (shorten) in response to stimulation, then relax (lengthen) and return to their uncontracted state in a coordinated fashion.

192. Answer (3)

Hint: Depends on the type of neurotransmitters released

Sol.: When a neuron is suitably stimulated, an electrical disturbance is generated which swiftly travels along its plasma membrane. Arrival of the disturbance at the neuron's endings, or output zone, triggers events that may cause stimulation or inhibition of adjacent neurons and other cells.

Chemical nature of a receptor can never change. Receptors are mostly proteinaceous in nature.

193. Answer (3)

Hint: Also known as gap junction

Sol.: Three types of cell junctions are found in the epithelium and other tissues. These are called as

tight, adhering and gap junctions. Tight junctions help to stop substances from leaking across a tissue. Adhering junctions perform cementing to keep neighbouring cells together. Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small molecules and sometimes big molecules.

194. Answer (3)

Hint: Compound epithelium has a limited role in secretion and absorption.

Sol.: Compound epithelium is made of more than one layer of cells and thus has a limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses. They cover the dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts.

Ciliated epithelium is mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes.

195. Answer (1)

Hint: Hormones are the secretions of ductless glands.

Sol.: On the basis of the mode of pouring of their secretions, glands are divided into two categories namely exocrine and endocrine glands.

Exocrine glands secrete mucus, saliva, earwax, oil, milk, digestive enzymes and other cell products. These products are released through ducts or tubes. In contrast, endocrine glands do not have ducts. Their products called hormones are secreted directly into the fluid bathing the gland.

Insulin is a proteinaceous hormone. Trypsin is a digestive enzyme.

196. Answer (2)

Hint: Transition state structure is not a permanent structure.

Sol.: During the state where substrate is bound to the enzyme active site, a new structure of the substrate called transition state structure is formed which is transient and unstable state.

197. Answer (3)

Hint: Cells of this tissue bear cilia and form ciliated epithelium.

Sol.: The columnar epithelium is composed of a single layer of tall and slender cells. Their nuclei are located at the base. Free surface may have microvilli. They are found in the lining of stomach and intestine and help in secretion and absorption. Endothelium of alveolar capillaries consists of simple squamous epithelial tissue.

Compound epithelial tissue is present in the moist surface of buccal cavity.

Cuboidal epithelium is commonly found in the ducts of glands.

198. Answer (1)

Hint: Made of many layers of cells

Sol.: Compound epithelium provides protection against chemical and mechanical stresses. It has limited role in secretion and absorption.

This epithelium covers the dry surface of the skin, the moist surface of buccal cavity, pharynx, *etc*.

199. Answer (3)

Hint: Constituents of areolar connective tissue

Sol.: A – Macrophage

B – Fibroblast

C – Collagen fibres

D – Mast cell

Areolar tissue serves as a support framework for epithelium. It contains fibroblasts (cells that produce and secrete fibres), macrophages and mast cells.

200. Answer (2)

Hint: Type of a specialised connective tissue

Sol.: Neural tissue exerts the greatest control over the body's responsiveness to changing conditions.

Tendons which attach skeletal muscles to bones and ligaments which attach one bone to another are examples of dense regular connective tissue.

Bone is the main tissue that provides structural frame to the body. Bones support and protect softer tissues and organs.

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