All India Aakash Test Series for NEET – 2022

OPEN MOCK TEST - 1 (Code-B)

Test Date : 12/06/2022

ANSWERS

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

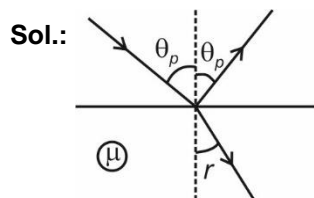CLICK HERE TO JOIN CHANNEL

HINTS & SOLUTIONS

[PHYSICS]

SECTION-A

1. **Answer (4)**

   Hint: At Brewster angle, refracted light is partially polarised and reflected is fully polarised.

   Sol.:

   When $i = \theta_p$ (Reflected light is totally polarised)

   By Brewster law: $\tan\theta_P = \mu$

   By Snell's law $\dfrac{\sin\theta_P}{\sin r} = \mu$

   $\Rightarrow \sin r = \cos\theta_p$

   $\Rightarrow \sin r = \sin(90° - \theta_p)$

   $\Rightarrow r = 90° - \theta_p$ or $r + \theta_P = 90°$

   $\Rightarrow$ Reflected and refracted rays are perpendicular

2. **Answer (1)**

   Hint:

   Resolving power of microscope $\propto \dfrac{1}{\text{Wavelength}}$

   Sol.: $R_1 \propto \dfrac{1}{\lambda_1}$ and $R_2 \propto \dfrac{1}{\lambda_2}$

   $\dfrac{R_1}{R_2} = \dfrac{\lambda_2}{\lambda_1} = \dfrac{450}{600} = \dfrac{3}{4}$

3. **Answer (2)**

   Hint: $y = n_1\beta_1 = n_2\beta_2$

   Sol.: $n_1\beta_1 = n_2\beta_2$ (for overlapping)

   $\dfrac{\beta_1}{\beta_2} = \dfrac{n_2}{n_1}$

   $\dfrac{\lambda_1\dfrac{D}{d}}{\lambda_2\dfrac{D}{d}} = \dfrac{n_2}{n_1}$ $\qquad \therefore \dfrac{\lambda_1}{\lambda_2} = \dfrac{n_2}{n_1}$

   $\dfrac{n_2}{n_1} = \dfrac{\lambda_1}{\lambda_2} = \dfrac{700}{500} = \dfrac{7}{5}$

   $\therefore n_1 = 5$

4. **Answer (3)**

   Hint: $\dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{f}$

   $\therefore v_i = \left(\dfrac{v}{u}\right)^2 \times v_o$

   Sol.: $\dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{f}$ $\qquad \Rightarrow \dfrac{1}{v} - \dfrac{1}{(-30)} = \dfrac{1}{20}$

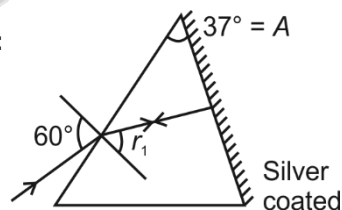 $\therefore \dfrac{1}{v} = \dfrac{1}{20} - \dfrac{1}{30} = \dfrac{3-2}{60}$ $\qquad \Rightarrow v = 60$ cm

   $\therefore v_i = \left(\dfrac{v}{u}\right)^2 \times (v_o)$

   $\Rightarrow v_i = \left(\dfrac{60}{30}\right)^2 \times (10) = 40$ cm/s

5. **Answer (1)**

   Hint: When light ray retraces its path, it incident normally on the silvered face.

   Sol.:

   For refraction at first face

   $\dfrac{\sin 60°}{\sin r_1} = \dfrac{\mu}{1} = \mu$ $\qquad$ …(1)

   When ray hits normally on silvered face, $\angle r_2 = 0$
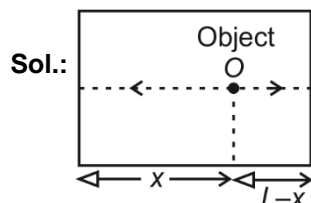
   $\therefore \angle r_1 + \angle r_2 = \angle A$

   $r_1 + 0 = 37°$ $\qquad$ …(2)

   $\therefore \mu = \dfrac{\sin 60°}{\sin 37°} = \dfrac{\left(\dfrac{\sqrt{3}}{2}\right)}{\left(\dfrac{3}{5}\right)} = \dfrac{5\sqrt{3}}{6} = \dfrac{5}{2\sqrt{3}}$

6. Answer (1)

Hint: Apparent depth = $\dfrac{\text{Real depth}}{\text{Refractive index}}$

Sol.:

Let L = thickness of glass slab

Let x = actual distance from first face

$9 = \dfrac{x}{\mu} \qquad \therefore \ x = 9\mu$

$5 = \dfrac{L-x}{\mu}$

$\therefore \quad 5\mu = L - 9\mu$
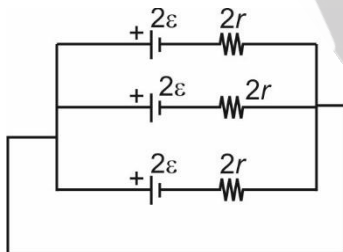
$L = 14\ \mu$

$L = 14 \times 1.5 = 21$ cm

7. Answer (2)

Hint: Equivalent $EMF = \dfrac{\dfrac{\varepsilon_1}{r_1} + \dfrac{\varepsilon_2}{r_2} + \dfrac{\varepsilon_3}{r_3}}{\dfrac{1}{r_1} + \dfrac{1}{r_2} + \dfrac{1}{r_3}}$

and equivalent internal resistance

$= \dfrac{1}{r_0} = \dfrac{1}{r_1} + \dfrac{1}{r_2} + \dfrac{1}{r_3}$

Sol.:

The equivalent circuit becomes
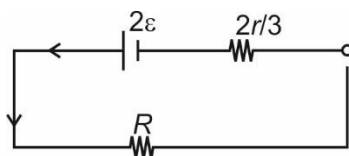
Current in circuit $I = \dfrac{2\varepsilon}{R + \dfrac{2r}{3}} = \dfrac{2 \times 1.1}{\left(2 + \dfrac{2}{3} \times 3\right)} = \dfrac{2.2}{4}$

$I = 0.55$ A

8. Answer (4)

Hint: Heat required $Q = ms\Delta\theta$

Sol.: Heat required for water = $ms\Delta\theta$

$P \times t = ms\Delta\theta \qquad (P = \text{Power of geyser})$

$P = \dfrac{ms\Delta\theta}{t} = \dfrac{1 \times 4200 \times (42-22)}{60} = \dfrac{4200 \times 20}{60} = 1400\,\text{W}$
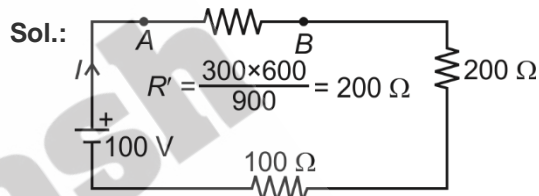
9. Answer (2)

Hint & Sol.: A negative charge in electric field will experience force opposite to direction of electric field.

For induced electric field produced by changing magnetic field with time forms closed loop.

The electrostatic force between two charges does not depend on presence of any other charge. The force remains same.

10. Answer (3)

Hint: Using Kirchhoff's voltage law for closed loop.

Sol.:

Current in circuit $I = \dfrac{100}{(200 + 200 + 100)} = \dfrac{1}{5}$ A

Voltmeter reading $V_{AB} = I \times R' = \dfrac{1}{5} \times 200 = 40$ V

11. Answer (3)

Hint: Total mechanical energy remains constant

$\Delta U + \Delta K = 0$

Sol.:

$\dfrac{-(qQ)}{4\pi\varepsilon_0 [(\sqrt{3}R)^2 + R^2]^{\frac{1}{2}}} + \dfrac{1}{2}m(0)^2 = \dfrac{-(Qq)}{4\pi\varepsilon_0 R} + \dfrac{1}{2}mv^2$

$\dfrac{1}{2}mv^2 = \text{KE} = \dfrac{-qQ}{4\pi\varepsilon_0 (2R)} + \dfrac{Qq}{4\pi\varepsilon_0 R} = \dfrac{(Qq)}{4\pi\varepsilon_0}\left[\dfrac{1}{R} - \dfrac{1}{2R}\right]$

$\Rightarrow \quad \text{KE} = \dfrac{Qq}{8\pi\varepsilon_0 R}$

12. Answer (3)

Hint & Sol.: Electric field lines due to large sheet are straight and parallel. Equipotential surfaces are perpendicular to electric field lines, which are planar.

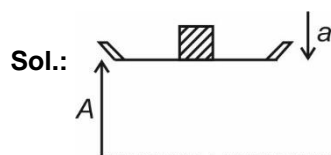13. Answer (1)

    Hint: By momentum conservation

    $0 = m_d.\vec{v}_d + m_\alpha.\vec{v}_\alpha$

    Sol.: Initial momentum is zero. By conservation of linear momentum

    $0 = m_d.\vec{v}_d + m_\alpha.\vec{v}_\alpha$

    $|\vec{v}_d| = \dfrac{m_\alpha.v_\alpha}{m_d} = \dfrac{4 \times v}{(210-4)} = \dfrac{4v}{206}$

14. Answer (3)

    Hint: When normal reaction becomes zero block gets separated from ship platform.

    Sol.:

    At the highest point of ship when motion is downward, acceleration is also along mean position

    $|a| = \omega^2 A$ \qquad (A = amplitude)

    When $ma \geq mg$ \qquad (N = 0)

    $\omega^2 A \geq g$

    $A \geq \dfrac{g}{\omega^2}$

    So block will leave its contact at minimum amplitude $A = \dfrac{g}{\omega^2}$, at highest position of ship.

15. Answer (3)

    Hint: Let frequency of C is n. Beat frequency $\Delta n = n_A - n_B$.

    Sol.: $n_A = n + \dfrac{5}{100}n = \dfrac{21}{20}n$ \quad (n = Frequency of C)

    $n_B = n - \dfrac{4}{100}n = \dfrac{24}{25}n$

    Also given $n_A - n_B = 9$

    $\Rightarrow \dfrac{21}{20}n - \dfrac{24}{25}n = 9$

    $\Rightarrow n\left[\dfrac{21}{20} - \dfrac{24}{25}\right] = 9$

    $\Rightarrow n\left[\dfrac{105-96}{100}\right] = 9 \quad \Rightarrow n = 100\,\text{Hz}$

    $\Rightarrow n_B = \dfrac{24}{25} \times 100 = 96\,\text{Hz}$

16. Answer (2)

    Hint: $\lambda = \dfrac{h}{mv}$ \qquad (from de Broglie)

    Sol.: $\lambda_p = \lambda_\alpha$

    $\dfrac{h}{m_p v_p} = \dfrac{h}{m_\alpha.v_\alpha}$

    $\dfrac{v_p}{v_\alpha} = \dfrac{m_\alpha}{m_p} = \dfrac{4m}{m} = \dfrac{4}{1}$

17. Answer (1)

    Hint: $t_a = \dfrac{u}{g}$,

    For total distance both upward and downward distances travelled during 1 second are added.

    Sol.:

    $t_a = \dfrac{u}{g} = \dfrac{68}{10} = 6.8\,\text{s}$

    $\therefore$ From $t = 6.0$ s to $t = 6.8$ s distance covered

    $d_1 = \dfrac{1}{2} \times 10 \times (0.8)^2 = 3.2\,\text{m}$

    In next 0.2 second, it falls under gravity

    $d_2 = 0 + \dfrac{1}{2} \times g \times (0.2)^2 = \dfrac{1}{2} \times 10 \times (0.2)^2 = 5 \times (0.04)$

    \qquad\qquad\qquad\qquad $= 0.2\,\text{m}$

    Total distance during $t = 6$ s to $t = 7$ s (7th second)

    $d = 3.2 + 0.2 = 3.4\,\text{m}$

18. Answer (2)

    Hint: Power of e should be dimensionless

    Sol.: $\therefore \left[\dfrac{hc}{x}\right] = [M^0 L^0 T^0]$

    $[x] = [hc]$

    $\Rightarrow [x] = [M.L^2 T^{-1}][LT^{-1}] = [ML^3 T^{-2}]$

19. Answer (3)

    Hint: By second law of motion $a = \dfrac{F}{m}$

    $v = u + at$

    Sol.: $\therefore a = \dfrac{F}{m} = \dfrac{10}{5} = 2\,\mathrm{m\,s^{-2}}$

    Force acts for 4 s, velocity at end of 4 s

    $v = u + at = 0 + 2 \times 4 = 8\,\mathrm{m/s}$

    Now object moves with same velocity due to inertia of motion.

20. Answer (4)

    Hint: $\eta = 1 - \dfrac{T_2}{T_1}$

    Sol.: $T_1 = 327 + 273 = 600$ K

    $T_2 = 27 + 273 = 300$ K

    $\eta = 1 - \dfrac{T_2}{T_1} = 1 - \dfrac{300}{600} = 0.5$

    $\therefore \quad \eta = 50\%$

21. Answer (2)

    Hint: When no torque acts, angular momentum will remain conserved.

    Sol.: $I\omega = $ Constant

    $\dfrac{mR^2}{2} \times \omega_0 = \dfrac{mR'^2}{2} \times \omega$

    $R' = R(1 + \alpha\Delta T)$

    $R^2\omega_0 = R^2(1 + \alpha\Delta T)^2 \times \omega$

    $\omega = \dfrac{\omega_0}{(1+\alpha\Delta T)^2} \quad \therefore \dfrac{\omega}{\omega_0} = (1+\alpha\Delta T)^{-2}$

    $\dfrac{\omega}{\omega_0} = 1 + (-2\alpha\Delta T)$ (Using binomial expansion)

    $\dfrac{\omega}{\omega_0} - 1 = -2\alpha\Delta T$

    $\dfrac{\Delta\omega}{\omega_0} = -2\alpha\Delta T$

22. Answer (4)

    Hint: Malus law, $I = I_0 \cos^2\theta$

    Sol.: $I_1 = \dfrac{I_0}{2}$

    $I_2 = I_1 \cos^2 45° = \dfrac{I_0}{2} \times \left(\dfrac{1}{\sqrt{2}}\right)^2$

    $= \dfrac{I_0}{4}$

    i.e. intensity becomes $\dfrac{1}{4}$ times

23. Answer (4)

    Hint: $\Delta l = l_0 \alpha \Delta T$

    Sol.: When temperature changes by ΔT

    $l = l_0(1 + \alpha\Delta T)$

    $l_2 - l_1 = l_{2,0}(1 + \alpha_2\Delta T) - l_{1,0}(1 + \alpha_1\Delta T)$

    $l_2 - l_1 = (l_{2,0} - l_{1,0}) - [l_{2,0}\,\alpha_2 - l_{1,0}\,\alpha_1]\Delta T$

    Given $l_2 - l_1 = l_{2,0} - l_{1,0}$

    $\therefore \quad \alpha_1 l_{1,0} = \alpha_2 l_{2,0}$

    $\therefore \quad \dfrac{l_{Cu}}{l_{Fe}} = \dfrac{\alpha_{Fe}}{\alpha_{Cu}} = \dfrac{1.2 \times 10^{-5}}{4.8 \times 10^{-5}} = \dfrac{1}{4}$

24. Answer (2)

    Hint & Sol.: $h = \dfrac{2T\cos\theta}{r\rho g}$, $r = $ radius of tube

    $A = \pi r^2$

    $\therefore \quad h \propto \dfrac{1}{\sqrt{A}}$

    $\therefore \quad \dfrac{h'}{h} = \dfrac{\sqrt{A}}{\sqrt{4A}} = \dfrac{1}{2}$

    $h' = \dfrac{1}{2} \times 40 = 20$ cm

25. Answer (3)

    Hint: $\beta = \dfrac{\Delta I_c}{\Delta I_b}$, $I_b + I_c = I_E$

    Sol.: $\therefore \dfrac{I_C}{50\,\mu A} = 60 \quad \therefore I_C = 50 \times 60 \times 10^{-6}$

    $= 3000 \times 10^{-6}$ A $= 3$ mA

    And $I_E = I_c + I_b = (3 + 50 \times 10^{-3})$ mA $= 3.05$ mA

26. Answer (1)

    Hint: Velocity of efflux $= \sqrt{2gh}$

    Sol.: $v = \sqrt{2gh}$, here $h = 10$ m

      (In formula, velocity does not depend on density)

    $v = \sqrt{2 \times 10 \times 10} = \sqrt{200} = 14.1\,\mathrm{m/s}$

27. **Answer (2)**

    Hint: $W = P\Delta V$ and $P = \dfrac{W}{t}$

    Sol.: $P = 1.5$ m of water $= 1.5 \times 10^3 \times 10$

    $\qquad\qquad = 15 \times 10^3$ N m^{-2}

    $\Delta V = 60 \times 10^{-6}$ m^3

    $P_{av} = \dfrac{P\Delta V}{\Delta t} = \dfrac{15 \times 10^3 \times 60 \times 10^{-6} \times 72}{60} = 1.08$ W

    $\qquad\qquad\qquad\qquad\qquad\qquad \approx 1.1$ W

28. **Answer (4)**

    Hint: Each planet with respect to sun traces equal area in equal intervals of time. So areal velocity is constant.

    Sol.: By IInd law of Kepler: areal velocity of each planet around sun is constant

29. **Answer (2)**

    Hint: Mechanical energy is conserved in conservative gravitational field.

    $U + K =$ Constant

    Sol.: $U_1 + K_1 = U_2 + K_2$

    $\Rightarrow \dfrac{-GmM}{R} + \dfrac{mgR}{2} = \dfrac{-2}{3}\dfrac{GmM}{R} + K_2$

    $\Rightarrow \dfrac{GmM}{R}\left(-1 + \dfrac{2}{3}\right) + \dfrac{mgR}{2} = K_2$

    $\Rightarrow \dfrac{-GmM}{3R} + \dfrac{mgR}{2} = K_2$

    $\Rightarrow \dfrac{-gR^2 \times m}{3R} + \dfrac{mgR}{2} = K_2$

    $\therefore K_2 = \dfrac{mgR}{2} - \dfrac{mgR}{3} = \dfrac{mgR}{6}$

30. **Answer (2)**

    Hint: $\vec{R} = \vec{A} + \vec{B}$ and $\tan\theta = \dfrac{R_y}{R_x}$

    Sol.:
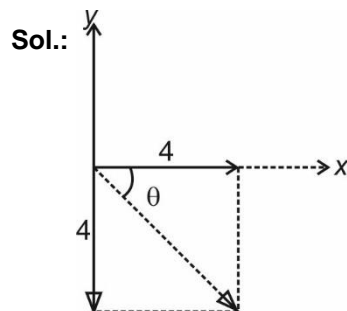
    $\vec{R} = \vec{A} + \vec{B} = 4\hat{i} - 2\hat{j} + 6\hat{k} + (-2\hat{j} - 6\hat{k})$

    $\vec{R} = 4\hat{i} - 4\hat{j}$

    $\tan\theta = \dfrac{4}{4} = 1$

    $\theta = 45°$ with positive x-axis

    With positive y-axis, angle $= 90° + 45° = 135°$

31. **Answer (1)**

    Hint: $a_t = \dfrac{d|v|}{dt}, a_c = \dfrac{v^2}{R}$

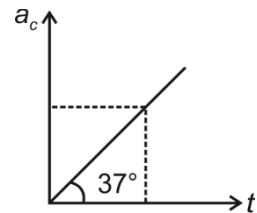   **Sol.:** $\dfrac{a_c}{t} = \tan 37°$

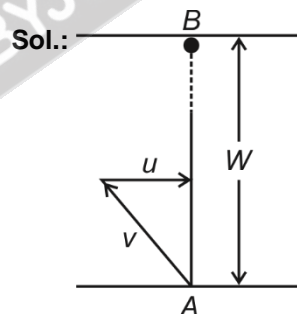 $a_c = \dfrac{3}{4}t$

    $\dfrac{v^2}{r} = \dfrac{3}{4}t$

    $v^2 = \dfrac{3}{4}t \times 12 = 9t$

    at $t = 1$ s, $v^2 = 9 \times 1 = 9$

    $\qquad\qquad\qquad v = 3$ m/s

32. **Answer (3)**

    Hint: $\tau = \dfrac{W}{\sqrt{v^2 - u^2}}$

    Sol.:

    Time taken to cross river through shortest path is

    $t = \dfrac{W}{\sqrt{v^2 - u^2}} = \dfrac{\dfrac{600}{1000}}{\sqrt{5^2 - 3^2}} = \dfrac{600}{1000 \times 4}$

    $t = \dfrac{3}{20}$ h $= 9$ min

33. **Answer (4)**

    Hint: $X_L = \omega L$ and $X_C = \dfrac{1}{\omega C}$

Sol.: $X_L = \omega L = 2\pi f L$

When frequency increase X_L increases linearly

$\therefore$ X_1 corresponds to inductor

$X_C = \dfrac{1}{\omega C} = \dfrac{1}{2\pi f C}$ $\qquad \therefore$ $X_C \propto \dfrac{1}{f}$

When frequency increase X_C decreases, graph is rectangular hyperbola. So X_2 corresponds to a capacitor.

34. **Answer (2)**

Hint: $f = \dfrac{1}{2\pi}\sqrt{\dfrac{1}{LC}}$

Sol.: $f = \dfrac{1}{2\pi}\sqrt{\dfrac{1}{LC}}$

$\dfrac{f_2}{f_1} = \sqrt{\dfrac{C_1}{C_2}} = \sqrt{\dfrac{C}{KC}}$

$\dfrac{25}{125} = \sqrt{\dfrac{1}{K}}$ $\qquad \therefore$ $\dfrac{1}{25} = \dfrac{1}{K}$ $\Rightarrow K = 25$

35. **Answer (1)**

Hint: For uniform acceleration $v = u + at$

Sol.: $v = u + at$

$30 = u + a \times 2 = u + 2a$ $\qquad$ ...(1)

$60 = u + a \times 4 = u + 4a$ $\qquad$ ...(2)

Subtracting (1) from (2)

$30 = 2a$ $\qquad \therefore$ $a = 15$ m s^{-2}

Using in (1), $30 = u + 2 \times 15$ $\quad \therefore$ $u = 0$ m s^{-1}

SECTION-B

36. **Answer (3)**

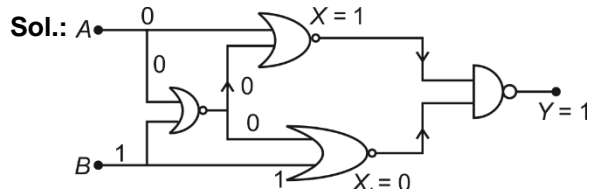**Hint:** $\varepsilon = Bvl$ and $i = \dfrac{\varepsilon}{R}$

Sol.: $v = 10$ m s^{-1}, $l = 1$ m, $B = 0.2$ T

$\varepsilon = $ induced emf $= Blv = 0.2 \times 10 \times 1 = 2$ volt

Induced current in loop

$i = \dfrac{\varepsilon}{R} = \dfrac{2}{100} = \dfrac{20}{1000} = 20$ mA

37. **Answer (3)**

Sol.:

38. **Answer (3)**

Hint: Longest wavelength appears when electron jumps from next energy state and shortest wavelength appears when electron jumps from $n = \infty$ to the lowest energy shell.

Sol.: $\dfrac{1}{\lambda_L} = R\left[\dfrac{1}{1^2} - \dfrac{1}{\infty^2}\right]$

$\dfrac{1}{\lambda_P} = R\left[\dfrac{1}{3^2} - \dfrac{1}{4^2}\right]$

$\dfrac{\lambda_L}{\lambda_P} = \dfrac{(16-9)}{144} = \dfrac{7}{144}$

39. **Answer (3)**

Hint: $|E| = \dfrac{\Delta V}{\Delta x}$

Sol.: $\Delta V = 0.6$ V , $\qquad \Delta x = 10^{-6}$ m

$\therefore$ $E = \dfrac{\Delta V}{\Delta x} = \dfrac{0.6}{10^{-6}} = 6 \times 10^{+5}$ V/m

40. **Answer (3)**

Hint: Change equation for y_2 to sinusoidal form

Sol.: $y_1 = 4\sin\left(3\pi t + \dfrac{\pi}{3}\right)$

$y_2 = 4\left[\sqrt{(1^2 + (\sqrt{3})^2)}\left((\sin 3\pi t) \times \dfrac{1}{\sqrt{1^2 + (\sqrt{3})^2}} + \dfrac{\sqrt{3}}{\sqrt{1^2 + (\sqrt{3})^2}} \cdot \cos 3\pi t\right)\right]$

$y_2 = 4 \times 2\left[\sin 3\pi t \times \dfrac{1}{2} + \dfrac{\sqrt{3}}{2}\cos 3\pi t\right]$

$= 8[\sin 3\pi t \cdot \cos 60° + \cos 3\pi t \cdot \sin 60°]$

$y_2 = 8[\sin(3\pi t + 60°)]$ $\quad \therefore$ $\dfrac{y_1}{y_2} = \dfrac{4}{8} = \dfrac{1}{2}$

41. **Answer (1)**

Hint: Fundamental frequency $n = \dfrac{1}{2l}\sqrt{\dfrac{T}{\mu}}$

Sol.: $\mu = \dfrac{M}{L} = \dfrac{\pi r^2 \times \rho \times L}{L}$, $T = $ max. stress $\times$ area

So, $\sqrt{\dfrac{T}{\mu}} = \sqrt{\dfrac{\text{max. stress} \times \pi r^2}{\pi r^2 \times \rho}} = \sqrt{\dfrac{\text{max. stress}}{\rho}}$
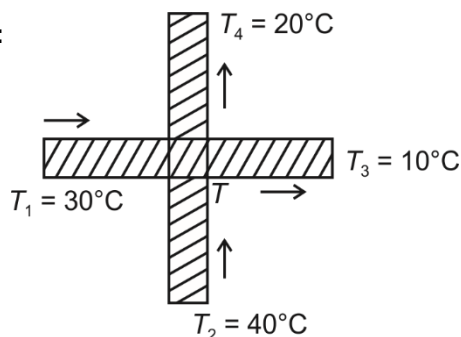
$\therefore$ $n = \dfrac{1}{2L} \times \sqrt{\dfrac{\text{max. stress}}{\rho}} = \dfrac{1}{2 \times 0.75}\sqrt{\dfrac{8.1 \times 10^8}{9 \times 10^3}}$

$= \dfrac{2}{3} \times 3 \times 10^2$

$= 200$ Hz

42. **Answer (1)**

    Hint: $\dfrac{\Delta H}{\Delta t} = KA\left(\dfrac{\Delta \theta}{l}\right)$ (For conductor)

    Sol.:

    Thermal resistance

    $$R = \dfrac{l}{KA}, K = \text{Thermal Conductivity}$$

    Let T = junction Temperature

    From diagram

    $\Rightarrow \dfrac{dH_1}{dt} + \dfrac{dH_2}{dt} = \dfrac{dH_3}{dt} + \dfrac{dH_4}{dt}$

    $\Rightarrow \dfrac{T_1 - T}{R} + \dfrac{T_2 - T}{R} = \dfrac{T - T_4}{R} + \dfrac{T - T_3}{R}$

    $\Rightarrow \dfrac{30 - T}{R} + \dfrac{40 - T}{R} = \dfrac{T - 20}{R} + \dfrac{T - 10}{R}$

    $\Rightarrow 30 - T + 40 - T = T - 20 + T - 10$

    $\Rightarrow 30 + 40 + 20 + 10 = 4T \qquad \therefore T = \dfrac{100}{4} = 25°C$

43. **Answer (3)**

    Hint: Use equation of continuity.

    Sol.: By continuity equation

    $A_1 v_1 + A_2 v_2 = A_3 v_3 + A_4 v_4$

    $\therefore \quad 10 + 5 = 8 + A_4 v_4$

    $15 - 8 = A_4 v_4$

    $7 = A_4 v_4$

    $7 = 0.7 \times v$

    $\therefore \quad v = 10 \text{ m/s}$

44. **Answer (4)**

    Hint: $R = \dfrac{u^2 \sin 2\theta}{g}, H_m = \dfrac{u^2 \sin^2 \theta}{2g}$

    $\therefore \quad \dfrac{R}{H_m} = \dfrac{4}{\tan \theta}$

45.

    Sol.: $\dfrac{R}{H_m} = \dfrac{4}{\tan \theta} \qquad \therefore \dfrac{12}{4} = \dfrac{4}{\tan \theta}$

    $\tan \theta = \dfrac{16}{12} = \dfrac{4}{3} \quad \therefore \sin \theta = \dfrac{4}{5}$

    $\therefore 4 = \dfrac{u^2 \sin^2 \theta}{2g} \Rightarrow 4 = \dfrac{u^2}{2g} \times \left(\dfrac{4}{5}\right)^2$
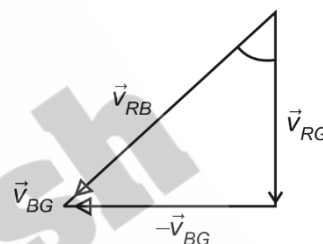
    $\therefore u^2 = 8g \times \dfrac{25}{16} = \dfrac{25g}{2}$

    $\therefore u = \sqrt{\dfrac{25g}{2}} = 5 \times \sqrt{\dfrac{g}{2}}$

    $\quad = 5\sqrt{5} \text{ m/s}$

45. **Answer (4)**

    Hint: $\vec{v}_{RB} = \vec{v}_{RG} - \vec{v}_{BG}$

    Sol.:

    $\vec{v}_{RB} = \vec{v}_{RG} + (-\vec{v}_{BG})$

    $|\vec{v}_{RB}| = \sqrt{v_{RG}^2 + v_{BG}^2} = 4\sqrt{2} \text{ km/h}$

46. **Answer (1)**

    Hint: Momentum transferred to surface when surface is reflecting or polished.

    $P = \left(\dfrac{2IA}{c}\right)\Delta t$

    Sol.: $P = \left(\dfrac{2IA}{c}\right)\Delta t = \dfrac{2 \times 24 \times 20 \times 3600}{3 \times 10^8}$

    $= 1.15 \times 10^{-2} \text{ kg m/s}$

    $\approx 1.2 \times 10^{-2} \text{ kg m/s}$

47. **Answer (4)**

    Hint: $qvB = \dfrac{mv^2}{r} \qquad \therefore r = \dfrac{mv}{qB}, T = \dfrac{2\pi m}{qB}$

    Sol.: Time period is independent of speed of charged particle

    $T = \dfrac{2\pi m}{qB}$

48. Answer (1)

    Hint: $eV = hf - W_0$

    Sol.: When light of frequency f_1 is incident on surface

    $eV_1 = hf_1 - W_0$

    When light of frequency f_2 is incident on same surface

    $eV_2 = hf_2 - W_0$

    $\therefore \quad eV_2 = hf_2 - [hf_1 - eV_1]$

    $V_2 = \dfrac{h}{e}(f_2 - f_1) + V_1$

49. Answer (2)

    Hint: For diffraction minima $n\lambda = a\sin\theta$

    a = Slit opening

    Sol.: $\lambda = a\sin\theta$, for first minima

    $\lambda = 5 \times \sin 30° = \dfrac{5}{2} = 2.5$ cm

50. Answer (1)

    Hint: Maximum magnifying power $M = \dfrac{f_0}{f_e}\left(1 + \dfrac{f_e}{D}\right)$

    Sol.: $f_e = 5$ cm, $f_0 = 200$ cm, $D = 25$ cm

    $M = \dfrac{200}{5}\left[1 + \dfrac{5}{25}\right] = 40 \times \dfrac{30}{25} = 48$

[CHEMISTRY]

SECTION-A

51. Answer (2)

    Hint: For high spin octahedral complexes, e_g orbitals starts to fill when each orbital of t_{2g} acquires one electron.

    Sol.:
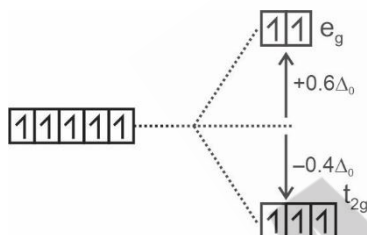
    CFSE = $3 \times -0.4\Delta_0 + 2 \times 0.6\Delta_0 = 0$

52. Answer (2)

    Hint: Because of the presence of unpaired electrons in the f-subshell, many lanthanoid ions are coloured.

    Sol.: Lanthanoids have typical metallic structure and are good conductors of heat and electricity.

53. Answer (3)

    Hint: Ions which contain unpaired electrons can exhibit colour in aqueous medium.
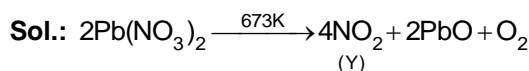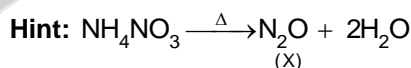
    Sol.:

Ions	No. of unpaired electrons	Colour
Sc^{3+}	0	Colourless
Ti^{4+}	0	Colourless
V^{3+}	2	Green
Zn^{2+}	0	Colourless

54. Answer (1)

    Hint: More is the acidic strength, lower will be the pK_a value

    Sol.: Down the group, as the size of halogen atom increases, the H-X bond length increases. As a result the H-X bond energy decreases

    $\therefore$ Acidic strength increases

    $\therefore$ The correct order of acidic strength is

    HI > HBr > HCl > HF
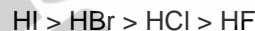
    So, the correct order of pK_a value is

	HF	>	HCl	>	HBr	>	HI
pK_a	3.2		−7.0		−9.5		−10.0

55. Answer (3)

    Hint: $NH_4NO_3 \xrightarrow{\Delta} \underset{(X)}{N_2O} + 2H_2O$

    Sol.: $2Pb(NO_3)_2 \xrightarrow{673K} \underset{(Y)}{4NO_2} + 2PbO + O_2$

    - Oxidation state of N in $N_2O(X)$: $2x - 2 = 0$

      $x = +1$

    - Oxidation state of N in $NO_2(Y) = x + 2(-2) = 0$

      $x = +4$

56. Answer (1)

    Hint: Vapour phase refining method includes Mond process and van Arkel Method.

    Sol.:

    - Mond process is used for the refining of Ni

      - $Ni + 4CO \xrightarrow{330K-350K} Ni(CO)_4$

      - $Ni(CO)_4 \xrightarrow{450-470\ K} Ni + 4CO$
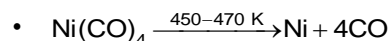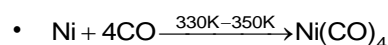
- van Arkel method is used for the refining of Zr and Ti

  - $Zr + 2I_2 \rightarrow ZrI_4$

  - $ZrI_4 \rightarrow Zr + 2I_2$

- Ge can be refined using zone refining

- Cu can be refined using electrolytic refining

57. **Answer (2)**

   Hint: Smoke is an example of aerosol

   Sol.: For smoke, the dispersed phase is solid and the dispersion medium is gas.

58. **Answer (4)**

   Hint: $Fe_2O_3 \cdot xH_2O$ is a positively charged sol

   Sol.:

   - A negative ion causes the precipitation of positively charged sol.

   - Greater the valency of the flocculating ion added, greater is its power to cause precipitation.

     ∴ $Fe_2O_3 \cdot xH_2O$ is most easily coagulated by PO_4^{3-}

59. **Answer (3)**

   Hint: Unit of rate constant is $(mol\ L^{-1})^{1-n}\ s^{-1}$, where n is the order of the reaction.

   Sol.: For second order reaction, n = 2

   ∴ Unit of rate constant = $(mol\ L^{-1})^{1-2}\ s^{-1}$

   = $mol^{-1}\ L\ s^{-1}$

60. **Answer (2)**

   Hint: $AlCl_3 \rightarrow Al^{3+} + 3Cl^-$

   For 1 mol of Al, 3 F is required.

   Sol.: No. of moles of $Al = \dfrac{w}{M} = \dfrac{1.35}{27} = 0.05$

   No. of Faraday's required to deposit
   1 mol of Al = 3

   No. of Faraday required to deposit 0.05 mol of Al

   = 3 × 0.05

   = 0.15 F

61. **Answer (3)**

   Hint: According to Kohlrausch Law of independent migration,

   $\Lambda_m^\circ(CH_3COOH) = \lambda_m^\circ(CH_3COO^-) + \lambda_m^\circ(H^+)$

Sol.:

- $\Lambda_m^\circ(CaCl_2) = \lambda_m^\circ(Ca^{2+}) + 2\lambda_m^\circ(Cl^-)$

- $\Lambda_m^\circ(HCl) = \lambda_m^\circ(H^+) + \lambda^\circ(Cl^-)$

- $\Lambda_m^\circ(CH_3COO)_2Ca = 2\lambda_m^\circ(CH_3COO^-) + \lambda_m^\circ(Ca^{2+})$

- ∴ $\Lambda_m^\circ(CH_3COOH) = \dfrac{\Lambda_m^\circ(CH_3COO)_2Ca}{2} + \Lambda_m^\circ(HCl)$

  $- \dfrac{\Lambda_m^\circ(CaCl_2)}{2}$

  $= \dfrac{x}{2} + y - \dfrac{z}{2}$

62. **Answer (4)**

   Hint: $\Delta T_f = iK_f m$

   Sol.: For urea, i = 1

   For water, $K_f = 1.86\ K\ kg\ mol^{-1}$

   $m = \dfrac{w \times 1000}{M \times W}$

   $= \dfrac{3 \times 1000}{60 \times 500}$

   $\Delta T_f = 1 \times 1.86 \times \dfrac{3 \times 1000}{60 \times 500} = 0.186$

   $T_f = T_f^\circ - \Delta T_f$

   = 0°C − 0.186°C

   = −0.186°C

63. **Answer (1)**

   Hint: In case of negative deviations from Raoult's Law, the intermolecular attractive forces between A-A and B-B are weaker than those between A-B and leads to decrease in vapour pressure resulting in negative deviations.

   Sol.: Mixture $CHCl_3$ and Acetone shows negative deviation because of hydrogen bonding.
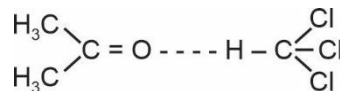
- Mixture of benzene and toluene and mixture of bromoethane and chloroethane show ideal behaviour.

- Mixture of ethanol and acetone shows positive deviation from Raoult's Law.

64. Answer (2)

Hint: In hcp lattice, no. of tetrahedral voids and octahedral voids formed by N closed packed atoms are 2N and N respectively

Sol.: Let the no. of atoms of A be N

So, the no. of atoms of $B = \dfrac{3}{4} \times 2N = \dfrac{3}{2}N$

(∵ atoms of B occupy $\dfrac{3}{4}$ th of the tetrahedral voids)
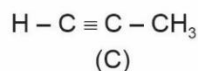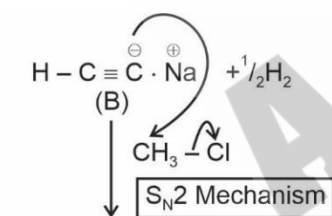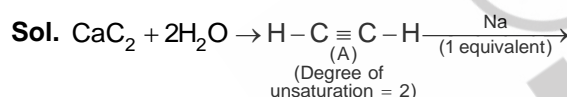
Also, the no. of atoms of $C = \dfrac{1}{2} \times N$

(∵ atoms of C occupy half of the octahedral voids)

∴ The formula of the compound is $A_N B_{\frac{3}{2}N} C_{\frac{N}{2}}$

⇒ A₂B₃C

65. Answer (4)
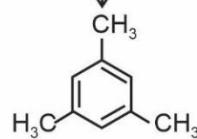
Hint: Calcium carbide on hydrolysis gives ethyne which has acidic hydrogen

Sol. $CaC_2 + 2H_2O \rightarrow \underset{\substack{(A) \\ \text{(Degree of} \\ \text{unsaturation = 2)}}}{H-C \equiv C-H} \xrightarrow[\text{(1 equivalent)}]{Na}$

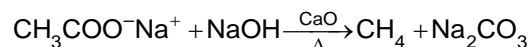- $CH \equiv CH$ is more acidic than $CH \equiv C - CH_3$

66. Answer (2)

Hint: In Wurtz reaction, alkyl halides on treatment with sodium metal in dry ether give higher alkanes
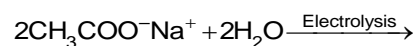
Sol.:

- Wurtz reaction:

  $2CH_3 - Br + 2Na \xrightarrow{\text{Dry Ether}} CH_3 - CH_3 + 2NaBr$

- Decarboxylation:

  $CH_3COO^-Na^+ + NaOH \xrightarrow[\Delta]{CaO} CH_4 + Na_2CO_3$
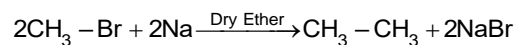
- Kolbe's Electrolytic method:

  $2CH_3COO^-Na^+ + 2H_2O \xrightarrow{\text{Electrolysis}}$

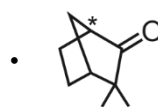 $CH_3 - CH_3 + 2CO_2 + H_2 + 2NaOH$

67. Answer (2)

Hint:

% of $N = \dfrac{14 \times \text{milliequivalent of } NH_3}{1000 \times \text{mass of organic compound}} \times 100$

Sol.: Milliequivalents of ammonia = 0.5 × 10 × 2

$\phantom{\text{Milliequivalents of ammonia}} = 10$

% of $N = \dfrac{14 \times 10 \times 100}{0.2 \times 1000} = 70\%$

68. Answer (3)

Hint: Bridgehead carbon cannot be *sp²* hybridised.

Sol.:

- (No enolisable hydrogen)
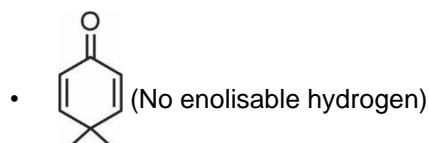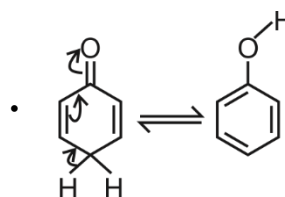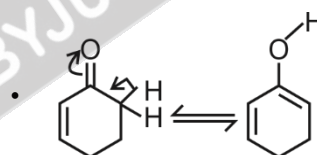
Bridgehead carbon C(*) cannot be *sp²* hybridised.

69. **Answer (2)**

    Hint: In diamond, each carbon atom is bonded to 4 carbon atoms.

    Sol.:

    - In diamond, each carbon atom undergoes sp^3 hybridisation and linked to four other carbon atoms.

    - In graphite, each carbon atom in hexagonal ring undergoes sp^2 hybridisation and makes three sigma bonds with three neighbouring carbon atoms. Fourth electron forms a π bond.

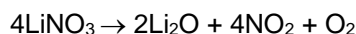   - In Buckminsterfullerene, all the carbon atoms are equal and they undergo sp^2 hybridisation. Each carbon atom forms three sigma bonds with other three carbon atoms.

70. **Answer (2)**

    Hint: Lithium nitrate when heated gives lithium oxide

    $4LiNO_3 \rightarrow 2Li_2O + 4NO_2 + O_2$

    Sol.:

    - LiCl is deliquescent and crystallises as a hydrate, $LiCl.2H_2O$ whereas other alkali metal chlorides do not form hydrates.

    - $LiHCO_3$ is not obtained in solid form while all other alkali metals form solid hydrogen carbonates.
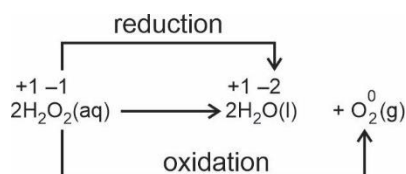
71. **Answer (1)**

    Hint: Volume strength $= M \times 11.2$

    Sol.: Volume strength $= 0.5 \times 11.2$

    $\qquad\qquad\qquad = 5.6$ V
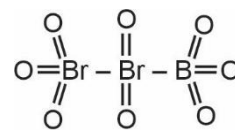
72. **Answer (3)**

    Hint: In a disproportionation reaction, an element in one oxidation state is simultaneously oxidised and reduced.
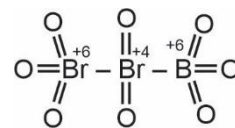
    Sol.:

73. **Answer (1)**

    Hint: Structure of Br_3O_8 is

    Sol.:

74. **Answer (3)**

    Hint: $K_{sp}[Sn(OH)_2] = [Sn^{2+}][OH^-]^2$

    Sol.: Let the solubility of $Sn(OH)_2$ be s mol L^{-1}

    - $Sn(OH)_2(s) \rightleftharpoons \underset{s}{Sn^{2+}}(aq) + \underset{2s}{2OH^-}(aq)$

    - $NaOH \rightarrow \underset{0.1}{Na^+} + \underset{0.1}{OH^-}$
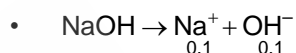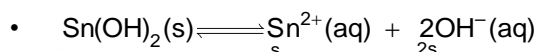
    $K_{sp[Sn(OH)_2]} = [Sn^{2+}][OH^-]^2$

    $K_{sp} = s(2s + 0.1)^2$

    $1.4 \times 10^{-28} = s \times (0.1)^2 \ (\because 2s + 0.1 \simeq 0.1)$

    $s = 1.4 \times 10^{-26}$ mol/L

75. **Answer (4)**

    Hint: Salt of weak acid and strong base undergoes anionic hydrolysis.

    Sol.: $NaCN + H_2O \rightleftharpoons HCN + Na^+ + OH^-$
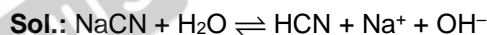
    NaCN is a salt of strong base and weak acid. So, hydrolysis of CN^- takes place.

76. **Answer (3)**

    Hint: Enthalpy of reaction

    $= (BE)_{Reactants} - (BE)_{Products}$

    Sol.: $\dfrac{1}{2}A_2(g) + \dfrac{1}{2}B_2(g) \longrightarrow AB(g)$
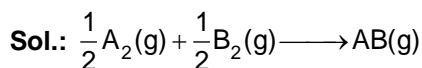
    $\Delta_f H = \Delta_r H = (BE)_{reactants} - (BE)_{products}$

    $= \dfrac{1}{2} \times (BE)_{A-A} + \dfrac{1}{2} \times (BE)_{B-B} - BE_{A-B}$

    $= \dfrac{x}{2} + \dfrac{y}{2} - z$

77. **Answer (2)**

    Hint: For free Expansion, $P_{ext} = 0$

    Also, $w = -P_{ext}\Delta V = 0$

Sol.: For adiabatic process, heat change in the process is zero.

• According to first Law of thermodynamics,

$\Delta U = q + w = 0$

• Also, $\Delta U = nC_v\Delta T$

∵ $\Delta U = 0$

∴ $\Delta T = 0$

78. Answer (1)

Hint: Ideal Gas Equation : PV = nRT.

Sol.: $n_{O_2} = \dfrac{4.8}{32} = 0.15$

$n_{SO_2} = \dfrac{3.2}{64} = 0.05$

$n_T = 0.15 + 0.05 = 0.2$

∵ PV = nRT

$\Rightarrow$ $P = \dfrac{0.2 \times 0.0821 \times 300}{2}$

$= 2.463 \simeq 2.5$ atm

79. Answer (3)

Hint: No. of hybrid orbitals = No. of σ bonds + No. of lone pairs of electrons on central atom

Sol.:

	No. of Hybrid orbitals = No. of σ bond + lone pair	Hybridisation of Xe
F–Xe–F (with lone pairs)	2 + 3 = 5	sp^3d
O=Xe(=O)(–O)	3 + 1 = 4	sp^3
XeF$_6$ type	6 + 1 = 7	sp^3d^3

80. Answer (2)

Hint:

• $BO = \dfrac{1}{2}(N_b - N_a)$

• Species which contain unpaired electrons are paramagnetic in nature.

• Species which do not contain unpaired electron are diamagnetic in nature.

Sol.:

• $N_2(14e)$

$BO = \dfrac{1}{2}(10 - 4) = 3$ (Diamagnetic)

• $N_2^-(15e^-)$

$BO = \dfrac{1}{2}(10 - 5) = 2.5$ (Paramagnetic)

• $NO(15e^-)$

$BO = \dfrac{1}{2}(10 - 5) = 2.5$ (Paramagnetic)

• $NO^+(14e^-)$

$BO = \dfrac{1}{2}(10 - 4) = 3$ (Diamagnetic)

• $O_2(16e^-)$

$BO = \dfrac{1}{2}(10 - 6) = 2$ (Paramagnetic)

• $O_2^+(15e^-)$

$BO = \dfrac{1}{2}(10 - 5) = 2.5$ (Paramagnetic)

• $H_2(2e^-)$

$BO = \dfrac{1}{2}(2 - 0) = 1$ (Diamagnetic)

• $H_2^-(3e^-)$

$BO = \dfrac{1}{2}(2 - 1) = 0.5$ (Paramagnetic)

81. Answer (4)

Hint: In modern periodic table on moving down the group, the electronegativity generally decreases and on moving left to right, in period, the electronegativity increases.

Sol.:

- Generally, ionisation enthalpy increases on moving left to right in the modern periodic table.

  The ionisation enthalpy of N is greater than O, because N has half filled $2p$ sub-shell.

- Generally, on moving top to bottom, the negative value of electron gain enthalpy decreases but the negative electron gain enthalpy of O is comparatively less than expected because of interelectronic repulsion.

- As the metallic character of elements increases, the basic character of their oxides also increases.

Elements	Electronegativity on Pauling Scale
N	3.0
C	2.5
Si	1.8
Al	1.5

82. **Answer (4)**

    Hint: For single electron species, the energy of atomic orbitals depends only upon the value of principal quantum number i.e. n.

    Sol.: For He^+ ion, higher is the value of principal quantum number i.e. n, higher will be the energy of atomic orbital.

    ∴ Correct order of energy of atomic orbitals is

    $5s > 4d = 4p = 4s > 3d = 3p = 3s$

83. **Answer (3)**

    Hint: Species with same number of electrons are isoelectronic in nature.

    Sol.:

Species		Number of Electrons
N^{3-}	:	10
S^{2-}	:	18
Ni^{2+}	:	26
Co^{2+}	:	25
Cr^{3+}	:	21
V^{2+}	:	21
Zn^{2+}	:	28
Cu^{2+}	:	27

84. **Answer (3)**

    Hint: Empirical formula is simple whole number ratio of elements present in a compound.

    Sol.:

Element	Mass%	Atomic Mass	No. of Moles	Molar Ratio
C	92.3	12 u	7.7	$\frac{7.7}{7.7} = 1$
H	7.7	1 u	7.7	$\frac{7.7}{7.7} = 1$

    ∴ The Empirical formula of the compound is CH

85. **Answer (4)**

    Hint: At STP, volume of 1 mol of a gas is 22.4 L

    Sol.:

    - 11 g of $CO_2 = \frac{11}{44}$ mol of CO_2 = 0.25 mol of CO_2 = 0.25 × 3 × N_A atoms = 0.75 N_A atoms

    - 11.2 L of $O_2(g)$ at STP = $\frac{11.2}{22.4}$ mol of $O_2(g)$

      = 0.5 mol of $O_2(g)$ = 0.5 × 2 × N_A atoms

      = N_A atoms

    - 12 g of Mg(s) = $\frac{12}{24}$ mol of Mg = 0.5 mol of Mg

      = 0.5 N_A atoms of Mg

    - 0.5 mol of H_2O_2 = 0.5 × 4 × N_A atoms = $2N_A$ atoms

SECTION-B

86. **Answer (4)**

    Hint: For fcc unit cell,

    $a = 2\sqrt{2}\ r$

    Sol.: a = 298 pm

    $r = \frac{1}{2\sqrt{2}}a$

    $r = \frac{1}{2\sqrt{2}} \times 298$ pm

87. **Answer (2)**

    Hint & Sol.: Maximum prescribed concentration of Cd in drinking water is 0.005 ppm.
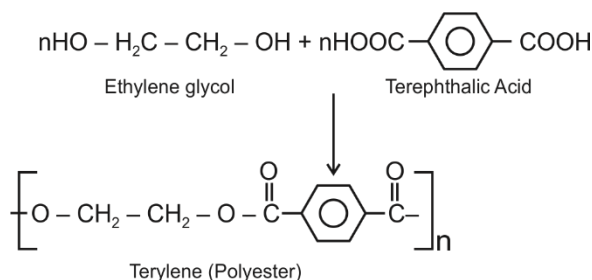
88. **Answer (1)**

    Hint: Veronal is a derivative of Barbituric Acid

    Sol.: Veronal is a tranquilizer.

89. **Answer (2)**

Hint: Polyester are the polycondensation products of dicarboxylic acids and diols

Sol.:

$$nHO - H_2C - CH_2 - OH + nHOOC -⟨O⟩- COOH$$

Ethylene glycol   Terephthalic Acid

Terylene (Polyester)

90. **Answer (2)**

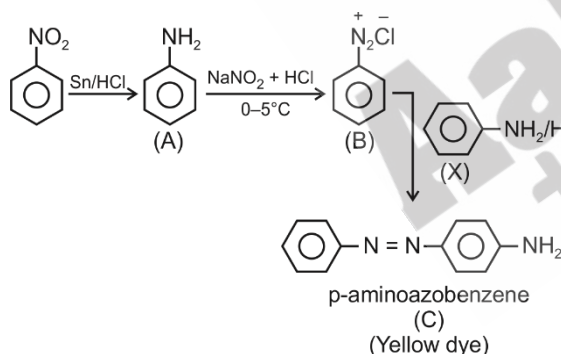**Hint:** Thiamine is vitamin B_1

Sol.:

- Deficiency of thiamine (vitamin B_1) causes Beri-Beri.
- Deficiency of vitamin A causes night blindness.
- Deficiency of vitamin B_2 causes Cheilosis.
- Deficiency of vitamin B_6 causes Convulsions.

91. **Answer (4)**

Hint: Nitrobenzene on reduction gives aniline

Sol.:

p-aminoazobenzene
(C)
(Yellow dye)

92. **Answer (3)**

Hint: Primary aromatic or aliphatic amines on reaction with chloroform and ethanolic potassium hydroxide give isocyanide. This is known as carbylamine test.

$$R-NH_2 + CHCl_3 + 3KOH \xrightarrow{\Delta} \underset{\substack{\text{Isocyanide} \\ \text{(pungent smell)}}}{R-NC} + 3KCl + 3H_2O$$

Sol.:
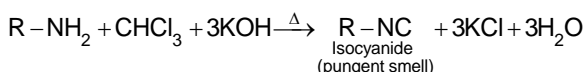
- CH_3NH_2 and ⟨O⟩$-CH_2NH_2$, both give carbylamine test.

- CH_3NH_2 and ⟨O⟩$-NH_2$, both give carbylamine test.

- $CH_3CH_2NH_2$ gives carbylamine test while $CH_3 - \underset{\underset{CH_3}{|}}{CH} - NH - CH_3$ will not give carbylamine test.

- $CH_3NH - CH_3$ and $CH_3 - \underset{\underset{CH_3}{|}}{N} - CH_3$, both do not give carbylamine test.

93. **Answer (1)**

Hint: Nucleophilic addition on acetone takes place using Grignard reagent.

Sol.:

2-Methylbutan-2-ol
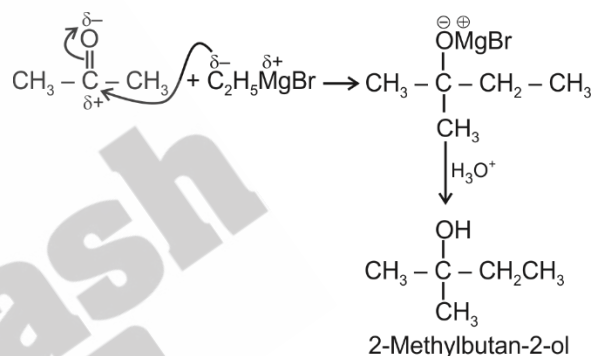
94. **Answer (3)**

Hint: Rearrangement of carbocation takes place.

Sol.:

95. **Answer (2)**

    Hint: Ketones neither give Tollens' test nor Fehling's test.

    Sol.: Compounds containing $CH_3 - \overset{\overset{O}{\|}}{C} -$ and $CH_3 - \overset{\overset{OH}{|}}{CH} -$ groups give iodoform test.

    - Aliphatic and aromatic aldehydes give Tollen's test.
    - Benzaldehyde does not give Fehling's test.

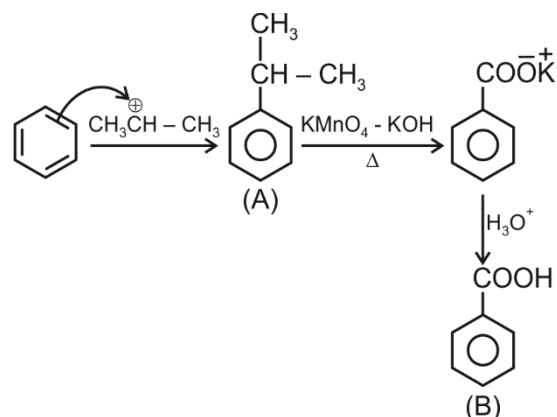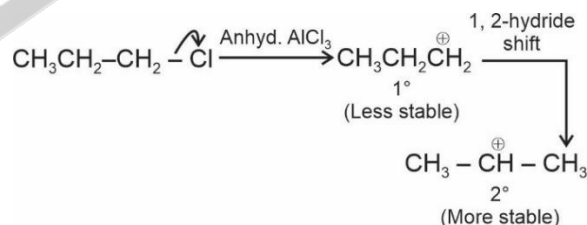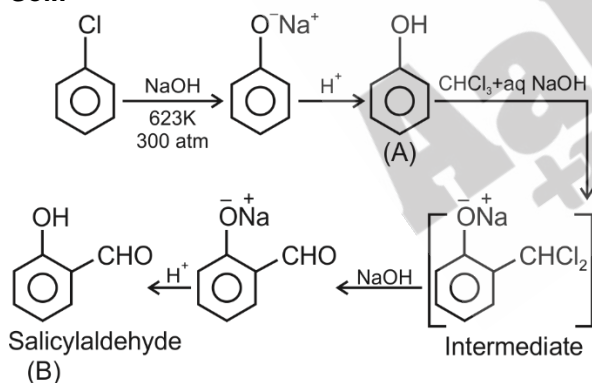 | Compounds | Iodoform Test | Tollen's Test | Fehling's Test |
    |---|---|---|---|
    | $CH_3 - \overset{\overset{O}{\|}}{C} - H$ | Positive | Positive | Positive |
    | $CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$ | Positive | Negative | Negative |
    | ⬡—CHO | Negative | Positive | Negative |
    | $CH_3 - \overset{\overset{OH}{|}}{CH} - CH_3$ | Positive | Negative | Negative |

96. **Answer (3)**

    Hint: Chlorobenzene when fused with NaOH at 623 K and 300 atm pressure followed by acidification gives phenol.

    Sol.:

    Salicylaldehyde (B)

97. **Answer (1)**

    Hint: Phenetole is ethoxybenzene, ⬡—OC_2H_5

    Sol.:
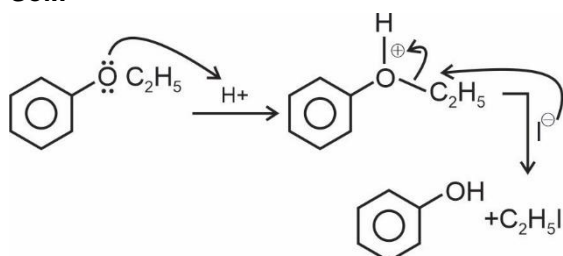
98. **Answer (2)**

    Hint: Reaction follows benzyne mechanism

    Sol.:
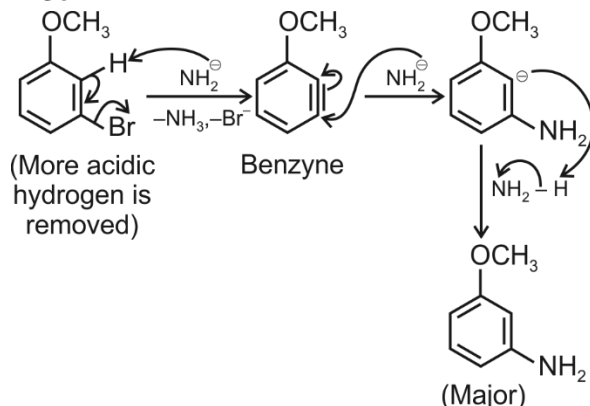
99. **Answer (3)**

    Hint: More is the stability of the carbocation, more will be the reactivity of alkyl halide towards S_N1 reaction.

    Sol.:

    - Correct order of stability of carbocation is

    $$(CH_3)_3\overset{\oplus}{C} > \underset{\overset{\oplus}{CH_2}}{⬡} > CH_2 = CH - \overset{\oplus}{CH_2} > (CH_3)_2\overset{\oplus}{CH}$$
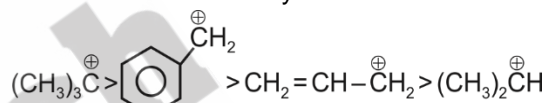
    - Correct order of reactivity of alkyl halides towards S_N1 reaction is

    $$(CH_3)_3C - Cl > \underset{\overset{CH_2Cl}{}}{⬡}$$

    $$> CH_2 = CH - CH_2 - Cl > (CH_3)_2CH - Cl$$
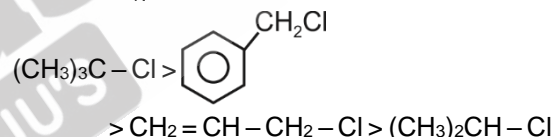
100. **Answer (1)**

    Hint: Magnetic moment, $\mu = \sqrt{n(n+2)}$ BM

    Where n is the no. of unpaired electrons.

    Sol.: ∵ H_2O is a weak field ligand

    So, pairing of electron will not take place.

    - $[Fe(H_2O)_6]^{3+}$; $Fe^{3+} = [Ar]\ 3d^5$

↑	↑	↑	↑	↑
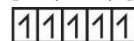
    n = 5

    $\mu = \sqrt{n\ (n+2)}$

    $\mu = \sqrt{5\ (5+2)}$

    = 5.92 BM

    - $[Fe(H_2O)_6]^{2+}$; $Fe^{2+} = [Ar]\ 3d^6$

↑↓	↑	↑	↑	↑
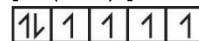
    n = 4

    $\mu = \sqrt{n\ (n+2)}$

    $\mu = \sqrt{4\ (4+2)}$

    = 4.90 BM.

[BOTANY]

101. Answer (3)

Hint: Biofertilizers are used in organic farming.

Sol.: Biofertilizers are organisms that enrich the nutrient quality of the soil. The main source of biofertilizers are bacteria, fungi and cyanobacteria.

102. Answer (1)

Hint: BOD is Biochemical oxygen demand.

Sol.: BOD test measures the amount of uptake of oxygen by micro-organisms in the given sample of water.

103. Answer (2)

Sol.: The IARI, New Delhi released vitamin C enriched bitter gourd, bathua, mustard and tomato.

104. Answer (2)

Hint: Pusa sem-2 and Pusa sem-3 are insect-pest resistant varieties of flat bean.

Sol.:

- Pusa snowball K1 is disease resistant variety of cauliflower.

- Pusa Komal is a disease resistant variety of cowpea.

- Pusa A-4 is disease resistant variety of Bhindi.

105. Answer (3)

Hint: Goats and Abingdon tortoise interaction is an interspecific competition.

Sol.: Introduction of goats, resulted in exclusion of Abingdon tortoise from Galapagos island because goats are better browser.

106. Answer (1)

Hint: On logarithmic scale, the relationship is a straight line.

Sol.:

- The species richness increases with the increase in explored area.

- For large areas value of Z lies in range of 0.6 to 1.2.

- Larger the explored area, more is the steepness of slope of line.

107. Answer (2)

Sol.: The temperature of Earth has increased by 0.6°C. This rise in temperature is leading to deleterious changes in the environment and resulting in odd climate changes (El Nino effect).

108. Answer (4)

Hint: DFC is detritus food chain and GFC is grazing food chain.

Sol.: GFC is the major conduit of energy flow in aquatic ecosystem.

109. Answer (3)

Sol.: Steller's sea cow and passenger pigeon species got extinct in the last 500 years due to over-exploitation by humans.

110. Answer (4)

Hint: Hot spots are regions of accelerated habitat loss.

Sol.: The concept of hot spot was developed to designate priority areas for *in-situ* conservation.

111. Answer (4)

Sol.: If an amino acid is coded by more than one codons, it is degenerate.

112. Answer (4)

Hint: Double chain of DNA is helically twisted in right-handed fashions.

Sol.:

- Uracil replaces thymine in RNA.

- The backbone is constituted by sugar-phosphate, and the bases project inside.

113. Answer (1)

Hint: The cells of this region divide repeatedly to produce new cells.

Sol.: The cells of region of meristematic activity are thin walled, very small with dense protoplasm, undifferentiated and divide repeatedly, present just above the root cap.

114. Answer (2)

Hint: Sclereids are type of sclerenchymatous cell.

Sol.: Sclereids are present in the fruit wall of nuts like walnut, almonds, etc.

115. Answer (3)

    Hint: Perianth is observed in lily family.

    Sol.: Floral formula $Br \oplus \male P_{(3+3)} A_{3+3} \underline{G}_{(3)}$ represents Liliaceae family.

116. Answer (2)

    Hint: The younger flowers are present towards the apex in racemose inflorescence.

    Sol.: The flowers are borne in a acropetal order and main axis continues to grow indefinitely in case of racemose inflorescence.

117. Answer (3)

    Hint: Telophase I is final stage of reduction division.

    Sol.: The nuclear membrane and nucleolus reappear in telophase I.

118. Answer (4)

    Hint: Centromere is slightly away from the middle of the chromosomes showing L-shape during anaphase.

    Sol.: Sub-metacentric chromosomes appear L-shaped during anaphase of cell cycle.

119. Answer (2)

    Hint: Leucoplast are the colourless plastids of variable shapes and size with stored nutrients.

    Sol.: Elaioplast is a kind of leucoplast; stores oils and fats as food.

120. Answer (3)

    Hint: Complete disintegration of the nuclear envelope marks the beginning of this phase.

    Sol.: During metaphase stage, chromosomes are thickest and shortest. Hence it is easy to study the morphology of chromosomes.

121. Answer (1)

    Sol.: Primata and Diptera represents order of human and housefly respectively.

122. Answer (3)

    Hint: ABA promotes seed dormancy.

    Sol.: By the application of nitrate and gibberellic acid we can remove effect of chemical inhibitors which promote seed dormancy.

123. Answer (1)

    Hint: They are pathogenic to both animals and plants.

    Sol.: *Mycoplasma* are smallest living cell which completely lack cell wall.

124. Answer (3)

    Sol.: ABA – derivative of carotenoids

    Auxin – Indole compound

    Gibberellic acid – Terpenes derivative

    Cytokinin – Adenine derivative

125. Answer (1)

    Hint: The precursor of chlorophyll is formed from α-ketoglutaric acid in Krebs cycle.

    Sol.: Succinyl CoA is used as raw material for chlorophyll and cytochrome synthesis.

126. Answer (4)

    Hint: Protoplasmic respiration occurs when body undergoes prolonged starvation.

    Sol.: In protoplasmic respiration, protein is used as respiratory substrate.

127. Answer (3)

    Sol.: Joseph Priestley performed a series of experiment with the help of a bell jar, a mouse, burning candle and mint plant. He revealed the essential role of air in the growth of green plants.

128. Answer (2)

    Hint: Leaves of C_4 plant show Kranz anatomy.

    Sol.: In C_4 plant, malic acid is formed from oxaloacetic acid in the cells of mesophyll tissue. Malic acid then enters in bundle sheath cells.

129. Answer (3)

    Hint: Orientation of microfibrils also aid in opening of stomata.

    Sol.: Cellulose microfibrils are oriented radially rather than longitudinally making it easier for stomata to open.

130. Answer (4)

    Sol.:

    - Manganese is involved in the splitting of water to liberate oxygen during photosynthesis.
    - Deficiency of copper cause necrosis of leaves.
    - Boron is required for pollen germination.
    - Sulphur is constituent of vitamins and coenzymes.

131. Answer (2)

    Hint: Band of suberised matrix called casparian strip which is impervious to water.

    Sol.: The inner boundary of the cortex the endodermis is impervious to water because of presence of casparian strip.

132. Answer (2)

    Hint: All solutions have lower water potential than pure water.

    Sol.: Solute potential is always negative.

133. Answer (1)

    Hint: Liverwort have thalloid plant body.

    Sol.: *Marchantia* is a liverwort in which thallus is dorsiventral and closely appressed to the substrate.

134. Answer (4)

    Hint: Members of Rhodophyceae show oogamy which is accompanied by complex post fertilisation development.

    Sol.: *Porphyra, Gracilaria* and *Gelidium* are members of Rhodophyceae.

135. Answer (2)

    Hint: G. Bentham and J.D. Hooker gave natural classification system.

    Sol.: Bentham and Hooker classified plants on the basis of natural affinities, external as well as internal features like embryology, anatomy and phytochemistry.

SECTION-B

136. Answer (2)

    Hint: Pseudocarp develop from floral parts other than ovary.

    Sol.: Apple and strawberry are false fruits.

137. Answer (4)

    Hint: Conduction of water is performed by peripheral region of secondary xylem.

    Sol.: Sapwood is actively involved in the conduction of water and minerals from root to leaves.

138. Answer (1)

    Hint: Inferior ovary is present in ray florets of sunflower.

    Sol.: Ray florets of sunflower have epigynous flower.

139. Answer (2)

    Hint: Female honey bee are diploid.

    Sol.: Female honey bee is diploid with 32 number of chromosomes.

140. Answer (3)

    Hint: In pleiotropy, single gene product may produce more than one effects.

    Sol.: Phenylketonuria is an example of Pleiotropy.

141. Answer (1)

    Hint: Meiosis II is also an equational division.

    Sol.: In anaphase-II, the splitting of centromere of each chromosomes occurs.

142. Answer (4)

    Sol.: Microsatellite – small repetitive sequence of 1-6 base pairs.

143. Answer (4)

    Hint: The phenotypic ratio of Mendelian dihybrid cross is 9 : 3 : 3 : 1.

    Sol.:

Round yellow	:	Round green	:	Wrinkled yellow	:	Wrinkled green
9	:	3	:	3	:	1

    $\therefore \dfrac{3}{16}$ = wrinkled yellow seeds.

144. Answer (2)

    Hint: Colourblindness is sex linked disorder.

    Sol.: The gene which is responsible for colour blindness is present on X-chromosome.

145. Answer (3)

    Hint: Generally, dsDNA is genetic material in bacteriophage.

    Sol.: QB-bacteriophages are RNA containing viruses.

146. Answer (2)

    Hint: Number of seeds never exceeds number of ovules.

    Sol.: *Orobanche* and *Striga* are parasitic plants produce thousands of tiny seeds and orchids also contain thousands of seeds.

    Wheat is single seeded.

147. Answer (3)

    Sol.: Mucilagenous covering protects the pollens from wetting in hydrophytes.

148. Answer (2)

Hint: This layer also nourishes the developing pollen grains.

Sol.: Cells of tapetum possess dense cytoplasm and generally have more than one nucleus.

149. Answer (4)

Sol.: Zygote $\longrightarrow$ Embryo

Ovary $\longrightarrow$ Fruit

Ovule $\longrightarrow$ Seed

Ovary wall develops into pericarp and it is protective in function.

150. Answer (3)

Hint: Endosperm is triploid and meiocyte is diploid.

Sol.: Endosperm (3n) = 51

Meiocyte (2n) = 34.

Gamete (haploid) = n = 17.

[ZOOLOGY]

SECTION-A

151. Answer (4)

Hint: Foetal haemoglobin has less P_{50} value.

Sol.: Foetal haemoglobin has less affinity for BPG, so it has more affinity for O_2. In emphysema, residual volume and lung volume increases. Pneumotaxic centre increases breathing rate by decreasing duration of inspiration.

152. Answer (2)

Hint: Branchial respiration

Sol.: Buccal respiration is present in frogs. Respiration through gills is known as branchial respiration. Branchial respiration is present in some arthropods, molluscs and fishes.

153. Answer (3)

Hint: Cells which secrete mucus

Sol.: Lipases are present in pancreatic juice and succus entericus. Small quantities of lipases are present in gastric juice also. Nucleases are present in pancreatic juice. Hepato-pancreatic duct opens into duodenum.

154. Answer (2)

Hint: Castle's intrinsic factor

Sol.: Oxyntic cell or parietal cell secretes HCl and Castle's intrinsic factor. HCl is responsible for reabsorption of iron and Castle's intrinsic factor is responsible for absorption of vitamin B_{12}. Iron deficiency as well as deficiency of vitamin B_{12} causes anaemia.

155. Answer (2)

Hint: Body is dorso-ventrally flattened

Sol.:

Earthworm – Segmented worm

Wuchereria – Filarial worm

Ancylostoma – Hook worm

Platyhelminthes – Flat worms

156. Answer (3)

Hint: Air bladder is present in bony fishes.

Sol.: *Exocoetus* is a marine bony fish having air bladder/swim bladder which regulates buoyancy. Air sacs are present in birds to supplement respiration. *Petromyzon* is a cyclostome having sucking and circular mouth. *Macaca* is a mammal having mammary glands.

157. Answer (2)

Hint: Complete digestive tract is present in roundworms.

Sol.: Incomplete digestive tract is present in flatworms but *Taenia solium* is an exception because digestive tract is completely absent in it. *Pheretima* is an annelid having complete digestive tract.

158. Answer (4)

Hint: Zinc is a cofactor for this enzyme.

Sol.: Zinc is a co-factor for carboxypeptidase which forms coordination bonds with side chains at active site and at the same time forms one or more coordination bonds with the substrate.

159. Answer (4)

Hint: Presence of zwitterionic form

Sol.: The structure of amino acids changes in solutions of different pH due to ionizable nature of $-NH_2$ and $-COOH$ groups.

160. Answer (4)

Hint: Structure present in female

Sol.: Spermathecae are two in number, present in 6th abdominal segment of only female cockroach and are responsible for storage of sperms.

161. Answer (2)

Hint: Biting and chewing type of mouth parts

Sol.: Maxillae and mandibles are paired mouth parts but labrum and labium are unpaired mouth parts of cockroach.

162. Answer (1)

Hint: Property of neurons and muscle fibres

Sol.: Connective tissue fibres provide strength, elasticity and flexibility to the tissues. Excitability is the property shared by both muscular and neural tissues.

163. Answer (3)

Hint: Secretion is also the function of cuboidal epithelium.

Sol.: Secretion and absorption are main functions of both cuboidal and columnar epithelia. Epithelium which forms glands is known as glandular epithelium. Both cuboidal and columnar epithelium form glandular epithelium.

164. Answer (1)

Hint: Endocrine glands

Sol.: In both plants and animals, hormones are responsible for the transitions between the three phases of life namely juvenile phase, reproductive phase and old age. Interaction between hormones and certain environmental factors regulate the reproductive processes and associated behavioural expressions of organisms.

165. Answer (3)

Hint: Formed after entry of sperm within ovum

Sol.: In humans, during oogenesis, meiosis-I is completed in tertiary follicle to form secondary oocyte and first polar body. Secondary oocyte completes meiosis II in fallopian tube after entry of sperm during fertilisation to form 2nd polar body and an ootid.

166. Answer (4)

Hint: Undifferentiated embryonic cells

Sol.: After implantation, finger-like projections appear on trophoblast called chorionic villi. Attachment of blastocyst with endometrium of uterus is called implantation. Oxytocin is released from maternal neurohypophysis.

167. Answer (4)

Hint: GnRH stimulates anterior pituitary to secrete gonadotropins

Sol.: Sex hormones inhibit the secretion of GnRH from hypothalamus and thus inhibit the secretion of both FSH and LH during pregnancy.

168. Answer (2)

Hint: Lined by germinal epithelium

Sol.: Cells of Sertoli are present in seminiferous tubules of testis which synthesize certain factors for transformation of spermatids into sperms called spermiogenesis. Rete testis and vasa efferentia are included in male sex accessory ducts.

169. Answer (3)

Hint: ZIFT

Sol.: When zygote or early embryo upto 8 celled stage is transferred into the fallopian tube, it is called ZIFT. In GIFT, both sperms and ovum are transferred into the fallopian tube/oviduct.

170. Answer (2)

Hint: Centchroman is present in Saheli

Sol.:

1.	Non-Medicated IUD	–	Lippes loop
2.	Hormone releasing IUDs	–	LNG-20 and Progestasert
3.	Copper-ions releasing IUDs	–	Cu-T, Cu-7 and Multiload-375
4.	Non-steroidal contraceptive pill	–	Saheli

171. Answer (4)

Hint: Not a directed process in terms of determinism

Sol.: Evolution is a stochastic process based on chance events in nature and chance mutation in organisms.

172. Answer (2)

   Hint: Bhopal is the capital

   Sol.: Cave paintings by pre-historic humans (Cro-Magnon man) are found at Bhimbetka rock shelter in Raisen district of Madhya Pradesh.

173. Answer (4)

   Hint: The extinct animals

   Sol.:

Formation of Earth	–	4.5 billion years back
Origin of life	–	4 bya
1st non- cellular forms of life	–	3 bya
Dinosaurs disappeared from the Earth	–	65 mya

174. Answer (4)

   Hint: Biogenetic law was proposed by Ernst Haeckel.

   Sol.: Darwin's finches are examples of adaptive radiation, allopatric speciation and natural selection but are not an example of evolution by anthropogenic action. Flippers of penguins and dolphins are examples of adaptive convergence.

175. Answer (3)

   Hint: Reptiles having 4-chambered heart

   Sol.: Sauropsids gave rise to thecodonts which evolved into crocodiles, dinosaurs and birds. So, crocodiles are the closest living relatives of birds.

176. Answer (2)

   Hint: Secretion containing lysozyme

   Sol.: Skin and mucus coating of digestive tract, respiratory tract and genital tract are included in physical barriers. Interferons are cytokine barriers.

177. Answer (4)

   Hint: First milk produced after parturition

   Sol.: Colostrum is yellow coloured fluid rich in IgA antibodies produced during initial few days of lactation. It provides natural passive immunity to new born. Antibodies are present in blood and body secretions to provide humoral immune response. Anamnestic response is based on memory cells produced during primary immune response.

178. Answer (4)

   Hint: Disease caused by Rhino virus

   Sol.: Typhoid is a bacterial disease caused by *Salmonella typhi*. Trichomoniasis is caused by a protozoan, *Trichomonas vaginalis*. Dengue is caused by Arbovirus. Hepatitis B, genital warts, genital herpes, common cold and chikungunya are viral diseases.

179. Answer (1)

   Hint: Saprophytic mode of nutrition

   Sol.: Muscarine is a hallucinogen obtained from a fungus, *Amanita muscaria.*

180. Answer (1)

   Hint: Receptors are present in GIT.

   Sol.: Morphine is an opioid analgesic and sedative obtained from latex of poppy plant. Cannabinoids are obtained from *Cannabis sativa*. Heroin/smack is chemically diacetyl morphine. Cocaine is a stimulant, obtained from *Erythroxylum coca*.

181. Answer (3)

   Hint: Hisardale

   Sol.: Breeding between individuals of same breed which are closely related for 4-6 generations is called inbreeding. Mating of animals within the same breed but having no common ancestors on either side of their pedigree up to 4-6 generations is called out-crossing. Breeding between two different related species is called interspecific hybridization.

182. Answer (3)

   Hint: PCR is used to amplify gene of interest.

   Sol.: DNA ligase is used for ligation of a gene of interest in a vector. Downstream processing includes all the processes to which a product is subjected before being marketed such as separation, preservation, etc. Insertion of rDNA into a bacterial host cell is called transformation.

183. Answer (4)

   Hint: Enzyme needed is obtained from *Thermus aquaticus* bacterium.

   Sol.: PCR is a technique of synthesizing multiple copies of desired gene *in vitro*. The basic requirements of PCR are DNA template, two nucleotide primers (forward and reverse primers) and a thermostable DNA polymerase (*Taq* polymerase).

184. Answer (3)

Hint: Organism which is genetically and morphologically similar to parent

Sol.: Dolly is a cloned sheep. Polly and Molly are transgenic sheeps and ANDi is a transgenic monkey. α-1-antitrypsin is used to treat emphysema. Rosie is a transgenic cow which produced human protein enriched milk. Golden rice is a transgenic rice enriched in β-carotene.

185. Answer (1)

Hint: Ethics include a set of standard protocols.

Sol.: Patents are supposed to satisfy certain criteria such as novelty, non-obviousness and utility. Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from countries and without compensatory payment to people concerned. Biowar is use of biological toxins or infectious agents with the intent to kill or harm humans or organisms as act of war.

SECTION-B

186. Answer (2)

Hint: Connects neural system with endocrine system

Sol.: Hypothalamus synthesizes somatostatin (GHIH) which inhibits secretion of growth hormone. Certain cells of pancreas also synthesize local hormone somatostatin to inhibit secretion of α and β cells of islets of Langerhans.

187. Answer (2)

Hint: Ganglionic cells form optic nerve

Sol.: Retina of human eye consists of 3 layers, from outside to inside, these are photoreceptor cells, bipolar cells and ganglionic cells.

188. Answer (3)

Hint: Hunger & thirst centre

Sol.: Urge of eating and drinking is regulated by hypothalamus. Medulla oblongata regulates swallowing, gastric secretion, cardiovascular reflexes and respiration.

189. Answer (3)

Hint: Head + short arm = cross arm

Sol.: Myosin filament is a polymeric protein formed by a number of monomeric units called meromyosin. Each meromyosin has two important parts globular head with short arm and tail. Head with short arm is called HMM and tail is called LMM.

190. Answer (4)

Hint: Vasodilator hormone

Sol.: Renin through Renin-angiotensin mechanism increases blood pressure and thus increases GFR. ANF has potent vasodilator effect and thus decreases blood pressure and GFR. So, this hormone is not released when GFR is already low.

191. Answer (4)

Hint: Androgens regulate libido.

Sol.: At puberty, synthesis of androgens starts under the effect of GnRH. Androgens act on CNS and have an influence on libido.

192. Answer (3)

Hint: Tall stature due to more growth

Sol.: Hypersecretion of growth hormone during childhood leads to a very tall stature called gigantism. Hyposecretion of growth hormone during childhood causes dwarfism.

193. Answer (1)

Hint: Velocity of sound waves is more in solid medium.

Sol.: Retinal absorbs light and dissociates from opsin so as to change the structure of opsin. Ear ossicles increase efficiency of transmission of sound waves.

194. Answer (4)

Hint: Centre present in medulla

Sol.: Swallowing centre is present in medulla oblongata, region of hindbrain. Association areas regulate complex functions of brain such as intersensory association, memory and communication.

195. Answer (1)

Hint: Cartilaginous joint

Sol.: Pubic symphysis is an example of cartilaginous joint. A block of white fibrous cartilage is present in between two vertebrae. So, these joints are considered as cartilaginous joints.

196. Answer (3)

Hint: Deficiency of protein dystrophin is due to genetic defect.

Sol.: Tetany is defined as rapid spasms due to low Ca^{+2} in body fluids. Muscular dystrophy is an X-linked genetic disease. Gout is an inflammation in the region of joints due to accumulation of uric acid crystals.

197. Answer (2)

Hint: GFR = 125 mL/min which is 1/5th of RPF.

Sol.: About 1/5th of cardiac output is filtered per minute by both kidneys. Filtration of blood takes place through 3 layers, endothelium of blood capillaries, podocytes of Bowman's capsule and basement membrane. Vasa recta is a branch of peritubular capillary network which is present along with juxtamedullary nephron.

198. Answer (2)

Hint: Collecting duct is not a part of nephron.

Sol.: Glomerulus is a part of nephron but not a part of renal tubule. Nephron is differentiated into two parts – glomerulus and renal tubule.

199. Answer (2)

Hint: Open circulation is present in insects.

Sol.: First heart sound called 'lub' is systolic and second heart sound called 'dub' is diastolic heart sound. Cockroach belongs to phylum Arthropoda exhibiting open circulatory system. Earthworm belongs to phylum Annelida exhibiting closed circulatory system.

200. Answer (1)

Hint: 6-8%

Sol.: Proteins constitute 6-8% of plasma, monocytes are 6-8% of total WBCs and neutrophils constitute about 60-65% of total WBCs. Lymphocytes form 20-25% of total WBCs.

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