All India Aakash Test Series for NEET - 2026

TEST - 1 (Code-E)

Click here for Code-F Sol.

Test Date : 02/11/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Use equation $\frac{dQ}{dt} = eA\sigma T^4$ to find the unit of Stefan's constant (σ)

Sol.: $\frac{dQ}{dt} = eA\sigma T^4$

$\sigma = \left(\frac{dQ}{dt}\right)\left(\frac{1}{eAT^4}\right)$

Unit of σ is $\frac{W}{m^2K^4}$

2. Answer (4)

Hint & Sol.: Angular momentum, $L = \frac{nh}{2\pi}$

$\therefore$ Unit of angular momentum (L) is same as Planck's constant.

$E = hf \Rightarrow h = \frac{E}{f}$

$\therefore$ Unit of $\frac{\text{Energy}}{\text{Frequency}}$ is same as Planck's constant.

3. Answer (2)

Hint: Length of rod L = MSR + (L.C.) × VSR

Sol.: L.C. = 1 MSD – 1 VSD

$= 1 - \frac{18}{20}$

$= \frac{1}{10}$ mm

$L = 94 + \frac{1}{10} \times 4$

= 94 + 0.4 = 94.4 mm

4. Answer (1)

Hint: Use principle of homogeneity.

Sol.: $[a] = [\alpha t^2] = [\beta t]$

$[\alpha t^2] = [\beta t] \Rightarrow \frac{\alpha t}{\beta}$ is dimensionless

5. Answer (3)

Hint: Rules of significant figures

Sol.: Leading zeroes are always insignificant. Trailing zeroes in a number with decimal are significant.

6. Answer (3)

Hint & Sol.: Dimensional constants have dimensions and thus they have units.

7. Answer (1)

Hint: Use equation of uniformly accelerated motion.

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

$2 \times a \times 6 = \left(\frac{u}{2}\right)^2 - u^2$ …(i)

$2 \times a \times d = 0 - \left(\frac{u}{2}\right)^2$ …(ii)

By dividing equation (i) and (ii), we get

$\frac{2 \times a \times 6}{2 \times a \times d} = \frac{-\frac{3u^2}{4}}{-\frac{u^2}{4}}$

$\frac{6}{d} = 3 \Rightarrow d = 2$ cm

8. Answer (4)

Hint: $v = \frac{ds}{dt} \Rightarrow \int ds = \int v dt$

Sol.: Given $v = 6t - t^2$

$\frac{ds}{dt} = 6t - t^2$

$\int_0^s ds = \int_0^t 6t dt - \int_0^t t^2 dt$

$s = \frac{6t^2}{2} - \frac{t^3}{3} = 0$

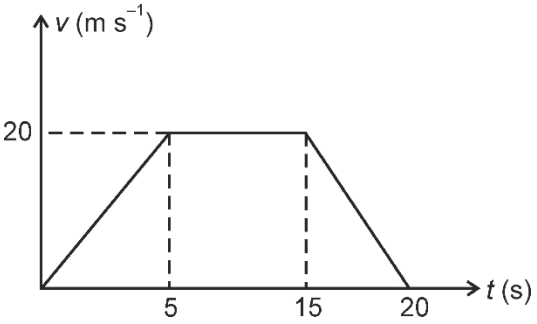
$3t^2 - \frac{t^3}{3} = 0 \Rightarrow t^2\left[3 - \frac{t}{3}\right] = 0$

$t = 9$ second

9. Answer (2)

Hint: Plot *v*-*t* graph and find area under *v*-*t* graph

Sol.:



Area under *v*-*t* graph = Displacement

Here distance travelled = displacement

$\therefore$ Distance = $\left(\frac{1}{2}\times5\times20\right)+(10\times20)+\left(\frac{1}{2}\times5\times20\right)$

= 50 + 200 + 50

= 300 m

10. Answer (2)

Hint: Average speed = $\frac{\text{Total distance}}{\text{Total time}}$

Sol.: $< v > = \frac{s}{t_1 + t_2} = \frac{\frac{s}{2}+\frac{s}{2}}{\frac{s}{2u}+\frac{s}{2v}} = \frac{2uv}{u+v}$

11. Answer (2)

Hint & Sol.: Slope of displacement-time curve is decreasing continuously and becomes zero eventually. Since slope of displacement-time curve gives velocity, the behaviour of velocity would be same as slope.

12. Answer (4)

Hint & Sol.: During retarding motion, angle between instantaneous velocity and acceleration is π.

13. Answer (4)

Hint: Apply equation $y = ut + \frac{1}{2}at^2$ for both the balls.

Sol.: For ball 1:

$$y_1 = -\frac{1}{2}gt^2 \quad \ldots(i)$$

For ball 2:

$$y_2 = -v_0(t-t_0) - \frac{1}{2}g(t-t_0)^2 \quad \ldots(ii)$$

When both the balls cross path, $y_1 = y_2$

$$\therefore \; -\frac{1}{2}gt^2 = -v_0(t-t_0) - \frac{1}{2}g(t-t_0)^2$$

After solving, we get

$$t = \left(\frac{2v_0 - gt_0}{v_0 - gt_0}\right)\frac{t_0}{2}$$

14. Answer (1)

Hint: Use the second equation of motion:

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

Sol.: $s = ut + \frac{1}{2}at^2$

$$h = 0 + \frac{1}{2}\times g \times t^2 \quad \ldots(i)$$

Displacement of the body in $\frac{t}{3}$ seconds

$$y = \frac{1}{2}\times g \times \left(\frac{t}{3}\right)^2$$

$$y = \frac{1}{9}\times h = \frac{h}{9}$$

$\therefore$ Height from the ground = $h - \frac{h}{9} = \frac{8h}{9}$

15. Answer (4)

Hint: To derive the equation of trajectory, eliminate time *t* from equation of *x* and *y* displacements.

Sol.: In *x*-direction:

v_x = 4 m/s = constant

$x = v_x t \;\Rightarrow\; x = 4t \quad \ldots(i)$

In *y*-direction:

$$v_y = \frac{5}{2}t \text{ m/s}$$

$$\frac{dy}{dt} = \frac{5}{2}t \;\Rightarrow\; \int_0^y dy = \int_0^t \frac{5}{2}t\,dt$$

$$y = \frac{5}{2}\frac{t^2}{2} \;\Rightarrow\; y = \frac{5}{4}t^2 \quad \ldots(ii)$$

Eliminate time (*t*) from (i) and (ii):

$$y = \frac{5}{4}\times\left(\frac{x}{4}\right)^2 \;\Rightarrow\; y = \frac{5}{64}x^2$$

16. Answer (3)

Hint & Sol.: For R_{max}, θ is 45°.

$R = 4H\cot\theta \Rightarrow R_{max} = 4H\cot45° \Rightarrow H = \frac{R_{max}}{4}$

17. Answer (1)

Hint: Centripetal acceleration = $r\omega^2$

Sol.: Angular speed (ω) of seconds hand

$\omega = \frac{\theta}{T} = \frac{2\pi}{60} = \frac{\pi}{30}$ rad/s

$a_c = r\omega^2 = \frac{5}{100} \times \left(\frac{\pi}{30}\right)^2 = \frac{5 \times 10}{100 \times 30 \times 30}$

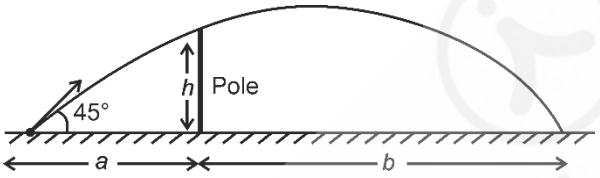
$a_c = \frac{5}{9} \times 10^{-3}$ m/s^2

18. Answer (1)

Hint: Use equation of trajectory in the form:

$y = x\tan\alpha\left(1 - \frac{x}{R}\right)$

Sol.: Let height of pole be h



$y = x\tan\alpha\left(1 - \frac{x}{R}\right)$

$h = a\tan45°\left(1 - \frac{a}{a+b}\right)$

$h = \frac{ab}{a+b}$

19. Answer (2)

Hint: To find the total time of flight, use equation of vertical motion along y-axis.

Sol.: Given $h = -45$ m, $u_y = u\sin\theta = 30 \times \sin30° = 15$ m/s

$y = u_y t + \frac{1}{2}a_y \times t^2$

$-45 = 15t + \frac{1}{2}(-10) \times t^2$

$5t^2 - 15t - 45 = 0 \Rightarrow t^2 - 3t - 9 = 0$

$t = \frac{-(-3) \pm \sqrt{3^2 - 4 \times 1 \times (-9)}}{2 \times 1}$

$t = \frac{3 \pm \sqrt{45}}{2} \Rightarrow T = \frac{3 + \sqrt{45}}{2}$ second

20. Answer (4)

Hint & Sol.: Net displacement is purely horizontal,

so average velocity = $\frac{\text{Total displacement}}{\text{Total time}}$

$\therefore$ Direction of average velocity is along horizontal.

21. Answer (4)

Hint & Sol.: Dimensional correctness does not ensure physical correctness of an equation.

22. Answer (3)

Hint & Sol.: If the digit to be dropped is 5 and the preceding digit is odd, it is increased by 1.

23. Answer (2)

Hint: Use rules of significant figures

Sol.: The number 4.700 has four significant figures.

Changing unit does not change the number of significant figures.

24. Answer (1)

Hint: First find the mean value, then calculate mean absolute error.

Sol.: Mean value =

$\frac{1.54 + 1.56 + 1.53 + 1.55 + 1.57}{5} = 1.55$

Mean absolute error =

$\frac{|1.54 - 1.55| + |1.56 - 1.55| + |1.53 - 1.55| + |1.55 - 1.55| + |1.57 - 1.55|}{5}$

Mean absolute error = $\frac{0.06}{5} = 0.012 \approx 0.01$

25. Answer (3)

Hint: Dimension of LHS = Dimension of RHS

Sol.: $[P] = [ML^{-1}T^{-2}]$

$[D] = [ML^{-3}]$

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

$\because T = kP^aD^bE^c$

$\therefore [T] = [ML^{-1}T^{-2}]^a [ML^{-3}]^b [ML^2T^{-2}]^c$

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

The solution to the system of equations is

$a = -\frac{5}{6}, b = \frac{1}{2}, c = \frac{1}{3}$

$\therefore a + b - c = \frac{-5}{6} + \frac{1}{2} - \frac{1}{3} = \frac{-5 + 3 - 2}{6} = \frac{-2}{3}$

26. Answer (2)

Hint: Use formula $n_1u_1 = n_2u_2$ to solve the problem

Sol.: Dimension of moment of inertia = $[ML^2]$

$n_1u_1 = n_2u_2$

10 kg m^2 = n_2 (10 g) (5 cm)^2

10 kg m^2 = $n_2 \times 10 \times 10^{-3}$ kg $\times 25 \times 10^{-4}$ m^2

$10 = n_2 \times 25 \times 10^{-6}$

$n_2 = \dfrac{100 \times 10^5}{25} = 4 \times 10^5$

27. Answer (2)

Hint & Sol.: Acceleration may cause speeding up or slowing down depending on its direction relative to velocity.

28. Answer (3)

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

Sol.: u = 108 km/h = $108 \times \dfrac{5}{18}$ = 30 m/s

$a = \dfrac{v-u}{t} = \dfrac{0-30}{10} = -3$ m/s^2

$s = ut + \dfrac{1}{2}at^2 \Rightarrow s = 30 \times 10 + \dfrac{1}{2}(-3) \times 10^2$

s = 150 m

29. Answer (3)

Hint: Change in velocity = Area under a-t graph

Sol.: $\Delta v = \int a\,dt$ = Area under a-t graph

For $v_f = v_i \Rightarrow \Delta v = 0$

$\therefore$ Area under a-t graph should be zero.

From graph, at t = 12 s upper and lower area would become equal in magnitude.

30. Answer (1)

Hint: Use relative velocity concept

Sol.: Let speeds of the objects are v_1 and v_2 ($v_1 > v_2$)

When they are moving towards each other

$v_1 + v_2$ = 6 m/s ...(i)

When they are moving in same direction

$v_1 - v_2 = \dfrac{6}{10}$ m/s ...(ii)

After solving equation (i) and (ii), we get

v_1 = 3.3 m/s, v_2 = 2.7 m/s

31. Answer (4)

Hint: Time of flight, $T = \sqrt{\dfrac{2h}{g}}$

Sol.: Time of flight of the bomb, $T = \sqrt{\dfrac{2 \times 490}{9.8}}$

T = 10 s

Displacement in x-direction = $v \times T$

$\Delta x = 49 \times 10 = 490$ m

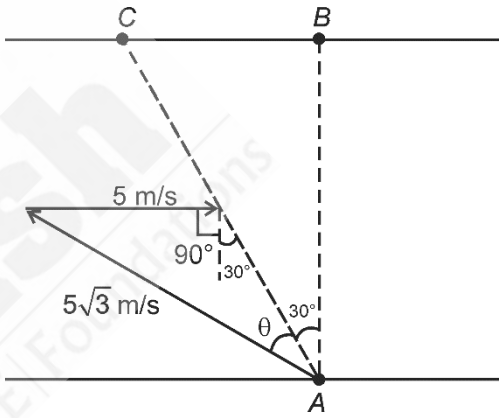
Displacement = $\sqrt{(\Delta x)^2 + (\Delta y)^2}$

$\sqrt{(490)^2 + (490)^2} = 490\sqrt{2}$ m

32. Answer (2)

Hint: Make proper figure and apply sine rule.

Sol.:



Apply sine rule :

$\dfrac{\sin(90° + 30°)}{5\sqrt{3}} = \dfrac{\sin\theta}{5}$

$\dfrac{\cos 30°}{\sqrt{3}} = \sin\theta \Rightarrow \sin\theta = \dfrac{1}{2} \Rightarrow \theta = 30°$

Angle with respect to the direction of flow = 90° + 30° + 30° = 150°

33. Answer (3)

Hint: Maximum height $H = \dfrac{u^2 \sin^2\theta}{2g}$

Sol.: Since speed of both projectile is same

$\therefore H \propto \sin^2\theta$

$\dfrac{H_1}{H_2} = \dfrac{\sin^2 30°}{\sin^2 60°} = \dfrac{\left(\frac{1}{2}\right)^2}{\left(\frac{\sqrt{3}}{2}\right)^2} = \dfrac{1}{3}$

34. Answer (4)

Hint & Sol.: In uniform circular motion, speed and kinetic energy remains constant.

35. Answer (1)

Hint: Use formula $a_{net} = \sqrt{a_c^2 + a_t^2}$

Sol.: $|\vec{a}_t| = K, a_c = \frac{v^2}{r}$

$$a_{net} = \sqrt{a_t^2 + a_c^2} = \sqrt{K^2 + \left(\frac{v^2}{r}\right)^2}$$

36. Answer (3)

Hint & Sol.: Time of flight $T = \frac{2u\sin\theta}{g}$

$\therefore T \propto u$

Horizontal range $R = \frac{u^2 \sin 2\theta}{g}$

37. Answer (2)

Hint & Sol. : Both distance travelled and displacement are non-zero and equal, since it does not turn.

38. Answer (3)

Hint: Velocity $v = \frac{dx}{dt} = \tan\theta$

Sol.: $\theta = 30° \Rightarrow \tan 30° = \frac{1}{\sqrt{3}}$

$v = \frac{dx}{dt} = \tan 30°$

$\therefore v = \frac{1}{\sqrt{3}}$

39. Answer (1)

Hint & Sol.: $Q = \frac{A^2}{B} \Rightarrow B = \frac{A^2}{Q}$

$\frac{\Delta B}{B} = \frac{2\Delta A}{A} + \frac{\Delta Q}{Q}$

$\frac{\Delta B}{B} \times 100 = (2 \times 3) + 2 = 8\%$

40. Answer (2)

Hint: Average acceleration, $\langle \vec{a} \rangle = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$

Sol.: $\langle \vec{a} \rangle = \frac{(5\cos 37°\hat{i} - 5\sin 37°\hat{j}) - (5\hat{i})}{2}$

$= \frac{(4\hat{i} - 3\hat{j}) - (5\hat{i})}{2}$

$= \frac{-\hat{i} - 3\hat{j}}{2}$

$|\langle \vec{a} \rangle| = \frac{1}{2}\sqrt{1+9} = \sqrt{\frac{5}{2}}$ m s^{-2}

41. Answer (4)

Hint: Reading = MSR + (LC × CSR)

Sol.: Least Count (LC) = $\frac{\text{Pitch}}{\text{Number of divisions}}$

LC = $\frac{1\text{mm}}{100} = 0.01\text{mm}$

Reading = MSR + (LC × CSR)

= 1 mm + (0.01 × 57) mm

= 1.57 mm

42. Answer (1)

Hint & Sol.: Plane angle has no dimension but it has unit equal to radian.

43. Answer (2)

Hint: Use formula $v = \sqrt{v_x^2 + v_y^2}$

Sol.: Velocity of ball after t = 2 s in horizontal direction:

$v_x = u_x + a_x t \Rightarrow v_x = 0 + 3 \times 2 = 6$ m/s

After t = 2 s, v_x remains constant

Velocity of ball at t = 4 s in vertical direction:

$v_y = u_y + a_y t \Rightarrow v_y = 0 + (-10) \times (4 - 2) = -20$ m/s

Speed $v = \sqrt{v_x^2 + v_y^2} = \sqrt{6^2 + 20^2}$

$v = \sqrt{436}$ m/s

44. Answer (4)

Hint: Use formula $\int dv = \int a dt$

Sol.: $\int_u^v dv = \int_0^t a dt$

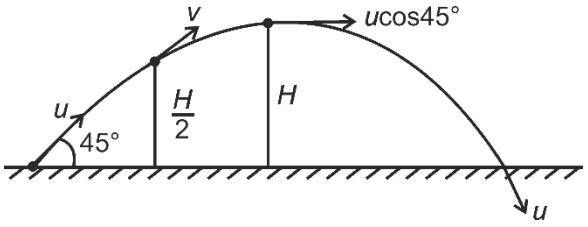
$v - u = \int_0^t a dt$

$v - u = \frac{at^2}{2} \Rightarrow v = u + \frac{at^2}{2}$

45. Answer (3)

Hint: Use the concept of projectile motion.

Sol.: For maximum range, $\theta = 45°$



Speed at the maximum height = $u\cos45° = \frac{u}{\sqrt{2}}$

Speed at half the maximum height :

$$u_x = u_y = \frac{u}{\sqrt{2}}, H = \frac{u_y^2}{2g} = \frac{u^2}{4g}$$

$$2a_y y = v_y^2 - u_y^2$$

$$2 \times (-g) \times \frac{H}{2} = v_y^2 - \left(\frac{u}{\sqrt{2}}\right)^2$$

$$-g \times \frac{u^2}{4g} = v_y^2 - \frac{u^2}{2} \Rightarrow v_y^2 = \frac{u^2}{4}$$

$$v_y = \frac{u}{2}$$

Speed = $\sqrt{v_x^2 + v_y^2} = \sqrt{\left(\frac{u}{\sqrt{2}}\right)^2 + \left(\frac{u}{2}\right)^2} = \sqrt{\frac{u^2}{2} + \frac{u^2}{4}}$

Speed = $\frac{u\sqrt{3}}{2}$

Magnitude of change in velocity when it returns to the ground:

$$\overrightarrow{\Delta v} = \vec{v}_f - \vec{v}_i = \left(\frac{u}{\sqrt{2}}\hat{i} - \frac{u}{\sqrt{2}}\hat{j}\right) - \left(\frac{u}{\sqrt{2}}\hat{i} + \frac{u}{\sqrt{2}}\hat{j}\right)$$

$$\overrightarrow{\Delta v} = -2\frac{u}{\sqrt{2}}\hat{j} = -\sqrt{2}u\hat{j}$$

$$|\overrightarrow{\Delta v}| = \sqrt{2}u$$

Average velocity till it reaches the ground:

$$< v > = \frac{\text{Displacement}}{\text{Time}} = \frac{R}{T}$$

$$< v > = \frac{\frac{u^2 \sin 2\theta}{g}}{\frac{2u\sin\theta}{g}} = u\cos\theta$$

$$< v > = \frac{u}{\sqrt{2}}$$

[CHEMISTRY]

46. Answer (4)

Hint:

$$\frac{\text{Weight of solute}}{\text{Molar mass of solute}} = \frac{\text{Number of atoms}}{\text{Number of atoms in one molecule} \times N_A}$$

Sol.:

49 g of H_2SO_4 $\Rightarrow \frac{49}{98} = \frac{\text{No. of atoms}}{7 \times N_A}$

No. of atoms = $\frac{7N_A}{2}$ $\Rightarrow$ 3.5 N_A

16 g of O_3 $\Rightarrow \frac{16}{48} = \frac{\text{No. of atoms}}{3 \times N_A}$

= N_A

20 g of NaOH $\Rightarrow \frac{20}{40} = \frac{\text{No. of atoms}}{3 \times N_A}$

= 1.5 N_A

22.8 g of N_2O_3 $\Rightarrow \frac{22.8}{76} = \frac{\text{No. of atoms}}{5 \times N_A}$

= 1.5 N_A

20 g of CO_2 $\Rightarrow \frac{22}{44} = \frac{\text{No. of atoms}}{3 \times N_A}$

= 1.5 N_A

47. Answer (1)

Hint: All non-zero digits are significant

Sol.:

Number	Significant figure
0.03	1
285	3
0.0050	2
20 eggs	Infinite

48. Answer (1)

Hint: Pure substances may be elements or compounds.

Sol.: Pure substances have fixed composition. Gold and ammonia are pure substances. Alloy is a homogeneous mixture whereas milk and mud are heterogeneous mixtures.

49. Answer (1)

Hint: The SI system allows the use of prefixes to indicate the multiplies or submultiples of a unit.

Sol.: SI unit of amount of substance is mole

50. Answer (2)

Hint: $B_2H_6 + 3O_2 \rightarrow B_2O_3 + 3H_2O$

Sol.: 1 mol B_2H_6 requires = 3 moles of O_2

28 g $B_2H_6 \rightarrow$ 96 g O_2

1 g $B_2H_6 \rightarrow \frac{96}{28}$ g O_2

= 3.42 g O_2

51. Answer (3)

Hint: In protein A, at least one alanine should be present

Sol.: $\frac{0.2}{100} = \frac{1 \times 89}{x}$

$x = \frac{85 \times 100}{0.2}$

$= 4.45 \times 10^4$ g/mol

52. Answer (2)

Hint: $Na_2O + H_2O \rightarrow 2NaOH + H_2$

Sol.: Mass of $Na_2O = \frac{1.55}{62}$

= 0.025 mol

1 mol of Na_2O gives $\rightarrow$ 2 mol of NaOH

0.025 mol of Na_2O gives $\rightarrow$ 0.05 mol of NaOH

Molarity (M) = $\frac{0.05}{250} \times 1000$

= 0.2 M

53. Answer (4)

Hint: 1 mole SO_2Cl_2 produces 4 moles of H^+ ions

20 moles of OH^- = 20 mole of H^+

Sol.: 4 mole H^+ produced = 1 mole SO_2Cl_2

20 mole H^+ produced = $\frac{1}{4} \times 20$

= 5 moles SO_2Cl_2

54. Answer (1)

Hint: Number of gm equivalent of metal = Number of gm equivalent of oxygen

Sol.: $\frac{\text{Weight of metal}}{\text{EW of metal}} = \frac{\text{Weight of oxygen}}{\text{EW of oxygen}}$

$\frac{68}{x} = \frac{32}{8}$

x = 17

55. Answer (3)

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

Sol.:

	% of element	Mole	Simplest ratio
C	37.5%	$\frac{37.5}{12} = 3.125$	1
H	12.5%	$\frac{12.5}{1} = 12.5$	4
O	50%	$\frac{50}{16} = 3.125$	1

The correct empirical formula is CH_4O

56. Answer (3)

Hint: O_2 is limiting reagent

Sol.: $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

Mole 2 2

$\frac{2}{4}$ $\frac{2}{5}$

So, O_2 is limiting reagent

5 mole of $O_2(g)$ produce $\rightarrow$ 4 mole of NO(g)

2 mole of $O_2(g)$ produce $\rightarrow \frac{4}{5} \times 2 = \frac{8}{5}$ = 1.6 mol of NO(g)

5 mole of $O_2(g)$ produce $\rightarrow$ 6 mole of $H_2O(g)$

2 mole of $O_2(g)$ produce $\rightarrow \frac{6}{5} \times 2$ = 2.4 mole of $H_2O(g)$

57. Answer (2)

Hint: $Zn + 4HNO_3 \rightarrow Zn(NO_3)_2 + 2H_2O + 2NO_2(g)$

Sol.: 1 mol Zn produce = 2 mol $NO_2(g)$

= 44.8 L $NO_2(g)$

44800 mL NO_2 produced from = 65 g of zinc

448 mL NO_2 produced from = $\frac{65}{44800} \times 448$

= 0.65 g of Zn

58. Answer (3)

Hint:

$$\underset{40\text{ mmol}}{3BaCl_2} + \underset{50\text{ mmol}}{2Na_3PO_4} \longrightarrow Ba_3(PO_4)_2 + 6NaCl$$

$BaCl_2$ is limiting reagent.

Sol.: 3 millimole of $BaCl_2$ = 1 mmol of $Ba_3(PO_4)_2$

40 millimole of $BaCl_2$ = $\frac{1}{3} \times 40$

= 13.33 mmol of $Ba_3(PO_4)_2$

Weight of $Ba_3(PO_4)_2$ = $601 \times \frac{13.33}{1000}$

= 8.01 g

59. Answer (1)

Hint: Equivalents of $H_2C_2O_4 \cdot 2H_2O$ = Equivalents of NaOH

Sol.: Molarity of $H_2C_2O_4 \cdot 2H_2O = \frac{12.6 \times 1000}{126 \times 1000}$

= 0.1 M

Normality of $H_2C_2O_4 \cdot 2H_2O$ = 0.2

$0.2 \times 10 = 0.1 \times V$

V = 20 mL

$$\frac{\frac{(W)_{N_2}}{(MM)_{N_2}}}{\frac{(W)_{O_2}}{(MM)_{O_2}}} = \frac{(n)_{N_2}}{(n)_{O_2}}$$

$$\frac{(n)_{N_2}}{(n)_{O_2}} = \frac{\frac{1}{28}}{\frac{2}{32}} \Rightarrow \frac{16}{28} \Rightarrow \frac{4}{7}$$

60. Answer (1)

Hint: Moles of solute $= \frac{\text{Weight of solute}}{\text{Molar mass of solute}}$

Sol.: $2 = \frac{24 \times 10^{-3}}{(MM)_{PQ}}$

$(MM)_{PQ} = 12 \times 10^{-3} \Rightarrow 0.012$ kg

$4 = \frac{56 \times 10^{-3}}{(MM)_{PQ_2}}$

$(MM)_{PQ_2} = 14 \times 10^{-3} \Rightarrow 0.014$ kg

P + Q = 0.012 …(1)

P + 2Q = 0.014 …(2)

Q = 0.002

Molar mass of Q = 0.002 kg mol^{-1}

$\Rightarrow 2 \times 10^{-3}$ kg mol^{-1}

P + 0.002 = 0.012

Molar mass of P $\Rightarrow 1 \times 10^{-2}$ kg mol^{-1}

61. Answer (3)

Hint: $\Delta E = \frac{hc}{\lambda} = hc\bar{\nu}$

$$\bar{\nu} = R_H Z^2 \left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$$

Sol.: $\bar{\nu}_1 = R_H Z^2 \left[\frac{1}{4} - \frac{1}{9}\right]$

$\bar{\nu}_2 = R_H Z^2 \left[\frac{1}{25} - \frac{1}{36}\right]$

$$\frac{\bar{\nu}_1}{\bar{\nu}_2} = \frac{\frac{5}{36}}{\frac{11}{25 \times 36}}$$

$$\frac{\bar{\nu}_1}{\bar{\nu}_2} = \frac{125}{11}$$

62. Answer (4)

Hint: Total number of electrons = $\frac{\text{Weight of substance}}{\text{Molar mass of substance}} \times N_A \times$ Number of e^- in one molecule

Sol.: 4 g CH_4 contains; $\frac{4}{16} = \frac{x}{10 \times N_A}$

$x = 2.5\ N_A\ e^-$

2 g SO_2 contains; $\frac{2}{64} = \frac{x}{32\,N_A}$

$x = N_A\ e^-$

4 g CO_2 contains; $\frac{4}{44} = \frac{x}{22\,N_A}$

$x = 2\ N_A\ e^-$

8 g NO_2 contains; $\frac{8}{46} = \frac{x}{23\,N_A}$

$x = 4\ N_A\ e^-$

63. Answer (1)

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

$\text{Molality (m)} = \frac{\text{Number of moles of solute}}{\text{Weight of solvent (in kg)}}$

Sol.: $M = \frac{30 \times 1000}{60 \times 100} \Rightarrow 5\ M$

$m = \frac{30 \times 1000}{60 \times 70} \Rightarrow 7.14\ m$

64. Answer (3)

Hint: $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

Number of g. eq. of $CaCO_3$ = Number of g. eq. of HCl

Sol.: 2 millimole of HCl = 1 mmol of $CaCO_3$

50 × 0.25 mmol of HCl = $\frac{1}{2}$ × 50 × 0.25 mm of $CaCO_3$

$\Rightarrow$ 6.25 mmol of $CaCO_3$

Weight of $CaCO_3$ = $\frac{6.25}{1000} \times 100$

= 0.625 g

65. Answer (4)

Hint: Hydrated barium chloride means ($BaCl_2 \cdot xH_2O$)

Sol.: Weigh of water = 122 – 104

= 18 g

Mole of water = $\frac{18}{18}$ $\Rightarrow$ 1 mol

Mole of $BaCl_2$ = $\frac{104}{208}$ $\Rightarrow$ $\frac{1}{2}$ mol

$\frac{1}{2}$ mol $BaCl_2$ combine with $\rightarrow$ 1 mol H_2O

1 mol $BaCl_2$ combine with $\rightarrow \frac{1}{1} \times 2 \Rightarrow 2$ mol H_2O

Formula is $\Rightarrow$ $BaCl_2 \cdot 2H_2O$

Molar mass of $BaCl_2 \cdot 2H_2O$ is $\Rightarrow$ 137 + 35.5 × 2 + 2 × 18

= 244 g mol^{-1}

66. Answer (2)

Hint: $\underset{1L}{CO_2(g)} + \underset{(1-x)L}{C(s)} \longrightarrow \underset{2xL}{2CO(g)}$

Sol.: $\underset{1L}{CO_2(g)} + \underset{(1-x)L}{C(s)} \longrightarrow \underset{2xL}{2CO(g)}$

Total volume $\Rightarrow$ 1 – x + 2x = 1.2

1 + x = 1.2

x = 0.2 L

Volume of $CO_2(g)$ = 1 – 0.2 = 0.8 L

Volume of CO(g) = 2 × 0.2 = 0.4 L

67. Answer (3)

Hint: N_2 is limiting reagent

Sol.: $\underset{\frac{1}{2}\text{ mol}}{N_2(g)} + \underset{1\text{ mol}}{O_2(g)} \longrightarrow 2NO(g)$

1 mol $N_2(g)$ = 2 mol NO(g)

$\frac{1}{2}$ mol $N_2(g) = \frac{2}{1} \times \frac{1}{2} \Rightarrow 1$ mol NO(g)

2 mol NO(g) = 2 mol $NO_2(g)$

1 mol NO(g) = 1 mol $NO_2(g)$

Weight of $NO_2(g)$ = 1 × 46

= 46 g

68. Answer (4)

Hint: $\%\ \text{purity} = \frac{\text{Mass pure } CaCO_3}{\text{Mass of impure } CaCO_3} \times 100$

Sol.: $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

56 g CaO = 100 g $CaCO_3$

11.2 g CaO = $\frac{100}{56}$ × 11.2 g of $CaCO_3$

= 20 g $CaCO_3$

% Purity = $\frac{20}{40}$ × 100

= 50%

69. Answer (4)

Hint: $M_1V_1 + M_2V_2 = M_3V_3$

Sol.: 20 × 1 + 200 × 0.25 = 220 × M

20 + 50 = 220 M

M = $\frac{70}{220}$

= 0.32 M

70. Answer (3)

Hint: Mass of electron is $\frac{1}{1837}^{th}$ mass of proton.

Sol.: $\left(\frac{e}{m}\right)_e = \frac{1}{1} \times 1837$

$\left(\frac{e}{m}\right)_p = \frac{1}{1}$

So $\left(\frac{e}{m}\right)_e > \left(\frac{e}{m}\right)_p$

- Higher the value of $\frac{e}{m}$, higher is the deflection.

$\left(\frac{e}{m}\right)_\beta > \left(\frac{e}{m}\right)_\alpha$

- Radius of atom = 10^{-10} m
- Radius of nucleus = 10^{-15} m

Ratio = $\frac{10^{-10}}{10^{-15}} \Rightarrow 10^5$

71. Answer (1)

Hint: $\Delta E = E_4 - E_3$

$\Delta E = \frac{hc}{\lambda} = hc\bar{\nu}$

Sol.: $\Delta E = -1.36 \times 10^{-12} - (-2.41 \times 10^{-12})$

$= 1.05 \times 10^{-12}$

$\Delta E = hc\bar{\nu}$

$\bar{\nu} = \frac{1.05 \times 10^{-12}}{6.6 \times 10^{-27} \times 3 \times 10^{10}}$

$= 5.3 \times 10^3\ cm^{-1}$

72. Answer (4)

Hint: K.E. = $\frac{1}{2}mv^2$

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

$r = a_0 \times \frac{n^2}{z}$

Sol.: K.E. = $\frac{1}{2}mv^2$ ...(1)

$v = \frac{nh}{2\pi mr}$ ...(2)

$r = a_0 \times \frac{n^2}{z}$ ...(3)

Putting the value of r in eq (2)

$v = \frac{nh \times z}{2\pi m a_0 \times n^2}$ ...(4)

Putting the value of v in eq (1)

K.E. $= \frac{1}{2}m\left(\frac{nhz}{2\pi m a_0 n^2}\right)^2$

$= \frac{1}{2}\frac{h^2z^2}{4\pi^2 m a_0^2 n^2} \quad \begin{pmatrix} z=3 \\ n=3 \end{pmatrix}$

$= \frac{h^2}{8\pi^2 m a_0^2}$

73. Answer (2)

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

Sol.: $r_H = a_0 \times \frac{(1)^2}{(1)}$ ...(1)

$r_{He^+} = a_0 \times \frac{4}{2}$ ...(2)

$\frac{r_H}{r_{He^+}} = \frac{a_0}{a_0 \times 2}$

$\frac{r_H}{r_{He^+}} = \frac{1}{2}$

74. Answer (1)

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

Sol.:

Metal	**W_0/eV**
Li	2.42
Na	2.3

75. Answer (1)

Hint: $E = w_0 + KE$

$h\nu = h\nu_0 + KE$

Sol.: $KE = \frac{hc}{\lambda} - h\nu_0$

$= \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{100 \times 10^{-9}} - 4.4 \times 10^{-19}$

$= 19.8 \times 10^{-19} - 4.4 \times 10^{-19}$

$= 10^{-19}(19.8 - 4.4)$

$= 15.4 \times 10^{-19}$ J

76. Answer (2)

Hint: $E = nh\nu$

$$E = \frac{nhc}{\lambda}$$

Sol.: Energy = P × time

= 30 J

$$30 = \frac{n \times 6.626 \times 10^{-34} \times 3 \times 10^{8}}{666 \times 10^{-9}}$$

$$n = \frac{666 \times 10^{-9} \times 30}{6.626 \times 10^{-34} \times 3 \times 10^{8}}$$

$n = 10.05 \times 10^{19}$

77. Answer (3)

Hint: For Paschen series $n_1 = 3$

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

Sol.: • $158.7 = 52.9 \times \frac{n^2}{3}$

$n = 3$

It belongs to Paschen series

• Total number of spectral lines = $\frac{4 \times 5}{2} = 10$

78. Answer (3)

Hint: According to Heisenberg's uncertainty principle; $\Delta x \cdot m\Delta v = \frac{h}{4\pi}$

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

$$\Delta v = 80 \times \frac{5}{100}$$

= 4 ms^{-1}

$$\Delta x = \frac{6.6 \times 10^{-34}}{4 \times 3.14 \times 6.6 \times 4} \times 1000$$

= 2×10^{-33} m

79. Answer (2)

Hint: (n + l) value increase, energy of orbitals also increases

If (n + l) value same then n increases, energy of orbitals also increases.

Sol.: (n + l) values

4*d*	→	6
4*p*	→	5
5s	→	5
3*d*	→	5

So, correct order is 4*d* > 5*s* > 4*p* > 3*d*

80. Answer (1)

Hint: Total number of radial nodes = (n – l – 1)

Sol.: For $4p \rightarrow 4 - 1 - 1 = 2$

For $5f \rightarrow 5 - 3 - 1 = 1$

For $3d \rightarrow 3 - 2 - 1 = 0$

For $4s \rightarrow 4 - 0 - 1 = 3$

81. Answer (3)

Hint: Spherical symmetric state means *s* orbital

Sol.: $P_1 = 1s$; $P_2 = 2s$

Number of radial nodes in $P_2 = 1$

$$\left(E_{He^+}\right)_2 = -13.6 \times \frac{4}{4} \Rightarrow -13.6 \text{ eV}$$

82. Answer (4)

Hint: Value of $m_l = -l$ to $+l$ including zero $n > l$ always.

Sol.: For n = 4, l = 4 is not possible

83. Answer (4)

Hint: The energy of an electron in a hydrogen atom is determined solely by the principal quantum number.

Sol.: Energy of 2*s* orbital of hydrogen atom is equal to the energy of 2*p* orbital of hydrogen atom.

84. Answer (1)

Hint: Isotones have same number of neutrons

Sol.: $\lambda = \frac{h}{mv}; \left(mvr = \frac{nh}{2\pi}\right)$

$$\lambda = \frac{h \times 2\pi r}{nh}$$

$$\lambda = \frac{2\pi r}{n}$$

$$= \frac{2\pi \times a_0 \times n^2}{Z \times n}$$

$$3\pi a_0 = 2\pi a_0 \times \frac{n}{Z}$$

$$\frac{n}{Z} = \frac{3}{2} \Rightarrow 1.5$$

Electronic configuration of Cu atom is

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

85. Answer (3)

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

$Cu \rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$

Sol.: Valence orbital of potassium is $4s^1$

$n = 4, l = 0, m_l = 0$ and $m_s = \pm\frac{1}{2}$

For Cu atom $(n + l) = 4 \begin{cases} \nearrow 4 + 0 \Rightarrow 4s \\ \searrow 3 + 1 \Rightarrow 3p \end{cases}$

So total number of electrons are 7 which have $(n + l) = 4$

86. Answer (3)

Hint: When electromagnetic radiations are arranged in their increasing order of wavelength then the series is obtained called electromagnetic spectrum.

Sol.: The correct order of wavelength of electromagnetic radiations is Radio waves > Microwave > IR > UV

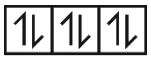
87. Answer (2)

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

Sol.: It follows only Pauli's exclusion principle. It violates Hund's rule of maximum multiplicity and Aufbau principle.

88. Answer (4)

Hint:



$3p$

Only three electrons have $+\frac{1}{2}$ and other three have $-\frac{1}{2}$ spin quantum number.

Sol.:

	Number of electrons
K^+	18
Ca^{2+}	18
S^{2-}	18

These are isoelectronic species

- Shape of orbital is determined by Azimuthal quantum number.

89. Answer (3)

Hint: $\frac{1}{\lambda} = R_H Z^2\left[\frac{1}{n_L^2} - \frac{1}{n_H^2}\right]$

Sol.: R_H the first line for Balmer series

$n_1 = 2\ n_2 = 3$

$$\frac{1}{\lambda_1} = R_H \times (1)^2\left[\frac{1}{4} - \frac{1}{9}\right]$$

$$\frac{1}{\lambda_2} = R_H \times (1)^2\left[\frac{1}{4} - \frac{1}{25}\right]$$

$$\frac{\lambda_2}{x} = \frac{500}{21 \times 36}$$

$\lambda_2 = 0.66x$ nm

90. Answer (3)

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

Sol.: • $\lambda = \frac{h}{mv}$;

Those species which have higher value of mass, have lower value of de Broglie wavelength.

- Angular momentum for hydrogen atom is given as $mvr = \frac{nh}{2\pi}$

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

  Angular momentum = $\frac{h}{\pi}$

- Paschen, Brackett and Pfund spectral lines for hydrogen atom lie in IR region.

[BOTANY]

91. Answer (3)

Hint: Reproduction can be regarded as characteristic of living organism but it is not their exclusive defining characteristic.

Sol.: All living organisms – present, past and future are linked to one another by the sharing of the common genetic material but to varying degrees.

92. Answer (2)

Hint: Genera *Panthera* and *Felis* belong to the family, Felidae.

Sol.: Genera *Panthera* and *Felis* belong to the class, Mammalia.

93. Answer (1)

Hint: Generic name, species epithet and author citation, collectively form a binomial epithet.

Sol.: Binomial epithet of mango is *Mangifera indica* Linn.

94. Answer (4)

Hint: The first word in a binomial nomenclature represents the genus and the second word represents the species.

Sol.: Name of the genus starts with a capital letter and name of the species starts with a small letter.

95. Answer (4)

Hint: Organelles are membrane bound structures, though there are certain non-membranous organelles as well.

Sol.: Centrosome is a non-membrane bound cell organelle.

96. Answer (2)

Hint: Prokaryotes lack nucleus and their genetic material is present in the nucleoid region.

Sol.: Plasmid – Many bacteria have small circular DNA outside the genomic DNA. It confers certain unique phenotypic characters to such bacteria.

Capsule – It is made up of polysaccharides, but may sometimes contain proteins also.

Cell wall – It determines the shape of the cell and provides a strong structural support to prevent the bacterium from bursting or collapsing.

97. Answer (1)

Hint: Schwann concluded that presence of cell wall is a unique character of the plant cells.

Sol.: Schleiden observed that all plants are composed of different kinds of cells which form the tissues of the plants.

98. Answer (2)

Hint: Schleiden and Schwann, together formulated the cell theory. This theory however did not explain as to how new cells were formed.

Sol.: Rudolf Virchow, first explained that cells divided and new cells are formed from the pre-existing cells.

99. Answer (2)

Hint: Microtubules help in spindle and astral ray formation during cell division.

Sol.: Middle lamella is a layer, mainly composed of calcium pectate. Vacuole contains water, sap, excretory products and other material, not useful for the plant cell.

100. Answer (4)

Hint: Lipoprotein synthesis is done by endoplasmic reticulum.

Sol.: β–oxidation of fats – Mitochondria, a cylindrical or sausage shaped double membranous organelle.

Protein synthesis – Ribosomes, that are composed of RNA and protein and are not surrounded by any membrane.

Carbohydrate synthesis – Chloroplast, a double membrane bound cell organelle.

101. Answer (3)

Hint: The protective layers are the cell envelope of a bacterial cell.

Sol.: Glycocalyx, cell wall and plasma membrane act together as a single protective unit.

102. Answer (2)

Hint: Almost all plant cells lack centriole.

Sol.: Plant cells and animal cells are different as the former possess cell wall, plastids and a large central vacuole which are absent in the animal cells.

103. Answer (1)

Hint: The outermost layer of cell envelope provides sticky character to the bacterial cell.

Sol.: The capsule is made up of glycocalyx that has polysaccharide macromolecules, and it gives gummy sticky character to the bacterial cell.

104. Answer (2)

Hint: Cell wall is a non-living, rigid structure that provides barrier for undesirable macromolecules.

Sol.: ER helps in the transport of substances and synthesis of proteins.

105. Answer (4)

Hint: Nucleolus is the site of rRNA synthesis.

Sol.: Larger and more numerous nucleoli are present in the cells actively carrying out protein synthesis.

106. Answer (1)

Hint: Inclusion bodies are not bound by any membrane and lie free in the cytoplasm.

Sol.: Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies like, phosphate granules, cyanophycean granules and glycogen granules.

107. Answer (4)

Hint: Endomembrane system comprises of single membrane-bound organelles.

Sol.: Chloroplast is not a part of endomembrane system.

108. Answer (3)

Hint: Human erythrocyte membrane has more proteins than lipids.

Sol.: Human erythrocyte membrane has approximately 52 percent proteins and 40 percent lipids.

109. Answer (4)

Hint: Cisternae is present in some organelles of the endomembrane system.

Sol.: Centromere is the primary constriction of chromosome.

110. Answer (4)

Hint: The fluid nature of the membrane is important from the point of view of functions like cell growth, endocytosis, cell division, etc.

Sol.: Majority of the chloroplasts of the green plants are found in the mesophyll cells of the leaves.

111. Answer (4)

Hint: Cytoskeleton forms the structural framework inside the cell.

Sol.: ER is composed of three kinds of structures *viz.* cisternae, tubules and vesicles.

112. Answer (3)

Hint: It is a membrane bound vesicular structure.

Sol.: The isolated lysosomal vesicles have been found to be very rich in almost all types of hydrolytic enzymes.

113. Answer (3)

Hint: Microtubules bind with the kinetochore of the chromosome.

Sol.: Microtubules help in the anaphasic movement of chromosomes.

114. Answer (4)

Hint: Two cylindrical structures in the centrosome are called centrioles.

Sol.: Centrioles are not surrounded by plasma membrane but they are surrounded by pericentriolar satellites, also known as massule.

115. Answer (4)

Hint: *Cis* face or forming face of Golgi apparatus receives the proteins from RER that need to be packaged and transported.

Sol.: The *trans* face or maturing face of Golgi apparatus releases the vesicles containing processed and packaged protein to its target location, either inside or outside of the cell.

116. Answer (1)

Hint: Kinetochore is a disc shaped structure at the primary constriction.

Sol.: Satellite – A part of chromosome beyond the non-staining secondary constriction.

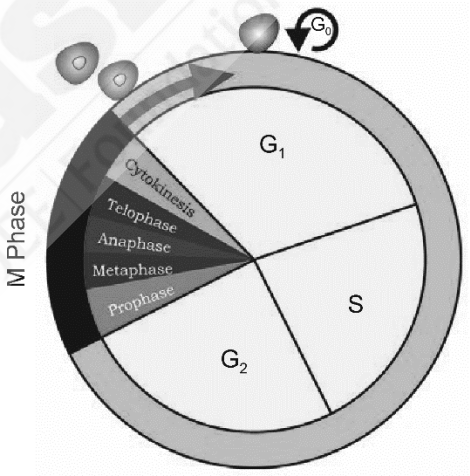
Chromatin – Composed of DNA + histone proteins + non histone proteins + RNA

Centromere – Appears as a narrow region, called primary constriction of chromosome.

117. Answer (4)

Hint: G_1 phase is the post mitotic stage of cell cycle.

Sol.: Cell cycle is as follows:



118. Answer (1)

Hint: Most active stage of the cell cycle is interphase.

Sol.: Interphase is long, non-dividing, growing phase of the cell cycle.

119. Answer (2)

Hint: G_1 phase corresponds to the interval between mitosis and initiation of DNA replication.

Sol.: Chromosome duplication occurs during the S phase of cell cycle in eukaryotes.

120. Answer (4)

Hint: It follows the G_2 phase of interphase.

Sol.: Prophase is the first stage of karyokinesis.

121. Answer (4)

Hint: Syncytium stage is seen in liquid endosperm of coconut.

Sol.: In some organisms, karyokinesis is not followed by cytokinesis, as a result of which, multinucleate condition arises, leading to the formation of syncytium.

122. Answer (3)

Hint: It is the second phase of mitosis called, metaphase.

Sol.: The sister chromatids reach to their respective poles during anaphase.

123. Answer (2)

Hint: Centrosome begins to move towards the opposite poles during prophase.

Sol.: The initiation of condensation of chromosomal material occurs during prophase.

124. Answer (3)

Hint: Most of the cell organelles duplicate during the first phase of interphase.

Sol.: S or synthesis phase marks the period during which DNA synthesis or replication takes place. However, there is no increase in the chromosome number.

125. Answer (1)

Hint: Crossing over occurs during the pachytene stage.

Sol.: Crossing over occurs between non-sister chromatids of homologous chromosomes during pachytene, a sub-stage of prophase I which introduces new combinations of traits among the gametes of an organism.

126. Answer (4)

Hint: Telophase I is characterised by formation of nuclear membrane around chromosomal dyads and nucleolus.

Sol.: The correct sequence of the events during meiosis is as follows:

$$\underset{(c)}{\text{Diakinesis}} \longrightarrow \underset{(e)}{\text{Metaphase I}} \longrightarrow \underset{(d)}{\text{Anaphase I}} \longrightarrow \text{Telophase I}$$

$$\longrightarrow \underset{(b)}{\text{Interkinesis}} \longrightarrow \text{Prophase II} \longrightarrow \text{Metaphase II} \longrightarrow$$

$$\text{Anaphase II} \longrightarrow \underset{(a)}{\text{Telophase II}}$$

127. Answer (3)

Hint: Tetrad is formed during the zygotene stage.

Sol.: Tetrad is clearly appear during the pachytene stage.

128. Answer (3)

Hint: The given diagram shows that spindle fibres are attached to the chromosomes.

Sol.: The given figure represents the transition to metaphase where chromosomes move to the spindle equator.

129. Answer (4)

Hint: It occurs during the fourth sub-stage of prophase I.

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

130. Answer (4)

Hint: Mitosis helps in cell repair.

Sol.: The cells of the upper layer of the epidermis and the cells of the lining of gut get constantly replaced by mitosis.

131. Answer (2)

Hint: Diakinesis represents the transition to metaphase.

Sol.: Zygotene – Chromosomes start pairing together and this process leads to the formation of bivalent.

Pachytene – Recombinase enzyme is involved during this stage and recombination is completed by the end of this stage.

Leptotene – Chromosomes gradually become visible under the light microscope.

132. Answer (4)

Hint: Diplotene can last for months or years in the oocytes of some vertebrates.

Sol.: Diplotene stage of oocytes that last for months or years in some vertebrates is also called dictyotene stage.

133. Answer (2)

Hint: The number of chromosomes becomes half in the daughter cell during meiosis.

Sol.: The reduction in the number of chromosomes in daughter cells occurs after anaphase I.

134. Answer (2)

Sol.: Prophase I is typically longer and more complex when compared to the prophase of meiosis II.

135. Answer (2)

Hint: Cell furrow formation occurs in animal cells.

Sol.: Cytokinesis is the division of cytoplasm. During cytokinesis, the furrow in the plasma membrane deepens and moves centripetally dividing the cytoplasm.

[ZOOLOGY]

136. Answer (3)

Hint: Identify a multicellular organism.

Sol.: In unicellular organisms, all functions like digestion, respiration and reproduction are performed by a single cell. In the complex body of multicellular organisms, the same 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 thousands.

137. Answer (4)

Hint: Present in the air sacs of lungs

Sol.: The simple 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.

The epithelial cells are compactly packed with little intercellular matrix.

138. Answer (3)

Hint: Dense irregular connective tissue

Sol.: Dense irregular connective tissue has fibroblasts and many fibres (mostly collagen) that are oriented differently. This tissue is present in the skin. Tendons, which attach skeletal muscles to bones, and ligaments which attach one bone to another are examples of dense regular connective tissue.

Blood is the main circulating fluid of the body.

139. Answer (1)

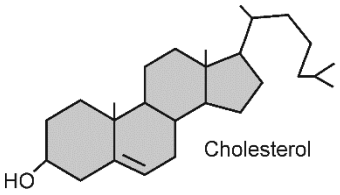
Hint: Compound epithelium

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

140. Answer (2)

Hint: Falls under the category of lipids

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 does not possess heterocyclic ring.



141. Answer (2)

Hint: Exclude toxins

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

142. Answer (1)

Hint: % of proteins

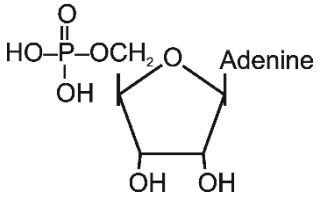
Sol.:

Component	% of the total cellular mass
Water	70-90
Proteins	10-15
Carbohydrates	3
Lipids	2
Nucleic acids	5-7
Ions	1

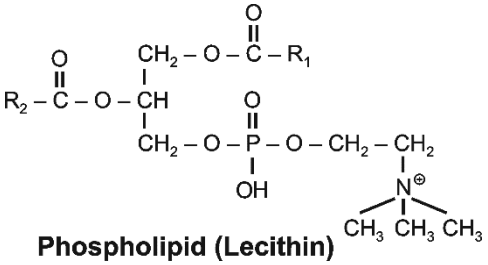
143. Answer (4)

Hint: Ribose and deoxyribose

Sol.:



Adenylic acid



Phospholipid (Lecithin)

144. Answer (2)

Hint: Ciliated epithelium

Sol.: If the columnar or cuboidal cells bear cilia on their free surface, they are called ciliated epithelium. Their function is to move particles or mucus in a specific direction over the epithelium. They are mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes.

145. Answer (3)

Hint: Protein chain contains amino acids.

Sol.: In a peptide chain, the first amino acid is called the N-terminal amino acid while the last amino acid is called the C-terminal amino acid. Thus, proline represents the N-terminal while glycine represents the C-terminal.

In a polysaccharide chain, the right end is called the reducing end and the left end is called the non-reducing end.

146. Answer (3)

Hint: Also present in the tip of nose

Sol.: The intercellular 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 present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adults.

Osteocytes are bone cells.

Lamellae are the characteristics of bones.

147. Answer (2)

Hint: Large and irregular masses of ribosomes and RER

Sol.: Neurons, the structural and functional unit of neural system, are excitable cells. The neuroglial cells which constitute the rest of the neural system protect and support neurons.

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

Tendons and ligaments are dense regular connective tissues.

148. Answer (2)

Hint: Areolar tissue

Sol.: Areolar tissue serves as a support framework for epithelium. In dense regular connective tissues, orientation of fibres show a regular pattern.

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

149. Answer (4)

Hint: Features of smooth muscle fibres

Sol.: The smooth muscle fibres taper at both ends (fusiform) and do not show striations. Cell junctions hold them together and they are bundled together in a connective tissue sheath. The wall of internal organs such as the blood vessels, stomach and intestine contains this type of muscle tissue.

150. Answer (4)

Hint: True for connective tissue

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

Each cell of the body is not regulated by the nervous system.

151. Answer (3)

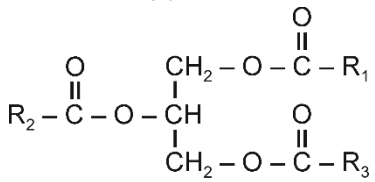
Hint: Competitive inhibitor resembles the substrate in structure

Sol.: Inhibition of succinic dehydrogenase by oxaloacetate/malonate which closely resembles the substrate succinate in structure is an example of competitive inhibition.

152. Answer (3)

Hint: Triglycerides have 3 fatty acid residues.

Sol.: Many lipids have both glycerol and fatty acids. The fatty acids are found esterified with glycerol. They can be monoglycerides, diglycerides and triglycerides.



Triglyceride

153. Answer (1)

Hint: Carbonic anhydrase

Sol.: The E.C. number of carbonic anhydrase is 4.2.1.1. Class IV enzymes are known as lyases which catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

Ligases catalyse the linking together of 2 compounds.

154. Answer (3)

Hint: Insulin and trypsin are proteins.

Sol.: Tyrosine is an aromatic amino acid as it possesses cyclic structure with a side chain. It is a neutral amino acid.

Protein is a polymer of amino acids. There are 20 types of amino acids which occur in proteins.

155. Answer (3)

Hint: Peptide bond formation

Sol.: GLUT-4 is a transporter protein. In a polypeptide or a protein, amino acids are linked by a peptide bond which is formed when the carboxyl (–COOH) group of one amino acid reacts with the amino group of the next amino acid with the elimination of a water moiety (the process is called dehydration).

156. Answer (4)

Hint: Blood is a fluid connective tissue.

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.

Areolar tissue contains fibroblasts, macrophages and mast cells.

157. Answer (2)

Hint: Cellulose is a polysaccharide.

Sol.: Collagen is the most abundant protein in the animal world while RuBisCO is the most abundant protein in the whole of the biosphere.

158. Answer (2)

Hint: Property of epithelial tissue.

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.

Goblet cell of the alimentary canal is an example of unicellular gland while salivary gland is an example of multicellular gland.

159. Answer (3)

Hint: Exclude the bond present in DNA

Sol.: A protein thread does not exist throughout as an extended rigid rod. The thread is folded in the form of helix. Only some portions of the protein thread are arranged in the form of a helix. In proteins, only right handed helices are observed. Other regions of the protein thread are folded into forms in what is called the secondary structure.

They have intramolecular hydrogen bonding.

160. Answer (1)

Hint: Include proteins

Sol.: Collagen is the most abundant protein in the animal world while RuBisCO is the most abundant protein in whole of the biosphere. Trypsin is a protein digesting enzyme.

Glycogen and inulin are polysaccharides.

161. Answer (4)

Hint: Identify a heterocyclic compound.

Sol.: Exoskeleton of arthropods have a complex polysaccharide called chitin whose monomeric unit is N-acetyl glucosamine.

Starch is a homopolysaccharide and can hold I_2 molecules in the helical portion.

Cellulose is also a homopolysaccharide which is present in plant cell wall.

162. Answer (3)

Hint: Ligases

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

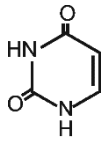
Class IV : **Lyases** : Enzymes that catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

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

163. Answer (2)

Hint: Presence of 2 H-bonds

Sol.:



Uracil

Three hydrogen bonds are present between guanine and cytosine while two hydrogen bonds are present between adenine and thymine.

164. Answer (4)

Hint: Tissue for co-ordination and control

Sol.: The bone marrow in some bones is the site of production of blood cells.

Arrival of the disturbance at the neuron's endings trigger events that may cause stimulation or inhibition of adjacent neurons and other cells. Muscle fibres shorten in response to stimulation and then lengthen to their uncontracted state.

165. Answer (3)

Hint: Property of zwitterion

Sol.: Lysine is a basic amino acid while valine is a neutral amino acid.

Basic amino acids have an additional amino group. Neutral amino acids have equal number of amino group and carboxyl group.

166. Answer (2)

Hint: 'P' are neuroglial cells.

Sol.: Neuroglial cells make up more than one-half the volume of the neural tissue in our body. Neuroglial cells protect and support neurons. Neurons are the excitable cells of neural tissue.

167. Answer (3)

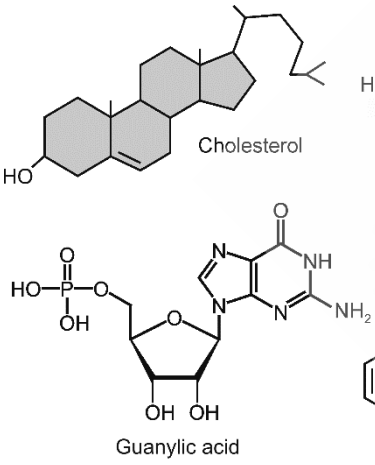
Hint: Present in loose connective tissue

Sol.: Blood is the main circulating fluid that helps in the transport of various substances. It contains plasma, RBCs, WBCs and platelets.

168. Answer (2)

Hint: Nitrogenous bases have heterocyclic rings.

Sol.:



169. Answer (4)

Hint: Possess osteocytes

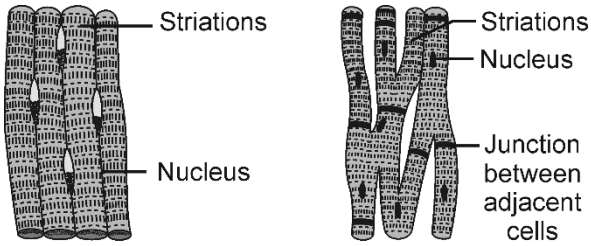
Sol.: The matrix of cartilage is solid, pliable and resists compression. Cartilage is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adult. Epiglottis is a cartilaginous flap that covers glottis.

Larynx is a cartilaginous box that helps in sound production. Fibrous joint is present between cranial bones.

170. Answer (4)

Hint: Human heart is myogenic

Sol.:



Skeletal muscle fibres Cardiac muscle fibres

171. Answer (1)

Hint: Collagen or elastin fibres

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

172. Answer (3)

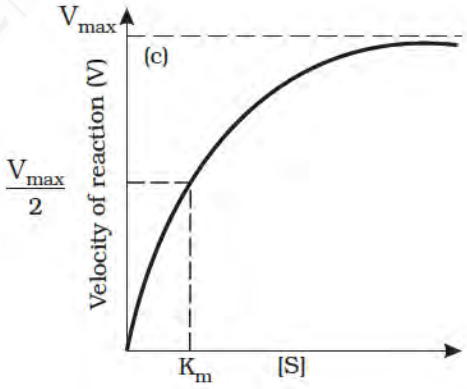
Hint: Both are examples of dense regular connective tissues.

Sol.: In dense regular connective tissues, the collagen fibres are present in rows between many parallel bundles of fibres. Tendons, which attach skeletal muscles to bones and ligaments which attach one bone to another are examples of this tissue.

173. Answer (3)

Hint: For non-competitive inhibition, K_m remains the same.

Sol.:



174. Answer (4)

Hint: Prosthetic group

Sol.: Prosthetic groups are organic compounds and are distinguished from other co-factors in that they are tightly bound to the apoenzyme. For example, in peroxidase and catalase, haem is the prosthetic group.

The association of co-enzyme with the apoenzyme is only transient, usually occurring during the course of catalysis.

175. Answer (1)

Hint: Aspartic acid is an acidic amino acid.

Sol.: Palmitic acid – Saturated fatty acid without C = C double bonds

Arachidonic acid – Unsaturated fatty acid with C = C double bonds

Aspartic acid – Acidic amino acid

Acetic acid – Precursor of cholesterol

176. Answer (2)

Hint: Enzymes get inactivated at temperature below optimum temperature

Sol.: Enzyme catalysts differ from inorganic catalysts in many ways, but one major difference needs mention. Inorganic catalysts work efficiently at high temperatures and high pressures, while enzymes get damaged at high temperatures.

177. Answer (3)

Hint: Monomeric unit of glycogen is glucose.

Sol.: Glycogen is a polysaccharide, present as the store house of energy in animal tissues.

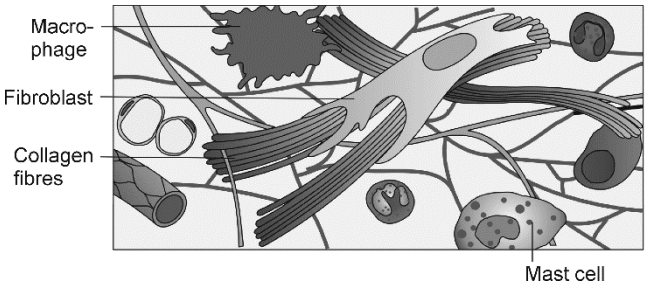
Glucagon is a hyperglycemic proteinaceous hormone.

Proteins possess right handed helices.

178. Answer (2)

Hint: Produce histamine and serotonin

Sol.:



179. Answer (4)

Hint: Communication junction

Sol.: Tight junctions help to stop substances from leaking across a tissue. Adhering junctions perform cementing to keep neighbouring cells together. Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells for rapid transfer of ions, small molecules and sometimes big molecules.

180. Answer (3)

Hint: Lipids

Sol.:

Component	% of the total cellular mass
Water	70-90
Proteins	10-15
Carbohydrates	3
Lipids	2
Nucleic acids	5-7
Ions	1

❑ ❑ ❑

All India Aakash Test Series for NEET - 2026

TEST - I (Code-F)

Click here for Code-E Sol.

Test Date : 02/11/2025

ANSWERS

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

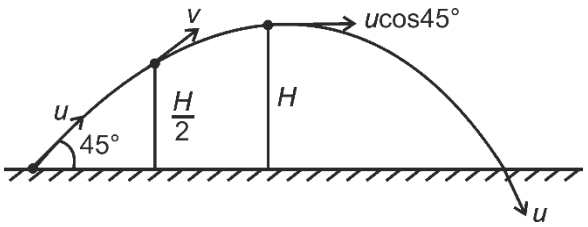
HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Use the concept of projectile motion.

Sol.: For maximum range, $\theta = 45°$



Speed at the maximum height = $u\cos45° = \frac{u}{\sqrt{2}}$

Speed at half the maximum height :

$$u_x = u_y = \frac{u}{\sqrt{2}}, H = \frac{u_y^2}{2g} = \frac{u^2}{4g}$$

$$2a_y y = v_y^2 - u_y^2$$

$$2 \times (-g) \times \frac{H}{2} = v_y^2 - \left(\frac{u}{\sqrt{2}}\right)^2$$

$$-g \times \frac{u^2}{4g} = v_y^2 - \frac{u^2}{2} \Rightarrow v_y^2 = \frac{u^2}{4}$$

$$v_y = \frac{u}{2}$$

Speed = $\sqrt{v_x^2 + v_y^2} = \sqrt{\left(\frac{u}{\sqrt{2}}\right)^2 + \left(\frac{u}{2}\right)^2} = \sqrt{\frac{u^2}{2} + \frac{u^2}{4}}$

Speed = $\frac{u\sqrt{3}}{2}$

Magnitude of change in velocity when it returns to the ground:

$$\overrightarrow{\Delta v} = \vec{v}_f - \vec{v}_i = \left(\frac{u}{\sqrt{2}}\hat{i} - \frac{u}{\sqrt{2}}\hat{j}\right) - \left(\frac{u}{\sqrt{2}}\hat{i} + \frac{u}{\sqrt{2}}\hat{j}\right)$$

$$\overrightarrow{\Delta v} = -2\frac{u}{\sqrt{2}}\hat{j} = -\sqrt{2}u\hat{j}$$

$$|\overrightarrow{\Delta v}| = \sqrt{2}u$$

Average velocity till it reaches the ground:

$$< v > = \frac{\text{Displacement}}{\text{Time}} = \frac{R}{T}$$

$$< v > = \frac{\frac{u^2 \sin 2\theta}{g}}{\frac{2u\sin\theta}{g}} = u\cos\theta$$

$$< v > = \frac{u}{\sqrt{2}}$$

2. Answer (4)

Hint: Use formula $\int dv = \int a dt$

Sol.: $\int_u^v dv = \int_0^t a dt$

$$v - u = \int_0^t a t dt$$

$$v - u = \frac{at^2}{2} \Rightarrow v = u + \frac{at^2}{2}$$

3. Answer (2)

Hint: Use formula $v = \sqrt{v_x^2 + v_y^2}$

Sol.: Velocity of ball after t = 2 s in horizontal direction:

$v_x = u_x + a_x t \Rightarrow v_x = 0 + 3 \times 2 = 6$ m/s

After t = 2 s, v_x remains constant

Velocity of ball at t = 4 s in vertical direction:

$v_y = u_y + a_y t \Rightarrow v_y = 0 + (-10) \times (4 - 2) = -20$ m/s

Speed $v = \sqrt{v_x^2 + v_y^2} = \sqrt{6^2 + 20^2}$

$v = \sqrt{436}$ m/s

4. Answer (1)

Hint & Sol.: Plane angle has no dimension but it has unit equal to radian.

5. Answer (4)

Hint: Reading = MSR + (LC × CSR)

Sol.: Least Count (LC) = $\frac{\text{Pitch}}{\text{Number of divisions}}$

LC = $\frac{1\text{mm}}{100} = 0.01\text{mm}$

Reading = MSR + (LC × CSR)

= 1 mm + (0.01 × 57) mm

= 1.57 mm

6. Answer (2)

Hint: Average acceleration, $\langle \vec{a} \rangle = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$

Sol.: $\langle \vec{a} \rangle = \frac{\left(5\cos 37^\circ \hat{i} - 5\sin 37^\circ \hat{j}\right) - \left(5\hat{i}\right)}{2}$

$= \frac{\left(4\hat{i} - 3\hat{j}\right) - \left(5\hat{i}\right)}{2}$

$= \frac{-\hat{i} - 3\hat{j}}{2}$

$|\langle \vec{a} \rangle| = \frac{1}{2}\sqrt{1+9} = \sqrt{\frac{5}{2}}\ \text{m s}^{-2}$

7. Answer (1)

Hint & Sol.: $Q = \frac{A^2}{B} \Rightarrow B = \frac{A^2}{Q}$

$\frac{\Delta B}{B} = \frac{2\Delta A}{A} + \frac{\Delta Q}{Q}$

$\frac{\Delta B}{B} \times 100 = (2 \times 3) + 2 = 8\%$

8. Answer (3)

Hint: Velocity $v = \frac{dx}{dt} = \tan\theta$

Sol.: $\theta = 30^\circ \Rightarrow \tan 30^\circ = \frac{1}{\sqrt{3}}$

$v = \frac{dx}{dt} = \tan 30^\circ$

$\therefore\ v = \frac{1}{\sqrt{3}}$

9. Answer (2)

Hint & Sol. : Both distance travelled and displacement are non-zero and equal, since it does not turn.

10. Answer (3)

Hint & Sol.: Time of flight $T = \frac{2u\sin\theta}{g}$

$\therefore\ T \propto u$

Horizontal range $R = \frac{u^2 \sin 2\theta}{g}$

11. Answer (1)

Hint: Use formula $a_{\text{net}} = \sqrt{a_c^2 + a_t^2}$

Sol.: $|\vec{a}_t| = K, a_c = \frac{v^2}{r}$

$a_{\text{net}} = \sqrt{a_t^2 + a_c^2} = \sqrt{K^2 + \left(\frac{v^2}{r}\right)^2}$

12. Answer (4)

Hint & Sol.: In uniform circular motion, speed and kinetic energy remains constant.

13. Answer (3)

Hint: Maximum height $H = \frac{u^2 \sin^2\theta}{2g}$

Sol.: Since speed of both projectile is same

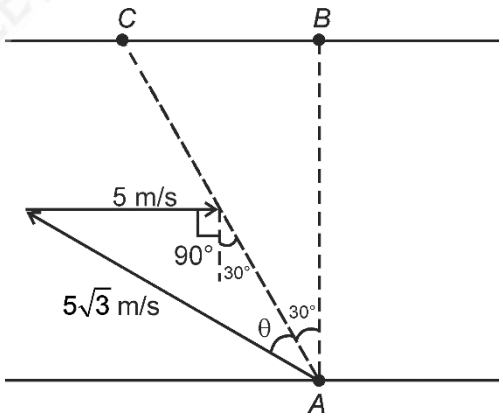
$\therefore\ H \propto \sin^2\theta$

$\frac{H_1}{H_2} = \frac{\sin^2 30^\circ}{\sin^2 60^\circ} = \frac{\left(\frac{1}{2}\right)^2}{\left(\frac{\sqrt{3}}{2}\right)^2} = \frac{1}{3}$

14. Answer (2)

Hint: Make proper figure and apply sine rule.

Sol.:



Apply sine rule :

$\frac{\sin(90^\circ + 30^\circ)}{5\sqrt{3}} = \frac{\sin\theta}{5}$

$\frac{\cos 30^\circ}{\sqrt{3}} = \sin\theta \Rightarrow \sin\theta = \frac{1}{2} \Rightarrow \theta = 30^\circ$

Angle with respect to the direction of flow = 90° + 30° + 30° = 150°

15. Answer (4)

Hint: Time of flight, $T = \sqrt{\frac{2h}{g}}$

Sol.: Time of flight of the bomb, $T = \sqrt{\frac{2 \times 490}{9.8}}$

T = 10 s

Displacement in x-direction = $v \times T$

$\Delta x = 49 \times 10 = 490$ m

Displacement = $\sqrt{(\Delta x)^2 + (\Delta y)^2}$

$\sqrt{(490)^2 + (490)^2} = 490\sqrt{2}$ m

16. Answer (1)

Hint: Use relative velocity concept

Sol.: Let speeds of the objects are v_1 and v_2 ($v_1 > v_2$)

When they are moving towards each other

$v_1 + v_2 = 6$ m/s ...(i)

When they are moving in same direction

$v_1 - v_2 = \frac{6}{10}$ m/s ...(ii)

After solving equation (i) and (ii), we get

$v_1 = 3.3$ m/s, $v_2 = 2.7$ m/s

17. Answer (3)

Hint: Change in velocity = Area under a-t graph

Sol.: $\Delta v = \int a dt$ = Area under a-t graph

For $v_f = v_i \Rightarrow \Delta v = 0$

$\therefore$ Area under a-t graph should be zero.

From graph, at t = 12 s upper and lower area would become equal in magnitude.

18. Answer (3)

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

Sol.: u = 108 km/h = $108 \times \frac{5}{18}$ = 30 m/s

$a = \frac{v-u}{t} = \frac{0-30}{10} = -3$ m/s^2

$s = ut + \frac{1}{2}at^2 \Rightarrow s = 30 \times 10 + \frac{1}{2}(-3) \times 10^2$

s = 150 m

19. Answer (2)

Hint & Sol.: Acceleration may cause speeding up or slowing down depending on its direction relative to velocity.

20. Answer (2)

Hint: Use formula $n_1u_1 = n_2u_2$ to solve the problem

Sol.: Dimension of moment of inertia = [ML^2]

$n_1u_1 = n_2u_2$

10 kg m^2 = n_2 (10 g) (5 cm)^2

10 kg m^2 = $n_2 \times 10 \times 10^{-3}$ kg $\times 25 \times 10^{-4}$ m^2

$10 = n_2 \times 25 \times 10^{-6}$

$n_2 = \frac{100 \times 10^5}{25} = 4 \times 10^5$

21. Answer (3)

Hint: Dimension of LHS = Dimension of RHS

Sol.: $[P] = [ML^{-1}T^{-2}]$

$[D] = [ML^{-3}]$

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

$\because T = kP^aD^bE^c$

$\therefore [T] = [ML^{-1}T^{-2}]^a [ML^{-3}]^b [ML^2T^{-2}]^c$

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

The solution to the system of equations is

$a = -\frac{5}{6}, \ b = \frac{1}{2}, \ c = \frac{1}{3}$

$\therefore a + b - c = \frac{-5}{6} + \frac{1}{2} - \frac{1}{3} = \frac{-5+3-2}{6} = \frac{-2}{3}$

22. Answer (1)

Hint: First find the mean value, then calculate mean absolute error.

Sol.: Mean value =

$\frac{1.54 + 1.56 + 1.53 + 1.55 + 1.57}{5} = 1.55$

Mean absolute error =

$$\frac{|1.54 - 1.55| + |1.56 - 1.55| + |1.53 - 1.55| + |1.55 - 1.55| + |1.57 - 1.55|}{5}$$

Mean absolute error = $\frac{0.06}{5} = 0.012 \approx 0.01$

23. Answer (2)

Hint: Use rules of significant figures

Sol.: The number 4.700 has four significant figures.

Changing unit does not change the number of significant figures.

24. Answer (3)
Hint & Sol.: If the digit to be dropped is 5 and the preceding digit is odd, it is increased by 1.

25. Answer (4)
Hint & Sol.: Dimensional correctness does not ensure physical correctness of an equation.

26. Answer (4)
Hint & Sol.: Net displacement is purely horizontal,
so average velocity = $\frac{\text{Total displacement}}{\text{Total time}}$
$\therefore$ Direction of average velocity is along horizontal.

27. Answer (2)
Hint: To find the total time of flight, use equation of vertical motion along *y*-axis.
Sol.: Given $h = -45$ m, $u_y = u\sin\theta = 30 \times \sin 30° = 15$ m/s

$$y = u_y t + \frac{1}{2}a_y \times t^2$$

$$-45 = 15t + \frac{1}{2}(-10) \times t^2$$

$$5t^2 - 15t - 45 = 0 \Rightarrow t^2 - 3t - 9 = 0$$

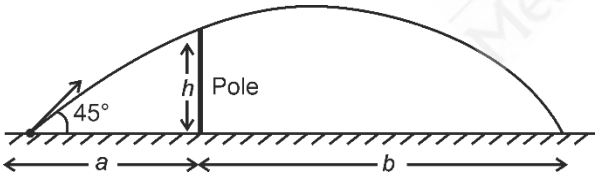
$$t = \frac{-(-3) \pm \sqrt{3^2 - 4 \times 1 \times (-9)}}{2 \times 1}$$

$$t = \frac{3 \pm \sqrt{45}}{2} \Rightarrow T = \frac{3 + \sqrt{45}}{2} \text{ second}$$

28. Answer (1)
Hint: Use equation of trajectory in the form:

$$y = x\tan\alpha\left(1 - \frac{x}{R}\right)$$

Sol.: Let height of pole be *h*



$$y = x\tan\alpha\left(1 - \frac{x}{R}\right)$$

$$h = a\tan 45°\left(1 - \frac{a}{a+b}\right)$$

$$h = \frac{ab}{a+b}$$

29. Answer (1)
Hint: Centripetal acceleration = $r\omega^2$
Sol.: Angular speed (ω) of seconds hand

$$\omega = \frac{\theta}{T} = \frac{2\pi}{60} = \frac{\pi}{30} \text{ rad/s}$$

$$a_c = r\omega^2 = \frac{5}{100} \times \left(\frac{\pi}{30}\right)^2 = \frac{5 \times 10}{100 \times 30 \times 30}$$

$$a_c = \frac{5}{9} \times 10^{-3} \text{ m/s}^2$$

30. Answer (3)
Hint & Sol.: For R_{max}, θ is 45°.

$$R = 4H\cot\theta \Rightarrow R_{max} = 4H\cot 45° \Rightarrow H = \frac{R_{max}}{4}$$

31. Answer (4)
Hint: To derive the equation of trajectory, eliminate time *t* from equation of *x* and *y* displacements.
Sol.: In *x*-direction:
$v_x = 4$ m/s = constant
$x = v_x t \Rightarrow x = 4t$ ...(i)
In *y*-direction:

$$v_y = \frac{5}{2}t \text{ m/s}$$

$$\frac{dy}{dt} = \frac{5}{2}t \Rightarrow \int_0^y dy = \int_0^t \frac{5}{2}t\,dt$$

$$y = \frac{5}{2}\frac{t^2}{2} \Rightarrow y = \frac{5}{4}t^2 \quad \text{...(ii)}$$

Eliminate time (*t*) from (i) and (ii):

$$y = \frac{5}{4} \times \left(\frac{x}{4}\right)^2 \Rightarrow y = \frac{5}{64}x^2$$

32. Answer (1)
Hint: Use the second equation of motion:

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

Sol.: $s = ut + \frac{1}{2}at^2$

$$h = 0 + \frac{1}{2} \times g \times t^2 \quad \text{...(i)}$$

Displacement of the body in $\frac{t}{3}$ seconds

$$y = \frac{1}{2} \times g \times \left(\frac{t}{3}\right)^2$$

$$y = \frac{1}{9} \times h = \frac{h}{9}$$

$\therefore$ Height from the ground = $h - \frac{h}{9} = \frac{8h}{9}$

33. Answer (4)

Hint: Apply equation $y = ut + \frac{1}{2}at^2$ for both the balls.

Sol.: For ball 1:

$$y_1 = -\frac{1}{2}gt^2 \qquad \ldots(i)$$

For ball 2:

$$y_2 = -v_0(t - t_0) - \frac{1}{2}g(t - t_0)^2 \qquad \ldots(ii)$$

When both the balls cross path, $y_1 = y_2$

$$\therefore \; -\frac{1}{2}gt^2 = -v_0(t - t_0) - \frac{1}{2}g(t - t_0)^2$$

After solving, we get

$$t = \left(\frac{2v_0 - gt_0}{v_0 - gt_0}\right)\frac{t_0}{2}$$

34. Answer (4)

Hint & Sol.: During retarding motion, angle between instantaneous velocity and acceleration is π.

35. Answer (2)

Hint & Sol.: Slope of displacement-time curve is decreasing continuously and becomes zero eventually. Since slope of displacement-time curve gives velocity, the behaviour of velocity would be same as slope.

36. Answer (2)

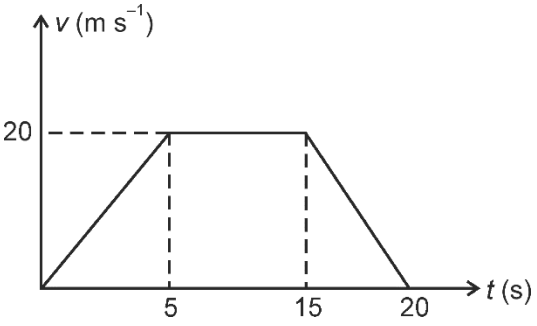
Hint: Average speed = $\frac{\text{Total distance}}{\text{Total time}}$

Sol.: $< v > = \frac{s}{t_1 + t_2} = \frac{\frac{s}{2} + \frac{s}{2}}{\frac{s}{2u} + \frac{s}{2v}} = \frac{2uv}{u + v}$

37. Answer (2)

Hint: Plot *v*-*t* graph and find area under *v*-*t* graph

Sol.:



Area under *v*-*t* graph = Displacement

Here distance travelled = displacement

$\therefore$ Distance = $\left(\frac{1}{2}\times 5\times 20\right) + (10\times 20) + \left(\frac{1}{2}\times 5\times 20\right)$

= 50 + 200 + 50

= 300 m

38. Answer (4)

Hint: $v = \frac{ds}{dt} \Rightarrow \int ds = \int v dt$

Sol.: Given $v = 6t - t^2$

$$\frac{ds}{dt} = 6t - t^2$$

$$\int_0^s ds = \int_0^t 6t dt - \int_0^t t^2 dt$$

$$s = \frac{6t^2}{2} - \frac{t^3}{3} = 0$$

$$3t^2 - \frac{t^3}{3} = 0 \Rightarrow t^2\left[3 - \frac{t}{3}\right] = 0$$

t = 9 second

39. Answer (1)

Hint: Use equation of uniformly accelerated motion.

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

$$2 \times a \times 6 = \left(\frac{u}{2}\right)^2 - u^2 \qquad \ldots(i)$$

$$2 \times a \times d = 0 - \left(\frac{u}{2}\right)^2 \qquad \ldots(ii)$$

By dividing equation (i) and (ii), we get

$$\frac{2\times a\times 6}{2\times a\times d} = \frac{-3u^2}{\frac{4}{-\frac{u^2}{4}}}$$

$$\frac{6}{d} = 3 \Rightarrow d = 2 \text{ cm}$$

40. Answer (3)

Hint & Sol.: Dimensional constants have dimensions and thus they have units.

41. Answer (3)

Hint: Rules of significant figures

Sol.: Leading zeroes are always insignificant. Trailing zeroes in a number with decimal are significant.

42. Answer (1)

Hint: Use principle of homogeneity.

Sol.: $[a] = [\alpha t^2] = [\beta t]$

$[\alpha t^2] = [\beta t] \Rightarrow \frac{\alpha t}{\beta}$ is dimensionless

43. Answer (2)

Hint: Length of rod L = MSR + (L.C.) × VSR

Sol.: L.C. = 1 MSD – 1 VSD

$$= 1 - \frac{18}{20}$$

$$= \frac{1}{10}\text{ mm}$$

$$L = 94 + \frac{1}{10} \times 4$$

= 94 + 0.4 = 94.4 mm

44. Answer (4)

Hint & Sol.: Angular momentum, $L = \frac{nh}{2\pi}$

$\therefore$ Unit of angular momentum (L) is same as Planck's constant.

$E = hf \Rightarrow h = \frac{E}{f}$

$\therefore$ Unit of $\frac{\text{Energy}}{\text{Frequency}}$ is same as Planck's constant.

45. Answer (3)

Hint: Use equation $\frac{dQ}{dt} = eA\sigma T^4$ to find the unit of Stefan's constant (σ)

Sol.: $\frac{dQ}{dt} = eA\sigma T^4$

$$\sigma = \left(\frac{dQ}{dt}\right)\left(\frac{1}{eAT^4}\right)$$

Unit of σ is $\frac{W}{m^2K^4}$

[CHEMISTRY]

46. Answer (3)

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

Sol.: • $\lambda = \frac{h}{mv}$;

Those species which have higher value of mass, have lower value of de Broglie wavelength.

- Angular momentum for hydrogen atom is given as $mvr = \frac{nh}{2\pi}$

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

  Angular momentum = $\frac{h}{\pi}$
- Paschen, Brackett and Pfund spectral lines for hydrogen atom lie in IR region.

47. Answer (3)

Hint: $\frac{1}{\lambda} = R_H Z^2\left[\frac{1}{n_L^2} - \frac{1}{n_H^2}\right]$

Sol.: R_H the first line for Balmer series

$n_1 = 2, n_2 = 3$

$$\frac{1}{\lambda_1} = R_H \times (1)^2\left[\frac{1}{4} - \frac{1}{9}\right]$$

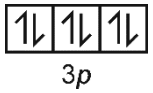
$$\frac{1}{\lambda_2} = R_H \times (1)^2\left[\frac{1}{4} - \frac{1}{25}\right]$$

$$\frac{\lambda_2}{x} = \frac{500}{21 \times 36}$$

$\lambda_2 = 0.66x$ nm

48. Answer (4)

Hint:



3*p*

Only three electrons have $+\frac{1}{2}$ and other three have $-\frac{1}{2}$ spin quantum number.

Sol.:

	Number of electrons
K^+	18
Ca^{2+}	18
S^{2-}	18

These are isoelectronic species

- Shape of orbital is determined by Azimuthal quantum number.

49. Answer (2)

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

Sol.: It follows only Pauli's exclusion principle. It violates Hund's rule of maximum multiplicity and Aufbau principle.

50. Answer (3)

Hint: When electromagnetic radiations are arranged in their increasing order of wavelength then the series is obtained called electromagnetic spectrum.

Sol.: The correct order of wavelength of electromagnetic radiations is Radio waves > Microwave > IR > UV

51. Answer (3)

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

$Cu \rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$

Sol.: Valence orbital of potassium is $4s^1$

$n = 4, l = 0, m_l = 0$ and $m_s = \pm\frac{1}{2}$

For Cu atom $(n + l) = 4 \begin{cases} \nearrow 4 + 0 \Rightarrow 4s \\ \searrow 3 + 1 \Rightarrow 3p \end{cases}$

So total number of electrons are 7 which have $(n + l) = 4$

52. Answer (1)

Hint: Isotones have same number of neutrons

Sol.: $\lambda = \frac{h}{mv}; \left(mvr = \frac{nh}{2\pi}\right)$

$$\lambda = \frac{h \times 2\pi r}{nh}$$

$$\lambda = \frac{2\pi r}{n}$$

$$= \frac{2\pi \times a_0 \times n^2}{Z \times n}$$

$$3\pi a_0 = 2\pi a_0 \times \frac{n}{Z}$$

$$\frac{n}{Z} = \frac{3}{2} \Rightarrow 1.5$$

Electronic configuration of Cu atom is

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

53. Answer (4)

Hint: The energy of an electron in a hydrogen atom is determined solely by the principal quantum number.

Sol.: Energy of $2s$ orbital of hydrogen atom is equal to the energy of $2p$ orbital of hydrogen atom.

54. Answer (4)

Hint: Value of $m_l = -l$ to $+l$ including zero $n > l$ always.

Sol.: For $n = 4$, $l = 4$ is not possible

55. Answer (3)

Hint: Spherical symmetric state means s orbital

Sol.: $P_1 = 1s$; $P_2 = 2s$

Number of radial nodes in $P_2 = 1$

$$\left(E_{He^+}\right)_2 = -13.6 \times \frac{4}{4} \Rightarrow -13.6 \text{ eV}$$

56. Answer (1)

Hint: Total number of radial nodes = $(n - l - 1)$

Sol.: For $4p \rightarrow 4 - 1 - 1 = 2$

For $5f \rightarrow 5 - 3 - 1 = 1$

For $3d \rightarrow 3 - 2 - 1 = 0$

For $4s \rightarrow 4 - 0 - 1 = 3$

57. Answer (2)

Hint: $(n + l)$ value increase, energy of orbitals also increases

If $(n + l)$ value same then n increases, energy of orbitals also increases.

Sol.:

	$(n + l)$ values
$4d \rightarrow$	6
$4p \rightarrow$	5
$5s \rightarrow$	5
$3d \rightarrow$	5

So, correct order is $4d > 5s > 4p > 3d$

58. Answer (3)

Hint: According to Heisenberg's uncertainty principle; $\Delta x \cdot m\Delta v = \frac{h}{4\pi}$

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

$$\Delta v = 80 \times \frac{5}{100}$$

$= 4\ ms^{-1}$

$$\Delta x = \frac{6.6 \times 10^{-34}}{4 \times 3.14 \times 6.6 \times 4} \times 1000$$

$= 2 \times 10^{-33}$ m

59. Answer (3)

Hint: For Paschen series $n_1 = 3$

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

Sol.: • $158.7 = 52.9 \times \frac{n^2}{3}$

$n = 3$

It belongs to Paschen series

• Total number of spectral lines = $\frac{4 \times 5}{2} = 10$

60. Answer (2)

Hint: $E = nh\nu$

$E = \frac{nhc}{\lambda}$

Sol.: Energy = P × time

= 30 J

$30 = \frac{n \times 6.626 \times 10^{-34} \times 3 \times 10^8}{666 \times 10^{-9}}$

$n = \frac{666 \times 10^{-9} \times 30}{6.626 \times 10^{-34} \times 3 \times 10^8}$

$n = 10.05 \times 10^{19}$

61. Answer (1)

Hint: $E = w_0 + KE$

$h\nu = h\nu_0 + KE$

Sol.: $KE = \frac{hc}{\lambda} - h\nu_0$

$= \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{100 \times 10^{-9}} - 4.4 \times 10^{-19}$

$= 19.8 \times 10^{-19} - 4.4 \times 10^{-19}$

$= 10^{-19}(19.8 - 4.4)$

$= 15.4 \times 10^{-19}$ J

62. Answer (1)

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

Sol.:

Metal	W_0/eV
Li	2.42
Na	2.3

63. Answer (2)

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

Sol.: $r_H = a_0 \times \frac{(1)^2}{(1)}$ ...(1)

$r_{He^+} = a_0 \times \frac{4}{2}$ ...(2)

$\frac{r_H}{r_{He^+}} = \frac{a_0}{a_0 \times 2}$

$\frac{r_H}{r_{He^+}} = \frac{1}{2}$

64. Answer (4)

Hint: K.E. = $\frac{1}{2}mv^2$

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

$r = a_0 \times \frac{n^2}{z}$

Sol.: K.E. = $\frac{1}{2}mv^2$ ...(1)

$v = \frac{nh}{2\pi mr}$ ...(2)

$r = a_0 \times \frac{n^2}{z}$ ...(3)

Putting the value of r in eq (2)

$v = \frac{nh \times z}{2\pi m a_0 \times n^2}$ ...(4)

Putting the value of v in eq (1)

$K.E. = \frac{1}{2}m\left(\frac{nhz}{2\pi m a_0 n^2}\right)^2$

$= \frac{1}{2}\frac{h^2z^2}{4\pi^2 m^2 a_0^2 n^2} \quad \begin{pmatrix} z = 3 \\ n = 3 \end{pmatrix}$

$= \frac{h^2}{8\pi^2 m a_0^2}$

65. Answer (1)

Hint: $\Delta E = E_4 - E_3$

$$\Delta E = \frac{hc}{\lambda} = hc\bar{\nu}$$

Sol.: $\Delta E = -1.36 \times 10^{-12} - (-2.41 \times 10^{-12})$

$= 1.05 \times 10^{-12}$

$$\Delta E = hc\bar{\nu}$$

$$\bar{\nu} = \frac{1.05 \times 10^{-12}}{6.6 \times 10^{-27} \times 3 \times 10^{10}}$$

$= 5.3 \times 10^3\ cm^{-1}$

66. Answer (3)

Hint: Mass of electron is $\frac{1}{1837}^{th}$ mass of proton.

Sol.: $\left(\frac{e}{m}\right)_e = \frac{1}{1} \times 1837$

$$\left(\frac{e}{m}\right)_p = \frac{1}{1}$$

So $\left(\frac{e}{m}\right)_e > \left(\frac{e}{m}\right)_p$

- Higher the value of $\frac{e}{m}$, higher is the deflection.

$$\left(\frac{e}{m}\right)_\beta > \left(\frac{e}{m}\right)_\alpha$$

- Radius of atom = 10^{-10} m
- Radius of nucleus = 10^{-15} m

Ratio = $\frac{10^{-10}}{10^{-15}} \Rightarrow 10^5$

67. Answer (4)

Hint: $M_1V_1 + M_2V_2 = M_3V_3$

Sol.: $20 \times 1 + 200 \times 0.25 = 220 \times M$

$20 + 50 = 220\ M$

$M = \frac{70}{220}$

$= 0.32\ M$

68. Answer (4)

Hint: $\%\ \text{purity} = \frac{\text{Mass pure } CaCO_3}{\text{Mass of impure } CaCO_3} \times 100$

Sol.: $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

56 g CaO = 100 g $CaCO_3$

11.2 g CaO = $\frac{100}{56}$ × 11.2 g of $CaCO_3$

= 20 g $CaCO_3$

$\%\ \text{Purity} = \frac{20}{40} \times 100$

= 50%

69. Answer (3)

Hint: N_2 is limiting reagent

Sol.: $\underset{\frac{1}{2}\text{mol}}{N_2(g)} + \underset{1\text{mol}}{O_2(g)} \longrightarrow 2NO(g)$

1 mol $N_2(g)$ = 2 mol NO(g)

$\frac{1}{2}$ mol $N_2(g) = \frac{2}{1} \times \frac{1}{2} \Rightarrow$ 1 mol NO(g)

2 mol NO(g) = 2 mol $NO_2(g)$

1 mol NO(g) = 1 mol $NO_2(g)$

Weight of $NO_2(g)$ = 1 × 46

= 46 g

70. Answer (2)

Hint: $\underset{1L}{CO_2(g)} + \underset{(1-x)L}{C(s)} \longrightarrow \underset{2xL}{2CO(g)}$

Sol.: $\underset{1L}{CO_2(g)} + \underset{(1-x)L}{C(s)} \longrightarrow \underset{2xL}{2CO(g)}$

Total volume $\Rightarrow$ 1 – x + 2x = 1.2

1 + x = 1.2

x = 0.2 L

Volume of $CO_2(g)$ = 1 – 0.2 = 0.8 L

Volume of CO(g) = 2 × 0.2 = 0.4 L

71. Answer (4)

Hint: Hydrated barium chloride means ($BaCl_2 \cdot xH_2O$)

Sol.: Weigh of water = 122 – 104

= 18 g

Mole of water = $\frac{18}{18} \Rightarrow$ 1 mol

Mole of $BaCl_2 = \frac{104}{208} \Rightarrow \frac{1}{2}$ mol

$\frac{1}{2}$ mol $BaCl_2$ combine with $\rightarrow$ 1 mol H_2O

1 mol $BaCl_2$ combine with $\rightarrow \frac{1}{1} \times 2 \Rightarrow$ 2 mol H_2O

Formula is $\Rightarrow$ $BaCl_2 \cdot 2H_2O$

Molar mass of $BaCl_2 \cdot 2H_2O$ is $\Rightarrow$ 137 + 35.5 × 2 + 2 × 18

= 244 g mol^{-1}

72. Answer (3)

Hint: $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

Number of g. eq. of $CaCO_3$ = Number of g. eq. of HCl

Sol.: 2 millimole of HCl = 1 mmol of $CaCO_3$

50 × 0.25 mmol of HCl = $\frac{1}{2}$ × 50 × 0.25 mm of $CaCO_3$

$\Rightarrow$ 6.25 mmol of $CaCO_3$

Weight of $CaCO_3$ = $\frac{6.25}{1000} \times 100$

= 0.625 g

73. Answer (1)

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

Molality $(m) = \frac{\text{Number of moles of solute}}{\text{Weight of solvent (in kg)}}$

Sol.: $M = \frac{30 \times 1000}{60 \times 100} \Rightarrow 5\ M$

$m = \frac{30 \times 1000}{60 \times 70} \Rightarrow 7.14\ m$

74. Answer (4)

Hint: Total number of electrons = $\frac{\text{Weight of substance}}{\text{Molar mass of substance}} \times N_A \times$ Number of e^- in one molecule

Sol.: 4 g CH_4 contains; $\frac{4}{16} = \frac{x}{10 \times N_A}$

$x = 2.5\ N_A\ e^-$

2 g SO_2 contains; $\frac{2}{64} = \frac{x}{32\ N_A}$

$x = N_A\ e^-$

4 g CO_2 contains; $\frac{4}{44} = \frac{x}{22\ N_A}$

$x = 2\ N_A\ e^-$

8 g NO_2 contains; $\frac{8}{46} = \frac{x}{23\ N_A}$

$x = 4\ N_A\ e^-$

75. Answer (3)

Hint: $\Delta E = \frac{hc}{\lambda} = hc\bar{\nu}$

$\bar{\nu} = R_H Z^2 \left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$

Sol.: $\bar{\nu}_1 = R_H Z^2 \left[\frac{1}{4} - \frac{1}{9}\right]$

$\bar{\nu}_2 = R_H Z^2 \left[\frac{1}{25} - \frac{1}{36}\right]$

$\frac{\bar{\nu}_1}{\bar{\nu}_2} = \frac{\frac{5}{36}}{\frac{11}{25 \times 36}}$

$\frac{\bar{\nu}_1}{\bar{\nu}_2} = \frac{125}{11}$

76. Answer (1)

Hint: Moles of solute = $\frac{\text{Weight of solute}}{\text{Molar mass of solute}}$

Sol.: $2 = \frac{24 \times 10^{-3}}{(MM)_{PQ}}$

$(MM)_{PQ} = 12 \times 10^{-3} \Rightarrow 0.012$ kg

$4 = \frac{56 \times 10^{-3}}{(MM)_{PQ_2}}$

$(MM)_{PQ_2} = 14 \times 10^{-3} \Rightarrow 0.014$ kg

P + Q = 0.012 ...(1)

P + 2Q = 0.014 ...(2)

Q = 0.002

Molar mass of Q = 0.002 kg mol^{-1}

$\Rightarrow 2 \times 10^{-3}$ kg mol^{-1}

P + 0.002 = 0.012

Molar mass of P $\Rightarrow 1 \times 10^{-2}$ kg mol^{-1}

77. Answer (1)

Hint: Equivalents of $H_2C_2O_4 \cdot 2H_2O$ = Equivalents of NaOH

Sol.: Molarity of $H_2C_2O_4 \cdot 2H_2O = \frac{12.6 \times 1000}{126 \times 1000}$

= 0.1 M

Normality of $H_2C_2O_4 \cdot 2H_2O$ = 0.2

0.2 × 10 = 0.1 × V

V = 20 mL

$$\frac{\frac{(W)_{N_2}}{(MM)_{N_2}}}{\frac{(W)_{O_2}}{(MM)_{O_2}}} = \frac{(n)_{N_2}}{(n)_{O_2}}$$

$$\frac{(n)_{N_2}}{(n)_{O_2}} = \frac{\frac{1}{28}}{\frac{2}{32}} \Rightarrow \frac{16}{28} \Rightarrow \frac{4}{7}$$

78. Answer (3)

Hint:

$$\underset{40\ mmol}{3BaCl_2} + \underset{50\ mmol}{2Na_3PO_4} \longrightarrow Ba_3(PO_4)_2 + 6NaCl$$

$BaCl_2$ is limiting reagent.

Sol.: 3 millimole of $BaCl_2$ = 1 mmol of $Ba_3(PO_4)_2$

40 millimole of $BaCl_2 = \frac{1}{3} \times 40$

= 13.33 mmol of $Ba_3(PO_4)_2$

Weight of $Ba_3(PO_4)_2 = 601 \times \frac{13.33}{1000}$

= 8.01 g

79. Answer (2)

Hint: $Zn + 4HNO_3 \rightarrow Zn(NO_3)_2 + 2H_2O + 2NO_2(g)$

Sol.: 1 mol Zn produce = 2 mol $NO_2(g)$

= 44.8 L $NO_2(g)$

44800 mL NO_2 produced from = 65 g of zinc

448 mL NO_2 produced from = $\frac{65}{44800} \times 448$

= 0.65 g of Zn

80. Answer (3)

Hint: O_2 is limiting reagent

Sol.: $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

Mole 2 2

$\frac{2}{4}$ $\frac{2}{5}$

So, O_2 is limiting reagent

5 mole of $O_2(g)$ produce $\rightarrow$ 4 mole of NO(g)

2 mole of $O_2(g)$ produce $\rightarrow \frac{4}{5} \times 2 = \frac{8}{5}$ = 1.6 mol of NO(g)

5 mole of $O_2(g)$ produce $\rightarrow$ 6 mole of $H_2O(g)$

2 mole of $O_2(g)$ produce $\rightarrow \frac{6}{5} \times 2$ = 2.4 mole of $H_2O(g)$

81. Answer (3)

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

Sol.:

	% of element	Mole	Simplest ratio
C	37.5%	$\frac{37.5}{12} = 3.125$	1
H	12.5%	$\frac{12.5}{1} = 12.5$	4
O	50%	$\frac{50}{16} = 3.125$	1

The correct empirical formula is CH_4O

82. Answer (1)

Hint: Number of gm equivalent of metal = Number of gm equivalent of oxygen

Sol.: $\frac{\text{Weight of metal}}{\text{EW of metal}} = \frac{\text{Weight of oxygen}}{\text{EW of oxygen}}$

$$\frac{68}{x} = \frac{32}{8}$$

x = 17

83. Answer (4)

Hint: 1 mole SO_2Cl_2 produces 4 moles of H^+ ions

20 moles of OH^- = 20 mole of H^+

Sol.: 4 mole H^+ produced = 1 mole SO_2Cl_2

20 mole H^+ produced = $\frac{1}{4} \times 20$

= 5 moles SO_2Cl_2

84. Answer (2)

Hint: $Na_2O + H_2O \rightarrow 2NaOH + H_2$

Sol.: Mass of $Na_2O = \frac{1.55}{62}$

= 0.025 mol

1 mol of Na_2O gives $\rightarrow$ 2 mol of NaOH

0.025 mol of Na_2O gives $\rightarrow$ 0.05 mol of NaOH

Molarity (M) = $\frac{0.05}{250} \times 1000$

= 0.2 M

85. Answer (3)

Hint: In protein A, at least one alanine should be present

Sol.: $\frac{0.2}{100} = \frac{1 \times 89}{x}$

$x = \frac{85 \times 100}{0.2}$

= 4.45×10^4 g/mol

86. Answer (2)

Hint: $B_2H_6 + 3O_2 \rightarrow B_2O_3 + 3H_2O$

Sol.: 1 mol B_2H_6 requires = 3 moles of O_2

28 g $B_2H_6 \rightarrow$ 96 g O_2

1 g $B_2H_6 \rightarrow \frac{96}{28}$ g O_2

= 3.42 g O_2

87. Answer (1)

Hint: The SI system allows the use of prefixes to indicate the multiplies or submultiples of a unit.

Sol.: SI unit of amount of substance is mole

88. Answer (1)

Hint: Pure substances may be elements or compounds.

Sol.: Pure substances have fixed composition. Gold and ammonia are pure substances. Alloy is a homogeneous mixture whereas milk and mud are heterogeneous mixtures.

89. Answer (1)

Hint: All non-zero digits are significant

Sol.:

Number	Significant figure
0.03	1
285	3
0.0050	2
20 eggs	Infinite

90. Answer (4)

Hint:

$\frac{\text{Weight of solute}}{\text{Molar mass of solute}} = \frac{\text{Number of atoms}}{\text{Number of atoms in one molecule} \times N_A}$

Sol.:

49 g of H_2SO_4 $\Rightarrow \frac{49}{98} = \frac{\text{No. of atoms}}{7 \times N_A}$

No. of atoms = $\frac{7N_A}{2}$ $\Rightarrow$ 3.5 N_A

16 g of O_3 $\Rightarrow \frac{16}{48} = \frac{\text{No. of atoms}}{3 \times N_A}$

= N_A

20 g of NaOH $\Rightarrow \frac{20}{40} = \frac{\text{No. of atoms}}{3 \times N_A}$

= 1.5 N_A

22.8 g of N_2O_3 $\Rightarrow \frac{22.8}{76} = \frac{\text{No. of atoms}}{5 \times N_A}$

= 1.5 N_A

20 g of CO_2 $\Rightarrow \frac{22}{44} = \frac{\text{No. of atoms}}{3 \times N_A}$

= 1.5 N_A

[BOTANY]

91. Answer (2)

Hint: Cell furrow formation occurs in animal cells.

Sol.: Cytokinesis is the division of cytoplasm. During cytokinesis, the furrow in the plasma membrane deepens and moves centripetally dividing the cytoplasm.

92. Answer (2)

Sol.: Prophase I is typically longer and more complex when compared to the prophase of meiosis II.

93. Answer (2)

Hint: The number of chromosomes becomes half in the daughter cell during meiosis.

Sol.: The reduction in the number of chromosomes in daughter cells occurs after anaphase I.

94. Answer (4)

Hint: Diplotene can last for months or years in the oocytes of some vertebrates.

Sol.: Diplotene stage of oocytes that last for months or years in some vertebrates is also called dictyotene stage.

95. Answer (2)

Hint: Diakinesis represents the transition to metaphase.

Sol.: Zygotene – Chromosomes start pairing together and this process leads to the formation of bivalent.

Pachytene – Recombinase enzyme is involved during this stage and recombination is completed by the end of this stage.

Leptotene – Chromosomes gradually become visible under the light microscope.

96. Answer (4)

Hint: Mitosis helps in cell repair.

Sol.: The cells of the upper layer of the epidermis and the cells of the lining of gut get constantly replaced by mitosis.

97. Answer (4)

Hint: It occurs during the fourth sub-stage of prophase I.

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

98. Answer (3)

Hint: The given diagram shows that spindle fibres are attached to the chromosomes.

Sol.: The given figure represents the transition to metaphase where chromosomes move to the spindle equator.

99. Answer (3)

Hint: Tetrad is formed during the zygotene stage.

Sol.: Tetrad is clearly appear during the pachytene stage.

100. Answer (4)

Hint: Telophase I is characterised by formation of nuclear membrane around chromosomal dyads and nucleolus.

Sol.: The correct sequence of the events during meiosis is as follows:

Diakinesis (c) ⟶ Metaphase I (e) ⟶ Anaphase I (d) ⟶ Telophase I ⟶ Interkinesis (b) ⟶ Prophase II ⟶ Metaphase II ⟶ Anaphase II ⟶ Telophase II (a)

101. Answer (1)

Hint: Crossing over occurs during the pachytene stage.

Sol.: Crossing over occurs between non-sister chromatids of homologous chromosomes during pachytene, a sub-stage of prophase I which introduces new combinations of traits among the gametes of an organism.

102. Answer (3)

Hint: Most of the cell organelles duplicate during the first phase of interphase.

Sol.: S or synthesis phase marks the period during which DNA synthesis or replication takes place. However, there is no increase in the chromosome number.

103. Answer (2)

Hint: Centrosome begins to move towards the opposite poles during prophase.

Sol.: The initiation of condensation of chromosomal material occurs during prophase.

104. Answer (3)

Hint: It is the second phase of mitosis called, metaphase.

Sol.: The sister chromatids reach to their respective poles during anaphase.

105. Answer (4)

Hint: Syncytium stage is seen in liquid endosperm of coconut.

Sol.: In some organisms, karyokinesis is not followed by cytokinesis, as a result of which, multinucleate condition arises, leading to the formation of syncytium.

106. Answer (4)

Hint: It follows the G_2 phase of interphase.

Sol.: Prophase is the first stage of karyokinesis.

107. Answer (2)

Hint: G_1 phase corresponds to the interval between mitosis and initiation of DNA replication.

Sol.: Chromosome duplication occurs during the S phase of cell cycle in eukaryotes.

108. Answer (1)

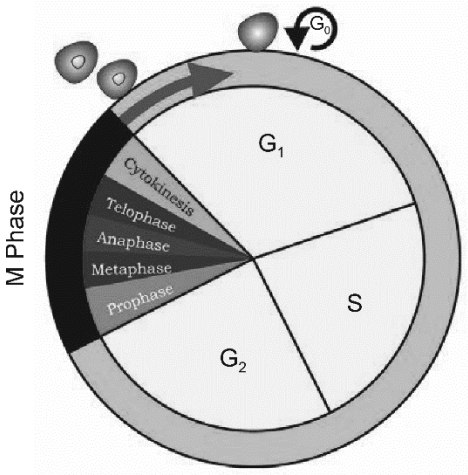
Hint: Most active stage of the cell cycle is interphase.

Sol.: Interphase is long, non-dividing, growing phase of the cell cycle.

109. Answer (4)

Hint: G_1 phase is the post mitotic stage of cell cycle.

Sol.: Cell cycle is as follows:



110. Answer (1)

Hint: Kinetochore is a disc shaped structure at the primary constriction.

Sol.: Satellite – A part of chromosome beyond the non-staining secondary constriction.

Chromatin – Composed of DNA + histone proteins + non histone proteins + RNA

Centromere – Appears as a narrow region, called primary constriction of chromosome.

111. Answer (4)

Hint: *Cis* face or forming face of Golgi apparatus receives the proteins from RER that need to be packaged and transported.

Sol.: The *trans* face or maturing face of Golgi apparatus releases the vesicles containing processed and packaged protein to its target location, either inside or outside of the cell.

112. Answer (4)

Hint: Two cylindrical structures in the centrosome are called centrioles.

Sol.: Centrioles are not surrounded by plasma membrane but they are surrounded by pericentriolar satellites, also known as massule.

113. Answer (3)

Hint: Microtubules bind with the kinetochore of the chromosome.

Sol.: Microtubules help in the anaphasic movement of chromosomes.

114. Answer (3)

Hint: It is a membrane bound vesicular structure.

Sol.: The isolated lysosomal vesicles have been found to be very rich in almost all types of hydrolytic enzymes.

115. Answer (4)

Hint: Cytoskeleton forms the structural framework inside the cell.

Sol.: ER is composed of three kinds of structures *viz.* cisternae, tubules and vesicles.

116. Answer (4)

Hint: The fluid nature of the membrane is important from the point of view of functions like cell growth, endocytosis, cell division, etc.

Sol.: Majority of the chloroplasts of the green plants are found in the mesophyll cells of the leaves.

117. Answer (4)

Hint: Cisternae is present in some organelles of the endomembrane system.

Sol.: Centromere is the primary constriction of chromosome.

118. Answer (3)

Hint: Human erythrocyte membrane has more proteins than lipids.

Sol.: Human erythrocyte membrane has approximately 52 percent proteins and 40 percent lipids.

119. Answer (4)

Hint: Endomembrane system comprises of single membrane-bound organelles.

Sol.: Chloroplast is not a part of endomembrane system.

120. Answer (1)

Hint: Inclusion bodies are not bound by any membrane and lie free in the cytoplasm.

Sol.: Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies like, phosphate granules, cyanophycean granules and glycogen granules.

121. Answer (4)

Hint: Nucleolus is the site of rRNA synthesis.

Sol.: Larger and more numerous nucleoli are present in the cells actively carrying out protein synthesis.

122. Answer (2)

Hint: Cell wall is a non-living, rigid structure that provides barrier for undesirable macromolecules.

Sol.: ER helps in the transport of substances and synthesis of proteins.

123. Answer (1)

Hint: The outermost layer of cell envelope provides sticky character to the bacterial cell.

Sol.: The capsule is made up of glycocalyx that has polysaccharide macromolecules, and it gives gummy sticky character to the bacterial cell.

124. Answer (2)

Hint: Almost all plant cells lack centriole.

Sol.: Plant cells and animal cells are different as the former possess cell wall, plastids and a large central vacuole which are absent in the animal cells.

125. Answer (3)

Hint: The protective layers are the cell envelope of a bacterial cell.

Sol.: Glycocalyx, cell wall and plasma membrane act together as a single protective unit.

126. Answer (4)

Hint: Lipoprotein synthesis is done by endoplasmic reticulum.

Sol.: β–oxidation of fats – Mitochondria, a cylindrical or sausage shaped double membranous organelle.

Protein synthesis – Ribosomes, that are composed of RNA and protein and are not surrounded by any membrane.

Carbohydrate synthesis – Chloroplast, a double membrane bound cell organelle.

127. Answer (2)

Hint: Microtubules help in spindle and astral ray formation during cell division.

Sol.: Middle lamella is a layer, mainly composed of calcium pectate. Vacuole contains water, sap, excretory products and other material, not useful for the plant cell.

128. Answer (2)

Hint: Schleiden and Schwann, together formulated the cell theory. This theory however did not explain as to how new cells were formed.

Sol.: Rudolf Virchow, first explained that cells divided and new cells are formed from the pre-existing cells.

129. Answer (1)

Hint: Schwann concluded that presence of cell wall is a unique character of the plant cells.

Sol.: Schleiden observed that all plants are composed of different kinds of cells which form the tissues of the plants.

130. Answer (2)

Hint: Prokaryotes lack nucleus and their genetic material is present in the nucleoid region.

Sol.: Plasmid – Many bacteria have small circular DNA outside the genomic DNA. It confers certain unique phenotypic characters to such bacteria.

Capsule – It is made up of polysaccharides, but may sometimes contain proteins also.

Cell wall – It determines the shape of the cell and provides a strong structural support to prevent the bacterium from bursting or collapsing.

131. Answer (4)

Hint: Organelles are membrane bound structures, though there are certain non-membranous organelles as well.

Sol.: Centrosome is a non-membrane bound cell organelle.

132. Answer (4)

Hint: The first word in a binomial nomenclature represents the genus and the second word represents the species.

Sol.: Name of the genus starts with a capital letter and name of the species starts with a small letter.

133. Answer (1)

Hint: Generic name, species epithet and author citation, collectively form a binomial epithet.

Sol.: Binomial epithet of mango is *Mangifera indica* Linn.

134. Answer (2)

Hint: Genera *Panthera* and *Felis* belong to the family, Felidae.

Sol.: Genera *Panthera* and *Felis* belong to the class, Mammalia.

135. Answer (3)

Hint: Reproduction can be regarded as characteristic, of living organism but it is not their exclusive defining characteristic.

Sol.: All living organisms – present, past and future are linked to one another by the sharing of the common genetic material but to varying degrees.

[ZOOLOGY]

136. Answer (3)

Hint: Identify a multicellular organism.

Sol.: In unicellular organisms, all functions like digestion, respiration and reproduction are performed by a single cell. In the complex body of multicellular organisms, the same 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 thousands.

137. Answer (4)

Hint: Present in the air sacs of lungs

Sol.: The simple 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.

The epithelial cells are compactly packed with little intercellular matrix.

138. Answer (3)

Hint: Dense irregular connective tissue

Sol.: Dense irregular connective tissue has fibroblasts and many fibres (mostly collagen) that are oriented differently. This tissue is present in the skin. Tendons, which attach skeletal muscles to bones, and ligaments which attach one bone to another are examples of dense regular connective tissue.

Blood is the main circulating fluid of the body.

139. Answer (1)

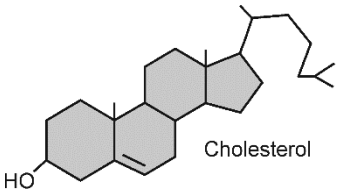
Hint: Compound epithelium

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

140. Answer (2)

Hint: Falls under the category of lipids

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 does not possess heterocyclic ring.



141. Answer (2)

Hint: Exclude toxins

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

142. Answer (1)

Hint: % of proteins

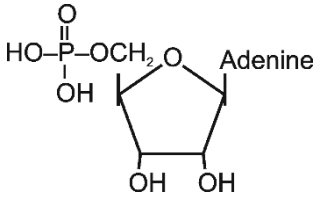
Sol.:

Component	% of the total cellular mass
Water	70-90
Proteins	10-15
Carbohydrates	3
Lipids	2
Nucleic acids	5-7
Ions	1

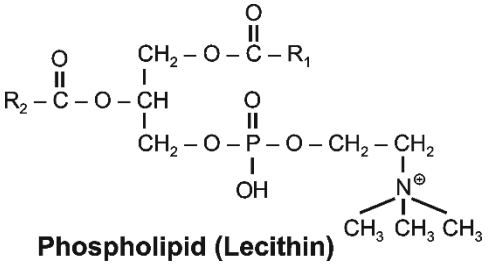
143. Answer (4)

Hint: Ribose and deoxyribose

Sol.:



Adenylic acid



Phospholipid (Lecithin)

144. Answer (2)

Hint: Ciliated epithelium

Sol.: If the columnar or cuboidal cells bear cilia on their free surface, they are called ciliated epithelium. Their function is to move particles or mucus in a specific direction over the epithelium. They are mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes.

145. Answer (3)

Hint: Protein chain contains amino acids.

Sol.: In a peptide chain, the first amino acid is called the N-terminal amino acid while the last amino acid is called the C-terminal amino acid. Thus, proline represents the N-terminal while glycine represents the C-terminal.

In a polysaccharide chain, the right end is called the reducing end and the left end is called the non-reducing end.

146. Answer (3)

Hint: Also present in the tip of nose

Sol.: The intercellular 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 present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adults.

Osteocytes are bone cells.

Lamellae are the characteristics of bones.

147. Answer (2)

Hint: Large and irregular masses of ribosomes and RER

Sol.: Neurons, the structural and functional unit of neural system, are excitable cells. The neuroglial cells which constitute the rest of the neural system protect and support neurons.

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

Tendons and ligaments are dense regular connective tissues.

148. Answer (2)

Hint: Areolar tissue

Sol.: Areolar tissue serves as a support framework for epithelium. In dense regular connective tissues, orientation of fibres show a regular pattern.

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

149. Answer (4)

Hint: Features of smooth muscle fibres

Sol.: The smooth muscle fibres taper at both ends (fusiform) and do not show striations. Cell junctions hold them together and they are bundled together in a connective tissue sheath. The wall of internal organs such as the blood vessels, stomach and intestine contains this type of muscle tissue.

150. Answer (4)

Hint: True for connective tissue

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

Each cell of the body is not regulated by the nervous system.

151. Answer (3)

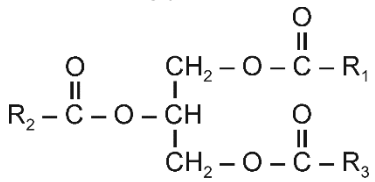
Hint: Competitive inhibitor resembles the substrate in structure

Sol.: Inhibition of succinic dehydrogenase by oxaloacetate/malonate which closely resembles the substrate succinate in structure is an example of competitive inhibition.

152. Answer (3)

Hint: Triglycerides have 3 fatty acid residues.

Sol.: Many lipids have both glycerol and fatty acids. The fatty acids are found esterified with glycerol. They can be monoglycerides, diglycerides and triglycerides.



Triglyceride

153. Answer (1)

Hint: Carbonic anhydrase

Sol.: The E.C. number of carbonic anhydrase is 4.2.1.1. Class IV enzymes are known as lyases which catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

Ligases catalyse the linking together of 2 compounds.

154. Answer (3)

Hint: Insulin and trypsin are proteins.

Sol.: Tyrosine is an aromatic amino acid as it possesses cyclic structure with a side chain. It is a neutral amino acid.

Protein is a polymer of amino acids. There are 20 types of amino acids which occur in proteins.

155. Answer (3)

Hint: Peptide bond formation

Sol.: GLUT-4 is a transporter protein. In a polypeptide or a protein, amino acids are linked by a peptide bond which is formed when the carboxyl (–COOH) group of one amino acid reacts with the amino group of the next amino acid with the elimination of a water moiety (the process is called dehydration).

156. Answer (3)

Hint: Lipids

Sol.:

Component	% of the total cellular mass
Water	70-90
Proteins	10-15
Carbohydrates	3
Lipids	2
Nucleic acids	5-7
Ions	1

157. Answer (4)

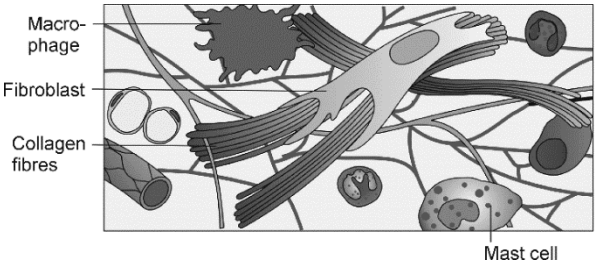
Hint: Communication junction

Sol.: Tight junctions help to stop substances from leaking across a tissue. Adhering junctions perform cementing to keep neighbouring cells together. Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells for rapid transfer of ions, small molecules and sometimes big molecules.

158. Answer (2)

Hint: Produce histamine and serotonin

Sol.:



159. Answer (3)

Hint: Monomeric unit of glycogen is glucose.

Sol.: Glycogen is a polysaccharide, present as the store house of energy in animal tissues.

Glucagon is a hyperglycemic proteinaceous hormone.

Proteins possess right handed helices.

160. Answer (2)

Hint: Enzymes get inactivated at temperature below optimum temperature

Sol.: Enzyme catalysts differ from inorganic catalysts in many ways, but one major difference needs mention. Inorganic catalysts work efficiently at high temperatures and high pressures, while enzymes get damaged at high temperatures.

161. Answer (1)

Hint: Aspartic acid is an acidic amino acid.

Sol.: Palmitic acid – Saturated fatty acid without C = C double bonds

Arachidonic acid – Unsaturated fatty acid with C = C double bonds

Aspartic acid – Acidic amino acid

Acetic acid – Precursor of cholesterol

162. Answer (4)

Hint: Prosthetic group

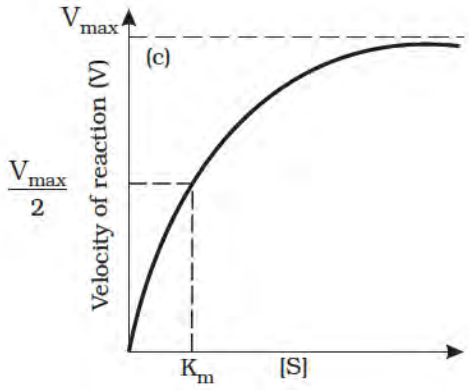
Sol.: Prosthetic groups are organic compounds and are distinguished from other co-factors in that they are tightly bound to the apoenzyme. For example, in peroxidase and catalase, haem is the prosthetic group.

The association of co-enzyme with the apoenzyme is only transient, usually occurring during the course of catalysis.

163. Answer (3)

Hint: For non-competitive inhibition, K_m remains the same.

Sol.:



164. Answer (3)

Hint: Both are examples of dense regular connective tissues.

Sol.: In dense regular connective tissues, the collagen fibres are present in rows between many parallel bundles of fibres. Tendons, which attach skeletal muscles to bones and ligaments which attach one bone to another are examples of this tissue.

165. Answer (1)

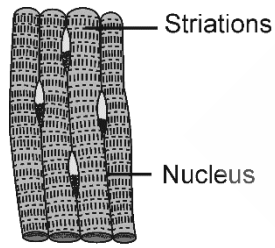
Hint: Collagen or elastin fibres

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

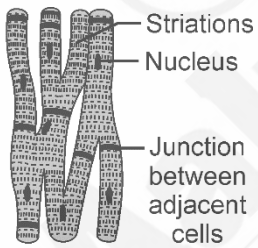
166. Answer (4)

Hint: Human heart is myogenic

Sol.:



Skeletal muscle fibres



Cardiac muscle fibres

167. Answer (4)

Hint: Possess osteocytes

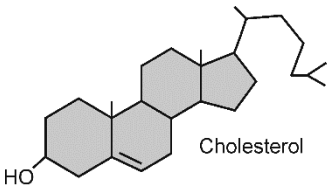
Sol.: The matrix of cartilage is solid, pliable and resists compression. Cartilage is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adult. Epiglottis is a cartilaginous flap that covers glottis.

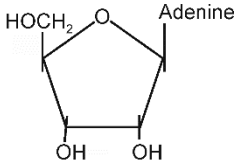
Larynx is a cartilaginous box that helps in sound production. Fibrous joint is present between cranial bones.

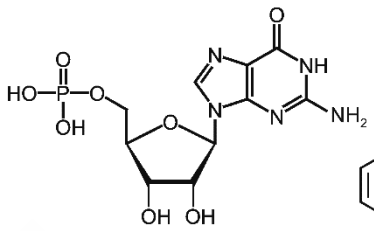
168. Answer (2)

Hint: Nitrogenous bases have heterocyclic rings.

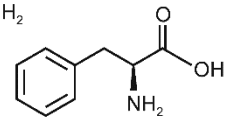
Sol.:







Guanylic acid



Phenylalanine

169. Answer (3)

Hint: Present in loose connective tissue

Sol.: Blood is the main circulating fluid that helps in the transport of various substances. It contains plasma, RBCs, WBCs and platelets.

170. Answer (2)

Hint: 'P' are neuroglial cells.

Sol.: Neuroglial cells make up more than one-half the volume of the neural tissue in our body. Neuroglial cells protect and support neurons. Neurons are the excitable cells of neural tissue.

171. Answer (3)

Hint: Property of zwitterion

Sol.: Lysine is a basic amino acid while valine is a neutral amino acid.

Basic amino acids have an additional amino group. Neutral amino acids have equal number of amino group and carboxyl group.

172. Answer (4)

Hint: Tissue for co-ordination and control

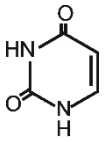
Sol.: The bone marrow in some bones is the site of production of blood cells.

Arrival of the disturbance at the neuron's endings trigger events that may cause stimulation or inhibition of adjacent neurons and other cells. Muscle fibres shorten in response to stimulation and then lengthen to their uncontracted state.

173. Answer (2)

Hint: Presence of 2 H-bonds

Sol.:



Uracil

Three hydrogen bonds are present between guanine and cytosine while two hydrogen bonds are present between adenine and thymine.

174. Answer (3)

Hint: Ligases

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

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

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

175. Answer (4)

Hint: Identify a heterocyclic compound.

Sol.: Exoskeleton of arthropods have a complex polysaccharide called chitin whose monomeric unit is N-acetyl glucosamine.

Starch is a homopolysaccharide and can hold I_2 molecules in the helical portion.

Cellulose is also a homopolysaccharide which is present in plant cell wall.

176. Answer (1)

Hint: Include proteins

Sol.: Collagen is the most abundant protein in the animal world while RuBisCO is the most abundant protein in whole of the biosphere. Trypsin is a protein digesting enzyme.

Glycogen and inulin are polysaccharides.

177. Answer (3)

Hint: Exclude the bond present in DNA

Sol.: A protein thread does not exist throughout as an extended rigid rod. The thread is folded in the form of helix. Only some portions of the protein thread are arranged in the form of a helix. In proteins, only right handed helices are observed. Other regions of the protein thread are folded into forms in what is called the secondary structure.

They have intramolecular hydrogen bonding.

178. Answer (2)

Hint: Property of epithelial tissue.

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.

Goblet cell of the alimentary canal is an example of unicellular gland while salivary gland is an example of multicellular gland.

179. Answer (2)

Hint: Cellulose is a polysaccharide.

Sol.: Collagen is the most abundant protein in the animal world while RuBisCO is the most abundant protein in the whole of the biosphere.

180. Answer (4)

Hint: Blood is a fluid connective tissue.

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.

Areolar tissue contains fibroblasts, macrophages and mast cells.

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