All India Aakash Test Series for NEET - 2027

TEST - I (Code - I)

Click here for Code-J Sol.

Test Date : 02/11/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint: $\frac{\Delta y}{y}=\frac{\Delta a}{a}+\frac{\Delta(b+c)}{(b+c)}$

Sol.:

$\frac{\Delta y}{y}\times 100=\frac{\Delta a}{a}\times 100+\frac{\Delta b}{(b+c)}\times 100+\frac{\Delta c}{(b+c)}\times 100$

2. Answer (2)

Hint: Dimension of acceleration = $[M^0LT^{-2}]$

Sol.: Dimension of

$$\sqrt{\text{Acceleration} \times \text{Distance}}=\left[\sqrt{LT^{-2}\times L}\right]$$

$= [LT^{-1}]$

$[LT^{-1}]$ is dimension of velocity

3. Answer (2)

Hint & Sol.: 0.020400 m has 5 significant figures.

4. Answer (2)

Hint: Let $x=\frac{L^2}{B}$

$\frac{\Delta x}{x}=\frac{2\Delta L}{L}+\frac{\Delta B}{B}$

Sol.: $\frac{\Delta x}{x}\times 100=\frac{2\Delta L}{L}\times 100+\frac{\Delta B}{B}\times 100$

$=2\times\left(\frac{0.01}{20}\right)\times 100+\frac{0.01}{10}\times 100$

$= 0.1 + 0.1 = 0.2\%$

5. Answer (1)

Hint: Newton is the unit of force

Sol.: $\left[\frac{N}{m^2}\right]=\left[\frac{MLT^{-2}}{L^2}\right]$

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

6. Answer (4)

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

Sol.: $\frac{\Delta A}{A}\times 100=\frac{2\Delta r}{r}\times 100$

$\frac{\Delta A}{4\pi 400}\times 100=2\times 0.2$

$\Delta A \approx 20.1\ cm^2$

7. Answer (2)

Hint: Random error is inversely proportional to number of observations

Sol.: $50x = 10x_1$

$x_1 = 5x$

8. Answer (4)

Hint & Sol.: Volume = a^3

$= (1.5)^3$

$= 3.375\ m^3$

Result should be upto two significant figures, so volume = $3.4\ m^3$

9. Answer (1)

Hint: Power $=\frac{\text{Work done}}{\text{Time}}$

Sol.: $[P] = [ML^2T^{-3}]$

$[P_1]=\left[M(2L)^2\left(\frac{T}{2}\right)^{-3}\right]$

$= 32[P]$

$\therefore\ \alpha = 32$

10. Answer (3)

Hint: $[E] = [ML^2T^{-2}]$

Sol.: $[ET^2] = [ML^2]$

$[L^2] = [M^{-1}ET^2]$

$[L] = [M^{-\frac{1}{2}}E^{\frac{1}{2}}T]$

11. Answer (4)

Hint & Sol.: $[v] = [u] = [at]$

$[s] = [ut] = [at^2]$

$[T^2] = \left[\frac{\ell}{g}\right]$

$\therefore$ All equations are dimensionally correct.

12. Answer (2)

Hint: Use principle of homogeneity

Sol.: $a=At+\left(\frac{B}{t+C}\right)$

$\frac{[B]}{[C]}=[a]$

$[A]=\frac{[a]}{[t]}$

$\left[\frac{B}{CA}\right]=[T]$

13. Answer (1)

Hint: Use principle of homogeneity

Sol.: $[P] = [F^aV^bT^c]$

$$\left[\frac{MLT^{-2}}{L^2}\right] = [(MLT^{-2})^a(LT^{-1})^b T^C]$$

$[ML^{-1}T^{-2}] = M^aL^{a+b}T^{-2a-b+c}$

$a = 1$

$a + b = -1$

$b = -2$

$-2a - b + c = -2$

$-2 + 2 + c = -2$

$c = -2$ $\quad\therefore$ $[P] = [F^1 V^{-2} T^{-2}]$

14. Answer (4)

Hint: In subtraction, answer will be reported upto minimum decimal place.

Sol.: $A - B = 3.348 - 1.1$

$= 2.248$

≈ 2.2 cm

15. Answer (3)

Hint & Sol.: Conversion of unit can be done using dimensional analysis and deduction of numerical constant cannot be done using dimensional analysis.

16. Answer (1)

Hint: Absolute error in measurement is 0.01 cm

Sol.: $\frac{\Delta x}{x} = \frac{0.01}{20}$

$$\left(\frac{\Delta x}{x}\right)\times 100 = \frac{0.01}{20}\times 100$$

$= 0.05\%$

17. Answer (4)

Hint : Use $n_1u_1 = n_2u_2$

Sol.: $n_1[L_1T_1^{-2}] = n_2[L_2T_2^{-2}]$

$$n_2 = n_1\left[\frac{L_1}{L_2}\right]\left[\frac{T_1}{T_2}\right]^{-2}$$

$$= (1)\left[\frac{1}{100}\right]\left[\frac{1}{\frac{1}{10}}\right]^{-2}$$

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

$$n_2 = \frac{1}{10^4}$$

18. Answer (4)

Hint & Sol.: Strain has no unit as well as no dimension while angular velocity and stress have both unit and dimension but solid angle has unit but no dimension. SI unit of solid angle is steradian.

19. Answer (2)

Hint & Sol.: Pitch $= \frac{\text{Distance moved}}{\text{Number of rotation}}$

$$= \frac{3}{15}$$

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

20. Answer (1)

Hint: Least count = 1 M.S.D – 1 V.S.D

Sol.: n M.S.D = $(n + 1)$ V.S.D

$$1 \text{ V.S.D} = \left(\frac{n}{n+1}\right) \text{M.S.D}$$

$$\text{L.C} = \left(1-\frac{n}{n+1}\right) \text{M.S.D}$$

$$= \left(\frac{1}{n+1}\right)\times 2$$

$$0.04 = \frac{2}{(n+1)}$$

$$\frac{1}{50} = \frac{1}{n+1}$$

$n = 49$

21. Answer (4)

Hint & Sol.: The reading having minimum least count will be the most precise reading. So 10.001 cm is most precise.

22. Answer (1)

Hint & Sol.: The last digit of decimal is the uncertain digit of a given measurement.

23. Answer (3)

Hint & Sol.: The reading closest to actual length will be most accurate.

24. Answer (3)

Hint & Sol.: Most accurate measurement may or may not be most precise. All dimensionless quantities are not unitless and the physical quantities having different dimensions can be multiplied with each other.

25. Answer (3)

Hint: $y = \frac{a\sqrt{b}}{c^2d} \Rightarrow d = \left(\frac{a\sqrt{b}}{c^2y}\right)$

Sol.:

$$\frac{\Delta d}{d}\times 100 = \frac{\Delta a}{a}\times 100 + \frac{1}{2}\frac{\Delta b}{b}\times 100 + 2\frac{\Delta c}{c}\times 100 + \frac{\Delta y}{y}\times 100$$

$$= 1 + \frac{1}{2}\times 2 + 2\times 0.5 + 3$$

= 1 + 1 + 1 + 3

= 6%

26. Answer (4)

Hint : The maximum absolute error in the sum/difference of quantities is equal to the sum of the absolute errors in the physical quantities.

Sol.: Let $x = a + b - c$

$\therefore\ \Delta x = \Delta a + \Delta b + \Delta c = 0.01 + 0.02 + 0.03$

= 0.06 cm

27. Answer (2)

Hint: Least count $= \dfrac{\text{Pitch}}{\text{Number of division}}$

Sol.: L.C = $\dfrac{1\,\text{mm}}{100}$

= 0.01 mm

Diameter = MSR + CSR (LC)

= 1 mm + 40(0.01)

= 1.4 mm

Surface area = $\pi D\ell$

$$= \frac{22}{7}\times 1.4\times 49\ \text{mm}^2$$

= 22 × 0.2 × 49 mm^2

= 215.6 mm^2

= 2.156 cm^2

= 2.2 cm^2

28. Answer (4)

Hint: Gravitational force $F = \dfrac{GM_1M_2}{r^2}$

Sol.: $[G] = \left[\dfrac{ML^3T^{-2}}{M^2}\right]$

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

$$\frac{G_1}{G_2} = \frac{M_2}{M_1}\times\left(\frac{L_1}{L_2}\right)^3\times\left(\frac{T_2}{T_1}\right)^2$$

$$= \frac{1}{1000}\times\left(\frac{100}{1}\right)^3\times\left(\frac{1}{1}\right)^2$$

= $10^3 : 1$

29. Answer (2)

Hint: Use equations of uniformly accelerated motion.

Sol.: $\dfrac{s_1}{s_2} = \dfrac{v_1^2}{v_2^2}$

$$\frac{25}{225} = \frac{v^2}{(nv)^2}$$

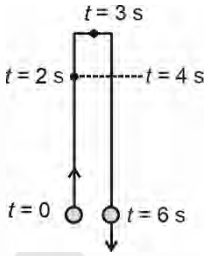
$n^2 = 9$

$n = 3$

30. Answer (3)

Hint: Ball will be at its highest point of trajectory at t = 3 s.

Sol.: Displacement of ball in 3rd second of journey



$$s_{3^{rd}} = u + \frac{a}{2}(2n-1)$$

$$= 30 - \frac{10}{2}(2\times 3 - 1)$$

= 30 – 25 = 5 m

Similarly $s_{4^{th}} = 30 - \dfrac{10}{2}(2\times 4 - 1)$

= – 5 m

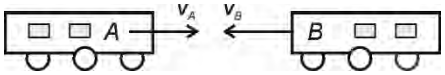
Total distance travelled between t = 2 s to t = 4 s

S_{Total} = 5 + 5 = 10 m

31. Answer (2)

Hint: Use concept of relative velocity

Sol.:



Relative velocity $= v_A + v_B$ (in opposite direction)

= 40 m/s

Time taken to cross each other

$$= \frac{1300}{40} = \frac{130}{4} = 32.5\ \text{s}$$

32. Answer (3)

Hint & Sol.:

- Any body moving under constant acceleration may change its direction of motion.
- Body may be at instantaneous rest while having non-zero acceleration at that point.
- $|\vec{v}_{inst}| = v_{inst}$

33. Answer (2)

Hint & Sol.:

- Speedometer of an automobile measures the instantaneous speed of the automobile.
- Average speed $v_{avg} = \dfrac{\text{Total distance travelled}}{\text{Time taken}}$

34. Answer (1)

Hint: Use equation of uniformly accelerated motion

Sol.: $v = u + at$

Velocity at the end of 6 s

$v = 4 \times 6 = 24$ m/s

Using, $s = ut + \dfrac{1}{2}at^2$

Distance travelled in first 6 s

$s_1 = \dfrac{1}{2} \times 4 \times (6)^2$

= 72 m

Distance travelled in next 4 s with uniform speed.

$s_2 = v \times t$

$= 24 \times 4 = 96$

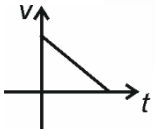
$s = s_1 + s_2$

$= 72 + 96 = 168$ m

35. Answer (1)

Hint: Use $v = u + at$

Sol.: $v = u - gt$



36. Answer (3)

Hint: Average speed $= \left(\dfrac{\text{Total distance}}{\text{Total time taken}}\right)$

Sol.: Total distance $= \left(\dfrac{3}{2}\right)2\pi R$

$= 3\pi R$

Average speed $= \dfrac{3\pi R}{30} = \left(\dfrac{\pi R}{10}\right)$ m/s

37. Answer (4)

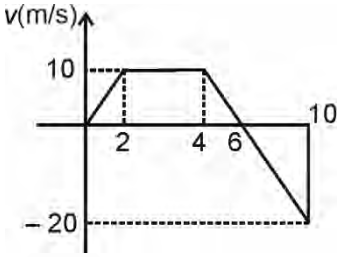
Hint: Slope of velocity – time graph represents acceleration

Sol.: Slope is constant upto time t_0 and after time t_0 slope is zero. So upto time t_o acceleration is constant and after time t_o acceleration becomes zero and velocity is constant.

38. Answer (4)

Hint: Area under velocity-time graph represents displacement

Sol.:



Displacement $= \dfrac{1}{2} \times 10 \times 2 + 10 \times 2 + \dfrac{1}{2} \times 2 \times 10$

$- \dfrac{1}{2} \times 4 \times 20$

= 10 + 20 + 10 – 40 = Zero

39. Answer (3)

Hint: $\int e^x dx = e^x$

Sol.: $\int_0^2 y dx = \int_0^2 e^x dx$

$= \left[e^x\right]_0^2$

$= e^2 - 1$

40. Answer (1)

Hint: Instantaneous velocity $v = \dfrac{dx}{dt}$

Sol.: $v = \dfrac{dx}{dt} = \dfrac{d}{dt}(2t^2 - 8t + 2)$

$v = (4t - 8)$

$v = 0$

$4t - 8 = 0$

$t = 2$ s

41. Answer (2)

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

Sol.: Path length $d_1 = (v_{avg})_1 t_1 = 12 \times 20 \times 60$

= 14400 m

Path length $d_2 = (v_{avg})_2 t_2 = 15 \times 40 \times 60 = 36000$ m

$\therefore$ Average velocity $= \dfrac{d_2 - d_1}{t_1 + t_2} = \dfrac{21600}{60 \times 60} = 6$ m/s

42. Answer (3)

Hint & Sol.: Velocity has both magnitude and direction, so it may be positive negative or zero.

43. Answer (2)

Hint: Use equation of uniformly accelerated motion.

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

$s = \frac{-h}{2}$, $a = -g$

$v = \sqrt{u^2 + gh}$

44. Answer (1)

Hint: $v_{AB} = v_A - v_B$

Sol.: $v_A = \tan 53°$

$= \frac{4}{3}$ m/s

$v_B = \tan 37°$

$= \frac{3}{4}$ m/s

$v_{AB} = \frac{4}{3} - \frac{3}{4}$

$= \frac{16-9}{12} = \left(\frac{7}{12}\right)$ m/s

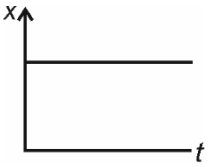
45. Answer (3)

Hint:

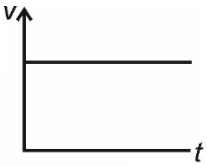
- Slope of position-time graph represents velocity
- Slope of velocity-time graph represents acceleration

Sol.:

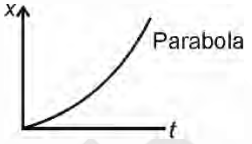
(1) Object is at rest



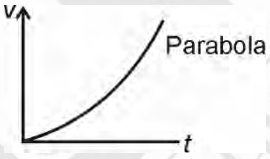
(2) Object moving with constant velocity



(3) Object moving with constant acceleration



(4) Object moving with variable acceleration



[CHEMISTRY]

46. Answer (2)

Hint: Number of atoms = Number of moles × atomicity × N_A

Sol.: Number of atoms in 1g of H_2 = 0.5 × 2 × N_A = N_A

Number of atoms in 11.2 L of O_3 = 0.5 × 3 × N_A = 1.5 N_A

Number of atoms in 10 g of Mg $= \frac{10}{24} \times 1 \times N_A$

= 0.42 N_A

Number of atoms in 6.022×10^{22} molecules of CO_2

= 3 × N_A × 10^{-1} = 0.3 N_A

47. Answer (1)

Hint: Only pure component participates in chemical reaction.

Sol.: $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

= 100 m mol

Mole of pure $CaCO_3$ = 50 m mol

Mass of pure $CaCO_3$ = 50 × 10^{-3} × 100 = 5g

Mass of sample $= \frac{5 \times 100}{90}$ = 5.55 g

48. Answer (4)

Hint: $r_n = 0.529 \times \frac{n^2}{z}$ Å

Sol.: $(r_2)_{He^+} = 0.529 \times \frac{4}{2}$

= 1.058 Å

= 105.8 pm

49. Answer (1)

Hint: For a neutral atom, number of protons and electrons are same.

Sol.: For $^{108}_{47}Ag^+$

Number of protons = 47

Number of neutrons = 108 – 47 = 61

Number of electrons = 47–(1) = 46

50. Answer (1)

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

Sol.: $1 = \frac{\text{Number of moles of } HNO_3}{500} \times 1000$

x = 0.5 mol

Weight of HNO_3 = 0.5 × 63

= 31.5 g

70g of HNO_3 = 100g of solution

31.5g of $HNO_3 = \frac{100}{70} \times 31.5$

= 45g of solution

51. Answer (3)

Hint: Number of mole $= \frac{\text{Mass (g)}}{\text{Molar mass}}$

Sol.: Mole of electron $= \frac{1000}{9.1 \times 10^{-28} \times 6.02 \times 10^{23}}$

$= 1.82 \times 10^6$

52. Answer (4)

Hint: The maximum number of electrons in the shell with principle quantum number n is equal to $2n^2$

Sol.: According to Pauli exclusion principle, no two electrons in an atom can have the same set of four quantum numbers.

Azimuthal quantum number defines the three dimensional shape of orbital.

53. Answer (4)

Hint: $N \times 10^n$ have positive or negative value of n and N varies between 1.000 ------ and 9.999 -----

Sol.: 0.001532 can be correctly expressed in scientific notation as 1.532×10^{-3}

54. Answer (1)

Hint: $BaCl_2$ is limiting reagent in given reaction

Sol.: $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$

Mole of $Na_2SO_4 = \frac{18.2}{142} = 0.13$

Mole of $BaSO_4 = \frac{23.3}{233} = 0.1$

$BaCl_2$ is limiting reagent

To produce 0.1 mol $BaSO_4$, 0.1 mol $BaCl_2$ is required

= 0.1 × 208 = 20.8 g

55. Answer (3)

Hint: Mass of 1 molecule of CH_4 = 16 u

Sol.: Mass of 2 molecules of CH_4 = 32 u

$= 32 \times 1.66 \times 10^{-24}$ g

$= 5.31 \times 10^{-23}$ g

56. Answer (1)

Hint: According to law of multiple proportions, If two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element, are in the ratio of small whole numbers.

Sol.:

- Mass composition of H and O will be same in H_2O irrespective of source.
- Equal volumes of gases contain equal number of molecules at constant temperature and pressure.
- Reaction of 1L of H_2 will give $\frac{2}{3}$ L of NH_3 gas
- Isotopes have different mass number which represent number of nucleons.

57. Answer (1)

Hint: In order to get molecular formula, number of atoms of element in one molecule is required.

Sol.: Mass of both P and Q = W

Mole of $P = \frac{W}{30}$

Mole of $Q = \frac{W}{40}$

Formula $\Rightarrow P_4Q_3$

58. Answer (2)

Hint: Average atomic mass $= \frac{\sum A_i X_i}{100}$

$A_i \Rightarrow$ mass number of i^{th} isotope

$X_i \Rightarrow$ Percentage abundance of i^{th} isotope

Sol.: $X_{Avg} = \frac{50 \times 70 + 51 \times 20 + 52 \times 10}{100}$

$= \frac{3500 + 1020 + 520}{100}$

= 50.4 u

59. Answer (4)

Hint: On reaction of 4g H_2 and 14g N_2, nitrogen is limiting reagent

Sol.:

- 14g of N_2 that is 0.5 mol of N_2 will give 1 mol ammonia that is 17g NH_3
- Mixing of 2g H_2 and 16g O_2 will give 18g H_2O.

60. Answer (3)

Hint: There are seven base physical quantities.

Sol.:

Base Physical Quantity	Symbol for Quantity	Name of SI Unit	Symbol for SI Unit
Length	ℓ	metre	m
Mass	m	kilogram	kg
Time	t	second	s
Electric current	I	ampere	A
Thermodynamic temperature	T	Kelvin	K
Amount of substance	n	Mole	mol
Luminous intensity	I_V	candela	cd

61. Answer (4)

Hint: For minimum molecular weight atomicity of sulphur in given molecule will be one.

Sol.: $\%\ \text{comp} = \dfrac{\text{Atomic mass} \times \text{Atomicity}}{\text{Molecular mass}} \times 100$

$0.32 = \dfrac{32 \times 1}{M} \times 100$

Molecular weight = 10000 u

62. Answer (2)

Hint: Limiting reagent gets completely consumed during a chemical reaction.

$N_2 + O_2 \longrightarrow 2NO$

Sol.: $\dfrac{10}{28}\text{mol}\quad \dfrac{14}{32}\text{ mol}$

N_2 is limiting reagent

- $N_2 + 2C + H_2 \longrightarrow 2HCN$

  $\dfrac{16}{28}\text{mol}\quad \dfrac{13}{12}\text{ mol}\quad \dfrac{1}{2}\text{ mol}$

H_2 is limiting reagent

$C + O_2 \longrightarrow CO_2$

- $\dfrac{14}{12}\text{mol}\quad \dfrac{16}{32}\text{ mol}$

  O_2 is L. R.

- $2H_2 + C \longrightarrow CH_4$

  $\dfrac{3}{2}\text{mol}\quad \dfrac{6}{12}\text{ mol}$

  Carbon is L.R.

63. Answer (1)

Hint: Vapour density $= \dfrac{\text{Molar mass}}{2}$

Sol.: Relative density of O_2 w.r.t. He

$d = \dfrac{32}{4} = 8$

- Volume of 0.17 g $NH_3(g)$ at STP is 224 mL

64. Answer (4)

Hint: Molality (m) $= \dfrac{\text{Number of moles of solute}}{\text{Mass of solvent (in kg)}}$

Sol.: $d = \dfrac{M}{V}$

Mass of solution = 1.25 × 1000 = 1250 g

Weight of solute = 1 × 50 = 50 g

Weight of solvent = 1250 – 50 = 1200 g

$m = \dfrac{1}{1200} \times 1000$

$\Rightarrow$ 0.83 m

65. Answer (1)

Hint: Orbital angular mometum $= \hbar\sqrt{\ell(\ell+1)}$

Sol.: Orbital angular momentum $= \hbar\sqrt{2(2+1)}$

$= \sqrt{6}\,\hbar$

66. Answer (1)

Hint: Empirical formula represents simplest ratio of number of atoms present in one molecule for different elements.

Sol.:

	H	Cl	C
% Composition	4.04	71.7	24.26
Mole	$\dfrac{4.04}{1}$ = 4.04	$\dfrac{71.7}{35.5}$ 2.02	$\dfrac{24.26}{12}$ = 2.02
Atomicity	2	1	1

Empirical formula = CH_2Cl

67. Answer (1)

Hint: $3O_2 \rightarrow 2O_3$

Sol.: $3O_2 \rightarrow 2O_3$

9 mL 0

9 – 0.9 0.6 mL

V_{total} = 9 – 0.9 + 0.6 = 8.7 mL

68. Answer (2)

Hint: To form 1 mol X_2O_3, 3 mol O and 2 mol X is required.

Sol.: Mass of O = mass of X_2O_3 – Mass of X

= 0.559 – 0.359 g

= 0.2 g

$= \frac{0.2}{16}$ mol

3 mol O combines with $\rightarrow$ 2 mol X

$\frac{0.2}{16}$ mol O combines with = $\frac{2}{3} \times \frac{0.2}{16}$ mol X

$= \frac{1}{120}$ mol X

M = 43.08 g mol^{-1}

69. Answer (3)

Hint: Combustion of hydrocarbon gives CO_2 and H_2O

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

Sol.: Volume of C_3H_8 = V

Volume of C_4H_{10} = 3 – V

$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$$

V 0

0 3V

$$C_4H_{10} + \frac{13}{2}O_2 \longrightarrow 4CO_2 + 5H_2O$$

3 – V 0

0 4(3 – V)

3V + 4(3 – V) = 10

3V + 12 – 4V = 10

V = 2L = Volume of C_3H_8

Volume of C_4H_{10} = 3 – V = 1 L

70. Answer (3)

Hint: Equal masses of O_2 and O_3 contain equal number of electrons

Sol.: Equal masses of different gases may contain different number of atoms

71. Answer (4)

Hint: According to J. J Thomson, atom is sphere of uniform positive charge in which negative charge is embedded.

Sol.: Presence of nucleus in an atom is confirmed by Rutherford's α-particle scattering experiment.

- $\frac{r_{atom}}{r_{nucleus}} = 10^5$
- $\frac{M_{proton}}{M_{electron}} = 1837$

72. Answer (1)

Hint: Radial nodes = $(n - \ell - 1)$

Sol.: For 4*s* orbital $\Rightarrow$ 4 – 0 – 1 = 3

For 3*d* orbital $\Rightarrow$ 3 – 2 – 1 = 0

For 4*p* orbital $\Rightarrow$ 4 – 1 – 1 = 2

For 5*f* orbital $\Rightarrow$ 5 – 3 – 1 = 1

73. Answer (1)

Hint: Isotopes have same atomic number but different mass number.

Sol.: ^{12}C and ^{14}C are isotopes

$^{39}_{19}K^+$ and $^{40}_{18}Ar$ are isoelectronic

$^{13}_{6}C$ and $^{14}_{7}N$ are isotones

$^{18}_{9}F$ and $^{18}_{8}O$ are isobars

74. Answer (1)

Hint: $M_1V_1 + M_2V_2 = M_3V_3$

Sol.: 2 × 1 + 3 × 2 = M × 5

$M = \frac{8}{5}$

$\Rightarrow$ 1.6 M

75. Answer (1)

Hint: Angular momentum of an electron

$mvr = \frac{nh}{2\pi}$

Sol.: For $(V_H)_1 = 2.18 \times 10^6$ m/s

For $(V_{Li^{2+}})_3 = 2.18 \times 10^6$ m/s

76. Answer (1)

Hint: Specific charge, $(e/m) = \frac{Charge}{Mass}$

Sol.: $(e/m)_{electron} = \frac{1.6 \times 10^{-19}}{9.1 \times 10^{-31}} = 1.758 \times 10^{11}$ C/kg

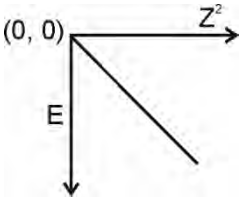
$(e/m)_{proton} = \frac{1.6 \times 10^{-19}}{1.67 \times 10^{-27}} = 9.58 \times 10^7$ C/kg

$(e/m)_{neutron} = \frac{0}{1.675 \times 10^{-27}} = 0$ C/kg

77. Answer (3)

Hint: $E_n = -\frac{13.6 \times Z^2}{n^2}$

Sol.: Correct graph



78. Answer (4)

Hint: Maximum energetic photon will emit if electron comes back to ground state from higher energy state.

Sol.: $4 \rightarrow 1$ will give most energetic photon.

79. Answer (3)

Hint: An atom absorbs energy in form of discrete photon and energy of photon must be equal to difference of energy between two energy levels.

Sol.: Since 11 eV is not value of any ΔE, $\Delta E_{minimum} = E_2 - E_1$

= – 3.9 + 13.6

= 10.2 eV

This photon will not be absorbed and electron will be present in ground state only.

80. Answer (1)

Hint: Electron can come back to ground state by single or multiple steps.

Sol.: If only one H-atom is present in sample, then we will observe only one maximum line in visible spectrum.

81. Answer (1)

Hint: For single electron species $2\pi r_n = n\lambda$

Sol.: $2\pi \times 0.529 \times \frac{(3)^2}{3} = 3\lambda$

$\lambda = 1.058\pi$ Å

82. Answer (2)

Hint: For Fe atom, last electron will be filled in 3d orbital.

Sol.: Be $\Rightarrow$ n = 2, l = 0, m = 0, $s = +\frac{1}{2}$

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

Cl $\Rightarrow$ n = 3, l = 1, m = –1, $s = +\frac{1}{2}$

Fe $\Rightarrow$ n = 3, l = 2, m = +1, $s = +\frac{1}{2}$

83. Answer (2)

Hint: For microscopic species

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

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

$(\Delta x)^2 = \frac{h}{4\pi m}$

$\Delta x = \left(\frac{h}{4\pi m}\right)^{\frac{1}{2}}$

$\sqrt{\frac{h}{4\pi m}} \times \Delta p = \frac{h}{4\pi}$

$\Delta p = \sqrt{\frac{hm}{4\pi}}$

84. Answer (4)

Hint: de-Broglie wavelength

$\lambda = \frac{h}{\sqrt{2mKE}}$

Sol.: $\lambda = \frac{6.626 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times 2.8 \times 10^{-23}}}$

$= \frac{6.626 \times 10^{-34}}{7.14 \times 10^{-27}}$

$= 9.28 \times 10^{-8}$ m

85. Answer (1)

Hint: Photoelectric effect can be explained by the particle nature of electromagnetic radiation.

Sol.: Heisenberg uncertainty principle is applicable only for motion of microscopic objects and is negligible for that of macroscopic objects.

86. Answer (1)

Hint: 'n' is a positive integer which always is larger than 'ℓ'.

Sol.:

- m, varies from '+l' to '–l' including zero.
- s can be only $+\frac{1}{2}$ or $-\frac{1}{2}$

87. Answer (1)

Hint: Total number of nodes = (n – 1)

Sol.:

- Total radial nodes in 4s orbital = (n – ℓ – 1)

  = 4 – 0 – 1 = 3
- Angular node = ℓ = 0
- Shape of d_{xz}, d_{yz}, d_{xy} and $d_{x^2-y^2}$ are similar to each others.

88. Answer (2)

Hint: Number of degenerated orbitals for H-atom in a shell = n^2

Sol.: Number of orbitals in 4^{th} shell = $4^2 = 16$

- As atomic number increases, energy of same orbital decreases.
- For single electronic species, energy depends only on principal quantum number.
- Splitting of spectral line in magnetic field is known as Zeeman effect.

89. Answer (4)

Hint: Cu $\Rightarrow 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^{10}$

Sol.: Number of electrons with l = 0 is 7

90. Answer (4)

Hint & Sol.:

Element	Number of unpaired electron (s)
Cr	6
N	3
Na	1
Ca	0

[BOTANY]

91. Answer (3)

Hint: Prokaryotic cells show the presence of fimbriae.

Sol: The middle layer of the cell envelope (cell wall) in the prokaryotic cell prevents these cells from bursting or collapsing. Glycocalyx differs in composition and thickness in different forms.

92. Answer (2)

Hint: Primary constriction in chromosome is centromere.

Sol: Vesicles containing materials made by the endoplasmic reticulum fuse with the convex face of the Golgi apparatus, and they are modified and released from the concave face of the Golgi apparatus. The two sub-units of 80 ribosome are 60 S and 40 S and that of 70 S are 50 S and 30 S.

93. Answer (3)

Hint: Robert Brown discovered nucleus and George Palade discovered ribosomes.

Sol: Ribosomes are composed of ribonucleoprotein. Ribosomes are found associated with the one of the components of endomembrane system (Endoplasmic reticulum) that is extensive and continuous with the outer membrane of the nucleus.

94. Answer (1)

Hint: Cilia and flagella are hair-like outgrowths of the cell membrane.

Sol.: Cilia are small structures which work like oars, causing the movement of either the cell or the surrounding fluid. Flagella are comparatively longer and responsible for cell movement.

95. Answer (1)

Hint: Human cells divide once in approximately every 24 hours.

Sol.: Yeast can progress through the cell cycle in only about 90 minutes.

96. Answer (4)

Hint: Mitochondria and chloroplast are semi-autonomous organelles.

Sol: Ribosomes (non-membrane bound organelle) is found in both prokaryotic and eukaryotic cell.

Lysosomes (component of endomembrane system) is rich in hydrolytic enzymes. Many single membrane bound minute vesicles are called microbodies that contain various enzymes. Mitochondria and chloroplasts are semi-autonomous organelles that duplicate during pre-mitotic phase.

97. Answer (3)

Hint: The metacentric chromosome has middle centromere and in acrocentric chromosome, centromere is present very close to one end.

Sol: The metacentric chromosome has middle centromere forming two equal arms of the chromosome (isobrachial).

98. Answer (2)

Hint: The interphase nucleus has highly extended and elaborate network of nucleoprotein fibres called chromatin.

Sol: Chromatin contains DNA and some basic proteins called histones, some non-histone proteins, and RNA.

99. Answer (1)

Hint: Centriole has an organisation like the cartwheel.

Sol: The centrioles form the spindle fibres that give rise to spindle apparatus during cell division in animal cells.

100. Answer (4)

Hint: It is also known as resting stage.

Sol.: The interphase lasts more than 95% of the duration of cell cycle.

101. Answer (4)

Hint: The given structure is a section of cilia/flagella showing different parts.

Sol: A – Plasma membrane (composed of phospholipid and protein)

C – Interdoublet bridge

D – Central microtubule (composed of tubulin protein)

B – Central sheath

102. Answer (2)

Hint: It is the phase of actual cell division.

Sol.: M phase is the most dramatic period of the cell cycle, involving a major reorganisation of virtually all components of the cell.

103. Answer (1)

Hint: The space limited by the inner membrane of the chloroplast is called the stroma.

Sol.: The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrates and proteins. A number of organised flattened membranous sacs called the thylakoids, are present in the stroma.

104. Answer (3)

Hint: This stage is also known as quiescent stage.

Sol.: Cells in G_0 stage remain metabolically active but no longer proliferate.

105. Answer (1)

Hint: An elaborate network of filamentous proteinaceous structures consisting of microtubules, microfilaments and intermediate filaments present in the cytoplasm is collectively referred to as the cytoskeleton.

Sol.: The cytoskeleton in a cell are involved in many functions such as mechanical support, motility, and maintenance of the shape of the cell.

106. Answer (1)

Hint: This phase represents the interval between mitosis and initiation of DNA replication.

Sol.: Most of the organelle duplication occurs during G_1 phase.

107. Answer (2)

Hint: Human has 23 pairs of chromosomes.

Sol.: Of the two, the inner chloroplast membrane is relatively less permeable.

108. Answer (3)

Hint: Cytokinesis in plant cell is facilitated by formation of cell plate.

Sol.: Cytokinesis in animal cell is facilitated by formation of furrow.

109. Answer (1)

Hint: Proteins are the polymers of amino acids.

Sol.: Amyloplasts store carbohydrates (starch), e.g., potato; elaioplasts store oils and fats whereas, the aleuroplasts store proteins. In the chromoplasts, fat soluble carotenoid pigments like carotene, xanthophylls and others are present.

110. Answer (2)

Hint: Liquid endosperm in coconut shows multinucleate condition.

Sol.: Liquid endosperm in coconut exemplifies syncytium.

111. Answer (3)

Hint: The inner membrane forms a number of infoldings called the cristae towards the matrix.

Sol.: The cristae increase the surface area. The inner compartment is filled with a dense homogeneous substance called the matrix.

112. Answer (1)

Hint: This is the fourth substage of prophase-I.

Sol.: In oocytes of some vertebrates, diplotene can last for months or years.

113. Answer (1)

Hint: Vacuoles contains water, sap, excretory product and other materials not useful for the cell.

Sol.: The vacuole is bound by a single membrane called tonoplast.

114. Answer (2)

Hint: This stage is characterised by the appearance of chiasmata.

Sol.: The beginning of diplotene is recognised by the dissolution of the synaptonemal complex.

115. Answer (4)

Hint: In animal cells, lipid-like steroidal hormones are synthesised in SER.

Sol.: The ER often show ribosomes attached to their outer surface. The endoplasmic reticulum bearing ribosomes on their surface is called rough endoplasmic reticulum (RER). In the absence of ribosomes, they appear smooth and are called smooth endoplasmic reticulum (SER).

116. Answer (3)

Hint: Diakinesis represents transition to metaphase.

Sol.: The final stage of meiotic prophase I is diakinesis. This is marked by terminalisation of chiasmata.

117. Answer (2)

Hint: Interval between post- and pre-mitotic phase represents S phase and interval between meiosis I and II represents interkinesis.

Sol.: Both S-phase and interkinesis shows centriole (component of centrosome) duplication.

118. Answer (4)

Hint: Leucoplasts are colourless plastids.

Sol.: Chromoplasts are pigment carrying plastids.

119. Answer (2)

Hint: Recombination nodule appears during pachytene.

Sol.: During metaphase I, the bivalent chromosomes align on the equatorial plate.

120. Answer (1)

Hint: This structure is mainly composed of calcium pectate.

Sol.: Middle lamellae holds or glues the different neighbouring cells together.

121. Answer (2)

Hint: Anaphase I does not show centromere splitting.

Sol.: During anaphase I, the homologous chromosomes separate, while sister chromatids remain associated at their centromeres.

122. Answer (3)

Hint: Na^+/K^+ pump requires ATP for their functioning.

Sol.: A few ions or molecules are transported across the membrane against their concentration gradient, i.e., from lower to the higher concentration. Such a transport is an energy dependent process, in which ATP is utilised and is called active transport, e.g., Na^+/K^+ pump.

123. Answer (4)

Hint: Both mitosis and meiosis show single cycle of DNA replication.

Sol.: Meiosis involves two sequential cycles of nuclear and cell division called meiosis I and meiosis II but only a single cycle of DNA replication. Meiosis is the mechanism by which conservation of specific chromosome number of each species is achieved across generations in sexually reproducing organisms, even though the process, per se, paradoxically, results in reduction of chromosome number by half.

124. Answer (1)

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

Sol.: The cell membrane is mainly composed of lipids and proteins. Later, biochemical investigation clearly revealed that the cell membranes also possess protein and carbohydrate.

125. Answer (3)

Hint: Although in many cases after telophase I, the chromosomes do undergo some dispersion, they do not reach the extremely extended state of the interphase nucleus.

Sol.: Meiosis II is initiated immediately after cytokinesis, usually before the chromosomes have fully elongated. Meiosis I is initiated after the parental chromosomes have replicated to produce identical sister chromatids at the S phase.

126. Answer (2)

Hint: Sap vacuole is a membrane bound organelle.

Sol.: Rest all are inclusion bodies.

127. Answer (4)

Hint: At the end of meiosis four haploid cells are formed.

Sol.: Telophase I results in the formation of dyad of cells

128. Answer (1)

Hint: The ribosomes of a polysome translate the mRNA into proteins.

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

129. Answer (2)

Hint: The nucleoli are spherical structures present in the nucleoplasm.

Sol.: Prophase – Movement of centrosomes towards opposite poles

Metaphase – Congression of chromosomes

Anaphase – Shortening of spindle fibres

Telophase – Reformation of the spherical structure in the nucleoplasm

130. Answer (2)

Hint: These are small bristle-like fibres sprouting out of the cell.

Sol.: In some bacteria, fimbriae are known to help attach the bacteria to rocks in streams and also to the host tissues.

131. Answer (3)

Hint: The actual period of cell division is M phase.

Sol.: Mitosis is the equational division in which the chromosome number of the parent is conserved in the daughter cell. Meiosis I is a reductional division. Interphase is further subdivided into G_1, S

and G_2. S phase is also characterised by chromosome duplication.

132. Answer (1)

Hint: The prokaryotic cell also possess flagella but these are structurally different from that of the eukaryotic flagella.

Sol.: The prokaryotic plasma membrane is similar structurally to that of the eukaryotes.

133. Answer (2)

Hint: The stage depicted in the figure is prophase.

Sol.: Prophase is marked by the initiation of condensation of chromosomal material. The chromosomal material becomes untangled during the process of chromatin condensation. Cells at the end of prophase, when viewed under the microscope, do not show Golgi complexes, endoplasmic reticulum, nucleolus and the nuclear envelope.

134. Answer (2)

Hint: It is conferred by extra-chromosomal DNA.

Sol.: The plasmid DNA confers certain unique phenotypic characters to such bacteria. One such character is resistance to antibiotics.

135. Answer (2)

Hint: These events depict the substages of meiosis-I which are: Leptotene → Zygotene → Pachytene → Diplotene → Diakinesis.

Sol.: Correct chronological sequence of the above given events is as follows:

b. Beginning of compaction of the structure named by Flemming – Leptotene

a. Formation of synaptonemal complex – Zygotene

d. Recombinase mediated process that brings genetic variability in the population of organisms from one generation to the next – Pachytene

c. Recombined homologous chromosomes of the bivalents separate from each other except at the sites of crossovers – Diplotene

e. Assemblage of meiotic spindle – Diakinesis.

[ZOOLOGY]

136. Answer (1)

Hint: Multicellular animal

Sol.: In unicellular organisms, all functions like digestion, respiration and reproduction are performed by a single cell. In the complex body of multicellular animals, the same basic functions are carried out by different groups of cells in a well organised manner. 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. *Hydra* exhibits division of labour. Others are protists which do not show division of labour.

137. Answer (4)

Hint: Stomach aids in digestion

Sol.: All complex animals consist of only four basic types of tissues *i.e.*, (i) epithelial tissue (ii) connective tissue (iii) muscular tissue (iv) neural tissue. These tissues are organised in specific proportion and pattern to form organs like stomach, lung, heart and kidney.

138. Answer (3)

Hint: Exclude the functions of simple squamous epithelium

Sol.: The simple squamous epithelium is made of single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs and are involved in functions like forming a diffusion boundary. It is not found in body areas that are subjected to mechanical stress. Simple squamous epithelium present in blood capillaries of glomerulus participates in filtration of blood. Simple cuboidal and columnar epithelium perform secretion. Protection is the main function of the compound epithelium.

139. Answer (3)

Hint: Identify a hormone.

Sol.: On the basis of the mode of pouring their secretions, glands are divided into two categories namely exocrine and endocrine glands. Exocrine glands secrete mucus, saliva, earwax, oil, milk, digestive enzymes and other cell products. These products are released through ducts or tubes. In contrast, endocrine glands do not have ducts. Their products called hormones are secreted directly into the fluid bathing the gland.

140. Answer (2)

Hint: One of them constitutes 9.5% weight of the human body.

Sol.:

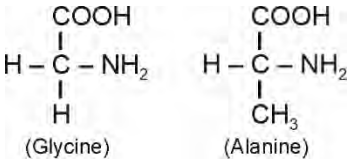
Element	% Weight of	
	Earth's crust	Human body
Hydrogen (H)	0.14	9.5
Carbon (C)	0.03	18.5
Oxygen (O)	46.6	65.0

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

141. Answer (4)

Hint: Neutral amino acids

Sol.:



Both glycine and alanine are neutral amino acids *i.e.*, they have one amino group and one carboxyl group.

Amino acids are present in acid-soluble fraction.

Acidic amino acids have an extra –COOH group while basic amino acids have an extra $–NH_2$ group.

142. Answer (3)

Hint: 'P' = Palmitic acid, 'Q' = Arachidonic acid

Sol.: Saturated fatty acids are without C = C double bond(s) while unsaturated fatty acids are with one or more C = C double bond(s).

Palmitic acid has 16 carbons including carboxyl carbon. Arachidonic acid has 20 carbon atoms including the carboxyl carbon.

Saturated fatty acids have higher melting point than the unsaturated fatty acids and both are soluble in organic solvents.

143. Answer (1)

Hint: Identify a steroid.

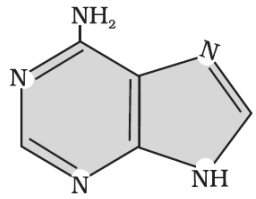
Sol.: Living organisms have a number of carbon compounds in which heterocyclic rings can be found. Some of these are nitrogen bases-adenine, guanine, cytosine, uracil and thymine.

Cholesterol possesses four homocyclic rings.

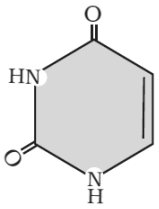
144. Answer (2)

Hint: Adenine is a purine.

Sol.:



Adenine (Purine)



Uracil (Pyrimidine)

145. Answer (3)

Hint: Hydrolases

Sol.: Class II: Transferases : Catalyse a transfer of a group, G (other than hydrogen) between a pair of substrate S and S′.

Class III: Hydrolases : Catalyse hydrolysis of ester, ether, peptide, glycosidic, C – C, C – halide or P – N bonds.

Class IV: Lyases : Catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

146. Answer (1)

Hint: Reason for the name of this tissue

Sol.: Connective tissues are the most abundant and widely distributed tissue in the body of complex animals. They are named connective tissue because of their special function of linking and supporting other tissues/organs of the body.

147. Answer (2)

Hint: Possesses a single layer of tall and slender cells

Sol.: Simple squamous epithelium are found in the walls of blood vessels and air sacs of lungs. Cuboidal epithelium is commonly found in ducts of glands and tubular parts of nephrons in kidneys. Ciliated epithelium are mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes. Compound epithelium is present in ducts of salivary glands.

148. Answer (3)

Hint: Columnar epithelium

Sol.: The simple columnar epithelium is composed of a single layer of tall and slender cells. They are found in the lining of stomach and intestine and help in secretion and absorption.

149. 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.

- Brush bordered cuboidal epithelium lines the proximal convoluted tubules of nephron.
- Simple squamous epithelium is present in the walls of capillaries.

150. Answer (4)

Hint: Tendon and ligament are dense regular connective tissues.

Sol.: Fibres and fibroblasts are compactly packed in the dense connective tissues. Orientation of fibres show a regular or irregular pattern and are called dense regular and dense irregular tissues respectively.

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

151. Answer (2)

Hint: True for cartilage

Sol.: The inter-cellular material of cartilage is solid and pliable and resists compression. Cells of this tissue (chondrocytes) are enclosed in small cavities within the matrix secreted by them. Cartilage is avascular and is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adults.

152. Answer (2)

Hint: Functions as a lining for body cavities

Sol.: The epithelial tissue has a free surface, which faces either a body fluid or the outside environment and thus, provides a covering or a lining for some parts of the body. The cells are compactly packed with little intercellular matrix.

Squamous epithelium possesses flattened cells and the nucleus of each cell is flattened, oval or sphere and is centrally located. Cuboidal epithelium possesses cells with round and centrally located nuclei.

153. Answer (1)

Hint: Gap junctions are also known as communication junctions.

Sol.: Gap junctions allow the cells in a tissue to communicate with one another. Gap junctions enable impulses to spread rapidly among cells.

Cells of epithelial tissues that line the stomach, intestine and urinary bladder have many tight junctions to retard the passage of substances between cells and prevent the contents of these organs from leaking into the blood or surrounding tissues.

154. Answer (4)

Hint: 'P' is haemoglobin

Sol.: Adult human haemoglobin consists of 4 subunits. Two of these are identical to each other. Hence, two subunits of α-type and two subunits of β-type together constitute the human haemoglobin. Haem is a part of active site of enzymes, catalase and peroxidase.

155. Answer (4)

Hint: Different from prosthetic groups and co-enzymes

Sol.: Zinc is the co-factor for the enzyme such as carbonic anhydrase. This forms coordination bonds with side chains at the active site and at the same time forms one or more coordination bonds with the substrate.

Co-enzymes are organic compounds and their association with the apoenzyme is only transient.

156. Answer (1)

Hint: Inulin is present in tubers of *Dahlia*.

Sol.: Cellulose is an unbranched polymer of glucose that serves as the structural element in plant cell wall. Cellulose does not contain complex helices and hence cannot hold iodine.

Inulin is a polymer of fructose. It is a storage polysaccharide found in roots and tubers of *Dahlia* and related plants.

157. Answer (3)

Hint: This property is observed at high temperature.

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

158. Answer (1)

Hint: Secondary structure of protein

Sol.: A protein thread does not exist throughout as an extended rigid rod. The thread is folded in the form of a helix (similar to a revolving staircase). Only some portions of the protein thread are arranged in the form of a helix. Other regions of protein thread are folded into other forms in what is called the secondary structure.

159. Answer (3)

Hint: Narcotic analgesic

Sol.:

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

160. Answer (2)

Hint: Action of sulpha drugs

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 on 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 the structure.

161. Answer (1)

Hint: Used to breakdown hydrogen peroxide

Sol.: Haem is the prosthetic group for peroxidase and catalase. NAD is a co-enzyme. Zinc is the co-factor for carbonic anhydrase.

162. Answer (3)

Hint: Areolar tissue

Sol.: Loose connective tissue has cells and fibres loosely arranged in a semi-fluid ground substance, for example, areolar tissue present beneath the skin. Often, it serves as a support framework for epithelium. It contains fibroblasts, macrophages, mast cells as well as adipocytes.

Chondrocytes are cartilage cells.

163. Answer (1)

Hint: Skeletal muscle tissue is closely attached to skeletal bones.

Sol.: Bone is the main tissue that provides structural frame to the body. Bones support and protect softer tissues and organs. Limb bones, such as the long bones of the legs, serve weight-bearing functions. They also interact with skeletal muscles attached to them to bring about some movements. The bone marrow in some bones is the site of production of blood cells.

164. Answer (4)

Hint: The functioning of muscle fibres associated with biceps can be controlled by our will.

Sol.: Smooth muscle fibres are present in the wall of urinary bladder.

Skeletal muscle fibres are associated with the biceps.

The smooth muscle fibres taper at both ends (fusiform) and do not show striations. Gap junctions are present in the smooth muscles.

Skeletal muscle fibres are striated, multinucleated and unbranched.

165. Answer (2)

Hint: Feature of neuroglial cells

Sol.: Neurons, the units of neural system, are excitable cells. The neuroglial cells which constitute the rest of the neural system protect and support neurons. Neuroglial cells make up more than one-half the volume of neural tissue in our body.

166. Answer (2)

Hint: Gives brush-bordered appearance

Sol.: Brush-bordered columnar epithelium is present in the lining of intestine which helps in secretion and absorption.

If the 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.

167. Answer (3)

Hint: Absent in blood

Sol.: In all connective tissues except blood, the cells secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the tissue. These cells also secrete modified polysaccharides which accumulate between cells and fibres and act as matrix.

168. Answer (4)

Hint: Also present in walls of blood vessels

Sol.: The squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs and are involved in functions like forming a diffusion boundary.

169. Answer (4)

Hint: Nucleotide is the monomeric unit of nucleic acid.

Sol.: Proteins constitute 10-15% of the total cellular mass while nucleic acids constitute 5-7% of the total cellular mass.

RNA does not follow Chargaff's rule; *i.e.,* 1:1 ratio does not exist between purines and pyrimidines bases due to single stranded nature and lack of complementarity.

170. Answer (3)

Hint: True for transferases

Sol.: Transferases belong to the class II of enzymes and these enzymes are responsible for transfer of a group, other than hydrogen, between a pair of substrate.

171. Answer (4)

Hint: Storage polysaccharide

Sol.: GLUT-4 is a transporter protein which enables glucose transport into the cells. Antibody, insulin as well as collagen are proteins. Glycogen is a storage polysaccharide in animals.

172. Answer (2)

Hint: Carbonic anhydrase

Sol.: CO_2 + Water (H_2O) $\underset{}{\overset{\text{Carbonic anhydrase}}{\rightleftharpoons}}$ H_2CO_3 (Carbonic acid)

In the absence of the enzyme, the above reaction is very slow, with about 200 molecules of H_2CO_3 being formed in an hour. However, by using the enzyme present within the cytoplasm called carbonic anhydrase, the reaction speeds up dramatically with about 600,000 molecules being formed every second.

The enzyme has accelerated the reaction rate by about 10 million times. Carbonic anhydrase belongs to the class IV of enzymes *i.e.*, Lyases.

173. Answer (3)

Hint: True for smooth muscle fibres

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

Cardiac muscle is characterised by the presence of uninucleated, striated and branched muscle fibres which are exclusively present in the heart wall.

Smooth muscle fibres are present in the wall of stomach and intestine.

174. Answer (1)

Hint: Equal to the number of nose you have

Sol.: Fibroblasts secrete modified polysaccharides, which accumulate between cells and fibres and act as the matrix (ground substance).

The excess of nutrients which are not used immediately are converted into fats and are stored in adipose tissue.

Muscles shorten in response to stimulation, then relax (lengthen) and return to their uncontracted state in a coordinated fashion.

175. Answer (2)

Hint: RuBisCO assists in carbon fixation in plants.

Sol.: Collagen – Intercellular ground substance

RuBisCO – Most abundant protein in the whole of the biosphere

Starch – Storage polysaccharide

Chitin – Found in exoskeleton of arthropods

176. Answer (4)

Hint: CO_2 and water vapour are removed

Sol.: Inorganic elements and compounds are present in the living organisms, which can be known with the help of a technique called 'ash analysis'.

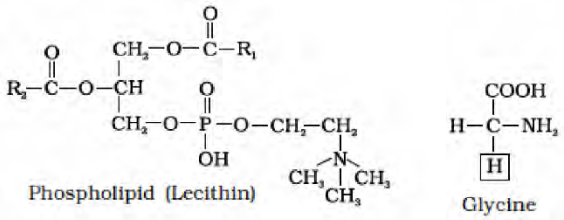
When the tissue is fully burnt, the carbon compounds are oxidised to gaseous forms like CO_2, water vapour and are removed and the remnant is called 'ash'. This ash contains many inorganic elements like calcium, magnesium, *etc.*,

Hydrogen is either removed in the form of water vapour or in the form of gases.

177. Answer (1)

Hint: A triglyceride possesses 3 fatty acids.

Sol.:



178. Answer (4)

Hint: Exclude drugs

Sol.:

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

179. Answer (4)

Hint: There are 20 different amino acids.

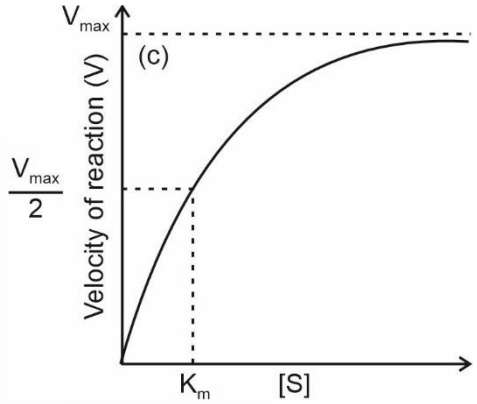
Sol.: Water constitutes 70-90% of the total cellular mass. Proteins are heteropolymers and not homopolymers.

The R-group in serine is hydroxy methyl.

180. Answer (3)

Hint: Less than V_{max}

Sol.:



❑ ❑ ❑

All India Aakash Test Series for NEET - 2027

TEST - I (Code - J)

Click here for Code-I Sol.

Test Date : 02/11/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

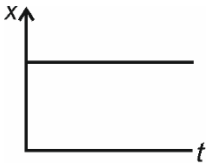
1. Answer (3)

Hint:

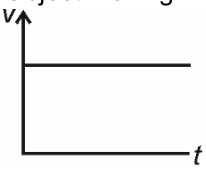
- Slope of position-time graph represents velocity
- Slope of velocity-time graph represents acceleration

Sol.:

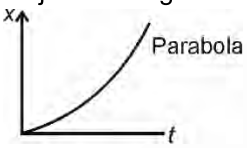
(1) Object is at rest



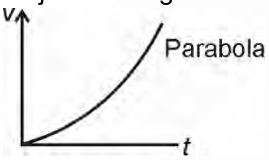
(2) Object moving with constant velocity



(3) Object moving with constant acceleration



(4) Object moving with variable acceleration



2. Answer (1)

Hint: $v_{AB} = v_A - v_B$

Sol.: $v_A = \tan 53°$

$= \frac{4}{3}$ m/s

$v_B = \tan 37°$

$= \frac{3}{4}$ m/s

$v_{AB} = \frac{4}{3} - \frac{3}{4}$

$= \frac{16-9}{12} = \left(\frac{7}{12}\right)$ m/s

3. Answer (2)

Hint: Use equation of uniformly accelerated motion.

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

$s = \frac{-h}{2}$, $a = -g$

$v = \sqrt{u^2 + gh}$

4. Answer (3)

Hint & Sol.: Velocity has both magnitude and direction, so it may be positive negative or zero.

5. Answer (2)

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

Sol.: Path length $d_1 = (v_{avg})_1 t_1 = 12 \times 20 \times 60$

$= 14400$ m

Path length $d_2 = (v_{avg})_2 t_2 = 15 \times 40 \times 60 = 36000$ m

$\therefore$ Average velocity $= \frac{d_2 - d_1}{t_1 + t_2} = \frac{21600}{60 \times 60} = 6$ m/s

6. Answer (1)

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

Sol.: $v = \frac{dx}{dt} = \frac{d}{dt}(2t^2 - 8t + 2)$

$v = (4t - 8)$

$v = 0$

$4t - 8 = 0$

$t = 2$ s

7. Answer (3)

Hint: $\int e^x dx = e^x$

Sol.: $\int_0^2 y dx = \int_0^2 e^x dx$

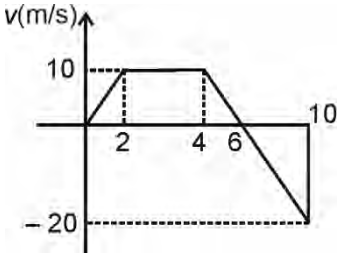
$= \left[e^x\right]_0^2$

$= e^2 - 1$

8. Answer (4)

Hint: Area under velocity-time graph represents displacement

Sol.:



Displacement $= \frac{1}{2}\times 10\times 2 + 10\times 2 + \frac{1}{2}\times 2\times 10$

$$-\frac{1}{2}\times 4\times 20$$

= 10 + 20 + 10 – 40 = Zero

9. Answer (4)

Hint: Slope of velocity-time graph represents acceleration

Sol.: Slope is constant upto time t_0 and after time t_0 slope is zero. So upto time t_0 acceleration is constant and after time t_0 acceleration becomes zero and velocity is constant.

10. Answer (3)

Hint: Average speed $= \left(\frac{\text{Total distance}}{\text{Total time taken}}\right)$

Sol.: Total distance $= \left(\frac{3}{2}\right)2\pi R$

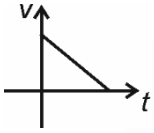
$= 3\pi R$

Average speed $= \frac{3\pi R}{30} = \left(\frac{\pi R}{10}\right)$ m/s

11. Answer (1)

Hint: Use $v = u + at$

Sol.: $v = u - gt$



12. Answer (1)

Hint: Use equation of uniformly accelerated motion

Sol.: $v = u + at$

Velocity at the end of 6 s

$v = 4 \times 6 = 24$ m/s

Using, $s = ut + \frac{1}{2}at^2$

Distance travelled in first 6 s

$s_1 = \frac{1}{2}\times 4\times (6)^2$

= 72 m

Distance travelled in next 4 s with uniform speed.

$s_2 = v \times t$

$= 24 \times 4 = 96$

$s = s_1 + s_2$

= 72 + 96 = 168 m

13. Answer (2)

Hint & Sol.:

- Speedometer of an automobile measures the instantaneous speed of the automobile.
- Average speed $v_{avg} = \frac{\text{Total distance travelled}}{\text{Time taken}}$

14. Answer (3)

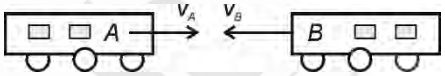
Hint & Sol.:

- Any body moving under constant acceleration may change its direction of motion.
- Body may be at instantaneous rest while having non-zero acceleration at that point.
- $|\vec{v}_{inst}| = v_{inst}$

15. Answer (2)

Hint: Use concept of relative velocity

Sol.:



Relative velocity $= v_A + v_B$ (in opposite direction)

= 40 m/s

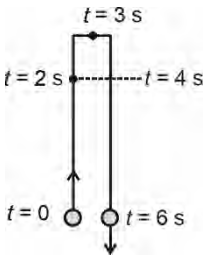
Time taken to cross each other

$= \frac{1300}{40} = \frac{130}{4} = 32.5$ s

16. Answer (3)

Hint: Ball will be at its highest point of trajectory at t = 3 s.

Sol.: Displacement of ball in 3rd second of journey



$s_{3rd} = u + \frac{a}{2}(2n-1)$

$= 30 - \frac{10}{2}(2\times 3 - 1)$

= 30 – 25 = 5 m

Similarly $s_{4th} = 30 - \frac{10}{2}(2\times 4 - 1)$

= – 5 m

Total distance travelled between t = 2 s to t = 4 s

S_{Total} = 5 + 5 = 10 m

17. Answer (2)

Hint: Use equations of uniformly accelerated motion.

Sol.: $\frac{s_1}{s_2} = \frac{v_1^2}{v_2^2}$

$\frac{25}{225} = \frac{v^2}{(nv)^2}$

$n^2 = 9$

$n = 3$

18. Answer (4)

Hint: Gravitational force $F = \frac{GM_1M_2}{r^2}$

Sol.: $[G] = \left[\frac{ML^3T^{-2}}{M^2}\right]$

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

$\frac{G_1}{G_2} = \frac{M_2}{M_1} \times \left(\frac{L_1}{L_2}\right)^3 \times \left(\frac{T_2}{T_1}\right)^2$

$= \frac{1}{1000} \times \left(\frac{100}{1}\right)^3 \times \left(\frac{1}{1}\right)^2$

$= 10^3 : 1$

19. Answer (2)

Hint: Least count $= \frac{\text{Pitch}}{\text{Number of division}}$

Sol.: L.C = $\frac{1\,\text{mm}}{100}$

= 0.01 mm

Diameter = MSR + CSR (LC)

= 1 mm + 40(0.01)

= 1.4 mm

Surface area = $\pi D\ell$

$= \frac{22}{7} \times 1.4 \times 49\ \text{mm}^2$

= 22 × 0.2 × 49 mm^2

= 215.6 mm^2

= 2.156 cm^2

= 2.2 cm^2

20. Answer (4)

Hint : The maximum absolute error in the sum/difference of quantities is equal to the sum of the absolute errors in the physical quantities.

Sol.: Let $x = a + b - c$

$\therefore\ \Delta x = \Delta a + \Delta b + \Delta c = 0.01 + 0.02 + 0.03$

= 0.06 cm

21. Answer (3)

Hint: $y = \frac{a\sqrt{b}}{c^2d} \Rightarrow d = \left(\frac{a\sqrt{b}}{c^2y}\right)$

Sol.:

$\frac{\Delta d}{d} \times 100 = \frac{\Delta a}{a} \times 100 + \frac{1}{2}\frac{\Delta b}{b} \times 100 + 2\frac{\Delta c}{c} \times 100 + \frac{\Delta y}{y} \times 100$

$= 1 + \frac{1}{2} \times 2 + 2 \times 0.5 + 3$

= 1 + 1 + 1 + 3

= 6%

22. Answer (3)

Hint & Sol.: Most accurate measurement may or may not be most precise. All dimensionless quantities are not unitless and the physical quantities having different dimensions can be multiplied with each other.

23. Answer (3)

Hint & Sol.: The reading closest to actual length will be most accurate.

24. Answer (1)

Hint & Sol.: The last digit of decimal is the uncertain digit of a given measurement.

25. Answer (4)

Hint & Sol.: The reading having minimum least count will be the most precise reading. So 10.001 cm is most precise.

26. Answer (1)

Hint: Least count = 1 M.S.D – 1 V.S.D

Sol.: n M.S.D = $(n + 1)$ V.S.D

1 V.S.D = $\left(\frac{n}{n+1}\right)$ M.S.D

L.C = $\left(1 - \frac{n}{n+1}\right)$ M.S.D

$= \left(\frac{1}{n+1}\right) \times 2$

$0.04 = \frac{2}{(n+1)}$

$\frac{1}{50} = \frac{1}{n+1}$

$n = 49$

27. Answer (2)

Hint & Sol.: Pitch = $\frac{\text{Distance moved}}{\text{Number of rotation}}$

$= \frac{3}{15}$

$= \frac{1}{5}$ cm

28. Answer (4)

Hint & Sol.: Strain has no unit as well as no dimension while angular velocity and stress have both unit and dimension but solid angle has unit but no dimension. SI unit of solid angle is steradian.

29. Answer (4)

Hint : Use $n_1u_1 = n_2u_2$

Sol.: $n_1[L_1T_1^{-2}] = n_2[L_2T_2^{-2}]$

$$n_2 = n_1\left[\frac{L_1}{L_2}\right]\left[\frac{T_1}{T_2}\right]^{-2}$$

$$= (1)\left[\frac{1}{100}\right]\left[\frac{1}{\frac{1}{10}}\right]^{-2}$$

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

$$n_2 = \frac{1}{10^4}$$

30. Answer (1)

Hint: Absolute error in measurement is 0.01 cm

Sol.: $\frac{\Delta x}{x} = \frac{0.01}{20}$

$$\left(\frac{\Delta x}{x}\right)\times 100 = \frac{0.01}{20}\times 100$$

= 0.05%

31. Answer (3)

Hint & Sol.: Conversion of unit can be done using dimensional analysis and deduction of numerical constant cannot be done using dimensional analysis.

32. Answer (4)

Hint: In subtraction, answer will be reported upto minimum decimal place.

Sol.: $A - B = 3.348 - 1.1$

= 2.248

≈ 2.2 cm

33. Answer (1)

Hint: Use principle of homogeneity

Sol.: $[P] = [F^aV^bT^c]$

$$\left[\frac{MLT^{-2}}{L^2}\right] = [(MLT^{-2})^a(LT^{-1})^b\,T^c]$$

$[ML^{-1}T^{-2}] = M^aL^{a+b}T^{-2a-b+c}$

$a = 1$

$a + b = -1$

$b = -2$

$-2a - b + c = -2$

$-2 + 2 + c = -2$

$c = -2$ $\quad\therefore$ $[P] = [F^1V^{-2}T^{-2}]$

34. Answer (2)

Hint: Use principle of homogeneity

Sol.: $a = At + \left(\frac{B}{t + C}\right)$

$$\frac{[B]}{[C]} = [a]$$

$$[A] = \frac{[a]}{[t]}$$

$$\left[\frac{B}{CA}\right] = [T]$$

35. Answer (4)

Hint & Sol.: $[v] = [u] = [at]$

$[s] = [ut] = [at^2]$

$$[T^2] = \left[\frac{\ell}{g}\right]$$

$\therefore$ All equations are dimensionally correct.

36. Answer (3)

Hint: $[E] = [ML^2T^{-2}]$

Sol.: $[ET^2] = [ML^2]$

$[L^2] = [M^{-1}ET^2]$

$[L] = [M^{-\frac{1}{2}}E^{\frac{1}{2}}T]$

37. Answer (1)

Hint: Power $= \frac{\text{Work done}}{\text{Time}}$

Sol.: $[P] = [ML^2T^{-3}]$

$$[P_1] = \left[M(2L)^2\left(\frac{T}{2}\right)^{-3}\right]$$

= 32[P]

$\therefore$ $\alpha = 32$

38. Answer (4)

Hint & Sol.: Volume $= a^3$

$= (1.5)^3$

$= 3.375\ m^3$

Result should be upto two significant figures, so volume = 3.4 m^3

39. Answer (2)

Hint: Random error is inversely proportional to number of observations

Sol.: $50x = 10x_1$

$x_1 = 5x$

40. Answer (4)

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

Sol.: $\frac{\Delta A}{A}\times 100=\frac{2\Delta r}{r}\times 100$

$\frac{\Delta A}{4\pi 400}\times 100=2\times 0.2$

$\Delta A \approx 20.1\ cm^2$

41. Answer (1)

Hint: Newton is the unit of force

Sol.: $\left[\frac{N}{m^2}\right]=\left[\frac{MLT^{-2}}{L^2}\right]$

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

42. Answer (2)

Hint: Let $x=\frac{L^2}{B}$

$\frac{\Delta x}{x}=\frac{2\Delta L}{L}+\frac{\Delta B}{B}$

Sol.: $\frac{\Delta x}{x}\times 100=\frac{2\Delta L}{L}\times 100+\frac{\Delta B}{B}\times 100$

$=2\times\left(\frac{0.01}{20}\right)\times 100+\frac{0.01}{10}\times 100$

= 0.1 + 0.1 = 0.2%

43. Answer (2)

Hint & Sol.: 0.020400 m has 5 significant figures.

44. Answer (2)

Hint: Dimension of acceleration = $[M^0LT^{-2}]$

Sol.: Dimension of

$$\sqrt{\text{Acceleration} \times \text{Distance}}=\left[\sqrt{LT^{-2}\times L}\right]$$

$= [LT^{-1}]$

$[LT^{-1}]$ is dimension of velocity

45. Answer (2)

Hint: $\frac{\Delta y}{y}=\frac{\Delta a}{a}+\frac{\Delta(b+c)}{(b+c)}$

Sol.:

$\frac{\Delta y}{y}\times 100=\frac{\Delta a}{a}\times 100+\frac{\Delta b}{(b+c)}\times 100+\frac{\Delta c}{(b+c)}\times 100$

[CHEMISTRY]

46. Answer (2)

Hint: Number of atoms = Number of moles × atomicity × N_A

Sol.: Number of atoms in 1g of H_2 = 0.5 × 2 × N_A = N_A

Number of atoms in 11.2 L of O_3 = 0.5 × 3 × N_A = 1.5 N_A

Number of atoms in 10 g of Mg $=\frac{10}{24}\times 1\times N_A$

= 0.42 N_A

Number of atoms in 6.022×10^{22} molecules of CO_2

= 3 × N_A × 10^{-1} = 0.3 N_A

47. Answer (1)

Hint: Only pure component participates in chemical reaction.

Sol.: $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

= 100 m mol

Mole of pure $CaCO_3$ = 50 m mol

Mass of pure $CaCO_3$ = 50 × 10^{-3} × 100 = 5 g

Mass of sample $=\frac{5\times 100}{90}$ = 5.55 g

48. Answer (4)

Hint: $r_n = 0.529\times\frac{n^2}{z}$ Å

Sol.: $(r_2)_{He^+} = 0.529\times\frac{4}{2}$

= 1.058 Å

= 105.8 pm

49. Answer (1)

Hint: For a neutral atom, number of protons and electrons are same.

Sol.: For $^{108}_{47}Ag^+$

Number of protons = 47

Number of neutrons = 108 – 47 = 61

Number of electrons = 47–(1) = 46

50. Answer (1)

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

Sol.: $1=\frac{\text{Number of moles of } HNO_3}{500}\times 1000$

x = 0.5 mol

Weight of HNO_3 = 0.5 × 63

= 31.5 g

70 g of HNO_3 = 100 g of solution

31.5 g of $HNO_3 = \frac{100}{70}\times 31.5$

= 45 g of solution

51. Answer (3)

Hint: Number of mole $= \frac{\text{Mass (g)}}{\text{Molar mass}}$

Sol.: Mole of electron $= \frac{1000}{9.1 \times 10^{-28} \times 6.02 \times 10^{23}}$

$= 1.82 \times 10^{6}$

52. Answer (4)

Hint: The maximum number of electrons in the shell with principle quantum number n is equal to $2n^2$

Sol.: According to Pauli exclusion principle, no two electrons in an atom can have the same set of four quantum numbers.

Azimuthal quantum number defines the three dimensional shape of orbital.

53. Answer (4)

Hint: $N \times 10^n$ have positive or negative value of n and N varies between 1.000 ------ and 9.999 -----

Sol.: 0.001532 can be correctly expressed in scientific notation as 1.532×10^{-3}

54. Answer (1)

Hint: $BaCl_2$ is limiting reagent in given reaction

Sol.: $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$

Mole of $Na_2SO_4 = \frac{18.2}{142} = 0.13$

Mole of $BaSO_4 = \frac{23.3}{233} = 0.1$

$BaCl_2$ is limiting reagent

To produce 0.1 mol $BaSO_4$, 0.1 mol $BaCl_2$ is required

$= 0.1 \times 208 = 20.8$ g

55. Answer (3)

Hint: Mass of 1 molecule of CH_4 = 16 u

Sol.: Mass of 2 molecules of CH_4 = 32 u

$= 32 \times 1.66 \times 10^{-24}$ g

$= 5.31 \times 10^{-23}$ g

56. Answer (1)

Hint: According to law of multiple proportions, If two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element, are in the ratio of small whole numbers.

Sol.:

- Mass composition of H and O will be same in H_2O irrespective of source.
- Equal volumes of gases contain equal number of molecules at constant temperature and pressure.
- Reaction of 1L of H_2 will give $\frac{2}{3}$ L of NH_3 gas
- Isotopes have different mass number which represent number of nucleons.

57. Answer (1)

Hint: In order to get molecular formula, number of atoms of element in one molecule is required.

Sol.: Mass of both P and Q = W

Mole of $P = \frac{W}{30}$

Mole of $Q = \frac{W}{40}$

Formula $\Rightarrow P_4Q_3$

58. Answer (2)

Hint: Average atomic mass $= \frac{\sum A_i X_i}{100}$

$A_i \Rightarrow$ mass number of i^{th} isotope

$X_i \Rightarrow$ Percentage abundance of i^{th} isotope

Sol.: $X_{Avg} = \frac{50 \times 70 + 51 \times 20 + 52 \times 10}{100}$

$= \frac{3500 + 1020 + 520}{100}$

$= 50.4$ u

59. Answer (4)

Hint: On reaction of 4g H_2 and 14g N_2, nitrogen is limiting reagent

Sol.:

- 14g of N_2 that is 0.5 mol of N_2 will give 1 mol ammonia that is 17g NH_3
- Mixing of 2g H_2 and 16g O_2 will give 18g H_2O.

60. Answer (3)

Hint: There are seven base physical quantities.

Sol.:

Base Physical Quantity	Symbol for Quantity	Name of SI Unit	Symbol for SI Unit
Length	ℓ	metre	m
Mass	m	kilogram	kg
Time	t	second	s
Electric current	I	ampere	A
Thermodynamic temperature	T	Kelvin	K
Amount of substance	n	Mole	mol
Luminous intensity	I_V	candela	cd

61. Answer (4)

Hint: For minimum molecular weight atomicity of sulphur in given molecule will be one.

Sol.: $\%\ \text{comp} = \dfrac{\text{Atomic mass} \times \text{Atomicity}}{\text{Molecular mass}} \times 100$

$$0.32 = \frac{32 \times 1}{M} \times 100$$

Molecular weight = 10000 u

62. Answer (2)

Hint: Limiting reagent gets completely consumed during a chemical reaction.

$$N_2 + O_2 \longrightarrow 2NO$$

Sol.: $\dfrac{10}{28}\text{mol}\quad \dfrac{14}{32}\text{ mol}$

N_2 is limiting reagent

- $N_2 + 2C + H_2 \longrightarrow 2HCN$

  $\dfrac{16}{28}\text{mol}\quad \dfrac{13}{12}\text{ mol}\quad \dfrac{1}{2}\text{ mol}$

H_2 is limiting reagent

$$C + O_2 \longrightarrow CO_2$$

- $\dfrac{14}{12}\text{mol}\quad \dfrac{16}{32}\text{ mol}$

  O_2 is L. R.

- $2H_2 + C \longrightarrow CH_4$

  $\dfrac{3}{2}\text{mol}\quad \dfrac{6}{12}\text{ mol}$

  Carbon is L.R.

63. Answer (1)

Hint: Vapour density $= \dfrac{\text{Molar mass}}{2}$

Sol.: Relative density of O_2 w.r.t. He

$$d = \frac{32}{4} = 8$$

- Volume of 0.17 g $NH_3(g)$ at STP is 224 mL

64. Answer (4)

Hint: Molality (m) $= \dfrac{\text{Number of moles of solute}}{\text{Mass of solvent (in kg)}}$

Sol.: $d = \dfrac{M}{V}$

Mass of solution = 1.25 × 1000 = 1250 g

Weight of solute = 1 × 50 = 50 g

Weight of solvent = 1250 – 50 = 1200 g

$$m = \frac{1}{1200} \times 1000$$

$\Rightarrow$ 0.83 m

65. Answer (1)

Hint: Orbital angular mometum $= \hbar\sqrt{\ell(\ell+1)}$

Sol.: Orbital angular momentum $= \hbar\sqrt{2(2+1)}$

$= \sqrt{6}\,\hbar$

66. Answer (4)

Hint & Sol.:

Element	Number of unpaired electron (s)
Cr	6
N	3
Na	1
Ca	0

67. Answer (4)

Hint: Cu $\Rightarrow 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^{10}$

Sol.: Number of electrons with l = 0 is 7

68. Answer (2)

Hint: Number of degenerated orbitals for H-atom in a shell = n^2

Sol.: Number of orbitals in 4^{th} shell = $4^2 = 16$

- As atomic number increases, energy of same orbital decreases.
- For single electronic species, energy depends only on principal quantum number.
- Splitting of spectral line in magnetic field is known as Zeeman effect.

69. Answer (1)

Hint: Total number of nodes = (n – 1)

Sol.:

- Total radial nodes in 4s orbital = (n – ℓ – 1)
  = 4 – 0 – 1 = 3
- Angular node = ℓ = 0
- Shape of d_{xz}, d_{yz}, d_{xy} and $d_{x^2-y^2}$ are similar to each others.

70. Answer (1)

Hint: 'n' is a positive integer which always is larger than 'ℓ'.

Sol.:

- m, varies from '+l' to '–l' including zero.
- s can be only $+\frac{1}{2}$ or $-\frac{1}{2}$

71. Answer (1)

Hint: Photoelectric effect can be explained by the particle nature of electromagnetic radiation.

Sol.: Heisenberg uncertainty principle is applicable only for motion of microscopic objects and is negligible for that of macroscopic objects.

72. Answer (4)

Hint: de-Broglie wavelength

$$\lambda = \frac{h}{\sqrt{2mKE}}$$

Sol.: $\lambda = \frac{6.626\times10^{-34}}{\sqrt{2\times9.1\times10^{-31}\times2.8\times10^{-23}}}$

$= \frac{6.626\times10^{-34}}{7.14\times10^{-27}}$

$= 9.28 \times 10^{-8}$ m

73. Answer (2)

Hint: For microscopic species

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

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

$(\Delta x)^2 = \frac{h}{4\pi m}$

$\Delta x = \left(\frac{h}{4\pi m}\right)^{\frac{1}{2}}$

$\sqrt{\frac{h}{4\pi m}} \times \Delta p = \frac{h}{4\pi}$

$\Delta p = \sqrt{\frac{hm}{4\pi}}$

74. Answer (2)

Hint: For Fe atom, last electron will be filled in 3d orbital.

Sol.: Be $\Rightarrow$ n = 2, l = 0, m = 0, $s = +\frac{1}{2}$

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

Cl $\Rightarrow$ n = 3, l = 1, m = –1, $s = +\frac{1}{2}$

Fe $\Rightarrow$ n = 3, l = 2, m = +1, $s = +\frac{1}{2}$

75. Answer (1)

Hint: For single electron species $2\pi r_n = n\lambda$

Sol.: $2\pi \times 0.529 \times \frac{(3)^2}{3} = 3\lambda$

$\lambda = 1.058\pi$ Å

76. Answer (1)

Hint: Electron can come back to ground state by single or multiple steps.

Sol.: If only one H-atom is present in sample, then we will observe only one maximum line in visible spectrum.

77. Answer (3)

Hint: An atom absorbs energy in form of discrete photon and energy of photon must be equal to difference of energy between two energy levels.

Sol.: Since 11 eV is not value of any ΔE, $\Delta E_{minimum} = E_2 - E_1$

= – 3.9 + 13.6

= 10.2 eV

This photon will not be absorbed and electron will be present in ground state only.

78. Answer (4)

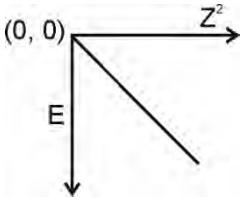
Hint: Maximum energetic photon will emit if electron comes back to ground state from higher energy state.

Sol.: 4 $\rightarrow$ 1 will give most energetic photon.

79. Answer (3)

Hint: $E_n = -\frac{13.6\times Z^2}{n^2}$

Sol.: Correct graph



80. Answer (1)

Hint: Specific charge, $(e/m) = \frac{\text{Charge}}{\text{Mass}}$

Sol.: $(e/m)_{electron} = \frac{1.6\times10^{-19}}{9.1\times10^{-31}} = 1.758\times10^{11}$ C/kg

$(e/m)_{proton} = \frac{1.6\times10^{-19}}{1.67\times10^{-27}} = 9.58\times10^{7}$ C/kg

$(e/m)_{neutron} = \frac{0}{1.675\times10^{-27}} = 0$ C/kg

81. Answer (1)

Hint: Angular momentum of an electron

$mvr = \frac{nh}{2\pi}$

Sol.: For $(V_H)_1 = 2.18 \times 10^6$ m/s

For $(V_{Li^{2+}})_3 = 2.18\times10^6$ m/s

82. Answer (1)

Hint: $M_1V_1 + M_2V_2 = M_3V_3$

Sol.: $2 \times 1 + 3 \times 2 = M \times 5$

$M = \frac{8}{5}$

$\Rightarrow$ 1.6 M

83. Answer (1)

Hint: Isotopes have same atomic number but different mass number.

Sol.: ^{12}C and ^{14}C are isotopes

$^{39}_{19}K^+$ and $^{40}_{18}Ar$ are isoelectronic

$^{13}_{6}C$ and $^{14}_{7}N$ are isotones

$^{18}_{9}F$ and $^{18}_{8}O$ are isobars

84. Answer (1)

Hint: Radial nodes = $(n - \ell - 1)$

Sol.: For 4*s* orbital $\Rightarrow 4 - 0 - 1 = 3$

For 3*d* orbital $\Rightarrow 3 - 2 - 1 = 0$

For 4*p* orbital $\Rightarrow 4 - 1 - 1 = 2$

For 5*f* orbital $\Rightarrow 5 - 3 - 1 = 1$

85. Answer (4)

Hint: According to J. J. Thomson, atom is sphere of uniform positive charge in which negative charge is embedded.

Sol.: Presence of nucleus in an atom is confirmed by Rutherford's α-particle scattering experiment.

- $\frac{r_{atom}}{r_{nucleus}} = 10^5$
- $\frac{M_{proton}}{M_{electron}} = 1837$

86. Answer (3)

Hint: Equal masses of O_2 and O_3 contain equal number of electrons

Sol.: Equal masses of different gases may contain different number of atoms.

87. Answer (3)

Hint: Combustion of hydrocarbon gives CO_2 and H_2O

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

Sol.: Volume of C_3H_8 = V

Volume of C_4H_{10} = 3 – V

$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$$
V 0
0 3V

$$C_4H_{10} + \frac{13}{2}O_2 \longrightarrow 4CO_2 + 5H_2O$$
3 – V 0
0 4(3 – V)

3V + 4(3 – V) = 10

3V + 12 – 4V = 10

V = 2L = Volume of C_3H_8

Volume of C_4H_{10} = 3 – V = 1 L

88. Answer (2)

Hint: To form 1 mol X_2O_3, 3 mol O and 2 mol X is required.

Sol.: Mass of O = mass of X_2O_3 – Mass of X

= 0.559 – 0.359 g

= 0.2 g

$= \frac{0.2}{16}$ mol

3 mol O combines with $\rightarrow$ 2 mol X

$\frac{0.2}{16}$ mol O combines with $= \frac{2}{3}\times\frac{0.2}{16}$ mol X

$= \frac{1}{120}$ mol X

M = 43.08 g mol^{-1}

89. Answer (1)

Hint: $3O_2 \rightarrow 2O_3$

Sol.: $3O_2 \rightarrow 2O_3$

9 mL 0

9 – 0.9 0.6 mL

$V_{total} = 9 - 0.9 + 0.6 = 8.7$ mL

90. Answer (1)

Hint: Empirical formula represents simplest ratio of number of atoms present in one molecule for different elements.

Sol.:

	H	Cl	C
% Composition	4.04	71.7	24.26
Mole	$\frac{4.04}{1}$ = 4.04	$\frac{71.7}{35.5}$ 2.02	$\frac{24.26}{12}$ = 2.02
Atomicity	2	1	1

Empirical formula = CH_2Cl

[BOTANY]

91. Answer (2)

Hint: These events depict the substages of meiosis-I which are: Leptotene → Zygotene → Pachytene → Diplotene → Diakinesis.

Sol.: Correct chronological sequence of the above given events is as follows:

b. Beginning of compaction of the structure named by Flemming – Leptotene

a. Formation of synaptonemal complex – Zygotene

d. Recombinase mediated process that brings genetic variability in the population of organisms from one generation to the next – Pachytene

c. Recombined homologous chromosomes of the bivalents separate from each other except at the sites of crossovers – Diplotene

e. Assemblage of meiotic spindle – Diakinesis.

92. Answer (2)

Hint: It is conferred by extra-chromosomal DNA.

Sol.: The plasmid DNA confers certain unique phenotypic characters to such bacteria. One such character is resistance to antibiotics.

93. Answer (2)

Hint: The stage depicted in the figure is prophase.

Sol.: Prophase is marked by the initiation of condensation of chromosomal material. The chromosomal material becomes untangled during the process of chromatin condensation. Cells at the end of prophase, when viewed under the microscope, do not show Golgi complexes, endoplasmic reticulum, nucleolus and the nuclear envelope.

94. Answer (1)

Hint: The prokaryotic cell also possess flagella but these are structurally different from that of the eukaryotic flagella.

Sol.: The prokaryotic plasma membrane is similar structurally to that of the eukaryotes.

95. Answer (3)

Hint: The actual period of cell division is M phase.

Sol.: Mitosis is the equational division in which the chromosome number of the parent is conserved in the daughter cell. Meiosis I is a reductional division. Interphase is further subdivided into G_1, S and G_2. S phase is also characterised by chromosome duplication.

96. Answer (2)

Hint: These are small bristle-like fibres sprouting out of the cell.

Sol.: In some bacteria, fimbriae are known to help attach the bacteria to rocks in streams and also to the host tissues.

97. Answer (2)

Hint: The nucleoli are spherical structures present in the nucleoplasm.

Sol.: Prophase – Movement of centrosomes towards opposite poles

Metaphase – Congression of chromosomes

Anaphase – Shortening of spindle fibres

Telophase – Reformation of the spherical structure in the nucleoplasm

98. Answer (1)

Hint: The ribosomes of a polysome translate the mRNA into proteins.

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

99. Answer (4)

Hint: At the end of meiosis four haploid cells are formed.

Sol.: Telophase I results in the formation of dyad of cells

100. Answer (2)

Hint: Sap vacuole is a membrane bound organelle.

Sol.: Rest all are inclusion bodies.

101. Answer (3)

Hint: Although in many cases after telophase I, the chromosomes do undergo some dispersion, they do not reach the extremely extended state of the interphase nucleus.

Sol.: Meiosis II is initiated immediately after cytokinesis, usually before the chromosomes have fully elongated. Meiosis I is initiated after the parental chromosomes have replicated to produce identical sister chromatids at the S phase.

102. Answer (1)

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

Sol.: The cell membrane is mainly composed of lipids and proteins. Later, biochemical investigation clearly revealed that the cell membranes also possess protein and carbohydrate.

103. Answer (4)

Hint: Both mitosis and meiosis show single cycle of DNA replication.

Sol.: Meiosis involves two sequential cycles of nuclear and cell division called meiosis I and meiosis II but only a single cycle of DNA replication. Meiosis is the mechanism by which conservation of specific chromosome number of each species is achieved across generations in sexually reproducing organisms, even though the process, per se, paradoxically, results in reduction of chromosome number by half.

104. Answer (3)

Hint: Na^+/K^+ pump requires ATP for their functioning.

Sol.: A few ions or molecules are transported across the membrane against their concentration gradient, i.e., from lower to the higher concentration. Such a transport is an energy dependent process, in which ATP is utilised and is called active transport, e.g., Na^+/K^+ pump.

105. Answer (2)

Hint: Anaphase I does not show centromere splitting.

Sol.: During anaphase I, the homologous chromosomes separate, while sister chromatids remain associated at their centromeres.

106. Answer (1)

Hint: This structure is mainly composed of calcium pectate.

Sol.: Middle lamellae holds or glues the different neighbouring cells together.

107. Answer (2)

Hint: Recombination nodule appears during pachytene.

Sol.: During metaphase I, the bivalent chromosomes align on the equatorial plate.

108. Answer (4)

Hint: Leucoplasts are colourless plastids.

Sol.: Chromoplasts are pigment carrying plastids.

109. Answer (2)

Hint: Interval between post- and pre-mitotic phase represents S phase and interval between meiosis I and II represents interkinesis.

Sol.: Both S-phase and interkinesis shows centriole (component of centrosome) duplication.

110. Answer (3)

Hint: Diakinesis represents transition to metaphase.

Sol.: The final stage of meiotic prophase I is diakinesis. This is marked by terminalisation of chiasmata.

111. Answer (4)

Hint: In animal cells, lipid-like steroidal hormones are synthesised in SER.

Sol.: The ER often show ribosomes attached to their outer surface. The endoplasmic reticulum bearing ribosomes on their surface is called rough endoplasmic reticulum (RER). In the absence of ribosomes, they appear smooth and are called smooth endoplasmic reticulum (SER).

112. Answer (2)

Hint: This stage is characterised by the appearance of chiasmata.

Sol.: The beginning of diplotene is recognised by the dissolution of the synaptonemal complex.

113. Answer (1)

Hint: Vacuoles contains water, sap, excretory product and other materials not useful for the cell.

Sol.: The vacuole is bound by a single membrane called tonoplast.

114. Answer (1)

Hint: This is the fourth substage of prophase-I.

Sol.: In oocytes of some vertebrates, diplotene can last for months or years.

115. Answer (3)

Hint: The inner membrane forms a number of infoldings called the cristae towards the matrix.

Sol.: The cristae increase the surface area. The inner compartment is filled with a dense homogeneous substance called the matrix.

116. Answer (2)

Hint: Liquid endosperm in coconut shows multinucleate condition.

Sol.: Liquid endosperm in coconut exemplifies syncytium.

117. Answer (1)

Hint: Proteins are the polymers of amino acids.

Sol.: Amyloplasts store carbohydrates (starch), e.g., potato; elaioplasts store oils and fats whereas, the aleuroplasts store proteins. In the chromoplasts, fat soluble carotenoid pigments like carotene, xanthophylls and others are present.

118. Answer (3)

Hint: Cytokinesis in plant cell is facilitated by formation of cell plate.

Sol.: Cytokinesis in animal cell is facilitated by formation of furrow.

119. Answer (2)

Hint: Human has 23 pairs of chromosomes.

Sol.: Of the two, the inner chloroplast membrane is relatively less permeable.

120. Answer (1)

Hint: This phase represents the interval between mitosis and initiation of DNA replication.

Sol.: Most of the organelle duplication occurs during G_1 phase.

121. Answer (1)

Hint: An elaborate network of filamentous proteinaceous structures consisting of microtubules, microfilaments and intermediate filaments present in the cytoplasm is collectively referred to as the cytoskeleton.

Sol.: The cytoskeleton in a cell are involved in many functions such as mechanical support, motility, and maintenance of the shape of the cell.

122. Answer (3)

Hint: This stage is also known as quiescent stage.

Sol.: Cells in G_0 stage remain metabolically active but no longer proliferate.

123. Answer (1)

Hint: The space limited by the inner membrane of the chloroplast is called the stroma.

Sol.: The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrates and proteins. A number of organised flattened membranous sacs called the thylakoids, are present in the stroma.

124. Answer (2)

Hint: It is the phase of actual cell division.

Sol.: M phase is the most dramatic period of the cell cycle, involving a major reorganisation of virtually all components of the cell.

125. Answer (4)

Hint: The given structure is a section of cilia/flagella showing different parts.

Sol: A – Plasma membrane (composed of phospholipid and protein)

C – Interdoublet bridge

D – Central microtubule (composed of tubulin protein)

B – Central sheath

126. Answer (4)

Hint: It is also known as resting stage.

Sol.: The interphase lasts more than 95% of the duration of cell cycle.

127. Answer (1)

Hint: Centriole has an organisation like the cartwheel.

Sol: The centrioles form the spindle fibres that give rise to spindle apparatus during cell division in animal cells.

128. Answer (2)

Hint: The interphase nucleus has highly extended and elaborate network of nucleoprotein fibres called chromatin.

Sol: Chromatin contains DNA and some basic proteins called histones, some non-histone proteins, and RNA.

129. Answer (3)

Hint: The metacentric chromosome has middle centromere and in acrocentric chromosome, centromere is present very close to one end.

Sol: The metacentric chromosome has middle centromere forming two equal arms of the chromosome (isobrachial).

130. Answer (4)

Hint: Mitochondria and chloroplast are semi-autonomous organelles.

Sol: Ribosomes (non-membrane bound organelle) is found in both prokaryotic and eukaryotic cell.

Lysosomes (component of endomembrane system) is rich in hydrolytic enzymes. Many single membrane bound minute vesicles are called microbodies that contain various enzymes. Mitochondria and chloroplasts are semi-autonomous organelles that duplicate during pre-mitotic phase.

131. Answer (1)

Hint: Human cells divide once in approximately every 24 hours.

Sol.: Yeast can progress through the cell cycle in only about 90 minutes.

132. Answer (1)

Hint: Cilia and flagella are hair-like outgrowths of the cell membrane.

Sol.: Cilia are small structures which work like oars, causing the movement of either the cell or the surrounding fluid. Flagella are comparatively longer and responsible for cell movement.

133. Answer (3)

Hint: Robert Brown discovered nucleus and George Palade discovered ribosomes.

Sol: Ribosomes are composed of ribonucleoprotein. Ribosomes are found associated with the one of the components of endomembrane system (Endoplasmic reticulum) that is extensive and continuous with the outer membrane of the nucleus.

134. Answer (2)

Hint: Primary constriction in chromosome is centromere.

Sol: Vesicles containing materials made by the endoplasmic reticulum fuse with the convex face of the Golgi apparatus, and they are modified and released from the concave face of the Golgi apparatus. The two sub-units of 80 ribosome are 60 S and 40 S and that of 70 S are 50 S and 30 S.

135. Answer (3)

Hint: Prokaryotic cells show the presence of fimbriae.

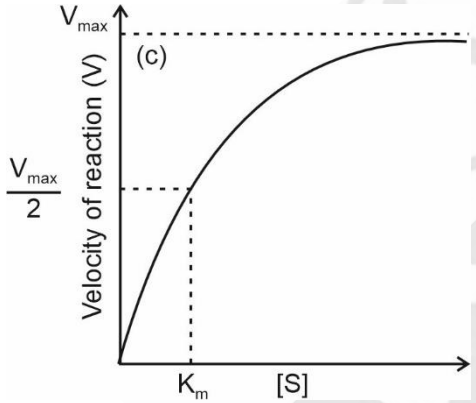
Sol: The middle layer of the cell envelope (cell wall) in the prokaryotic cell prevents these cells from bursting or collapsing. Glycocalyx differs in composition and thickness in different forms.

[ZOOLOGY]

136. Answer (3)

Hint: Less than V_{max}

Sol.:



137. Answer (4)

Hint: There are 20 different amino acids.

Sol.: Water constitutes 70-90% of the total cellular mass. Proteins are heteropolymers and not homopolymers.

The R-group in serine is hydroxy methyl.

138. Answer (4)

Hint: Exclude drugs

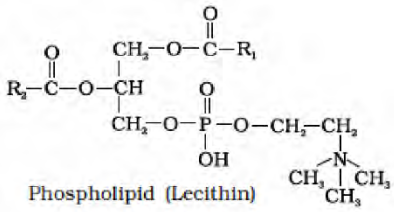
Sol.:

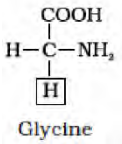
Pigments	Carotenoids, Anthocyanins, *etc*.
Alkaloids	Morphine, Codeine, *etc*.
Terpenoides	Monoterpenes, Diterpenes *etc*.
Essential oils	Lemon grass oil, *etc*.
Toxins	Abrin, Ricin
Lectins	Concanavalin A
Drugs	Vinblastin, curcumin, *etc*.
Polymeric substances	Rubber, gums, cellulose

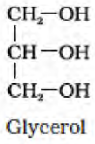
139. Answer (1)

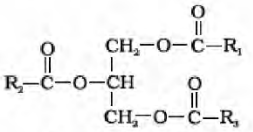
Hint: A triglyceride possesses 3 fatty acids.

Sol.:


Phospholipid (Lecithin)


Glycine


Glycerol


Triglyceride (R_1, R_2 and R_3 are fatty acids)

140. Answer (4)

Hint: CO_2 and water vapour are removed

Sol.: Inorganic elements and compounds are present in the living organisms, which can be known with the help of a technique called 'ash analysis'.

When the tissue is fully burnt, the carbon compounds are oxidised to gaseous forms like CO_2, water vapour and are removed and the remnant is called 'ash'. This ash contains many inorganic elements like calcium, magnesium, *etc.*,

Hydrogen is either removed in the form of water vapour or in the form of gases.

141. Answer (2)

Hint: RuBisCO assists in carbon fixation in plants.

Sol.: Collagen – Intercellular ground substance

RuBisCO – Most abundant protein in the whole of the biosphere

Starch – Storage polysaccharide

Chitin – Found in exoskeleton of arthropods

142. Answer (1)

Hint: Equal to the number of nose you have

Sol.: Fibroblasts secrete modified polysaccharides, which accumulate between cells and fibres and act as the matrix (ground substance).

The excess of nutrients which are not used immediately are converted into fats and are stored in adipose tissue.

Muscles shorten in response to stimulation, then relax (lengthen) and return to their uncontracted state in a coordinated fashion.

143. Answer (3)

Hint: True for smooth muscle fibres

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

Cardiac muscle is characterised by the presence of uninucleated, striated and branched muscle fibres which are exclusively present in the heart wall.

Smooth muscle fibres are present in the wall of stomach and intestine.

144. Answer (2)

Hint: Carbonic anhydrase

Sol.: CO_2 + Water (H_2O) $\underset{}{\overset{\text{Carbonic anhydrase}}{\rightleftharpoons}}$ $\underset{\text{(Carbonic acid)}}{H_2CO_3}$

In the absence of the enzyme, the above reaction is very slow, with about 200 molecules of H_2CO_3 being formed in an hour. However, by using the enzyme present within the cytoplasm called carbonic anhydrase, the reaction speeds up dramatically with about 600,000 molecules being formed every second.

The enzyme has accelerated the reaction rate by about 10 million times. Carbonic anhydrase belongs to the class IV of enzymes *i.e.*, Lyases.

145. Answer (4)

Hint: Storage polysaccharide

Sol.: GLUT-4 is a transporter protein which enables glucose transport into the cells. Antibody, insulin as well as collagen are proteins. Glycogen is a storage polysaccharide in animals.

146. Answer (3)

Hint: True for transferases

Sol.: Transferases belong to the class II of enzymes and these enzymes are responsible for transfer of a group, other than hydrogen, between a pair of substrate.

147. Answer (4)

Hint: Nucleotide is the monomeric unit of nucleic acid.

Sol.: Proteins constitute 10-15% of the total cellular mass while nucleic acids constitute 5-7% of the total cellular mass.

RNA does not follow Chargaff's rule; *i.e.,* 1:1 ratio does not exist between purines and pyrimidines bases due to single stranded nature and lack of complementarity.

148. Answer (4)

Hint: Also present in walls of blood vessels

Sol.: The squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs and are involved in functions like forming a diffusion boundary.

149. Answer (3)

Hint: Absent in blood

Sol.: In all connective tissues except blood, the cells secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the tissue. These cells also secrete modified polysaccharides which accumulate between cells and fibres and act as matrix.

150. Answer (2)

Hint: Gives brush-bordered appearance

Sol.: Brush-bordered columnar epithelium is present in the lining of intestine which helps in secretion and absorption.

If the 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.

151. Answer (2)

Hint: Feature of neuroglial cells

Sol.: Neurons, the units of neural system, are excitable cells. The neuroglial cells which constitute the rest of the neural system protect and support neurons. Neuroglial cells make up more than one-half the volume of neural tissue in our body.

152. Answer (4)

Hint: The functioning of muscle fibres associated with biceps can be controlled by our will.

Sol.: Smooth muscle fibres are present in the wall of urinary bladder.

Skeletal muscle fibres are associated with the biceps.

The smooth muscle fibres taper at both ends (fusiform) and do not show striations. Gap junctions are present in the smooth muscles.

Skeletal muscle fibres are striated, multinucleated and unbranched.

153. Answer (1)

Hint: Skeletal muscle tissue is closely attached to skeletal bones.

Sol.: Bone is the main tissue that provides structural frame to the body. Bones support and protect softer tissues and organs. Limb bones, such as the long bones of the legs, serve weight-bearing functions. They also interact with skeletal muscles attached to them to bring about some movements. The bone marrow in some bones is the site of production of blood cells.

154. Answer (3)

Hint: Areolar tissue

Sol.: Loose connective tissue has cells and fibres loosely arranged in a semi-fluid ground substance, for example, areolar tissue present beneath the skin. Often, it serves as a support framework for epithelium. It contains fibroblasts, macrophages, mast cells as well as adipocytes.

Chondrocytes are cartilage cells.

155. Answer (1)

Hint: Used to breakdown hydrogen peroxide

Sol.: Haem is the prosthetic group for peroxidase and catalase. NAD is a co-enzyme. Zinc is the co-factor for carbonic anhydrase.

156. Answer (2)

Hint: Action of sulpha drugs

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 on 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 the structure.

157. Answer (3)

Hint: Narcotic analgesic

Sol.:

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

158. Answer (1)

Hint: Secondary structure of protein

Sol.: A protein thread does not exist throughout as an extended rigid rod. The thread is folded in the form of a helix (similar to a revolving staircase). Only some portions of the protein thread are arranged in the form of a helix. Other regions of protein thread are folded into other forms in what is called the secondary structure.

159. Answer (3)

Hint: This property is observed at high temperature.

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

160. Answer (1)

Hint: Inulin is present in tubers of *Dahlia*.

Sol.: Cellulose is an unbranched polymer of glucose that serves as the structural element in plant cell wall. Cellulose does not contain complex helices and hence cannot hold iodine.

Inulin is a polymer of fructose. It is a storage polysaccharide found in roots and tubers of *Dahlia* and related plants.

161. Answer (4)

Hint: Different from prosthetic groups and co-enzymes

Sol.: Zinc is the co-factor for the enzyme such as carbonic anhydrase. This forms coordination bonds with side chains at the active site and at the same time forms one or more coordination bonds with the substrate.

Co-enzymes are organic compounds and their association with the apoenzyme is only transient.

162. Answer (4)

Hint: 'P' is haemoglobin

Sol.: Adult human haemoglobin consists of 4 subunits. Two of these are identical to each other. Hence, two subunits of α-type and two subunits of β-type together constitute the human haemoglobin. Haem is a part of active site of enzymes, catalase and peroxidase.

163. Answer (1)

Hint: Gap junctions are also known as communication junctions.

Sol.: Gap junctions allow the cells in a tissue to communicate with one another. Gap junctions enable impulses to spread rapidly among cells.

Cells of epithelial tissues that line the stomach, intestine and urinary bladder have many tight junctions to retard the passage of substances between cells and prevent the contents of these organs from leaking into the blood or surrounding tissues.

164. Answer (2)

Hint: Functions as a lining for body cavities

Sol.: The epithelial tissue has a free surface, which faces either a body fluid or the outside environment and thus, provides a covering or a lining for some parts of the body. The cells are compactly packed with little intercellular matrix.

Squamous epithelium possesses flattened cells and the nucleus of each cell is flattened, oval or sphere and is centrally located. Cuboidal epithelium possesses cells with round and centrally located nuclei.

165. Answer (2)

Hint: True for cartilage

Sol.: The inter-cellular material of cartilage is solid and pliable and resists compression. Cells of this tissue (chondrocytes) are enclosed in small cavities within the matrix secreted by them. Cartilage is avascular and is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adults.

166. Answer (4)

Hint: Tendon and ligament are dense regular connective tissues.

Sol.: Fibres and fibroblasts are compactly packed in the dense connective tissues. Orientation of fibres show a regular or irregular pattern and are called dense regular and dense irregular tissues respectively.

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

167. 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.

- Brush bordered cuboidal epithelium lines the proximal convoluted tubules of nephron.
- Simple squamous epithelium is present in the walls of capillaries.

168. Answer (3)

Hint: Columnar epithelium

Sol.: The simple columnar epithelium is composed of a single layer of tall and slender cells. They are found in the lining of stomach and intestine and help in secretion and absorption.

169. Answer (2)

Hint: Possesses a single layer of tall and slender cells

Sol.: Simple squamous epithelium are found in the walls of blood vessels and air sacs of lungs. Cuboidal epithelium is commonly found in ducts of glands and tubular parts of nephrons in kidneys. Ciliated epithelium are mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes. Compound epithelium is present in ducts of salivary glands.

170. Answer (1)

Hint: Reason for the name of this tissue

Sol.: Connective tissues are the most abundant and widely distributed tissue in the body of complex animals. They are named connective tissue because of their special function of linking and supporting other tissues/organs of the body.

171. Answer (3)

Hint: Hydrolases

Sol.: Class II: Transferases : Catalyse a transfer of a group, G (other than hydrogen) between a pair of substrate S and S′.

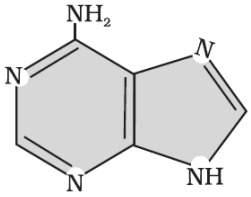
Class III: Hydrolases : Catalyse hydrolysis of ester, ether, peptide, glycosidic, C – C, C – halide or P – N bonds.

Class IV: Lyases : Catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

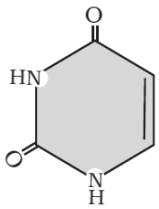
172. Answer (2)

Hint: Adenine is a purine.

Sol.:



Adenine (Purine)



Uracil (Pyrimidine)

173. Answer (1)

Hint: Identify a steroid.

Sol.: Living organisms have a number of carbon compounds in which heterocyclic rings can be found. Some of these are nitrogen bases-adenine, guanine, cytosine, uracil and thymine.

Cholesterol possesses four homocyclic rings.

174. Answer (3)

Hint: 'P' = Palmitic acid, 'Q' = Arachidonic acid

Sol.: Saturated fatty acids are without C = C double bond(s) while unsaturated fatty acids are with one or more C = C double bond(s).

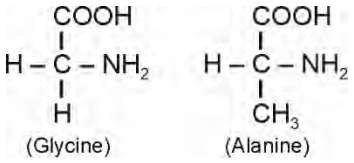
Palmitic acid has 16 carbons including carboxyl carbon. Arachidonic acid has 20 carbon atoms including the carboxyl carbon.

Saturated fatty acids have higher melting point than the unsaturated fatty acids and both are soluble in organic solvents.

175. Answer (4)

Hint: Neutral amino acids

Sol.:



(Glycine) (Alanine)

Both glycine and alanine are neutral amino acids *i.e.*, they have one amino group and one carboxyl group.

Amino acids are present in acid-soluble fraction.

Acidic amino acids have an extra –COOH group while basic amino acids have an extra $-NH_2$ group.

176. Answer (2)

Hint: One of them constitutes 9.5% weight of the human body.

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

177. Answer (3)

Hint: Identify a hormone.

Sol.: On the basis of the mode of pouring their secretions, glands are divided into two categories namely exocrine and endocrine glands. Exocrine glands secrete mucus, saliva, earwax, oil, milk, digestive enzymes and other cell products. These products are released through ducts or tubes. In contrast, endocrine glands do not have ducts. Their products called hormones are secreted directly into the fluid bathing the gland.

178. Answer (3)

Hint: Exclude the functions of simple squamous epithelium

Sol.: The simple squamous epithelium is made of single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs and are involved in functions like forming a diffusion boundary. It is not found in body areas that are subjected to mechanical stress. Simple squamous epithelium present in blood capillaries of glomerulus participates in filtration of blood. Simple cuboidal and columnar epithelium perform secretion. Protection is the main function of the compound epithelium.

179. Answer (4)

Hint: Stomach aids in digestion

Sol.: All complex animals consist of only four basic types of tissues *i.e.*, (i) epithelial tissue (ii) connective tissue (iii) muscular tissue (iv) neural tissue. These tissues are organised in specific proportion and pattern to form organs like stomach, lung, heart and kidney.

180. Answer (1)

Hint: Multicellular animal

Sol.: In unicellular organisms, all functions like digestion, respiration and reproduction are performed by a single cell. In the complex body of multicellular animals, the same basic functions are carried out by different groups of cells in a well organised manner. 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. *Hydra* exhibits division of labour. Others are protists which do not show division of labour.

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