All India Aakash Test Series for NEET - 2027

TEST - 1 (Code-C)

Click here for Code-D sol.

Test Date : 31/08/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: In multiplication/division, final answer will have the minimum number of significant figures as in the quantities being operated.

Sol.: $\frac{1.2\times0.950}{6.00}=0.20\times0.950=0.19$

2. Answer (4)

Hint: Instantaneous speed $v=|\vec{v}|$ where $\vec{v}$ = Instantaneous velocity.

Sol.: If speed v is changing, then velocity $\vec{v}$ is also changing $\Rightarrow$ $\vec{v}$ cannot be constant.

3. Answer (3)

Hint: Use equation of motion $S=ut+\frac{1}{2}gt^2$ by taking proper sign convention.

Sol.: $-20=20t-\frac{1}{2}(10)t^2$

$\Rightarrow$ $t^2-4t-4=0$

$\therefore$ $t=\frac{+4\pm\sqrt{4^2+4^2}}{2}=\frac{4\pm4\sqrt{2}}{2}$

$\Rightarrow$ $t=\left(2+2\sqrt{2}\right)$s ($\because$ Time can't be negative)

4. Answer (3)

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

Sol.: $S=0(t)+\frac{1}{2}(9.8)4^2=9.8\times8=78.4$ m

5. Answer (3)

Hint & Sol.: Random errors can be reduced by repeated measurements.

6. Answer (4)

Hint: Least count of vernier callipers = 1 MSD – 1 VSD

Sol.: 5 VSD = 4 MSD $\Rightarrow$ 1 VSD $=\frac{4}{5}$MSD

$\therefore$ L.C. $=1\text{MSD}-\frac{4}{5}\text{MSD}=\frac{1}{5}\text{MSD}$

$=\frac{1}{5}\times\frac{1\text{ cm}}{10}=0.02$ cm

7. Answer (3)

Hint & Sol.: Second is the SI unit of physical quantity 'Time'.

8. Answer (4)

Hint: Multiplication/Division of different physical quantities A and B yields a new quantity.

Sol.: $(2A + B)$ is not possible as A, B have different dimensions.

9. Answer (4)

Hint: Use 3rd equation of motion, $v^2 = u^2 + 2ax$.

Sol.: Comparing we get, $u^2 = 80$ and $2a = -8$

$\therefore$ $a = -4$ m/s^2

10. Answer (3)

Hint: Area under $a - t$ graph = change in velocity

Sol.: Area = $\frac{1}{2}\times4\times4=v-u$

$\Rightarrow$ $8 = v - 0 \Rightarrow v = 8$ m/s

11. Answer (3)

Hint: Use equations of uniformly accelerated motion

Sol.: If the ball crosses helicopter after three seconds, then

Displacement of ball = 15 m

$\Rightarrow$ $s=ut+\frac{1}{2}at^2\Rightarrow15=v\times3-\frac{1}{2}\times10\times9$

$\Rightarrow$ $15 = 3v - 45 \Rightarrow 3v = 60 \Rightarrow v = 20$ m s^{-1}

12. Answer (1)

Hint: Acceleration = slope of $v - t$ graph = $\tan\theta$

Sol.: $\frac{a_A}{a_B}=\frac{\tan60^\circ}{\tan30^\circ}=\frac{\sqrt{3}}{\frac{1}{\sqrt{3}}}=3:1$

13. Answer (2)

Hint: The zeros on the right of decimal point are significant but to the left of first digit 1 are not significant.

Sol.: The 5 significant figures are 1, 0, 0, 1, 0.

14. Answer (3)

Hint: $\frac{\Delta A}{A}\times 100=\left(\frac{2\Delta x}{x}\times 100\right)+\left(\frac{2\Delta y}{y}\times 100\right)+\left(\frac{3\Delta z}{z}\times 100\right)$

Sol.: Maximum % error in

$A=(2\times 1+2\times 2+3\times 3)\%=15\%$

15. Answer (4)

Hint: Greater precision implies smaller least count.

Sol.: Statement I is false as least count of 25.0001 cm is smaller than of 50.01 cm.

Statement II is true because

50 km + 50 m = 50 km + 0.050 km = 50.050 km $\approx$ 50 km as the original number had no decimal places.

16. Answer (4)

Hint: The maximum permissible error in R_{eq} is $\Delta R_{eq} = \Delta R_1 + \Delta R_2$

Sol.:

$R_{eq}=R_1+R_2=(20+30)\pm\Delta R_{eq}=(50\pm 0.8)\Omega$

17. Answer (3)

Hint: If particle crosses the same point at instants t_1 and t_2 then total time of flight $T = t_1 + t_2$.

Sol.: Total time of flight,

$T=\frac{2u}{g}=\frac{2\times 80}{10}=16\ \text{s}$

$T = 3.5 + n \Rightarrow 16 = 3.5 + n \Rightarrow n = 12.5$ s

18. Answer (3)

Hint: Stopping distance $x=\frac{v^2}{2a}$

Sol.: No collision will happen if $d > x \Rightarrow d > \frac{v^2}{2a}$

19. Answer (4)

Hint: Speed of bus = $v=\frac{dx}{dt}=\frac{1}{\frac{dt}{dx}}$

Sol.: $\frac{dt}{dx}=\frac{1}{2\sqrt{x^2+48}}\times 2x$

$\Rightarrow \frac{dx}{dt}=v=\frac{\sqrt{x^2+48}}{x}=2$ m/s

$\Rightarrow \sqrt{x^2+48}=2x \Rightarrow 48=3x^2$

$\Rightarrow$ x = +4 m is valid

20. Answer (4)

Hint: Speed of a body and path length travelled by a body cannot be negative.

Sol.:

(1) When speed increases, displacement can increase.

(2) When path length increases, displacement can decrease.

(3) When speed increases, position of body can increase.

21. Answer (3)

Hint: $n_1u_1 = n_2u_2$ and [momentum] = [MLT^{-1}]

Sol.: $n_2=\frac{n_1u_1}{u_2}=100\left[\frac{M}{2M}\right]\left[\frac{L}{2L}\right]\left[\frac{T}{4T}\right]^{-1}$

$\Rightarrow n_2=100\frac{1}{2}\times\frac{1}{2}\times 4=100$

22. Answer (4)

Hint: If the digit to be rounded off is 5, then the preceding digit is increased by one if it is odd and is left unchanged if it is even.

Sol.: 2.345 $\approx$ 2.34 and 5.435 $\approx$ 5.44

23. Answer (1)

Hint & Sol.:

In graph (A):

x is decreasing, hence $v < 0$.

$\left|\frac{dx}{dt}\right|=|\vec{v}|$ is decreasing, hence $a > 0$

In graph (B) :

x is decreasing, hence $v < 0$

$\frac{dx}{dt}$ = constant, hence $a = 0$

In graph (C) :

x is decreasing, hence $v < 0$

$\left|\frac{dx}{dt}\right|=|\vec{v}|$ is increasing, hence $a < 0$

In graph (D) :

x is constant, hence $v = 0$, and $a = 0$

24. Answer (1)

Hint: According to principle of homogeneity,

$[v] = [M]^{\alpha}[A]^{\beta}[\rho]^{\gamma}[g]^{\delta}$

Sol.: $[LT^{-1}] = [M]^{\alpha}[L^2]^{\beta}[ML^{-3}]^{\gamma}[LT^{-2}]^{\delta}$

Equating the dimensions on both sides,

$0 = \alpha + \gamma$

$1 = 2\beta - 3\gamma + \delta$

$-1 = -2\delta \Rightarrow \delta = \frac{1}{2}$

$\Rightarrow 2\beta - 3\gamma = \frac{1}{2}$

If $\alpha = K$, then $\gamma = -K$ and $\beta = \frac{1}{4} - \frac{3K}{2}$

By hit and trial [put $\alpha = K = \frac{1}{2}$ from option (1)]

$\therefore \gamma = \frac{-1}{2}$ and $\beta = \frac{-1}{2}$

25. Answer (1)

Hint: For uniform motion of football, acceleration a = zero.

Sol.: a = zero just before it is hit. When the foot strikes the ball, the ball gets accelerated due to the applied impulsive reaction by foot. After that, again a = zero.

26. Answer (3)

Hint: Average speed

$$v_{avg} = \frac{\text{Total distance travelled}}{\text{Total time taken}} = \frac{x}{\frac{T}{3}}$$

Sol.: $v = \frac{dx}{dt} = 9\alpha t^2 \Rightarrow \int_0^x dx = \int_0^{T/3} 9\alpha t^2 dt$

$\Rightarrow x = 9\alpha\left[\frac{t^3}{3}\right]_0^{T/3}$

$\Rightarrow x = \frac{\alpha T^3}{9}$

$\therefore V_{avg} = \frac{3x}{T} = \frac{\alpha T^2}{3}$

27. Answer (4)

Hint: SI unit of angle is radian, of pressure is Pa and of time is sec.

Sol.: $1^{\circ} = \frac{\pi}{180}$ rad

1 bar = 10^5 Pa

1 day = 24 h = 24 × 3600 = 86400 sec

28. Answer (1)

Hint: $\int \sin t\, dt = -\cos t + C$

Sol.: $\int \sin(\beta t)dt = -\frac{\cos(\beta t)}{\beta} + C$ is both physically and dimensionally correct.

29. Answer (4)

Hint: [Energy] = $[ML^2T^{-2}]$ and [Force] = $[MLT^{-2}]$

Sol.: [Energy density] = [Modulus of elasticity]

$$= \frac{[\text{Energy}]}{[\text{Volume}]} = [ML^{-1}T^{-2}]$$

[Surface tension] = [Spring constant]

$$= \frac{[\text{Force}]}{[\text{Length}]} = [MT^{-2}]$$

[Energy gradient] = [Force] = $[MLT^{-2}]$

[Gravitational field intensity] = $\frac{[\text{Force}]}{[\text{Mass}]} = \left[LT^{-2}\right]$

30. Answer (4)

Hint: Use homogeneity of dimensions.

Sol.: $[v] = \left[at^2\right] = [bt] = \left[\frac{c}{t}\right] = \left[LT^{-1}\right]$

$\Rightarrow [a] = \left[LT^{-3}\right], [b] = \left[LT^{-2}\right], [c] = [L]$

$\therefore \frac{[a][c]}{[b]} = \frac{[L^2T^{-3}]}{\left[LT^{-2}\right]} = \left[LT^{-1}\right] = [v]$

31. Answer (3)

Hint: Distance covered in n^{th} second = $S_{n_{th}} = u + \frac{g}{2}(2n-1)$

Sol.: $S_2 = \frac{g}{2}(2\times 2 - 1) = \frac{3g}{2}$

$S_4 = \frac{g}{2}(2\times 4 - 1) = \frac{7g}{2}$

$\therefore S_2 : S_4 = 3 : 7$

32. Answer (4)

Hint: Average velocity = $\frac{\text{Total displacement}}{\text{Total time taken}}$

Sol.: Total displacement = zero, when ball reaches ground again.

$\therefore$ Average velocity = zero

33. Answer (3)

Hint: Acceleration $a = \frac{dv}{dt}$ where v is velocity, t is time.

Sol.: $\frac{dv}{dt} = 2e^{-2t} \Rightarrow \int_0^v dv = \int_0^1 2e^{-2t}dt$

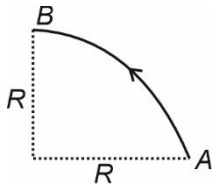
$\Rightarrow v - 0 = 2\left[\frac{e^{-2t}}{-2}\right]_0^1 = -1\left[e^{-2} - 1\right]$

$\therefore \quad v = 1 - e^{-2}$

34. Answer (2)

Hint: Displacement = shortest distance between initial position (A) and final position (B).

Sol.:



$\therefore$ Displacement = $AB = \sqrt{R^2 + R^2} = \sqrt{2}R$

35. Answer (4)

Hint: At maximum velocity, $\frac{dv}{dt} = 0$ as t can take any value.

Sol.: $v = \frac{dx}{dt} = 2t - 3 - \sin t + \cos t$

$a = \frac{dv}{dt} = 2 - \cos t - \sin t = 0$

$\Rightarrow$ sin$t$ + cos$t$ = 2 is not possible as

$\left(\sin t + \cos t\right)_{max} = \sqrt{2}$

$\therefore$ Maximum velocity is not defined.

36. Answer (4)

Hint & Sol.: Strain, angle and refractive index have no dimensions i.e., $[M^oL^oT^o]$ but angle has unit.

37. Answer (3)

Hint: According to the principle of dimensional homogeneity, [L.H.S.] = [R.H.S]

Sol.:

A is correct as $[v_{avg}] = [u] = [LT^{-1}]$

B is correct as $[v^2] = [as] = [L^2T^{-2}]$

C is correct as $[F] = \left[\frac{mv^2}{r}\right] = \left[MLT^{-2}\right]$

D is wrong as $[s^2] = \left[L^2\right] \neq [ut]$

38. Answer (3)

Hint: Mean absolute error =

$$\Delta a_{mean} = \frac{|\Delta a_1| + |\Delta a_2| + |\Delta a_3|}{3}$$

Sol.:

$a_{mean} = \frac{a_1 + a_2 + a_3}{3} = \frac{2.4 + 2.5 + 2.6}{3} = 2.5$ m

$|\Delta a_1| = |a_1 - a_{mean}| = |2.4 - 2.5| = 0.1$ m $= |\Delta a_3|$

$|\Delta a_2| = |a_2 - a_{mean}| =$ zero

$\therefore \quad \Delta a_{mean} = \frac{0.1 + 0 + 0.1}{3} = \frac{0.2}{3} = 0.0666... \approx 0.1$ m

according to significant figures.

39. Answer (3)

Hint: Diameter of wire, d = M.S.R + L C × C.S.R

Sol.: $d = 2 \text{ mm} + 51 \times \left(\frac{1 \text{ mm}}{100}\right) = (2 + 0.51) \text{ mm}$

$= 2.51$ mm

40. Answer (4)

Hint: Equation of straight line is given by $y = mx + c$, where m = slope

Sol.:

(1) Slope = zero

(2) Slope = +1

(3) Slope = $+\frac{3}{2}$

(4) Slope = $-\frac{2}{3}$

41. Answer (1)

Hint & Sol.: Relative acceleration of ball w.r.t. man = Acceleration due to gravity = g

($\because$ ball falls freely and man has no acceleration)

42. Answer (1)

Hint: During ascent,

Retardation = $a_{ascent} = \frac{F_{net}}{m} = \frac{mg + F_d}{m}$ and

$a_{descent} = \frac{mg - F_d}{m}$

Sol.: $a_{ascent} > a_{descent} \Rightarrow t_{ascent} < t_{descent} \left(\because t \propto \frac{1}{a}\right)$

43. Answer (4)

Hint: Average acceleration $\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t} = \frac{\Delta \vec{v}}{\Delta t}$

Sol.: If $< \vec{a} >= 0 \Rightarrow |\vec{v}_i| = |\vec{v}_f|$ and $\vec{v}_i = \vec{v}_f$

During the time interval, velocity may change as well.

44. Answer (1)

Hint: % error in $T = \frac{\Delta t}{t} \times 100 = \frac{\Delta T}{T} \times 100$

Sol.: $t_{100} = 100\ T = 100 \times 2 = 200$ s

Δt = L.C. = 0.1 s

$\therefore \quad \frac{\Delta t}{t} \times 100 = \frac{0.1 \times 100}{200} = \frac{5}{100} = 0.05\%$

45. Answer (3)

Hint: Closer the measured value to its true value, more accurate is the reading.

Sol.: The readings can be arranged in increasing order of accuracy as

18.1 cm < 18.22 cm = 18.444 cm < 18.3 cm

[CHEMISTRY]

46. Answer (3)

Hint: $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

Sol.: 2 mol of C_2H_6 produces = 4 mol of CO_2

$\therefore$ Mass of CO_2 evolved = 44 × 4 = 176 g

CO_2 gets absorbed over 10 mol (560 g) of KOH

$\therefore$ Final weight of KOH after absorption of CO_2 = 560 + 176 = 736 g

47. Answer (4)

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

Sol.: Mass of one molecule of water = $\frac{18}{6.02 \times 10^{23}}$

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

$$\text{Volume} = \frac{18}{6.02 \times 10^{23} \times 1} = 2.99 \times 10^{-23}\ \text{cm}^3$$

48. Answer (2)

Hint: Total Number of electrons = Moles × N_A × Electrons in one ion

Sol.: Total number of $e^- = \frac{3.2}{32} \times N_A \times 18$

$\Rightarrow 1.8\ N_A$

49. Answer (3)

Hint: $CO_2(g) + C(s) \rightarrow 2CO(g)$

Sol.: 100 mL $CO_2 \equiv$ 200 mL CO

$\therefore$ Change in volume = 200 – 100

= 100 mL increase

50. Answer (1)

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

Sol.: $0.1 = \frac{\text{Mass} / 100}{100 / 1000}$

Mass = 1 g

51. Answer (2)

Hint: Percentage of carbon

= 100 – (5.94 + 70.29)

= 23.77%

Sol.:

Element	Mass percent	Mole	Simplest Rateo
C	23.77	$\frac{23.77}{12} = 1.98$	$\frac{1.98}{1.98} = 1$
H	5.94	$\frac{5.94}{1} = 5.94$	$\frac{5.94}{1.98} = 3$
Cl	70.29	$\frac{70.29}{35.5} = 1.98$	$\frac{1.98}{1.98} = 1$

Empirical formula = CH_3Cl.

52. Answer (2)

Hint: Zeros between the two non-zero digits are significant.

Sol.: 2.004 has 4 significant figures.

Zero at the end of a number are significant provided they are on the right side of decimal point.

53. Answer (4)

Hint: Percentage of oxygen

$$= \frac{\text{Mass of oxygen}}{\text{Molar mass of compound}} \times 100$$

Sol.:

a. Percentage of oxygen in H_2SO_4 = $\frac{64}{98} \times 100 = 65.3$

b. Percentage of oxygen in ammonium sulphate

$= \frac{64}{132} \times 100 = 48.48$

c. Percentage of oxygen in SO_2 = $\frac{32}{64} \times 100 = 50\%$

d. Percentage of oxygen in CaO = $\frac{16}{56} \times 100 = 28.57\%$

54. Answer (1)

Hint: For minimum molecular mass, one molecule of enzyme should contain at least one zinc

Sol.: 0.01 g of Zn $\equiv$ 100 g of enzyme

$\therefore$ 65.3 g of Zn $\equiv \frac{100}{0.01} \times 65.3$

$= 6.53 \times 10^5$ g

$\therefore$ Molecular mass of enzyme = 6.53×10^5 u

55. Answer (4)

Hint: $2Mg + O_2 \rightarrow 2MgO$

Sol.: 32 g of O_2 reacts with 48 g of Mg to form 80 g MgO

$\therefore$ 0.64 g of O_2 reacts with $\frac{48}{32} \times 0.64$

= 0.96 g

Excess amount of Mg = 2 – 0.96 = 1.04 g

limiting reagent $\Rightarrow O_2$

Amount of MgO formed = $\frac{80}{32} \times 0.64 = 1.6$ g

56. Answer (3)

Hint: 1 mol of X_2Y_3 weighs $\equiv \frac{9}{0.05} = 180$ g

Sol.: 2x + 3y = 180

$\Rightarrow$ (2 × 30) + 3y = 180

$\therefore$ $y = \frac{120}{3} = 40$ u

Atomic mass of y = 40 u

Molecular mass of X_2Y = (2 × 30) + 40

= 100 u

57. Answer (2)

Hint: $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

Sol.: Mass of $AgNO_3$ in 50 mL of given $AgNO_3$ solution = $\frac{34}{100} \times 50 = 17$ g

Mass of NaCl in 50 mL of given NaCl solution = $\frac{11.7}{100} \times 50 = 5.85$ g

$\Rightarrow$ 1 mol of $AgNO_3 \equiv$ 1mol of NaCl $\equiv$ 1 mol of AgCl

$\therefore$ $\frac{17}{170} = 0.1$ mol of $AgNO_3 \equiv \frac{5.85}{58.5} = 0.1$ mol of NaCl $\equiv$ 0.1 mol of AgCl

Mass of 0.1 mol of AgCl = 143.5 × 0.1 $\Rightarrow$ 14.35 g

58. Answer (3)

Hint: Number of atoms = Moles × N_A × Atomicity

Sol.:

a. $\frac{1.8}{18} \times N_A \times 3 = 0.3N_A$

b. $\frac{3.1}{31 \times 4} \times N_A \times 4 = 0.1N_A$

c. $\frac{1.6}{32 \times 8} \times N_A \times 8 = 0.05\ N_A$

d. $\frac{9.2}{46} \times N_A \times 3 = 0.6\ N_A$

59. Answer (4)

Hint: Haber's process: $N_2(g) + 3H_2 \rightarrow 2NH_3(g)$

Sol.:

$\because$ 28 g of $N_2 \equiv$ 6 g of H_2

$\therefore$ 56 g of $N_2 \equiv \frac{6}{28} \times 56 = 12$ g of H_2 (Required)

available amount of H_2 = 10 g

Hence, H_2 is the limiting reagent

$\Rightarrow$ 10 g H_2 will react with $= \frac{28}{6} \times 10 = 46.67$ g

Excess amount of $N_2 \Rightarrow$ 56 – 46.67 = 9.33 g

Amount of NH_3 formed = $\frac{34}{6} \times 10 = 56.67$ g

60. Answer (3)

Hint & Sol.: One mole is the amount of substance that contains exactly the same number of entities which are present in 12 g of C–12 isotope of carbon.

61. Answer (3)

Hint: Average atomic mass

$$= \frac{(\text{Atomic mass of } E_1 \times \text{Its\% Abundance}) + (\text{Atomic mass of } E_2 \times \text{Its\% abundance})}{100}$$

Sol.: $= \frac{(14 \times x) + 15 \times (100 - x)}{100}$

$\Rightarrow$ 14x + 1500 – 15x = 14.80 ×100

x = 1500 – 1480 = 20%

$\therefore$ % abundance of lighter isotope

E_1 = 20%

62. Answer (4)

Hint & Sol.: Formula mass term is applicable to ionic compounds only. CCl_4 is a covalent compound hence formula mass term is not applicable to it.

63. Answer (1)

Hint: Molarity of a solution is number of moles of solute present in 1000 ml of solution.

Sol.: 98% w/v H_2SO_4 has 98 g H_2SO_4 in 100 ml solution

$$M = \frac{M \times 1000}{MW \times V_{ml}}$$

$$= \frac{98 \times 1000}{98 \times 100} = 10\ M$$

64. Answer (4)

Hint: As per reaction stoichiometry, 1 mol of $O_2 \equiv$ 2 mol of H_2O

Sol.: Mole of water = $\frac{90}{18} = 5$ mol

2 moles of water $\equiv$ 1 mol of $O_2 \equiv N_A$ of O_2 molecules

$\therefore$ 5 moles of water $\equiv \frac{5}{2}$ of $O_2 \equiv 2.5\ N_A$ of O_2 molecules

65. Answer (3)

Hint: Molarity of ions = $\frac{\text{Moles of ions}}{\text{Volume of solution}}$

Sol.: $Na_2CO_3(aq) \rightarrow 2Na^+(aq) + CO_3^{2-}(aq)$

Moles of Na_2CO = $\frac{10.6}{106} = 0.1$ mol

$\therefore$ Moles of Na^+ = 0.2 mol

Moles of $CO_3^{2-} = 0.1$ mol

Molarity of Na^+ ion = $\frac{0.2 \times 1000}{250} = 0.8$ M

Molarity of CO_3^{2-} ion = $\frac{0.1 \times 1000}{250} = 0.4$ M

66. Answer (4)

Hint: $x_{solvent} = \frac{n_{solvent}}{\text{Total moles of solution}}$

Sol.: In 2 molal aqueous solution,

moles of solute = 2 mol

Mass of solvent = 1000 g

$\therefore$ Moles of solvent = $\frac{1000}{18} = 55.56$ mol

$$x_{solvent} = \frac{55.56}{55.56 + 2} = \frac{55.56}{57.56} = 0.965$$

67. Answer (4)

Hint: As per the question,

100 g of air $\equiv$ 78 g N_2 gas

Sol.: Mass of nitrogen in 1 kg (1000 g) of air = $\frac{78}{100} \times 1000 \Rightarrow 780$ g

Molecules of N_2 = $\frac{780}{28} \times N_A$

= 1.68×10^{25} molecules

68. Answer (2)

Hint: Species containing same number of electrons are known as isoelectronic species.

Sol.:

Species	No. of electrons
N_2O, CO_2	22
Ca^{2+}, Ar, K^+	18
Na^+, O^{2-}	10
N_2, NO^+, CO	14
O_3	24

69. Answer (2)

Hint: $E_n = -2.18 \times 10^{-18} \frac{Z^2}{n^2}$ J/atom

Sol.: For He^+,

$$E_{He^+} = -a = -2.18 \times 10^{-18} \frac{2^2}{1^2} \quad ...(1)$$

For Li^{2+},

$$E_{Li^{2+}} = -2.18 \times 10^{-18} \frac{3^2}{2^2} \quad ...(2)$$

Dividing equation (2) by equation (1):

$$\frac{E_{Li^{2+}}}{-a} = \frac{9}{16}$$

$\therefore$ $E_{Li^{2+}} = \frac{-9}{16}a$

70. Answer (3)

Hint & Sol.: Cathode rays get deflected in the presence of electric or magnetic field and their properties do not depend upon the nature of the gas taken in discharge tube.

71. Answer (4)

Hint: $\bar{\nu} = \frac{1}{\lambda}$

Sol.: $\bar{\nu} = \frac{1}{\lambda} 109677\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right) cm^{-1}$

$\bar{\nu} = \frac{109677}{4} cm^{-1}$

$= 2.7 \times 10^4\ cm^{-1}$

72. Answer (2)

Hint & Sol.: Diffraction and interference can be explained by wave nature of electromagnetic radiation not by particle nature of electromagnetic radiation.

73. Answer (3)

Hint: $r_n = a_0 \frac{n^2}{Z}$

Sol.: $\left(r_{2^{nd}}\right)_{He^+} = \frac{a_0 \times 2^2}{2}$ ...(1)

$\left(r_{3^{rd}}\right)_{Be^{3+}} = \frac{a_0 \times 3^2}{4}$ ...(2)

Dividing equation (2) by (1):

$\frac{\left(r_{3^{rd}}\right)_{Be^{3+}}}{\left(r_{2^{nd}}\right)_{He^+}} = \frac{a_0 \times 3 \times 3}{2 \times a_0 \times 4}$

$\therefore \left(r_{3^{rd}}\right)_{Be^{3+}} = \frac{105.8 \times 9}{8} \approx 119$ pm

74. Answer (4)

Hint: Rutherford's model did not describe about stationary states.

Sol.: Rutherford's model is not about stationary state or fixed energy of the orbits (shells) around nucleus.

75. Answer (2)

Hint: Number of subshells in a principal shell = n

Sol.: Number of orbitals in a shell = n^2

Number of orbitals in a subshell = $(2l + 1)$

Maximum number of electrons in a shell = $2n^2$

76. Answer (2)

Hint: For hydrogen atom, the energy of the orbitals increases as follows:

1s < 2s = 2p < 3s = 3p = 3d

Sol.: For multielectron system, the energy of orbitals in same subshell decreases with increase in atomic numbers.

77. Answer (2)

Hint: $\Delta E = 13.6\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ where $n_2 > n_1$

Sol.: For the transition from n = 4 to n = 1, the ΔE will be highest.

78. Answer (3)

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

Sol.:

$\frac{1}{\lambda_{3^{rd}}} = R_H\left(\frac{1}{2^2} - \frac{1}{5^2}\right) = R_H\left(\frac{1}{4} - \frac{1}{25}\right) = R_H \frac{21}{100}$ ...(1)

(for Balmer series $n_1 = 2$)

$\frac{1}{\lambda_{1^{st}}} = R_{HZ}\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = R_H \times \frac{3}{4} = \frac{3R_H}{4}$ ...(2)

(for Lyman series $n_1 = 1$)

Dividing equation (2)

$\frac{\lambda_{3^{rd}}}{\lambda_{1^{st}}} = \frac{3R_H}{4} \times \frac{100}{21 R_H} \Rightarrow \frac{25}{7}$

79. Answer (4)

Hint: For the given value of n, l = 0 to (n – 1)

For the given value of l, m_l = –l to +l

Sol.:

For the value of l = 1 possible value of m_l = –1, 0, +1

There fore (a) is not possible.

For the given value of n = 3 possible value of l = 0, 1, 2

Therefor (d) is not possible

80. Answer (4)

Hint: Radial node = n – l – 1

Sol.: Angular node for $5d_{xy}$ = l = 2

Radial node for 4p orbital = n – l – 1 = 4 – 1 – 1 = 2

81. Answer (4)

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

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

$\Delta v = \frac{3\times10^4 \times 0.02}{100} = 6$

$\therefore \quad \Delta x = \frac{6.626\times10^{-34}}{4\times3.14\times9\times10^{-31}\times6} \approx 9.7\times10^{-6}\,m$

82. Answer (3)

Hint & Sol.: For n = 3 and l = 2, the subshell is 3d in which total 10 electrons are present among which 5 have spin quantum number $s = +\frac{1}{2}$ and other 5 have $s = -\frac{1}{2}$

83. Answer (3)

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

Sol.: $3.3\times10^{-31} = \frac{6.626\times10^{-34}}{0.1\times v}$

$v = \frac{6.626\times10^{-33}}{3.3\times10^{-30}} \approx 2\times10^{-3}$

$= 2\times10^{-3}$ m/s

84. Answer (4)

Hint: Orbital wave function $|\psi|^2$ at a point is known as probability density.

Sol.: The probability of finding an electron at a point within an atom is proportional to the square of the orbital wave function.

85. Answer (1)

Hint: Principal quantum number is denoted by n and defines the shell, determines the size of the orbital and also a large extent of energy

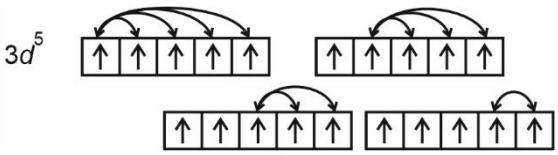
Sol.:

	Quantum number	Information
(1)	Principal quantum number (*n*)	Size and energy
(2)	Azimuthal quantum number (*l*)	Shape of orbital
(3)	Magnetic quantum number (m_l)	Orientation of orbitals
(4)	Spin quantum number (m_s)	Orientation of spin of electrons

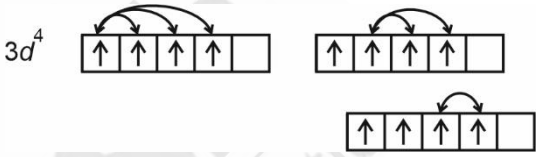
86. Answer (4)

Hint: More the number of electrons with identical spin, more are the number of ways of exchanging with other electrons.

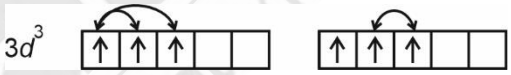
Sol.:



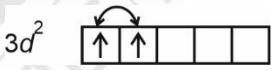
10 exchanges



6 exchanges



3 exchanges

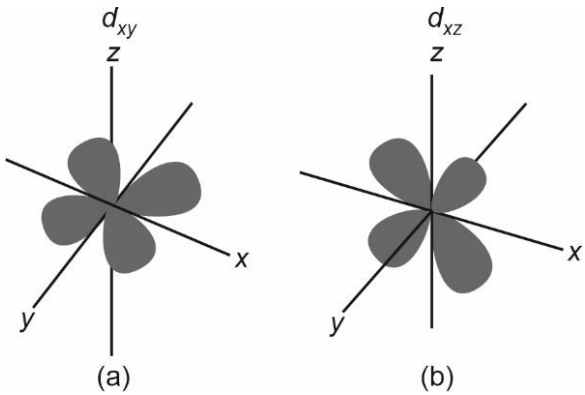


1 exchange

87. Answer (3)

Hint & Sol.:

d_{z^2}, $d_{x^2-y^2}$ orbitals have electron density along the axes.



88. Answer (3)

Hint: Shell number is represented by principal quantum number

Sol.:

(Orbital)		Quantum number
2*s*	⇒	n = 2 l = 0
3*s*	⇒	n = 3 l = 0
2*p*	⇒	n = 2 l = 1
3*d*	⇒	n = 3 l = 2

89. Answer (1)

Hint & Sol.:

Lyman series – UV

Balmer series – Visible

Paschen series – IR

Pfund series – IR

90. Answer (2)

Hint: Number of atoms = Moles × N_A × Atomicity

Sol.:

A. $\frac{12}{2} \times N_A \times 2 \Rightarrow 12N_A$

B. $\frac{160}{40} \times N_A \times 3 \Rightarrow 12N_A$

C. $\frac{176}{44} \times N_A \times 3 \Rightarrow 12N_A$

D. $\frac{248}{62} \times N_A \times 3 \Rightarrow 12N_A$

E. $\frac{200}{100} \times N_A \times 5 \Rightarrow 10N_A$

[BOTANY]

91. Answer (1)

Hint: Activities of an organism are the outcome of the sum total of activities and interactions of its constituent cells.

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

92. Answer (3)

Hint: Robert Brown discovered the nucleus of a cell.

Sol.: Antonie Von Leeuwenhoek was the first person who observed few living cells capable of moving such as bacteria, protozoa, spermatozoa under his own designed microscope.

93. Answer (3)

Hint: Mycoplasma is the smallest living cell.

Sol.: The largest isolated single cell is egg of ostrich.

94. Answer (4)

Hint: The size of typical bacteria is 1-2 µm.

Sol.: The size of PPLO is about 0.1 µm.

95. Answer (4)

Hint: Some of the cell organelles function in a coordinated manner and constitute an endomembrane system.

Sol.: The organelles included in this system are ER, Golgi complex, lysosomes and vacuoles.

96. Answer (3)

Hint: Adjacent cells in a plant tissue are held together by a thin, sticky, amorphous layer of cementing materials called middle lamella.

Sol.: Middle lamella is made up of calcium and magnesium pectate.

97. Answer (2)

Hint: Several ribosomes may attach to a single mRNA and form a chain called polyribosome.

Sol.: Mesosomes help in respiration and cell wall formation.

Chromatophores contain pigments.

Reserve materials in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies.

98. Answer (2)

Sol.: The two ribosomal subunits remain united with each other due to a specific concentration of Mg^{2+} ions.

99. Answer (3)

Hint: Plastids are absent in animal cells.

Sol.: Plant cells have many simpler and unconnected units of Golgi apparatus called dictyosomes.

100. Answer (3)

Hint: Cell wall maintains the shape of cells.

Sol.: Cell wall allows the materials to pass in and out of the cell.

101. Answer (1)

Hint: Metacentric chromosomes appear 'V' shaped during anaphase.

Sol.: Sub-metacentric chromosome – Have p and q arms.

Acrocentric chromosome–'J' shaped

Telocentric chromosome–'I' shaped

102. Answer (4)

Hint: The endoplasmic reticulum which is free of ribosomes is known as SER.

Sol.: Rough endoplasmic reticulum provides precursors of enzymes for the formation of lysosomes in Golgi complex.

103. Answer (3)

Hint: The cytoplasm is the main arena of cellular activities in both plant and animal cells.

Sol.: Capsule allows bacterium to hide from host's immune system.

104. Answer (3)

Hint: The pili are elongated tubular structures made up of a special protein. They are involved in DNA transfer from one cell to another cell.

Sol.: The fimbriae are small bristle like fibres sprouting out of the cell. In some bacteria, they are known to help in attaching the bacteria to rocks in streams and also to the host tissues.

105. Answer (4)

Hint: Mesosomes are in the form of vesicles, tubules and lamellae.

Sol.: Mesosomes help in respiration and secretion process.

106. Answer (1)

Hint: Flagella provide motility to bacteria.

Sol.: Motile bacteria have thin filamentous extensions from their cell wall called flagella.

107. Answer (3)

Hint: This structure is formed by the extensions of plasma membrane into the prokaryotic cell.

Sol.: Mesosome helps in DNA replication and distribution to daughter cells.

108. Answer (1)

Hint: Middle layer of cell envelope in bacteria is cell wall.

Sol.: Cell wall gives protection from mechanical damage. It also helps in cell-to-cell interactions and it is a non-living rigid structure. It is made up of peptidoglycan in bacteria.

109. Answer (2)

Hint: Delimiting structure of human cheek cell is plasma membrane.

Sol.: The cell wall gives shape to the cell and protects the cell from mechanical damage and infection. The component of cell wall is water insoluble.

110. Answer (3)

Hint: All eukaryotic cells are not identical.

Sol.: The eukaryotes include all the protists, plants, animals and fungi. In eukaryotic cells, there is an extensive compartmentalization of cytoplasm. But eukaryotic cells differ in many aspects as well, such as absence of cell wall and plastids in animal cells.

111. Answer (2)

Hint: Label E represents cristae.

Sol.: Matrix, labelled as C, is the site of Krebs cycle. Label D is the inter-membrane space. Cristae have oxysomes.

112. Answer (2)

Hint: Steroidal hormones in animal cell are synthesised by SER.

Sol.: When SER is observed under the electron microscope, it appears as a smooth tubular structure.

113. Answer (1)

Hint: Ribosomes were discovered by George Palade in 1953 in the animal cell.

Sol.: Chromatin is stained by basic dyes.

Matthias Schleiden was a German botanist. Golgi apparatus was first observed by Camillo Golgi.

114. Answer (1)

Hint: Polyribosomes are formed in both prokaryotic and eukaryotic organisms.

Sol.: In eukaryotes, genetic material is organised into chromosomes formed by the addition of histone and non- histone proteins.

115. Answer (4)

Hint: Mature sieve tubes of plants lack Golgi bodies.

Sol.: Nerve cells in animals have Golgi bodies.

116. Answer (1)

Hint: Ribosomes are non-membrane bound organelles that are associated with the plasma membrane.

Sol.: In prokaryotes, ribosomes are about 15 nm by 20 nm in size.

117. Answer (3)

Hint: Chlorophyll pigments are associated with the sac like structures in the chroroplast.

Sol.: Chlorophyll pigments are present in the thylakoid membrane.

118. Answer (1)

Hint: Both chloroplast and mitochondria have their own DNA.

Sol.: Mitochondria perform β - oxidation of fats.

119. Answer (4)

Hint: In bacteria, the smaller circular DNA outside the genomic DNA confers resistance to antibiotics.

Sol.: Pathogenic bacteria gain resistance to antibiotics due to change in their plasmid.

120. Answer (4)

Hint: It is a single membrane bound organelle.

Sol.: Sap vacuoles contain water, sap, excretory products and other material not useful for the plant cell.

121. Answer (1)

Hint: In green plants, cells of ground tissue of leaves have majority of the chloroplasts.

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

122. Answer (1)

Hint: Golgi complex receives precursors of enzymes from RER for the formation of lysosomes.

Sol.: Golgi complex is the important site of for- mation of glycoproteins and glycolipids and formation of secretory vesicles.

123. Answer (4)

Hint: Dark reaction occurs in stroma of chloroplast.

Sol.: Light reaction occurs in thylakoids.

124. Answer (4)

Hint: Diplosomes are units of two centrioles arranged at right angles.

Sol.: Microtubules- They help in the spindle and astral ray formation during cell division.

Microfilaments- They help in the formation of cleavage furrow during cell division in animal cell.

Diplosome- They help in the formation of basal bodies which give rise to cilia and flagella.

Intermediate filaments- They are involved in formation of scaffolds for chromatin.

125. Answer (4)

Hint: Chromatin contains some basic proteins called histones.

Sol.: Chromatin contains DNA, histones, non-histone proteins and also RNA.

126. Answer (4)

Hint: Ribosomes are found in both, eukaryotes and prokaryotes.

Sol.: The nucleolus occurs only in eukaryotic cells.

127. Answer (2)

Hint: Structure A is centriole.

Structure D is peroxisome, a single membrane bound organelle.

Sol.: Structure B is the lysosome. It is formed from detached Golgian vacuole and contains hydrolytic enzymes.

128. Answer (3)

Hint: Amyloplast is a type of leucoplast.

Sol.: Chromoplasts have fat soluble carotenoids. Aleuroplasts store proteins. Elaioplasts are leucoplasts that store fats and oils.

129. Answer (3)

Sol.: Cilia are small structures which work like oars. They are not found in bacteria.

130. Answer (2)

Hint: Ergasome is also called polysome.

Sol.: Massules or percentriolar satellites surround the centriole.

131. Answer (3)

Hint: Endoplasmic reticulum plays a role in origin of this living component.

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

132. Answer (1)

Hint: Membrane bound organelles are absent in prokaryotes.

Sol.: In *Amoeba,* the contractile vacuole is important for osmoregulation and excretion.

133. Answer (2)

Hint: Centrosome is an organelle in animal cells.

Sol.: A chromosome consists of two identical halves, the chromatids which are held together at one point called centromere.

134. Answer (3)

Hint: Interphase nucleus has highly extended and elaborate chromatin.

Sol.: The outer membrane of nuclear envelope usually remains continuous with the endoplasmic reticulum and also bears ribosomes on it.

135. Answer (3)

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

Sol.: Lysosomes contain enzymes for digestion of all types of macromolecules. Sometimes a few chromosomes have non-staining secondary constrictions at a constant location. This gives the appearance of a small fragment called the satellite.

[ZOOLOGY]

136. Answer (3)

Hint: Former includes neurons

Sol.: Neural tissue exerts the greatest control over the body's responsiveness to changing conditions. Connective tissues are the most abundant and widely distributed tissues in the body of complex animals.

137. Answer (1)

Hint: Identify a protein.

Sol.: Inulin is a polymer of fructose while insulin is a protein. Proteins are heteropolymers.

- Monomeric unit of chitin is N-acetyl glucosamine.
- Monomeric unit of starch and glycogen is glucose.

138. Answer (2)

Hint: Also found in cartilage.

Sol.: In bones, matrix is arranged in the form of layers called lamellae. Bones support and protect softer tissues and organs. The bone cells (osteocytes) are present in the spaces called lacunae.

Bone marrow does not contain osteocytes.

139. Answer (4)

Hint: Smooth muscle fibres are tapered on both ends.

Sol.: Muscle fibres contract (shorten) in response to stimulation, then relax (lengthen) and return to their uncontracted state in a coordinated fashion. Their action moves the body to adjust to the changes in the environment and to maintain the positions of the various parts of the body.

Smooth muscle fibres are involuntary while skeletal muscle fibres are voluntary in nature.

140. Answer (3)

Hint: First amino acid represents the N-terminal amino acid.

Sol.: The first amino acid is called the N-terminal amino acid. The last amino acid is called the C-terminal amino acid. Tyrosine and tryptophan are aromatic in nature. Valine, glycine and alanine are neutral in nature. Lysine and arginine are basic amino acids.

141. Answer (1)

Hint: Fibres and fibroblasts are compactly packed

Sol.: Tendons, which attach skeletal muscles to bones, and ligaments which attach one bone to another are examples of dense regular connective tissue. Bones, cartilage and blood are specialised connective tissues. Adipose and areolar tissue are examples of loose connective tissue.

142. Answer (4)

Hint: Structures of protein

Sol.: Biologists describe the protein structure at four levels, *i.e.,* primary, secondary, tertiary and quaternary. Haemoglobin represents the quaternary structural level.

143. Answer (1)

Hint: Tight junctions prevent leakage.

Sol.: Mainly three types of cell junctions are found in the epithelium and other tissues. These are called tight, adhering and gap junctions.

- Tight junctions help to stop substances from leaking across a tissue.
- Adhering junctions form plaque-like structures (protein plates) which perform cementing to keep the neighbouring cells together.
- Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells.

144. Answer (3)

Hint: Activation energy remains unaffected.

Sol.: Each enzyme shows its highest activity at a particular temperature and pH called the optimum temperature and pH respectively. Activity declines both below and above the optimum value. Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.

145. Answer (3)

Hint: Function of competitive inhibitior

Sol.: The activity of an enzyme is inhibited in the presence of inhibitors that bind to the enzyme. When the binding of the chemical shuts off enzyme activity, the process is called inhibition and the chemical is called an inhibitor.

146. Answer (2)

Hint: Compound epithelium

Sol.: Compound epithelium covers the dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts.

- Squamous epithelium forms the diffusion boundary.
- Ciliated epithelium is present in the lining of bronchioles and fallopian tubes.

147. Answer (1)

Hint: Exclude the class III and IV enzymes

Sol.: Enzymes are divided into 6 classes each with 4-13 subclasses and named accordingly by a four-digit number.

Oxidoreductases/dehydrogenases: Enzymes which catalyse oxidoreduction between two substrates S and S'

Transferases: Enzymes catalysing a transfer of a group, G (other than hydrogen) between a pair of substrate S and S'

Hydrolases: Enzymes catalysing hydrolysis of ester, ether, peptide, glycosidic, C-C, C-halide or P-N bonds.

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

Isomerases: Include all enzymes catalysing inter-conversion of optical, geometric or positional isomers.

Ligases: Enzymes catalysing the linking together of 2 compounds, *e.g.*, enzymes which catalyse joining of C-O, C-S, C-N, P-O *etc*., bonds.

148. Answer (3)

Hint: Lined by simple cuboidal brush-bordered epithelium

Sol.: In PCT, brush-border cuboidal epithelium is present, where microvilli (small finger-like projections) on the surface of cuboidal cells increase the surface area for absorption.

Columnar cells are tall and slender cells with basal nuclei and are present in the intestine.

149. Answer (1)

Hint: Basic amino acid

Sol.: Lysine and arginine are basic amino acids, *i.e,* the number of amino groups ($-NH_2$) > number of carboxy groups (–COOH) in their structures.

Valine and glycine are neutral amino acids.

Cysteine is a sulfur containing amino acid.

150. Answer (4)

Hint: Skeletal muscle fibres are voluntary.

Sol.: Smooth muscle fibres are involuntary, fusiform-shaped, unstriated and uninucleated.

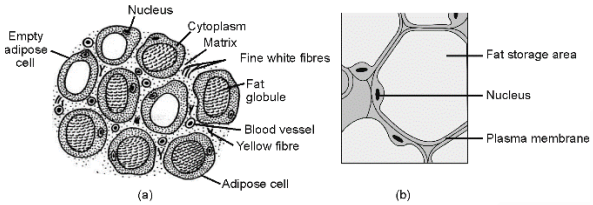
Skeletal muscle fibres are voluntary, cylindrical, multinucleated and striated.

Cardiac muscle fibres are involuntary, cylindrical uninucleated and striated.

151. Answer (3)

Hint: Adipocytes are fat storing cells.

Sol.: Adipose tissue is basically an aggregation of fat cells or adipose cells (adipocytes). Each fat cell is rounded or oval with peripheral nucleus and contains a large droplet of fat that almost fills it. The excess of nutrients which are not used immediately are converted into fats and are stored in this tissue. The protein fibres are few in number and form a loose network for supporting the fat-laden cells.



152. Answer (1)

Hint: Exclude the secondary metabolites that are polymeric.

Sol.:

Pigments	Carotenoids, Anthocyanins, *etc.*
Alkaloids	Morphine, Codeine, *etc.*
Terpenoides	Monoterpenes, Diterpenes, *etc.*
Essential oils	Lemon grass oil
Toxins	Abrin, Ricin
Lectins	Concanavalin A
Drugs	Vinblastin, Curcumin, *etc.*
Polymeric substances	Rubber, Gums, Cellulose

153. Answer (3)

Hint: Co-factors play a crucial role in enzyme activity.

Sol.: Catalytic activity of an enzyme is lost when co-factor is removed from the enzyme.

Three kinds of co-factors may be identified: prosthetic groups, co-enzymes and metal ions.

Blood is a specialised fluid connective tissue.

154. Answer (1)

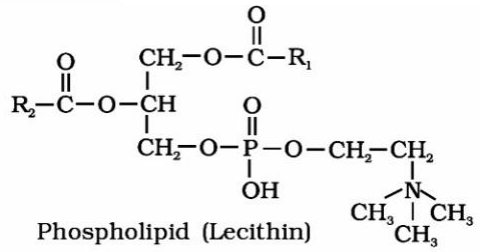
Hint: $2H_2O$ molecules are formed and released for the formation of tripeptide.

Sol.: Formation of 'n' number of glycosidic bonds and 'm' number of peptide bonds require the formation and removal of 'n' and 'm' water molecules, respectively.

155. Answer (2)

Hint: Lecithin is a phospholipid.

Sol.: Lecithin contains a glycerol, 2 fatty acids, 1 phosphate group and 1 moiety.



156. Answer (3)

Hint: Nucleoside + phosphate group = nucleotide

Sol.: Adenosine, guanosine, thymidine, uridine and cytidine are nucleosides. Adenylic acid, thymidylic acid, guanylic acid, uridylic acid and cytidylic acid are nucleotides.

Glutamic acid is an acidic amino acid.

157. Answer (4)

Hint: Twice the number of eyes you have

Sol.: On the basis of structural modifications of the cells, simple epithelium is divided into three types. These are (i) Squamous, (ii) Cuboidal, (iii) Columnar

158. Answer (4)

Hint: Endocrine glands are ductless glands.

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

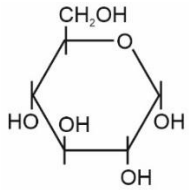
Exocrine glands secrete mucus (mucus glands), saliva (salivary glands), ear wax (ceruminous glands), oil (sebaceous glands), milk (mammary glands), digestive enzymes (digestive glands), *etc.*

These products are released through ducts or tubes.

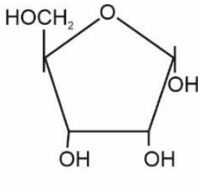
In contrast, endocrine glands do not have ducts. Their secretions are called hormones.

159. Answer (2)

Sol.:



$C_6H_{12}O_6$ (Glucose)



$C_5H_{10}O_5$ (Ribose)

Glucose	Ribose
• 6 – C ring • Obtained in filtrate • 5 OH groups	• 5 – C ring • Obtained in filtrate • 4 OH groups

160. Answer (1)

Hint: Exclude the muscle containing multinucleated muscle fibres.

Sol.: The smooth muscle fibres taper at both ends and do not show striations. Cell junctions hold them together and they are bundled together in a connective tissue sheath.

Communication junctions (intercalated discs) at some fusion points allow cardiac muscle cells to contract as a unit, *i.e.*, when one cell receives a signal to contract, its neighbours are also stimulated to contract.

Skeletal muscle does not have any cell-cell junctions.

161. Answer (1)

Hint: Mediated by neurotransmitters

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.

162. Answer (3)

Hint: Mast cells secrete vasoconstrictor, vasodilator and anticoagulant.

Sol.: In all connective tissues except specialized connective tissue, the fibroblast secretes fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the tissue.

Macrophages are phagocytic cells. Mast cells secrete histamine, serotonin and heparin, *etc.*

Adipocytes are fat storing cells.

163. Answer (1)

Hint: Haemoglobin represents the quaternary structure.

Sol.:

Primary structure	–	Provides positional information of amino acids
Secondary structure	–	Alpha helices and beta pleated sheets
Tertiary structure		Three dimensional view of proteins
Quaternary structure	–	Assembly of more than one polypeptide

164. Answer (2)

Hint: Competitive inhibition

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: The gas that is most important for survival.

Sol.:

Element	% Weight of	
	Earth's crust	Human body
Hydrogen (H)	0.14	9.5
Carbon (C)	0.03	18.5
Oxygen (O)	46.6	65.0
Nitrogen (N)	Very little	3.3
Sulphur (S)	0.03	0.3
Sodium (Na)	2.8	0.2
Calcium (Ca)	3.6	1.5
Magnesium (Mg)	2.1	0.1
Silicon (Si)	27.7	Negligible

166. Answer (2)

Hint: Exclude the protein part

Sol.: The protein portion of the enzymes is called the apoenzyme.

Prosthetic groups are organic compounds and are distinguished from other co-factors in that they are tightly bound to the apoenzyme. For example, in peroxidase and catalase, which catalyze the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme.

The essential chemical components of many co-enzymes are vitamins, *e.g.*, coenzyme nicotinamide adenine dinucleotide (NAD) and NADP contain the vitamin niacin.

Zinc is a co-factor for the proteolytic enzyme carboxypeptidase.

167. Answer (3)

Hint : Attribute of multicellular organisms.

Sol.: The structure of the cells vary according to their function.

Therefore, the tissues are broadly classified into four types: (i) Epithelial (ii) Connective (iii) Muscular and (iv) Neural.

The body of a simple organism like *Hydra* is made of different types of cells and the number of cells in each type can be in thousands. In multicellular animals, a group of similar cells alongwith intercellular substances perform a specific function. Such an organisation is called tissue.

168. Answer (1)

Hint: Biceps have skeletal muscle fibres

Sol.:

Bicep muscle fibres (skeletal)	Heart muscle fibres (cardiac)
• Striated	Striated
• No cell junctions	Communication junctions present
• Unbranched	Branched
• Peripheral nuclei	Centrally located nucleus

169. Answer (1)

Hint: Pitch of DNA = 34 Å

Sol.: Rise/bp = 3.4 Å in B-DNA

Length of B-DNA = 340 Å,

So, total number of bp = $\frac{340}{3.4}$

= 100 base pairs = 200 bases

Because each base joins with one deoxyribose sugar by glycosidic bond.

So, number of deoxyribose sugar residues = 200

170. Answer (2)

Hint: Equal to the number of limbs in humans

Sol.: Collagen, GLUT-4, antibody and insulin have peptide bonds as they are proteins.

Glutamic acid and cysteine are amino acids and they lack peptide bonds in their structures.

171. Answer (4)

Hint: Include the structure that contains of Nissl's bodies.

Sol.: Neurons, the unit of neural system, are excitable cells.

It is a microscopic structure composed of cell body, dendrites, axon and synaptic knob.

The cell body contains cytoplasm with typical cell organelles and certain granular bodies called Nissl's granules.

Short fibres which branch repeatedly and project out of cell body are called dendrites.

Axon is a long fibre, the distal end of which is branched.

172. Answer (4)

Hint: Exclude the one present in foetal Hb

Sol.: Adult human haemoglobin consists of 2 subunits of α-type and two subunits of β-type to form a quaternary structure.

γ-chain is present in the foetal Hb.

173. Answer (3)

Hint: Brush border refers to the presence of microvilli.

Sol.: Squamous epithelium is found in walls of blood vessels and air sacs of lungs.

Columnar epithelium is found in inner lining of stomach and intestine. Its free surface also possesses microvilli.

If columnar or cuboidal cells bear cilia on their free surface, they are called ciliated epithelium. They are mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes.

174. Answer (2)

Hint: Hydrolases – Class III enzymes

Sol.: Hydrolases– Enzymes catalysing hydrolysis of ester, ether, peptide, glycosidic, C – C, C – halide, P – N bonds.

175. Answer (4)

Hint: Decrease in substrate concentration occurs during a reaction.

Sol.: When old bonds break and new bonds form during transformation, it is called a chemical reaction.

Rate of a chemical reaction can be defined as

- Amount of product formed per unit time
- Velocity of reaction if direction is specified

Rate of reaction can be expressed as:

$$\frac{\delta P}{\delta t}\left[\frac{(\text{Product})}{(\text{Time})}\right]$$

176. Answer (1)

Hint: Oils have melting point similar to that of unsaturated fatty acids.

Sol.: Fatty acids are also called fats and oils based on their melting point. Oils have lower melting point (*e.g.* Gingelly oil) and hence remain as oil in winters.

177. Answer (1)

Hint: Enzymes are proteins.

Sol.: An enzyme like any proteins has secondary and the tertiary structure.

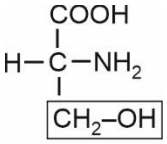
When we look at tertiary structure of enzymes, their backbone of the protein chain folds upon itself, the chain criss-crosses itself and hence, many crevices or pockets are made.

Carbohydrates do not form enzymes.

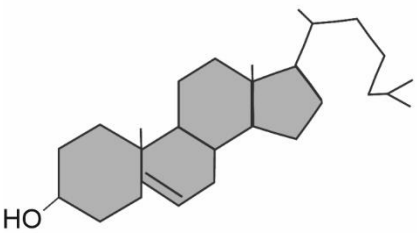
178. Answer (3)

Hint: Serine is an alcoholic amino acid.

Sol.:



Serine

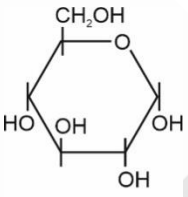


Cholesterol

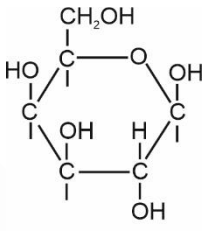
179. Answer (3)

Hint: Deoxyribose sugar

Sol.: Glucose and galactose both are monosaccharides.

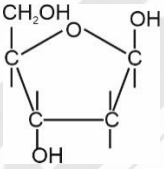


(Glucose)

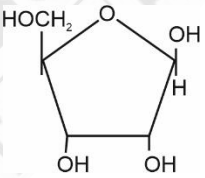


(Galactose)

Deoxyribose is a constituent of DNA.



Ribose is a constituent of RNA.



180. Answer (3)

Hint: Glands are endocrine or exocrine based on the mode of pouring their secretions.

Sol.:

Exocrine glands	Secrete milk
Unicellular glands	Goblet cells
Endocrine glands	Secrete insulin
Multicellular glands	Salivary glands

❑ ❑ ❑

All India Aakash Test Series for NEET - 2027

TEST - 1 (Code-D)

Click here for Code-C sol.

Test Date : 31/08/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Closer the measured value to its true value, more accurate is the reading.

Sol.: The readings can be arranged in increasing order of accuracy as

18.1 cm < 18.22 cm = 18.444 cm < 18.3 cm

2. Answer (1)

Hint: % error in $T = \frac{\Delta t}{t} \times 100 = \frac{\Delta T}{T} \times 100$

Sol.: $t_{100} = 100\ T = 100 \times 2 = 200$ s

Δt = L.C. = 0.1 s

$\therefore \quad \frac{\Delta t}{t} \times 100 = \frac{0.1 \times 100}{200} = \frac{5}{100} = 0.05\%$

3. Answer (4)

Hint: Average acceleration $\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t} = \frac{\Delta \vec{v}}{\Delta t}$

Sol.: If $< \vec{a} >= 0 \Rightarrow |\vec{v}_i| = |\vec{v}_f|$ and $\vec{v}_i = \vec{v}_f$

During the time interval, velocity may change as well.

4. Answer (1)

Hint: During ascent,

Retardation = $a_{\text{ascent}} = \frac{F_{\text{net}}}{m} = \frac{mg + F_d}{m}$ and

$a_{\text{descent}} = \frac{mg - F_d}{m}$

Sol.: $a_{\text{ascent}} > a_{\text{descent}} \Rightarrow t_{\text{ascent}} < t_{\text{descent}} \left(\because t \propto \frac{1}{a} \right)$

5. Answer (1)

Hint & Sol.: Relative acceleration of ball w.r.t. man

= Acceleration due to gravity = g

($\because$ ball falls freely and man has no acceleration)

6. Answer (4)

Hint: Equation of straight line is given by $y = mx + c$, where m = slope

Sol.:

(1) Slope = zero

(2) Slope = +1

(3) Slope = $+\frac{3}{2}$

(4) Slope = $-\frac{2}{3}$

7. Answer (3)

Hint: Diameter of wire, d = M.S.R + L C × C.S.R

Sol.: $d = 2 \text{ mm} + 51 \times \left(\frac{1 \text{ mm}}{100} \right) = (2 + 0.51) \text{ mm}$

$= 2.51 \text{ mm}$

8. Answer (3)

Hint: Mean absolute error =

$$\Delta a_{\text{mean}} = \frac{|\Delta a_1| + |\Delta a_2| + |\Delta a_3|}{3}$$

Sol.:

$a_{\text{mean}} = \frac{a_1 + a_2 + a_3}{3} = \frac{2.4 + 2.5 + 2.6}{3} = 2.5$ m

$|\Delta a_1| = |a_1 - a_{\text{mean}}| = |2.4 - 2.5| = 0.1 \text{ m} = |\Delta a_3|$

$|\Delta a_2| = |a_2 - a_{\text{mean}}| =$ zero

$\therefore \quad \Delta a_{\text{mean}} = \frac{0.1 + 0 + 0.1}{3} = \frac{0.2}{3} = 0.0666... \approx 0.1 \text{ m}$

according to significant figures.

9. Answer (3)

Hint: According to the principle of dimensional homogeneity, [L.H.S.] = [R.H.S]

Sol.:

A is correct as $[v_{\text{avg}}] = [u] = [LT^{-1}]$

B is correct as $[v^2] = [as] = [L^2T^{-2}]$

C is correct as $[F] = \left[\frac{mv^2}{r} \right] = \left[MLT^{-2} \right]$

D is wrong as $[s^2] = \left[L^2 \right] \neq [ut]$

10. Answer (4)

Hint & Sol.: Strain, angle and refractive index have no dimensions i.e., $[M^oL^oT^o]$ but angle has unit.

11. Answer (4)

Hint: At maximum velocity, $\frac{dv}{dt}=0$ as t can take any value.

Sol.: $v=\frac{dx}{dt}=2t-3-\sin t+\cos t$

$a=\frac{dv}{dt}=2-\cos t-\sin t=0$

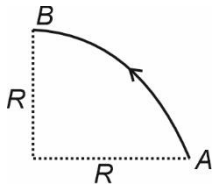
$\Rightarrow$ sin$t$ + cos$t$ = 2 is not possible as $(\sin t+\cos t)_{max}=\sqrt{2}$

$\therefore$ Maximum velocity is not defined.

12. Answer (2)

Hint: Displacement = shortest distance between initial position (A) and final position (B).

Sol.:



$\therefore$ Displacement = $AB=\sqrt{R^2+R^2}=\sqrt{2}R$

13. Answer (3)

Hint: Acceleration $a=\frac{dv}{dt}$ where v is velocity, t is time.

Sol.: $\frac{dv}{dt}=2e^{-2t}\Rightarrow\int_0^v dv=\int_0^1 2e^{-2t}dt$

$\Rightarrow v-0=2\left[\frac{e^{-2t}}{-2}\right]_0^1=-1\left[e^{-2}-1\right]$

$\therefore$ $v=1-e^{-2}$

14. Answer (4)

Hint: Average velocity = $\frac{\text{Total displacement}}{\text{Total time taken}}$

Sol.: Total displacement = zero, when ball reaches ground again.

$\therefore$ Average velocity = zero

15. Answer (3)

Hint: Distance covered in n^{th} second = $S_{n_{th}}=u+\frac{g}{2}(2n-1)$

Sol.: $S_2=\frac{g}{2}(2\times2-1)=\frac{3g}{2}$

$S_4=\frac{g}{2}(2\times4-1)=\frac{7g}{2}$

$\therefore$ $S_2:S_4=3:7$

16. Answer (4)

Hint: Use homogeneity of dimensions.

Sol.: $[v]=\left[at^2\right]=[bt]=\left[\frac{c}{t}\right]=\left[LT^{-1}\right]$

$\Rightarrow [a]=\left[LT^{-3}\right],\ [b]=\left[LT^{-2}\right],\ [c]=[L]$

$\therefore$ $\frac{[a][c]}{[b]}=\frac{[L^2T^{-3}]}{\left[LT^{-2}\right]}=\left[LT^{-1}\right]=[v]$

17. Answer (4)

Hint: [Energy] = [ML^{2}T^{-2}] and [Force] = [MLT^{-2}]

Sol.: [Energy density] = [Modulus of elasticity]

$=\frac{[\text{Energy}]}{[\text{Volume}]}=[ML^{-1}T^{-2}]$

[Surface tension] = [Spring constant]

$=\frac{[\text{Force}]}{[\text{Length}]}=[MT^{-2}]$

[Energy gradient] = [Force] = [MLT^{-2}]

[Gravitational field intensity] = $\frac{[\text{Force}]}{[\text{Mass}]}=\left[LT^{-2}\right]$

18. Answer (1)

Hint: $\int\sin t\,dt=-\cos t+C$

Sol.: $\int\sin(\beta t)dt=-\frac{\cos(\beta t)}{\beta}+C$ is both physically and dimensionally correct.

19. Answer (4)

Hint: SI unit of angle is radian, of pressure is Pa and of time is sec.

Sol.: $1^\circ=\frac{\pi}{180}$ rad

1 bar = 10^5 Pa

1 day = 24 h = 24 × 3600 = 86400 sec

20. Answer (3)

Hint: Average speed

$$v_{avg} = \frac{\text{Total distance travelled}}{\text{Total time taken}} = \frac{x}{\frac{T}{3}}$$

Sol.: $v = \frac{dx}{dt} = 9\alpha t^2 \Rightarrow \int_0^x dx = \int_0^{T/3} 9\alpha t^2 dt$

$\Rightarrow x = 9\alpha\left[\frac{t^3}{3}\right]_0^{T/3}$

$\Rightarrow x = \frac{\alpha T^3}{9}$

$\therefore V_{avg} = \frac{3x}{T} = \frac{\alpha T^2}{3}$

21. Answer (1)

Hint: For uniform motion of football, acceleration a = zero.

Sol.: a = zero just before it is hit. When the foot strikes the ball, the ball gets accelerated due to the applied impulsive reaction by foot. After that, again a = zero.

22. Answer (1)

Hint: According to principle of homogeneity,

$[v] = [M]^{\alpha}[A]^{\beta}[\rho]^{\gamma}[g]^{\delta}$

Sol.: $[LT^{-1}] = [M]^{\alpha}[L^2]^{\beta}[ML^{-3}]^{\gamma}[LT^{-2}]^{\delta}$

Equating the dimensions on both sides,

$0 = \alpha + \gamma$

$1 = 2\beta - 3\gamma + \delta$

$-1 = -2\delta \Rightarrow \delta = \frac{1}{2}$

$\Rightarrow 2\beta - 3\gamma = \frac{1}{2}$

If $\alpha = K$, then $\gamma = -K$ and $\beta = \frac{1}{4} - \frac{3K}{2}$

By hit and trial [put $\alpha = K = \frac{1}{2}$ from option (1)]

$\therefore \gamma = \frac{-1}{2}$ and $\beta = \frac{-1}{2}$

23. Answer (1)

Hint & Sol.:

In graph (A):

x is decreasing, hence $v < 0$.

$\left|\frac{dx}{dt}\right| = |\vec{v}|$ is decreasing, hence $a > 0$

In graph (B) :

x is decreasing, hence $v < 0$

$\frac{dx}{dt}$ = constant, hence $a = 0$

In graph (C) :

x is decreasing, hence $v < 0$

$\left|\frac{dx}{dt}\right| = |\vec{v}|$ is increasing, hence $a < 0$

In graph (D) :

x is constant, hence $v = 0$, and $a = 0$

24. Answer (4)

Hint: If the digit to be rounded off is 5, then the preceding digit is increased by one if it is odd and is left unchanged if it is even.

Sol.: $2.345 \approx 2.34$ and $5.435 \approx 5.44$

25. Answer (3)

Hint: $n_1u_1 = n_2u_2$ and [momentum] = $[MLT^{-1}]$

Sol.: $n_2 = \frac{n_1u_1}{u_2} = 100\left[\frac{M}{2M}\right]\left[\frac{L}{2L}\right]\left[\frac{T}{4T}\right]^{-1}$

$\Rightarrow n_2 = 100\frac{1}{2} \times \frac{1}{2} \times 4 = 100$

26. Answer (4)

Hint: Speed of a body and path length travelled by a body cannot be negative.

Sol.:

(1) When speed increases, displacement can increase.

(2) When path length increases, displacement can decrease.

(3) When speed increases, position of body can increase.

27. Answer (4)

Hint: Speed of bus = $v = \frac{dx}{dt} = \frac{1}{\frac{dt}{dx}}$

Sol.: $\frac{dt}{dx} = \frac{1}{2\sqrt{x^2 + 48}} \times 2x$

$\Rightarrow \frac{dx}{dt} = v = \frac{\sqrt{x^2 + 48}}{x} = 2$ m/s

$\Rightarrow \sqrt{x^2 + 48} = 2x \Rightarrow 48 = 3x^2$

$\Rightarrow$ $x = +4$ m is valid

28. Answer (3)

Hint: Stopping distance $x = \frac{v^2}{2a}$

Sol.: No collision will happen if $d > x \Rightarrow d > \frac{v^2}{2a}$

29. Answer (3)

Hint: If particle crosses the same point at instants t_1 and t_2 then total time of flight $T = t_1 + t_2$.

Sol.: Total time of flight,

$$T = \frac{2u}{g} = \frac{2\times 80}{10} = 16 \text{ s}$$

$T = 3.5 + n \Rightarrow 16 = 3.5 + n \Rightarrow n = 12.5$ s

30. Answer (4)

Hint: The maximum permissible error in R_{eq} is $\Delta R_{eq} = \Delta R_1 + \Delta R_2$

Sol.:

$$R_{eq} = R_1 + R_2 = (20+30) \pm \Delta R_{eq} = (50 \pm 0.8)\Omega$$

31. Answer (4)

Hint: Greater precision implies smaller least count.

Sol.: Statement I is false as least count of 25.0001 cm is smaller than of 50.01 cm.

Statement II is true because

50 km + 50 m = 50 km + 0.050 km = 50.050 km $\approx$ 50 km as the original number had no decimal places.

32. Answer (3)

Hint: $\frac{\Delta A}{A}\times 100 = \left(\frac{2\Delta x}{x}\times 100\right) + \left(\frac{2\Delta y}{y}\times 100\right) + \left(\frac{3\Delta z}{z}\times 100\right)$

Sol.: Maximum % error in

$$A = (2\times 1 + 2\times 2 + 3\times 3)\% = 15\%$$

33. Answer (2)

Hint: The zeros on the right of decimal point are significant but to the left of first digit 1 are not significant.

Sol.: The 5 significant figures are 1, 0, 0, 1, 0.

34. Answer (1)

Hint: Acceleration = slope of $v - t$ graph = $\tan\theta$

Sol.: $\frac{a_A}{a_B} = \frac{\tan 60^\circ}{\tan 30^\circ} = \frac{\sqrt{3}}{\frac{1}{\sqrt{3}}} = 3:1$

35. Answer (3)

Hint: Use equations of uniformly accelerated motion

Sol.: If the ball crosses helicopter after three seconds, then

Displacement of ball = 15 m

$$\Rightarrow s = ut + \frac{1}{2}at^2 \Rightarrow 15 = v\times 3 - \frac{1}{2}\times 10\times 9$$

$$\Rightarrow 15 = 3v - 45 \Rightarrow 3v = 60 \Rightarrow v = 20 \text{ m s}^{-1}$$

36. Answer (3)

Hint: Area under $a - t$ graph = change in velocity

Sol.: Area = $\frac{1}{2}\times 4\times 4 = v - u$

$\Rightarrow 8 = v - 0 \Rightarrow v = 8$ m/s

37. Answer (4)

Hint: Use 3rd equation of motion, $v^2 = u^2 + 2ax$.

Sol.: Comparing we get, $u^2 = 80$ and $2a = -8$

$\therefore \quad a = -4$ m/s^2

38. Answer (4)

Hint: Multiplication/Division of different physical quantities A and B yields a new quantity.

Sol.: $(2A + B)$ is not possible as A, B have different dimensions.

39. Answer (3)

Hint & Sol.: Second is the SI unit of physical quantity 'Time'.

40. Answer (4)

Hint: Least count of vernier callipers = 1 MSD – 1 VSD

Sol.: 5 VSD = 4 MSD $\Rightarrow$ 1 VSD $= \frac{4}{5}$MSD

$$\therefore \text{ L.C.} = 1\text{MSD} - \frac{4}{5}\text{MSD} = \frac{1}{5}\text{MSD}$$

$$= \frac{1}{5}\times\frac{1\text{ cm}}{10} = 0.02 \text{ cm}$$

41. Answer (3)

Hint & Sol.: Random errors can be reduced by repeated measurements.

42. Answer (3)

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

Sol.: $S = 0(t) + \frac{1}{2}(9.8)4^2 = 9.8\times 8 = 78.4$ m

43. Answer (3)

Hint: Use equation of motion $S = ut + \frac{1}{2}gt^2$ by taking proper sign convention.

Sol.: $-20 = 20t - \frac{1}{2}(10)t^2$

$\Rightarrow \quad t^2 - 4t - 4 = 0$

$\therefore \quad t = \frac{+4 \pm \sqrt{4^2 + 4^2}}{2} = \frac{4 \pm 4\sqrt{2}}{2}$

$\Rightarrow \quad t = \left(2 + 2\sqrt{2}\right)$s ($\because$ Time can't be negative)

44. Answer (4)

Hint: Instantaneous speed $v = |\vec{v}|$ where $\vec{v}$ = Instantaneous velocity.

Sol.: If speed v is changing, then velocity $\vec{v}$ is also changing $\Rightarrow$ $\vec{v}$ cannot be constant.

45. Answer (3)

Hint: In multiplication/division, final answer will have the minimum number of significant figures as in the quantities being operated.

Sol.: $\frac{1.2 \times 0.950}{6.00} = 0.20 \times 0.950 = 0.19$

[CHEMISTRY]

46. Answer (2)

Hint: Number of atoms = Moles × N_A × Atomicity

Sol.:

A. $\frac{12}{2} \times N_A \times 2 \Rightarrow 12N_A$

B. $\frac{160}{40} \times N_A \times 3 \Rightarrow 12N_A$

C. $\frac{176}{44} \times N_A \times 3 \Rightarrow 12N_A$

D. $\frac{248}{62} \times N_A \times 3 \Rightarrow 12N_A$

E. $\frac{200}{100} \times N_A \times 5 \Rightarrow 10N_A$

47. Answer (1)

Hint & Sol.:

Lyman series – UV
Balmer series – Visible
Paschen series – IR
Pfund series – IR

48. Answer (3)

Hint: Shell number is represented by principal quantum number

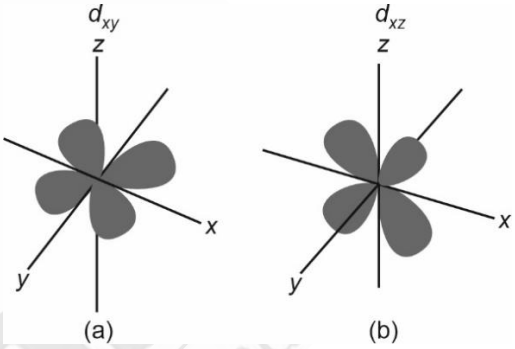
Sol.:

(Orbital)		Quantum number
2*s*	$\Rightarrow$	n = 2 l = 0
3*s*	$\Rightarrow$	n = 3 l = 0
2*p*	$\Rightarrow$	n = 2 l = 1
3*d*	$\Rightarrow$	n = 3 l = 2

49. Answer (3)

Hint & Sol.:

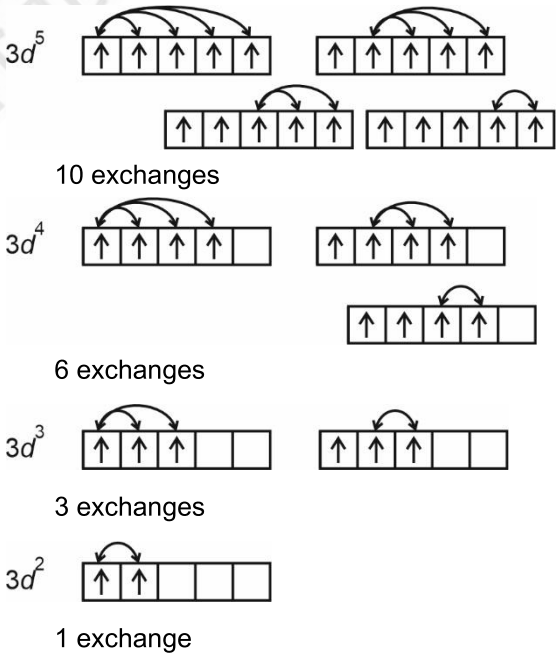
d_{z^2}, $d_{x^2-y^2}$ orbitals have electron density along the axes.



50. Answer (4)

Hint: More the number of electrons with identical spin, more are the number of ways of exchanging with other electrons.

Sol.:



51. Answer (1)

Hint: Principal quantum number is denoted by n and defines the shell, determines the size of the orbital and also a large extent of energy

Sol.:

	Quantum number	Information
(1)	Principal quantum number (*n*)	Size and energy
(2)	Azimuthal quantum number (*l*)	Shape of orbital
(3)	Magnetic quantum number (m_l)	Orientation of orbitals
(4)	Spin quantum number (m_s)	Orientation of spin of electrons

52. Answer (4)

Hint: Orbital wave function $|\psi|^2$ at a point is known as probability density.

Sol.: The probability of finding an electron at a point within an atom is proportional to the square of the orbital wave function.

53. Answer (3)

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

Sol.: $3.3\times10^{-31} = \frac{6.626\times10^{-34}}{0.1\times v}$

$v = \frac{6.626\times10^{-33}}{3.3\times10^{-30}} \approx 2\times10^{-3}$

$= 2\times10^{-3}$ m/s

54. Answer (3)

Hint & Sol.: For n = 3 and l = 2, the subshell is 3d in which total 10 electrons are present among which 5 have spin quantum number $s = +\frac{1}{2}$ and other 5 have $s = -\frac{1}{2}$

55. Answer (4)

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

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

$\Delta v = \frac{3\times10^4 \times 0.02}{100} = 6$

$\therefore \quad \Delta x = \frac{6.626\times10^{-34}}{4\times3.14\times9\times10^{-31}\times6} \approx 9.7\times10^{-6}$ m

56. Answer (4)

Hint: Radial node = n – l – 1

Sol.: Angular node for $5d_{xy}$ = l = 2

Radial node for 4p orbital = n – l – 1 = 4 – 1 – 1 = 2

57. Answer (4)

Hint: For the given value of n, l = 0 to (n – 1)

For the given value of l, m_l = –l to +l

Sol.:

For the value of l = 1 possible value of m_l = –1, 0, +1

There fore (a) is not possible.

For the given value of n = 3 possible value of l = 0, 1, 2

Therefor (d) is not possible

58. Answer (3)

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

Sol.:

$$\frac{1}{\lambda_{3^{rd}}} = R_H\left(\frac{1}{2^2} - \frac{1}{5^2}\right) = R_H\left(\frac{1}{4} - \frac{1}{25}\right) = R_H\frac{21}{100} \quad \ldots(1)$$

(for Balmer series n_1 = 2)

$$\frac{1}{\lambda_{1^{st}}} = R_{HZ}\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = R_H \times \frac{3}{4} = \frac{3R_H}{4} \quad \ldots(2)$$

(for Lyman series n_1 = 1)

Dividing equation (2)

$$\frac{\lambda_{3^{rd}}}{\lambda_{1^{st}}} = \frac{3R_H}{4} \times \frac{100}{21R_H} \Rightarrow \frac{25}{7}$$

59. Answer (2)

Hint: $\Delta E = 13.6\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ where $n_2 > n_1$

Sol.: For the transition from n = 4 to n = 1, the ΔE will be highest.

60. Answer (2)

Hint: For hydrogen atom, the energy of the orbitals increases as follows:

1s < 2s = 2p < 3s = 3p = 3d

Sol.: For multielectron system, the energy of orbitals in same subshell decreases with increase in atomic numbers.

61. Answer (2)

Hint: Number of subshells in a principal shell = n

Sol.: Number of orbitals in a shell = n^2

Number of orbitals in a subshell = (2l + 1)

Maximum number of electrons in a shell = $2n^2$

62. Answer (4)

Hint: Rutherford's model did not describe about stationary states.

Sol.: Rutherford's model is not about stationary state or fixed energy of the orbits (shells) around nucleus.

63. Answer (3)

Hint: $r_n = a_0 \frac{n^2}{Z}$

Sol.: $\left(r_{2^{nd}}\right)_{He^+} = \frac{a_0 \times 2^2}{2}$ ...(1)

$\left(r_{3^{rd}}\right)_{Be^{3+}} = \frac{a_0 \times 3^2}{4}$ ...(2)

Dividing equation (2) by (1):

$$\frac{\left(r_{3^{rd}}\right)_{Be^{3+}}}{\left(r_{2^{nd}}\right)_{He^+}} = \frac{a_0 \times 3 \times 3}{2 \times a_0 \times 4}$$

$$\therefore \quad \left(r_{3^{rd}}\right)_{Be^{3+}} = \frac{105.8 \times 9}{8} \approx 119 \text{ pm}$$

64. Answer (2)

Hint & Sol.: Diffraction and interference can be explained by wave nature of electromagnetic radiation not by particle nature of electromagnetic radiation.

65. Answer (4)

Hint: $\bar{\nu} = \frac{1}{\lambda}$

Sol.: $\bar{\nu} = \frac{1}{\lambda} 109677 \left(\frac{1}{2^2} - \frac{1}{\infty^2}\right) \text{cm}^{-1}$

$\bar{\nu} = \frac{109677}{4} \text{cm}^{-1}$

$= 2.7 \times 10^4 \text{ cm}^{-1}$

66. Answer (3)

Hint & Sol.: Cathode rays get deflected in the presence of electric or magnetic field and their properties do not depend upon the nature of the gas taken in discharge tube.

67. Answer (2)

Hint: $E_n = -2.18 \times 10^{-18} \frac{Z^2}{n^2}$ J/atom

Sol.: For He^+,

$E_{He^+} = -a = -2.18 \times 10^{-18} \frac{2^2}{1^2}$ ...(1)

For Li^{2+},

$E_{Li^{2+}} = -2.18 \times 10^{-18} \frac{3^2}{2^2}$ ...(2)

Dividing equation (2) by equation (1):

$$\frac{E_{Li^{2+}}}{-a} = \frac{9}{16}$$

$$\therefore \quad E_{Li^{2+}} = \frac{-9}{16} a$$

68. Answer (2)

Hint: Species containing same number of electrons are known as isoelectronic species.

Sol.:

Species	No. of electrons
N_2O, CO_2	22
Ca^{2+}, Ar, K^+	18
Na^+, O^{2-}	10
N_2, NO^+, CO	14
O_3	24

69. Answer (4)

Hint: As per the question,

100 g of air ≡ 78 g N_2 gas

Sol.: Mass of nitrogen in 1 kg (1000 g) of air = $\frac{78}{100} \times 1000 \Rightarrow 780$ g

Molecules of N_2 = $\frac{780}{28} \times N_A$

= 1.68×10^{25} molecules

70. Answer (4)

Hint: $x_{solvent} = \frac{n_{solvent}}{\text{Total moles of solution}}$

Sol.: In 2 molal aqueous solution,

moles of solute = 2 mol

Mass of solvent = 1000 g

$\therefore$ Moles of solvent = $\frac{1000}{18} = 55.56$ mol

$x_{solvent} = \frac{55.56}{55.56+2} = \frac{55.56}{57.56} = 0.965$

71. Answer (3)

Hint: Molarity of ions = $\frac{\text{Moles of ions}}{\text{Volume of solution}}$

Sol.: $Na_2CO_3(aq) \rightarrow 2Na^+(aq) + CO_3^{2-}(aq)$

Moles of Na_2CO = $\frac{10.6}{106} = 0.1$ mol

$\therefore$ Moles of Na^+ = 0.2 mol

Moles of $CO_3^{2-} = 0.1$ mol

Molarity of Na^+ ion = $\frac{0.2\times1000}{250} = 0.8$ M

Molarity of CO_3^{2-} ion = $\frac{0.1\times1000}{250} = 0.4$ M

72. Answer (4)

Hint: As per reaction stoichiometry, 1 mol of $O_2 \equiv$ 2 mol of H_2O

Sol.: Mole of water = $\frac{90}{18} = 5$ mol

2 moles of water $\equiv$ 1 mol of $O_2 \equiv N_A$ of O_2 molecules

$\therefore$ 5 moles of water $\equiv \frac{5}{2}$ of $O_2 \equiv 2.5\ N_A$ of O_2 molecules

73. Answer (1)

Hint: Molarity of a solution is number of moles of solute present in 1000 ml of solution.

Sol.: 98% w/v H_2SO_4 has 98 g H_2SO_4 in 100 ml solution

$M = \frac{M\times1000}{MW\times V_{ml}}$

$= \frac{98\times1000}{98\times100} = 10$ M

74. Answer (4)

Hint & Sol.: Formula mass term is applicable to ionic compounds only. CCl_4 is a covalent compound hence formula mass term is not applicable to it.

75. Answer (3)

Hint: Average atomic mass

$= \frac{(\text{Atomic mass of } E_1 \times \text{Its\% Abundance}) + (\text{Atomic mass of } E_2 \times \text{Its\% abundance})}{100}$

Sol.: $= \frac{(14\times x) + 15\times(100-x)}{100}$

$\Rightarrow$ 14x + 1500 – 15x = 14.80 ×100

x = 1500 – 1480 = 20%

$\therefore$ % abundance of lighter isotope

E_1 = 20%

76. Answer (3)

Hint & Sol.: One mole is the amount of substance that contains exactly the same number of entities which are present in 12 g of C–12 isotope of carbon.

77. Answer (4)

Hint: Haber's process: $N_2(g) + 3H_2 \rightarrow 2NH_3(g)$

Sol.:

$\because$ 28 g of $N_2 \equiv$ 6 g of H_2

$\therefore$ 56 g of $N_2 \equiv \frac{6}{28}\times56 = 12$ g of H_2 (Required)

available amount of H_2 = 10 g

Hence, H_2 is the limiting reagent

$\Rightarrow$ 10 g H_2 will react with $= \frac{28}{6}\times10 = 46.67$ g

Excess amount of $N_2 \Rightarrow 56 - 46.67 = 9.33$ g

Amount of NH_3 formed = $\frac{34}{6}\times10 = 56.67$ g

78. Answer (3)

Hint: Number of atoms = Moles × N_A × Atomicity

Sol.:

a. $\frac{1.8}{18}\times N_A \times 3 = 0.3N_A$

b. $\frac{3.1}{31\times4}\times N_A \times 4 = 0.1\,N_A$

c. $\frac{1.6}{32\times8}\times N_A \times 8 = 0.05\ N_A$

d. $\frac{9.2}{46}\times N_A \times 3 = 0.6\ N_A$

79. Answer (2)

Hint: $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

Sol.: Mass of $AgNO_3$ in 50 mL of given $AgNO_3$ solution = $\frac{34}{100}\times 50 = 17\,g$

Mass of NaCl in 50 mL of given NaCl solution = $\frac{11.7}{100}\times 50 = 5.85\,g$

$\Rightarrow$ 1 mol of $AgNO_3 \equiv$ 1mol of NaCl $\equiv$ 1 mol of AgCl

$\therefore$ $\frac{17}{170} = 0.1$ mol of $AgNO_3 \equiv \frac{5.85}{58.5} = 0.1$ mol of NaCl $\equiv$ 0.1 mol of AgCl

Mass of 0.1 mol of AgCl = 143.5 × 0.1 $\Rightarrow$ 14.35 g

80. Answer (3)

Hint: 1 mol of X_2Y_3 weighs $\equiv \frac{9}{0.05} = 180$ g

Sol.: 2x + 3y = 180

$\Rightarrow$ (2 × 30) + 3y = 180

$\therefore$ $y = \frac{120}{3} = 40$ u

Atomic mass of y = 40 u

Molecular mass of X_2Y = (2 × 30) + 40

= 100 u

81. Answer (4)

Hint: $2Mg + O_2 \rightarrow 2MgO$

Sol.: 32 g of O_2 reacts with 48 g of Mg to form 80 g MgO

$\therefore$ 0.64 g of O_2 reacts with $\frac{48}{32}\times 0.64$

= 0.96 g

Excess amount of Mg = 2 – 0.96 = 1.04 g limiting reagent $\Rightarrow O_2$

Amount of MgO formed = $\frac{80}{32}\times 0.64 = 1.6$ g

82. Answer (1)

Hint: For minimum molecular mass, one molecule of enzyme should contain at least one zinc

Sol.: 0.01 g of Zn $\equiv$ 100 g of enzyme

$\therefore$ 65.3 g of Zn $\equiv \frac{100}{0.01}\times 65.3$

$= 6.53 \times 10^5$ g

$\therefore$ Molecular mass of enzyme = 6.53×10^5 u

83. Answer (4)

Hint: Percentage of oxygen

$= \frac{\text{Mass of oxygen}}{\text{Molar mass of compound}}\times 100$

Sol.:

a. Percentage of oxygen in H_2SO_4 = $\frac{64}{98}\times 100 = 65.3$

b. Percentage of oxygen in ammonium sulphate

= $\frac{64}{132}\times 100 = 48.48$

c. Percentage of oxygen in SO_2 = $\frac{32}{64}\times 100 = 50\%$

d. Percentage of oxygen in CaO = $\frac{16}{56}\times 100 = 28.57\%$

84. Answer (2)

Hint: Zeros between the two non-zero digits are significant.

Sol.: 2.004 has 4 significant figures.

Zero at the end of a number are significant provided they are on the right side of decimal point.

85. Answer (2)

Hint: Percentage of carbon

= 100 – (5.94 + 70.29)

= 23.77%

Sol.:

Element	Mass percent	Mole	Simplest Rateo
C	23.77	$\frac{23.77}{12} = 1.98$	$\frac{1.98}{1.98} = 1$
H	5.94	$\frac{5.94}{1} = 5.94$	$\frac{5.94}{1.98} = 3$
Cl	70.29	$\frac{70.29}{35.5} = 1.98$	$\frac{1.98}{1.98} = 1$

Empirical formula = CH_3Cl.

86. Answer (1)

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

Sol.: $0.1 = \frac{\text{Mass}/100}{100/1000}$

Mass = 1 g

87. Answer (3)

Hint: $CO_2(g) + C(s) \rightarrow 2CO(g)$

Sol.: 100 mL $CO_2 \equiv$ 200 mL CO

$\therefore$ Change in volume = 200 – 100
= 100 mL increase

88. Answer (2)

Hint: Total Number of electrons = Moles × N_A × Electrons in one ion

Sol.: Total number of $e^- = \frac{3.2}{32} \times N_A \times 18$

$\Rightarrow 1.8\ N_A$

89. Answer (4)

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

Sol.: Mass of one molecule of water = $\frac{18}{6.02 \times 10^{23}}$

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

$\text{Volume} = \frac{18}{6.02 \times 10^{23} \times 1} = 2.99 \times 10^{-23} cm^3$

90. Answer (3)

Hint: $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

Sol.: 2 mol of C_2H_6 produces = 4 mol of CO_2

$\therefore$ Mass of CO_2 evolved = 44 × 4 = 176 g

CO_2 gets absorbed over 10 mol (560 g) of KOH

$\therefore$ Final weight of KOH after absorption of CO_2 = 560 + 176 = 736 g

[BOTANY]

91. Answer (1)

Hint: Activities of an organism are the outcome of the sum total of activities and interactions of its constituent cells.

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

92. Answer (3)

Hint: Robert Brown discovered the nucleus of a cell.

Sol.: Antonie Von Leeuwenhoek was the first person who observed few living cells capable of moving such as bacteria, protozoa, spermatozoa under his own designed microscope.

93. Answer (3)

Hint: Mycoplasma is the smallest living cell.

Sol.: The largest isolated single cell is egg of ostrich.

94. Answer (4)

Hint: The size of typical bacteria is 1-2 µm.

Sol.: The size of PPLO is about 0.1 µm.

95. Answer (4)

Hint: Some of the cell organelles function in a coordinated manner and constitute an endomembrane system.

Sol.: The organelles included in this system are ER, Golgi complex, lysosomes and vacuoles.

96. Answer (3)

Hint: Adjacent cells in a plant tissue are held together by a thin, sticky, amorphous layer of cementing materials called middle lamella.

Sol.: Middle lamella is made up of calcium and magnesium pectate.

97. Answer (2)

Hint: Several ribosomes may attach to a single mRNA and form a chain called polyribosome.

Sol.: Mesosomes help in respiration and cell wall formation.

Chromatophores contain pigments.

Reserve materials in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies.

98. Answer (2)

Sol.: The two ribosomal subunits remain united with each other due to a specific concentration of Mg^{2+} ions.

99. Answer (3)

Hint: Plastids are absent in animal cells.

Sol.: Plant cells have many simpler and unconnected units of Golgi apparatus called dictyosomes.

100. Answer (3)

Hint: Cell wall maintains the shape of cells.

Sol.: Cell wall allows the materials to pass in and out of the cell.

101. Answer (1)

Hint: Metacentric chromosomes appear 'V' shaped during anaphase.

Sol.: Sub-metacentric chromosome – Have p and q arms.

Acrocentric chromosome–'J' shaped

Telocentric chromosome–'I' shaped

102. Answer (4)

Hint: The endoplasmic reticulum which is free of ribosomes is known as SER.

Sol.: Rough endoplasmic reticulum provides precursors of enzymes for the formation of lysosomes in Golgi complex.

103. Answer (3)

Hint: The cytoplasm is the main arena of cellular activities in both plant and animal cells.

Sol.: Capsule allows bacterium to hide from host's immune system.

104. Answer (3)

Hint: The pili are elongated tubular structures made up of a special protein. They are involved in DNA transfer from one cell to another cell.

Sol.: The fimbriae are small bristle like fibres sprouting out of the cell. In some bacteria, they are known to help in attaching the bacteria to rocks in streams and also to the host tissues.

105. Answer (4)

Hint: Mesosomes are in the form of vesicles, tubules and lamellae.

Sol.: Mesosomes help in respiration and secretion process.

106. Answer (1)

Hint: Flagella provide motility to bacteria.

Sol.: Motile bacteria have thin filamentous extensions from their cell wall called flagella.

107. Answer (3)

Hint: This structure is formed by the extensions of plasma membrane into the prokaryotic cell.

Sol.: Mesosome helps in DNA replication and distribution to daughter cells.

108. Answer (1)

Hint: Middle layer of cell envelope in bacteria is cell wall.

Sol.: Cell wall gives protection from mechanical damage. It also helps in cell-to-cell interactions and it is a non-living rigid structure. It is made up of peptidoglycan in bacteria.

109. Answer (2)

Hint: Delimiting structure of human cheek cell is plasma membrane.

Sol.: The cell wall gives shape to the cell and protects the cell from mechanical damage and infection. The component of cell wall is water insoluble.

110. Answer (3)

Hint: All eukaryotic cells are not identical.

Sol.: The eukaryotes include all the protists, plants, animals and fungi. In eukaryotic cells, there is an extensive compartmentalization of cytoplasm. But eukaryotic cells differ in many aspects as well, such as absence of cell wall and plastids in animal cells.

111. Answer (3)

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

Sol.: Lysosomes contain enzymes for digestion of all types of macromolecules. Sometimes a few chromosomes have non-staining secondary constrictions at a constant location. This gives the appearance of a small fragment called the satellite.

112. Answer (3)

Hint: Interphase nucleus has highly extended and elaborate chromatin.

Sol.: The outer membrane of nuclear envelope usually remains continuous with the endoplasmic reticulum and also bears ribosomes on it.

113. Answer (2)

Hint: Centrosome is an organelle in animal cells.

Sol.: A chromosome consists of two identical halves, the chromatids which are held together at one point called centromere.

114. Answer (1)

Hint: Membrane bound organelles are absent in prokaryotes.

Sol.: In *Amoeba,* the contractile vacuole is important for osmoregulation and excretion.

115. Answer (3)

Hint: Endoplasmic reticulum plays a role in origin of this living component.

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

116. Answer (2)

Hint: Ergasome is also called polysome.

Sol.: Massules or percentriolar satellites surround the centriole.

117. Answer (3)

Sol.: Cilia are small structures which work like oars. They are not found in bacteria.

118. Answer (3)

Hint: Amyloplast is a type of leucoplast.

Sol.: Chromoplasts have fat soluble carotenoids. Aleuroplasts store proteins. Elaioplasts are leucoplasts that store fats and oils.

119. Answer (2)

Hint: Structure A is centriole.

Structure D is peroxisome, a single membrane bound organelle.

Sol.: Structure B is the lysosome. It is formed from detached Golgian vacuole and contains hydrolytic enzymes.

120. Answer (4)

Hint: Ribosomes are found in both, eukaryotes and prokaryotes.

Sol.: The nucleolus occurs only in eukaryotic cells.

121. Answer (4)

Hint: Chromatin contains some basic proteins called histones.

Sol.: Chromatin contains DNA, histones, non-histone proteins and also RNA.

122. Answer (4)

Hint: Diplosomes are units of two centrioles arranged at right angles.

Sol.: Microtubules- They help in the spindle and astral ray formation during cell division.

Microfilaments- They help in the formation of cleavage furrow during cell division in animal cell.

Diplosome- They help in the formation of basal bodies which give rise to cilia and flagella.

Intermediate filaments- They are involved in formation of scaffolds for chromatin.

123. Answer (4)

Hint: Dark reaction occurs in stroma of chloroplast.

Sol.: Light reaction occurs in thylakoids.

124. Answer (1)

Hint: Golgi complex receives precursors of enzymes from RER for the formation of lysosomes.

Sol.: Golgi complex is the important site of for- mation of glycoproteins and glycolipids and formation of secretory vesicles.

125. Answer (1)

Hint: In green plants, cells of ground tissue of leaves have majority of the chloroplasts.

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

126. Answer (4)

Hint: It is a single membrane bound organelle.

Sol.: Sap vacuoles contain water, sap, excretory products and other material not useful for the plant cell.

127. Answer (4)

Hint: In bacteria, the smaller circular DNA outside the genomic DNA confers resistance to antibiotics.

Sol.: Pathogenic bacteria gain resistance to antibiotics due to change in their plasmid.

128. Answer (1)

Hint: Both chloroplast and mitochondria have their own DNA.

Sol.: Mitochondria perform β - oxidation of fats.

129. Answer (3)

Hint: Chlorophyll pigments are associated with the sac like structures in the chroroplast.

Sol.: Chlorophyll pigments are present in the thylakoid membrane.

130. Answer (1)

Hint: Ribosomes are non-membrane bound organelles that are associated with the plasma membrane.

Sol.: In prokaryotes, ribosomes are about 15 nm by 20 nm in size.

131. Answer (4)

Hint: Mature sieve tubes of plants lack Golgi bodies.

Sol.: Nerve cells in animals have Golgi bodies.

132. Answer (1)

Hint: Polyribosomes are formed in both prokaryotic and eukaryotic organisms.

Sol.: In eukaryotes, genetic material is organised into chromosomes formed by the addition of histone and non- histone proteins.

133. Answer (1)

Hint: Ribosomes were discovered by George Palade in 1953 in the animal cell.

Sol.: Chromatin is stained by basic dyes.

Matthias Schleiden was a German botanist. Golgi apparatus was first observed by Camillo Golgi.

134. Answer (2)

Hint: Steroidal hormones in animal cell are synthesised by SER.

Sol.: When SER is observed under the electron microscope, it appears as a smooth tubular structure.

135. Answer (2)

Hint: Label E represents cristae.

Sol.: Matrix, labelled as C, is the site of Krebs cycle. Label D is the inter-membrane space. Cristae have oxysomes.

[ZOOLOGY]

136. Answer (3)

Hint: Glands are endocrine or exocrine based on the mode of pouring their secretions.

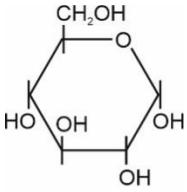
Sol.:

Exocrine glands	Secrete milk
Unicellular glands	Goblet cells
Endocrine glands	Secrete insulin
Multicellular glands	Salivary glands

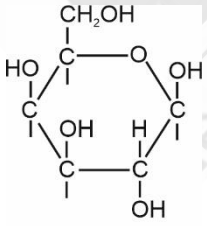
137. Answer (3)

Hint: Deoxyribose sugar

Sol.: Glucose and galactose both are monosaccharides.

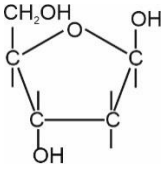


(Glucose)

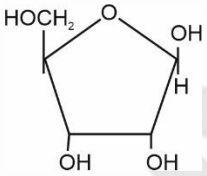


(Galactose)

Deoxyribose is a constituent of DNA.



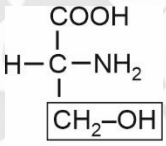
Ribose is a constituent of RNA.



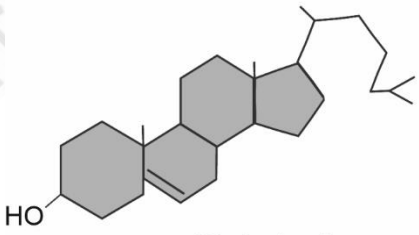
138. Answer (3)

Hint: Serine is an alcoholic amino acid.

Sol.:



Serine



Cholesterol

139. Answer (1)

Hint: Enzymes are proteins.

Sol.: An enzyme like any proteins has secondary and the tertiary structure.

When we look at tertiary structure of enzymes, their backbone of the protein chain folds upon itself, the chain criss-crosses itself and hence, many crevices or pockets are made.

Carbohydrates do not form enzymes.

140. Answer (1)

Hint: Oils have melting point similar to that of unsaturated fatty acids.

Sol.: Fatty acids are also called fats and oils based on their melting point. Oils have lower melting point (*e.g*. Gingelly oil) and hence remain as oil in winters.

141. Answer (4)

Hint: Decrease in substrate concentration occurs during a reaction.

Sol.: When old bonds break and new bonds form during transformation, it is called a chemical reaction.

Rate of a chemical reaction can be defined as

- Amount of product formed per unit time
- Velocity of reaction if direction is specified

Rate of reaction can be expressed as:

$$\frac{\delta P}{\delta t}\left[\frac{(\text{Product})}{(\text{Time})}\right]$$

142. Answer (2)

Hint: Hydrolases – Class III enzymes

Sol.: **Hydrolases–** Enzymes catalysing hydrolysis of ester, ether, peptide, glycosidic, C – C, C – halide, P – N bonds.

143. Answer (3)

Hint: Brush border refers to the presence of microvilli.

Sol.: Squamous epithelium is found in walls of blood vessels and air sacs of lungs.

Columnar epithelium is found in inner lining of stomach and intestine. Its free surface also possesses microvilli.

If columnar or cuboidal cells bear cilia on their free surface, they are called ciliated epithelium. They are mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes.

144. Answer (4)

Hint: Exclude the one present in foetal Hb

Sol.: Adult human haemoglobin consists of 2 subunits of α-type and two subunits of β-type to form a quaternary structure.

γ-chain is present in the foetal Hb.

145. Answer (4)

Hint: Include the structure that contains of Nissl's bodies.

Sol.: Neurons, the unit of neural system, are excitable cells.

It is a microscopic structure composed of cell body, dendrites, axon and synaptic knob.

The cell body contains cytoplasm with typical cell organelles and certain granular bodies called Nissl's granules.

Short fibres which branch repeatedly and project out of cell body are called dendrites.

Axon is a long fibre, the distal end of which is branched.

146. Answer (2)

Hint: Equal to the number of limbs in humans

Sol.: Collagen, GLUT-4, antibody and insulin have peptide bonds as they are proteins.

Glutamic acid and cysteine are amino acids and they lack peptide bonds in their structures.

147. Answer (1)

Hint: Pitch of DNA = 34 Å

Sol.: Rise/bp = 3.4 Å in B-DNA

Length of B-DNA = 340 Å,

So, total number of bp = $\frac{340}{3.4}$

= 100 base pairs = 200 bases

Because each base joins with one deoxyribose sugar by glycosidic bond.

So, number of deoxyribose sugar residues = 200

148. Answer (1)

Hint: Biceps have skeletal muscle fibres

Sol.:

Bicep muscle fibres (skeletal)	Heart muscle fibres (cardiac)
• Striated	Striated
• No cell junctions	Communication junctions present
• Unbranched	Branched
• Peripheral nuclei	Centrally located nucleus

149. Answer (3)

Hint : Attribute of multicellular organisms.

Sol.: The structure of the cells vary according to their function.

Therefore, the tissues are broadly classified into four types: (i) Epithelial (ii) Connective (iii) Muscular and (iv) Neural.

The body of a simple organism like *Hydra* is made of different types of cells and the number of cells in each type can be in thousands. In multicellular animals, a group of similar cells alongwith intercellular substances perform a specific function. Such an organisation is called tissue.

150. Answer (2)

Hint: Exclude the protein part

Sol.: The protein portion of the enzymes is called the apoenzyme.

Prosthetic groups are organic compounds and are distinguished from other co-factors in that they are tightly bound to the apoenzyme. For example, in peroxidase and catalase, which catalyze the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme.

The essential chemical components of many co-enzymes are vitamins, *e.g.*, coenzyme nicotinamide adenine dinucleotide (NAD) and NADP contain the vitamin niacin.

Zinc is a co-factor for the proteolytic enzyme carboxypeptidase.

151. Answer (3)

Hint: The gas that is most important for survival.

Sol.:

Element	% Weight of	
	Earth's crust	Human body
Hydrogen (H)	0.14	9.5
Carbon (C)	0.03	18.5
Oxygen (O)	46.6	65.0
Nitrogen (N)	Very little	3.3
Sulphur (S)	0.03	0.3
Sodium (Na)	2.8	0.2
Calcium (Ca)	3.6	1.5
Magnesium (Mg)	2.1	0.1
Silicon (Si)	27.7	Negligible

152. Answer (2)

Hint: Competitive inhibition

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.

153. Answer (1)

Hint: Haemoglobin represents the quaternary structure.

Sol.:

Primary structure	–	Provides positional information of amino acids
Secondary structure	–	Alpha helices and beta pleated sheets
Tertiary structure		Three dimensional view of proteins
Quaternary structure	–	Assembly of more than one polypeptide

154. Answer (3)

Hint: Mast cells secrete vasoconstrictor, vasodilator and anticoagulant.

Sol.: In all connective tissues except specialized connective tissue, the fibroblast secretes fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the tissue.

Macrophages are phagocytic cells. Mast cells secrete histamine, serotonin and heparin, *etc*.

Adipocytes are fat storing cells.

155. Answer (1)

Hint: Mediated by neurotransmitters

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.

156. Answer (1)

Hint: Exclude the muscle containing multinucleated muscle fibres.

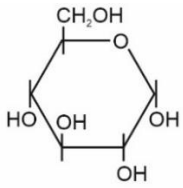
Sol.: The smooth muscle fibres taper at both ends and do not show striations. Cell junctions hold them together and they are bundled together in a connective tissue sheath.

Communication junctions (intercalated discs) at some fusion points allow cardiac muscle cells to contract as a unit, *i.e.*, when one cell receives a signal to contract, its neighbours are also stimulated to contract.

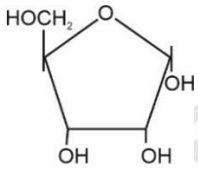
Skeletal muscle does not have any cell-cell junctions.

157. Answer (2)

Sol.:



$C_6H_{12}O_6$ (Glucose)



$C_5H_{10}O_5$ (Ribose)

Glucose	Ribose
• 6 – C ring • Obtained in filtrate • 5 OH groups	• 5 – C ring • Obtained in filtrate • 4 OH groups

158. Answer (4)

Hint: Endocrine glands are ductless glands.

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

Exocrine glands secrete mucus (mucus glands), saliva (salivary glands), ear wax (ceruminous glands), oil (sebaceous glands), milk (mammary glands), digestive enzymes (digestive glands), *etc.*

These products are released through ducts or tubes.

In contrast, endocrine glands do not have ducts. Their secretions are called hormones.

159. Answer (4)

Hint: Twice the number of eyes you have

Sol.: On the basis of structural modifications of the cells, simple epithelium is divided into three types. These are (i) Squamous, (ii) Cuboidal, (iii) Columnar

160. Answer (3)

Hint: Nucleoside + phosphate group = nucleotide

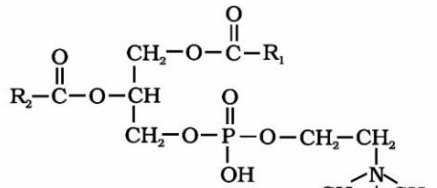
Sol.: Adenosine, guanosine, thymidine, uridine and cytidine are nucleosides. Adenylic acid, thymidylic acid, guanylic acid, uridylic acid and cytidylic acid are nucleotides.

Glutamic acid is an acidic amino acid.

161. Answer (2)

Hint: Lecithin is a phospholipid.

Sol.: Lecithin contains a glycerol, 2 fatty acids, 1 phosphate group and 1 moiety.



Phospholipid (Lecithin)

162. Answer (1)

Hint: $2H_2O$ molecules are formed and released for the formation of tripeptide.

Sol.: Formation of 'n' number of glycosidic bonds and 'm' number of peptide bonds require the formation and removal of 'n' and 'm' water molecules, respectively.

163. Answer (3)

Hint: Co-factors play a crucial role in enzyme activity.

Sol.: Catalytic activity of an enzyme is lost when co-factor is removed from the enzyme.

Three kinds of co-factors may be identified: prosthetic groups, co-enzymes and metal ions.

Blood is a specialised fluid connective tissue.

164. Answer (1)

Hint: Exclude the secondary metabolites that are polymeric.

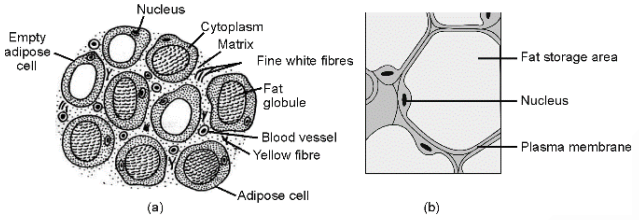
Sol.:

Pigments	Carotenoids, Anthocyanins, *etc.*
Alkaloids	Morphine, Codeine, *etc.*
Terpenoides	Monoterpenes, Diterpenes, *etc.*
Essential oils	Lemon grass oil
Toxins	Abrin, Ricin
Lectins	Concanavalin A
Drugs	Vinblastin, Curcumin, *etc.*
Polymeric substances	Rubber, Gums, Cellulose

165. Answer (3)

Hint: Adipocytes are fat storing cells.

Sol.: Adipose tissue is basically an aggregation of fat cells or adipose cells (adipocytes). Each fat cell is rounded or oval with peripheral nucleus and contains a large droplet of fat that almost fills it. The excess of nutrients which are not used immediately are converted into fats and are stored in this tissue. The protein fibres are few in number and form a loose network for supporting the fat-laden cells.



166. Answer (4)

Hint: Skeletal muscle fibres are voluntary.

Sol.: Smooth muscle fibres are involuntary, fusiform-shaped, unstriated and uninucleated.

Skeletal muscle fibres are voluntary, cylindrical, multinucleated and striated.

Cardiac muscle fibres are involuntary, cylindrical uninucleated and striated.

167. Answer (1)

Hint: Basic amino acid

Sol.: Lysine and arginine are basic amino acids, *i.e,* the number of amino groups ($-NH_2$) > number of carboxy groups (–COOH) in their structures.

Valine and glycine are neutral amino acids.

Cysteine is a sulfur containing amino acid.

168. Answer (3)

Hint: Lined by simple cuboidal brush-bordered epithelium

Sol.: In PCT, brush-border cuboidal epithelium is present, where microvilli (small finger-like projections) on the surface of cuboidal cells increase the surface area for absorption.

Columnar cells are tall and slender cells with basal nuclei and are present in the intestine.

169. Answer (1)

Hint: Exclude the class III and IV enzymes

Sol.: Enzymes are divided into 6 classes each with 4-13 subclasses and named accordingly by a four-digit number.

Oxidoreductases/dehydrogenases: Enzymes which catalyse oxidoreduction between two substrates S and S'

Transferases: Enzymes catalysing a transfer of a group, G (other than hydrogen) between a pair of substrate S and S'

Hydrolases: Enzymes catalysing hydrolysis of ester, ether, peptide, glycosidic, C-C, C-halide or P-N bonds.

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

Isomerases: Include all enzymes catalysing inter-conversion of optical, geometric or positional isomers.

Ligases: Enzymes catalysing the linking together of 2 compounds, *e.g.*, enzymes which catalyse joining of C-O, C-S, C-N, P-O *etc*., bonds.

170. Answer (2)

Hint: Compound epithelium

Sol.: Compound epithelium covers the dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts.

- Squamous epithelium forms the diffusion boundary.
- Ciliated epithelium is present in the lining of bronchioles and fallopian tubes.

171. Answer (3)

Hint: Function of competitive inhibitior

Sol.: The activity of an enzyme is inhibited in the presence of inhibitors that bind to the enzyme. When the binding of the chemical shuts off enzyme activity, the process is called inhibition and the chemical is called an inhibitor.

172. Answer (3)

Hint: Activation energy remains unaffected.

Sol.: Each enzyme shows its highest activity at a particular temperature and pH called the optimum temperature and pH respectively. Activity declines both below and above the optimum value. Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.

173. Answer (1)

Hint: Tight junctions prevent leakage.

Sol.: Mainly three types of cell junctions are found in the epithelium and other tissues. These are called tight, adhering and gap junctions.

- Tight junctions help to stop substances from leaking across a tissue.
- Adhering junctions form plaque-like structures (protein plates) which perform cementing to keep the neighbouring cells together.
- Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells.

174. Answer (4)

Hint: Structures of protein

Sol.: Biologists describe the protein structure at four levels, *i.e.,* primary, secondary, tertiary and quaternary. Haemoglobin represents the quaternary structural level.

175. Answer (1)

Hint: Fibres and fibroblasts are compactly packed

Sol.: Tendons, which attach skeletal muscles to bones, and ligaments which attach one bone to another are examples of dense regular connective tissue. Bones, cartilage and blood are specialised connective tissues. Adipose and areolar tissue are examples of loose connective tissue.

176. Answer (3)

Hint: First amino acid represents the N-terminal amino acid.

Sol.: The first amino acid is called the N-terminal amino acid. The last amino acid is called the C-terminal amino acid. Tyrosine and tryptophan are aromatic in nature. Valine, glycine and alanine are neutral in nature. Lysine and arginine are basic amino acids.

177. Answer (4)

Hint: Smooth muscle fibres are tapered on both ends.

Sol.: Muscle fibres contract (shorten) in response to stimulation, then relax (lengthen) and return to their uncontracted state in a coordinated fashion. Their action moves the body to adjust to the changes in the environment and to maintain the positions of the various parts of the body.

Smooth muscle fibres are involuntary while skeletal muscle fibres are voluntary in nature.

178. Answer (2)

Hint: Also found in cartilage.

Sol.: In bones, matrix is arranged in the form of layers called lamellae. Bones support and protect softer tissues and organs. The bone cells (osteocytes) are present in the spaces called lacunae.

Bone marrow does not contain osteocytes.

179. Answer (1)

Hint: Identify a protein.

Sol.: Inulin is a polymer of fructose while insulin is a protein. Proteins are heteropolymers.

- Monomeric unit of chitin is N-acetyl glucosamine.
- Monomeric unit of starch and glycogen is glucose.

180. Answer (3)

Hint: Former includes neurons

Sol.: Neural tissue exerts the greatest control over the body's responsiveness to changing conditions. Connective tissues are the most abundant and widely distributed tissues in the body of complex animals.

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