

HINTS & SOLUTIONS
MATHEMATICS

1. If the lines.....

Sol. The given lines intersect each other if

$$\begin{vmatrix} 2-1 & 3-4 & 4-5 \\ 1 & 1 & \lambda \\ \lambda & 2 & 1 \end{vmatrix} = 0 \Rightarrow \lambda = 0, -1.$$

 2. If $\arg\left(\frac{z-2i}{z+2i}\right) = \frac{\pi}{6}$

 Sol. $\arg\left(\frac{z-2i}{z+2i}\right) = \frac{\pi}{6}$

$$\Rightarrow \arg(z-2i) - \arg(z+2i) = \frac{\pi}{6}$$

$$\Rightarrow \tan^{-1}\left(\frac{y-2}{x}\right) - \tan^{-1}\left(\frac{y+2}{x}\right) = \frac{\pi}{6}$$

$$\Rightarrow \frac{xy-2x-xy-2x}{x^2+y^2-4} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow x^2+y^2-4 = -4\sqrt{3}x$$

$$\Rightarrow x^2+y^2+4\sqrt{3}x-4=0$$

$$\Rightarrow (x+2\sqrt{3})^2+y^2=12+4=16$$

$$\therefore \text{centre } (-2\sqrt{3}, 0), \text{ radius} = 4$$

 3. Let ΔPQR be.....

 Sol. $\vec{a} + \vec{b} + \vec{c} = 0$

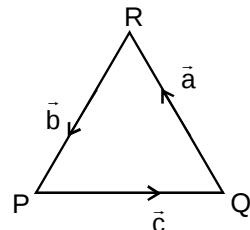
$$\Rightarrow \vec{b} + \vec{c} = -\vec{a}$$

$$\Rightarrow 48 + \vec{c}^2 + 48 = 144$$

$$\Rightarrow \vec{c}^2 = 48$$

$$\Rightarrow |\vec{c}| = 4\sqrt{3}$$

$$\therefore \frac{|\vec{c}|^2}{2} - |\vec{a}| = 24 - 12 = 12 \text{ Ans. (A)}$$



Further

$$\vec{a} + \vec{b} = -\vec{c}$$

$$\Rightarrow 144 + 48 + 2\vec{a} \cdot \vec{b} = 48$$

$$\Rightarrow \vec{a} \cdot \vec{b} = -72 \text{ Ans. (D)}$$

$$\therefore \vec{a} + \vec{b} + \vec{c} = 0$$

$$\Rightarrow \vec{a} \times \vec{b} + \vec{a} \times \vec{c} = 0$$

$$\therefore |\vec{a} \times \vec{b} + \vec{c} \times \vec{a}| = 2|\vec{a} \times \vec{b}|$$

$$= 2\sqrt{144.48 - (72)^2} = 48\sqrt{3} \text{ Ans. (C)}$$

 4. If $x^2 + x + 1 = 0$

 Sol. $N = \left(x + \frac{1}{x}\right)^2 + \left(x^2 + \frac{1}{x^2}\right)^2 + \left(x^3 + \frac{1}{x^3}\right)^2 + \dots + \left(x^{81} + \frac{1}{x^{81}}\right)^2$
 $x^2 + x + 1 = 0$ roots are ω and ω^2

first 3 terms repeated 27 times some value

$$27\left[\left(\omega + \frac{1}{\omega}\right)^2 + \left(\omega^2 + \frac{1}{\omega^2}\right)^2 + \left(\omega^3 + \frac{1}{\omega^3}\right)^2\right]$$

$$27\left[(\omega + \omega^2)^2 + (\omega^2 + \omega)^2 + (2)^2\right]$$

$$27[(-1)^2 + (-1)^2 + (2)^2] = 162$$

$$N = 162$$

$$N = 2 \cdot 3^4$$

$$\text{Divisors} = (1+1)(4+1) = 10$$

Prime factors are 2 and 3 so total = 2

Highest prime factor = 3

 5. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$,

 Sol. We have $(\vec{a} \times \vec{b}) \times \vec{a} = (\vec{a} \cdot \vec{a})\vec{b} - (\vec{b} \cdot \vec{a})\vec{a} = |\vec{a}|^2 \vec{b} - 2\vec{a}$

$$\therefore \vec{b} = \frac{(\vec{a} \times \vec{b}) \times \vec{a} + 2\vec{a}}{|\vec{a}|^2}$$

 Now, $(\vec{a} \times \vec{b}) \times \vec{a} = 4\hat{i} - 5\hat{j} + \hat{k}$ and $|\vec{a}| = 3$.

$$\therefore \vec{b} = \frac{(4\hat{i} - 5\hat{j} + \hat{k}) + 2(\hat{i} + \hat{j} + \hat{k})}{3} = 2\hat{i} - \hat{j} + \hat{k}$$

 6. Projection of $\vec{a} = \hat{i} + \hat{j} + \hat{k}$,

$$\text{Sol. } \frac{x+1}{2} = \frac{y+1}{-1} = \frac{z+3}{4} = r$$

 any point $(2r-1, -r-1, 4r-3)$

 lie on plane $x+2y+z=6$

$$2r-1-2r-2+4r-3=6$$

$$4r=12$$

$$A(5, -4, 9)$$

 at $r=0$ point is $(-1, -1, -3)$

and foot of perpendicular on plane is

$$\frac{x+1}{1} = \frac{y+1}{2} = \frac{z+3}{1} = \frac{-(-1-2-3-6)}{1+4+1}$$

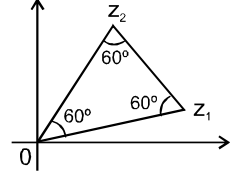
$$= \frac{12}{6} = 2$$

$$x = 1, y = 3, z = -1$$

$$\frac{x-1}{4} = \frac{y-3}{-7} = \frac{z+1}{10}$$

7. If the vertices of.....

Sol. $|z_1| = |z_2| = |z_2 - z_1|$



$$\arg \frac{z_1}{z_2} = \frac{\pi}{3} \Rightarrow |\arg(z_1) - \arg(z_2)| = \frac{\pi}{3}$$

8. Let $\vec{\alpha} = a\hat{i} + b\hat{j} + c\hat{k}$,

Sol. Given vectors are coplanar $\Rightarrow \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$

$$\Rightarrow a^3 + b^3 + c^3 - 3abc = 0$$

$$\Rightarrow (a+b+c) \left[(a-b)^2 + (b-c)^2 + (c-a)^2 \right] = 0$$

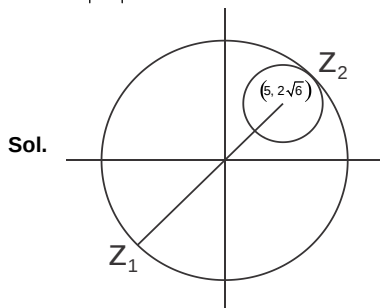
$$\Rightarrow a+b+c = 0$$

as $a \neq b$ and

$$\Rightarrow \vec{v} \cdot (a\hat{i} + b\hat{j} + c\hat{k}) = \vec{v} \cdot (b\hat{i} + c\hat{j} + a\hat{k})$$

$$= \vec{v} \cdot (c\hat{i} + a\hat{j} + b\hat{k}) = 0$$

9. If $|z_1| = 12$ and.....



10. If $\sqrt{5-12i} + \dots$

Sol. $\sqrt{5-12i} = \sqrt{(3-2i)^2} = \pm(3-2i)$

$$\sqrt{-5-12i} = \sqrt{(2-3i)^2} = \pm(2-3i)$$

$$Z = -1-i, -5+5i, 5-5i, 1+i$$

11. If $\vec{x} + \vec{y} = \vec{a}$,

Sol. $\vec{x} \times \vec{y} = \vec{b}$

$$\vec{x} \times (\vec{a} - \vec{x}) = \vec{b}$$

$$\vec{x} \times \vec{a} = \vec{b}$$

$$(\vec{x} \times \vec{a}) \times \vec{a} = \vec{b} \times \vec{a}$$

$$(\vec{x} \cdot \vec{a})\vec{a} - (\vec{a} \cdot \vec{a})\vec{x} = \vec{b} \times \vec{a}$$

$$\vec{x} = \frac{\vec{a} + \vec{a} \times \vec{b}}{\vec{a}^2}$$

$$\therefore \vec{y} = \vec{a} - \vec{x} = \vec{a} - \frac{\vec{a} \times \vec{b} + \vec{a}}{\vec{a}^2}$$

12. Let $\vec{a}, \vec{c}$ be.....

Sol. $\vec{a} \cdot \vec{c} = |\vec{a}| |\vec{c}| \cos \left(\cos^{-1} \frac{1}{4} \right)$

$$\Rightarrow \vec{a} \cdot \vec{c} = \frac{1}{4} \quad \dots\dots(i)$$

taking dot product by $\vec{a}, \vec{b}, \vec{c}$

we have $\vec{a} \cdot \vec{b} - 2(\vec{a} \cdot \vec{c}) = k(\vec{a} \cdot \vec{a})$

$$\Rightarrow \vec{a} \cdot \vec{b} - \frac{1}{2} = k \Rightarrow \vec{a} \cdot \vec{b} = k + \frac{1}{2} \quad \dots\dots(ii)$$

$$\text{Similarly } \vec{b} \cdot \vec{c} = 8 - \frac{k^2}{2} - \frac{k}{4} \quad \dots\dots(iii)$$

$$\text{and } \vec{b} \cdot \vec{c} - 2 = k(\vec{a} \cdot \vec{c}) \quad \dots\dots(iv)$$

from (ii), (iii) and (iv) we get

$$8 - \frac{k^2}{2} - \frac{k}{4} - 2 = k \left(\frac{1}{4} \right) \Rightarrow k = 3, -4$$

13. The equation.....

Sol. $\left(x - \frac{1}{26} \right)^2 + \left(y - \frac{3}{26} \right)^2 = \frac{k}{4} \left(\frac{5x - 12y + 1}{13} \right)^2$

14. Given α, β

Sol. $\alpha^4 + \alpha^3 + \alpha^2 + \alpha + 1 = 0$ and $\beta^3 + \beta^2 + \beta + 1 = 0$

$$(1 + \alpha + \alpha^2 + \alpha^3)(1 + \alpha^4)(1 + \beta + \beta^2 + \beta^3)(1 + \beta^4) = 0$$

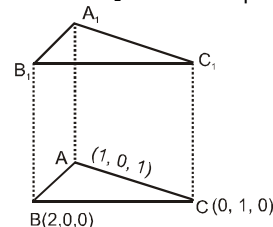
15. The volume of.....

Sol. Volume of prism = Area of base ABC $\times$ height or $3 = \frac{\sqrt{6}}{2} \times h$

$$\Rightarrow h = \sqrt{6}$$

Required point A_1 should be just above point A

i.e. line AA_1 is normal to plane ABC and $AA_1 = \sqrt{6}$



16. Let $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$

Sol. Let the required vector be $d = xi + yj + zk$. For this to be coplanar with b and c . We must have

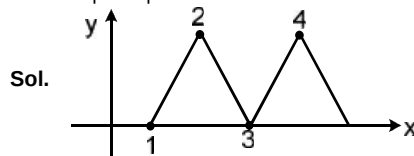
$$\begin{vmatrix} x & y & z \\ 1 & 2 & -1 \\ 1 & 1 & -2 \end{vmatrix} = 0$$

$$\Rightarrow x(-4+1) + y(-1+2) + z(1-2) = 0$$

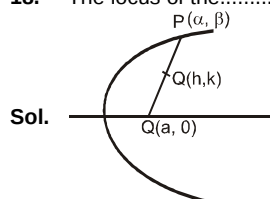
$$\Rightarrow -3x + y - z = 0$$

The projection of d on a is $\frac{|a \cdot d|}{|a|}$. So

17. If $|Z - 3| = \min$



18. The locus of the.....



$$h = \frac{a + \alpha}{2}, k = \frac{\beta}{2} \Rightarrow \alpha = 2h - a, \beta = 2k$$

α, β satisfies the parabola

$$\therefore \beta^2 = 4a\alpha \Rightarrow 4k^2 = 4a(2h - a)$$

$$\Rightarrow y^2 = a(2x - a) \Rightarrow y^2 = 2a \left(x - \frac{a}{2} \right)$$

19. The vector

Sol. Given vector will be collinear and $\vec{a} = k\vec{b}$

$$x\hat{i} - 2\hat{j} + 5\hat{k} = k(\hat{i} + y\hat{j} - z\hat{k})$$

$$(x-k)\hat{i}(-2-ky)\hat{j} + (5+kz)\hat{k} = 0$$

$$x = k, y = \frac{-2}{k}$$

$$z = -\frac{5}{k}$$

20. Let C denote the.....

Sol. $A \cap B$ is the set of complex numbers represented by the shaded region in the figure where QC || OX and CP

makes an angle of $\frac{\pi}{3}$ with the positive x-axis

21. The unit vector.....

Sol. Direction ratio of L_1 are 3, 1, 2 and of L_2 are 1, 2, 3

$$\text{Vector perpendicular to } L_1 \text{ and } L_2 \text{ is } \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{vmatrix}$$

$$= -\hat{i} - 7\hat{j} + 5\hat{k} \text{ unit vector is } \frac{-\hat{i} - 7\hat{j} + 5\hat{k}}{5\sqrt{3}}$$

Hence 'B' is correct

22. The shortest.....

Sol. Shortest distance between L_1 and L_2 is

$$\frac{|(\vec{b} - \vec{a}) \cdot \vec{p} \times \vec{q}|}{|\vec{p} \times \vec{q}|}, \text{ Now } \vec{p} \times \vec{q} = -\hat{i} - 7\hat{j} + 5\hat{k}$$

$$\text{and } \vec{b} - \vec{a} = 3\hat{i} + 4\hat{k}$$

$$\text{Hence } \frac{|-3+20|}{5\sqrt{3}} = \frac{17}{5\sqrt{3}}$$

Hence (D) is correct

23. Value of 2m is.....

24. Value of x and.....

Sol. (23 to 24)

$$Z = x + iy$$

$$z\bar{z} + (z-3)(\bar{z}-3) + (z-6i)(\bar{z}+6i)$$

$$= 3z\bar{z} - 3(z+\bar{z}) + 9 + 6(z-\bar{z})i + 36$$

$$= 3(x^2 + y^2) - 6x - 12y + 45$$

$$= 3[(x-1)^2 + (y-2)^2 + 10] \Rightarrow m = 30$$

25. Co-ordinates.....

Sol. Let $Q(x_2, y_2, z_2)$ be image of $A(2, 1, 6)$ about mirror $x + y - 2z = 3$ then

$$\frac{x_2 - 2}{1} = \frac{y_2 - 1}{1} = \frac{z_2 - 6}{-2}$$

$$= \frac{-2(2+1-12-3)}{1^2 + 1^2 + 2^2} = 4$$

$$\Rightarrow (x_2, y_2, z_2) = (6, 5, -2)$$

26. If $L_1 = 0$ is the.....

Sol. Equation of reflected ray $L_1 = 0$ is , line joining

$$Q(x_2, y_2, z_2) \text{ and } B(-10, -15, -14)$$

$$\text{i.e. } \frac{x+10}{16} = \frac{y+15}{20} = \frac{z+14}{12}$$

$$\Rightarrow \frac{x+10}{4} = \frac{y+15}{5} = \frac{z+14}{3}$$

(B is intersection point of $L = 0$ and plane)

27. $\vec{c}$ is

28. Volume of.....

Sol. (27 to 28)

$$(\vec{a} \times \vec{b}) \times \vec{c} = \vec{a} \times (\vec{b} \times \vec{c})$$

$$(\vec{a} \cdot \vec{c})\vec{b} - (\vec{b} \cdot \vec{c})\vec{a} = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$$

$$(\vec{b} \cdot \vec{c})\vec{a} = (\vec{a} \cdot \vec{b})\vec{c}$$

$$\therefore \vec{a} \parallel \vec{c}$$

$$\therefore \vec{c} = 2\vec{a} \quad (\because |\vec{c}| = 6)$$

$$\therefore [\vec{a} \vec{b} \vec{c}] = 0$$

$$[\vec{a} \vec{b} \vec{b} \times \vec{c}] = (\vec{a} \times \vec{b}) \cdot (\vec{b} \times \vec{c}) = -2(\vec{a} \times \vec{b})^2$$

$$(\vec{a} \times \vec{b})^2 = |\vec{a}|^2 |\vec{b}|^2 - (\vec{a} \cdot \vec{b})^2 = 9 \times 14 - 4 = 122$$

$$\therefore [\vec{a} \vec{b} \vec{b} \times \vec{c}] = -244$$

29. The possible.....

30. The given circle.....

Sol. (29 to 30)

Centre of circle = (1, 2)

$$\text{radius of circle} = \sqrt{5+13} = 3\sqrt{2}$$

$$\text{line } (x+iy)(1-i) + (x-iy)(1+i) - 24 = 0$$

$$x+y-ix+iy+x+y+ix-iy-2k=0$$

$$2x+2y-24=0$$

$$x+y-k=0$$

$$\text{line is secant if } \left| \frac{1+2-k}{\sqrt{2}} \right| < 3\sqrt{2}$$

$$|3-k| < 6$$

$$-6 \leq k-3 < 6$$

$$-3 < 4 < 9$$

$$\Rightarrow a = -3, b = 9$$

$$a+b=6$$

31. Area of the.....

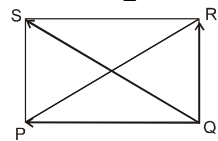
32. The volume of.....

Sol. (31 to 32)

$$\vec{PR} = \vec{PQ} + \vec{PS}$$

$$\vec{SQ} = \vec{PQ} - \vec{PS}$$

$$\vec{PS} = \frac{\vec{PR} - \vec{SQ}}{2}$$



$$V = \left| \begin{bmatrix} \vec{PQ} & \vec{PS} & \vec{PT} \end{bmatrix} \right|$$

$$V = \frac{1}{4} \left| \begin{bmatrix} \vec{PR} + \vec{SQ} & \vec{PR} - \vec{SQ} & \vec{PT} \end{bmatrix} \right|$$

$$V = \frac{1}{2} \left| \begin{bmatrix} \vec{PR} & \vec{SQ} & \vec{PT} \end{bmatrix} \right|$$

$$\frac{1}{2} \begin{vmatrix} 3 & 1 & -2 \\ 1 & -3 & -4 \\ 1 & 2 & 3 \end{vmatrix}$$

$$\frac{1}{2} (-3 - 7 - 10) = 10$$

33. Orthocentre of.....

Sol. Circumcentre is (origin) O

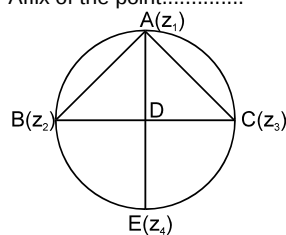
Since orthocentre divides the segments joining circumcentre

and the centroid in the ratio 3 : 2 externally.

$$\therefore \text{affix of orthocentre is } z_1 + z_2 + z_3.$$

34. Affix of the point.....

Sol.



Let affix of E be z_4

$$|z_1| = |z_2| = |z_3| = |z_4| = 1$$

$$\arg \left(\frac{z_1 - z_4}{z_2 - z_3} \right) = \pm \frac{\pi}{2} \Rightarrow \frac{z_1 - z_4}{z_2 - z_3} + \left(\frac{\bar{z}_1 - \bar{z}_4}{\bar{z}_2 - \bar{z}_3} \right) = 0$$

$$\Rightarrow \frac{z_1 - z_4}{z_2 - z_3} + \left(\frac{\frac{1}{z_2} - \frac{1}{z_3}}{\frac{1}{z_1} - \frac{1}{z_4}} \right) = 0$$

$$\Rightarrow \frac{z_1 - z_4}{z_2 - z_3} \left(1 + \frac{z_2 z_3}{z_1 z_4} \right) = 0 \Rightarrow z_4 = -\frac{z_2 z_3}{z_1}$$

35. Which of the.....

36. $(2 - z_1)(2 - z_2)$

Sol. (35 to 36)

$$(z-1)(z^6 + z^5 + z^4 + z^3 + z^2 + z + 1) = 0$$

$$z^7 - 1 = 0 \Rightarrow z = (1)^{1/7}$$

Its roots are 1, $z_1, z_2, z_3, z_4, z_5, z_6$

$$1 + z_1^5 + z_2^5 + z_3^5 + \dots + z_6^5 = 0$$

$$\therefore z_1^5 + z_2^5 + z_3^5 + \dots + z_6^5 = -1$$

$$\sum_{i=1}^6 z_i^5 = -1, \prod_{i=1}^5 z_i = 1$$

$$\therefore \sum z_i^5 + \prod z_i = 0$$

$$z^7 - 1 = (z - z_1)(z - z_2)(z - z_3)(z - z_4)(z - z_5)(z - z_6)$$

putting $z = 2$ we get

$$(2 - z_1)(2 - z_2)(2 - z_3)(2 - z_4)(2 - z_5)(2 - z_6)$$

$$= 2^7 - 1 = 127$$

37. The value of.....

38. The value of θ

Sol. (37 to 38)

$$z = \frac{1 - i \sin \theta}{1 + i \cos \theta} = \frac{(1 - i \sin \theta)(1 - i \cos \theta)}{(1 + i \cos \theta)(1 - i \cos \theta)}$$

$$= \frac{1 - \sin \theta \cos \theta - i(\cos \theta + \sin \theta)}{1 + \cos^2 \theta}$$

37. If z is purely imaginary $1 - \sin \theta \cos \theta = 0$

or $\sin \theta \cos \theta = 1$ which is not possible

$$38. \arg(z) = \frac{\pi}{4}$$

$$39. [\vec{a} + \vec{b} \vec{b} + \vec{c} \vec{c} + \vec{a}] \dots\dots\dots$$

$$40. [\vec{a} \times \vec{b} \vec{b} \times \vec{c} \vec{c} \times \vec{a}] \dots\dots\dots$$

Sol. (39 to 40)

$$\vec{a} = \frac{(\hat{u} + \hat{v})}{2|\cos \frac{\alpha}{2}|}, \vec{b} = \frac{(\hat{v} + \hat{w})}{2|\cos \frac{\beta}{2}|}, \vec{c} = \frac{(\hat{w} + \hat{u})}{2|\cos \frac{\gamma}{2}|}$$

$$\begin{aligned}
 39. \quad [\vec{a} + \vec{b} \quad \vec{b} + \vec{c} \quad \vec{c} + \vec{a}] &= 2[\vec{a} \vec{b} \vec{c}] \\
 &= 2 \left[\frac{(\hat{u} + \hat{v})}{2|\cos(\alpha/2)|} \frac{(\hat{v} + \hat{w})}{2|\cos(\beta/2)|} \frac{(\hat{w} + \hat{u})}{2|\cos(\gamma/2)|} \right] \\
 &= 2 \left[\frac{2[\hat{u} \hat{v} \hat{w}]}{8|\cos(\alpha/2)\cos(\beta/2)\cos(\gamma/2)|} \right] \\
 &= \frac{1}{2} [\hat{u} \hat{v} \hat{w}] \left| \sec \frac{\alpha}{2} \sec \frac{\beta}{2} \sec \frac{\gamma}{2} \right|
 \end{aligned}$$

$$\begin{aligned}
 40. \quad \therefore [\vec{a} \times \vec{b} \quad \vec{b} \times \vec{c} \quad \vec{c} \times \vec{a}] &= [\vec{a} \vec{b} \vec{c}]^2 \\
 &= \left[\frac{((\hat{u} + \hat{v}) \times (\hat{v} + \hat{w})) \cdot (\hat{w} + \hat{u})}{8|\cos \frac{\alpha}{2} \cos \frac{\beta}{2} \cos \frac{\gamma}{2}|} \right]^2 \\
 &= \left[\frac{2[\hat{u} \hat{v} \hat{w}]}{8|\cos \frac{\alpha}{2} \cos \frac{\beta}{2} \cos \frac{\gamma}{2}|} \right]^2 \\
 &= \frac{[\hat{u} \hat{v} \hat{w}]^2}{16} \sec^2(\alpha/2) \cdot \sec^2(\beta/2) \cdot \sec^2(\gamma/2)
 \end{aligned}$$

PHYSICS

1. Photons of energy 5 eV.....

Sol. $KE_{\max} = (5 - \phi)$ eV

when these electrons are accelerated through 5V, they will reach the anode with maximum energy = $(5 - \phi + 5)$ eV

$$\therefore 10 - \phi = 8$$

$$f = 2\text{eV Ans.}$$

Current is less than saturation current because if slowest electron also reached the plate it would have 5eV energy at the anode, but there it is given that the minimum energy is 6eV.

2. An electron makes a transition.....

Sol. Magnetic field at centre (site of nucleus)

$$B = \frac{\mu_0 I}{2r} = \frac{\mu_0 qf}{2r} = \frac{\mu_0 qv}{2r \times 2\pi r}$$

$$\Rightarrow B \propto \frac{1}{r^2} \text{ and } B \propto v$$

$$\therefore B \propto \frac{1}{n^5}$$

$$\frac{B_1}{B_2} = \frac{(2)^5}{(1)^5} \quad (\text{Since, } n_1 = 1 \text{ to } n_2 = 2)$$

$$\therefore B_1 = 32 B_2$$

$$\text{Also, } mvr = n \cdot \frac{h}{2\pi}, \text{ therefore angular momentum is}$$

$$\text{changed by } \frac{h}{2\pi}.$$

3. X-ray from a tube with a target.....

$$\text{Sol. } \frac{\lambda_0}{\lambda_1} = 4 \Rightarrow \frac{(Z_1 - 1)^2}{(Z - 1)^2} = 4 \Rightarrow Z_1 = 2Z - 1$$

$$\frac{\lambda_0}{\lambda_2} = \frac{1}{4} \Rightarrow \frac{(Z_2 - 1)^2}{(Z - 1)^2} = \frac{1}{4} \Rightarrow Z_2 = \frac{Z + 1}{2}.$$

4. A string is holding a solid block.....

Sol. Let σ is density of liquid & ρ is density at object

$$B_i = \sigma vg \quad B_f = \sigma v(g + a) = B_i \left(\frac{g + a}{a} \right)$$

$$T_i = (\sigma - \rho)vg$$

$$T_f = (\sigma - \rho) v (g + a) = T_i \left(\frac{g + a}{a} \right)$$

5. Two radioactive materials A & B.....

$$\text{Sol. When no. of nuclei or equal } 4N_0 e^{-3\lambda t} = 2N_0 e^{-2\lambda t} \Rightarrow t = \frac{\ln 2}{\lambda}$$

when decay rate equal
 $3\lambda \cdot 4N_0 e^{-3\lambda t} = 2\lambda \cdot 2N_0 e^{-2\lambda t}$

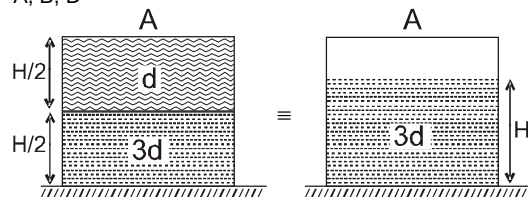
$$t = \frac{\ln 3}{\lambda}$$

$$\text{at } t = \frac{\ln 4}{\lambda} \text{ decay rate of A} = (3\lambda) (4N_0) e^{-3\lambda \frac{\ln 4}{\lambda}}$$

$$\text{at } t = \frac{\ln 4}{\lambda} \text{ decay rate of B} = 2\lambda \cdot 4N_0 e^{-2\lambda \frac{\ln 4}{\lambda}}$$

6. A container of large uniform cross.....

Sol. A, B, D



$$\frac{H}{2} \times d + \frac{H}{2} \times 3d = H' \times 3d$$

$$\Rightarrow H' = \frac{2H}{3}$$

$$V_{\text{efflux}} = \sqrt{2g(H' - h)}$$

$$V_{\text{efflux}} \text{ is maximum when } h = H'/2 \therefore$$

$$V_{\text{max}} = \sqrt{\frac{2gH}{3}}$$

$$\text{Range } R = V_{\text{efflux}} \times \sqrt{\frac{2(H' - h)}{g}}$$

$$R_{\text{max}} = \frac{2H}{3}$$

7. In a radioactive decay.....

$$\text{Sol. } N_A 2\lambda = N_B 9\lambda$$

$$\Rightarrow N_A = 4.5 N_B$$

8. A fusion reaction consists of.....

Sol. Mass defect $\Delta m = 4m_H - m_{\text{He}}$

$$= 4(1.007825) - 4.002603 = 0.028697 \text{ u} = 0.028697 \text{ u}$$

$$\times 932 \frac{\text{MeV}}{\text{u}} = 26.7 \text{ MeV}$$

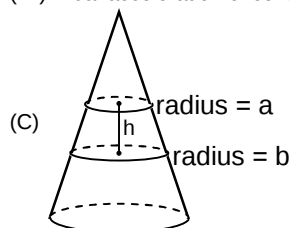
9. In an α decay the parent.....

Sol. $X_Z^{200} = Y_{Z-2}^{200-4} + He_2^4$

10. An elastic ring of mass.....

Sol. (A) initial acceleration of any point on circumference of ring is $g \cos \theta$

(B*) initial acceleration of centre of ring is $g \sin \theta \cos \theta$



$$\tan \theta = \frac{b-a}{h}$$

$$h = (b-a) \cot \theta$$

$$mg(b-a) \cot \theta = \frac{1}{2} k(2\pi b - 2\pi a)^2$$

$$mg(b-a) \cot \theta = \frac{1}{2} 4\pi^2 k(b-a)^2$$

$$b-a = \frac{mg \cot \theta}{2\pi^2 k}$$

(D) at the moment maximum vertical displacement acceleration of centre of ring is upward.

11. In Young double slit.....

Sol. $2I_0 = I_0 + I_0 + 2I_0 \cos \phi \Rightarrow \cos \phi = 0$

$$\phi = \frac{\pi}{2}, 2\pi - \frac{\pi}{2}, 2\pi + \frac{\pi}{2}, 4\pi - \frac{\pi}{2} \dots$$

$$\Delta X = \frac{\lambda}{4}, \frac{3\lambda}{4}, \frac{5\lambda}{4}, \frac{7\lambda}{4} \dots$$

$$\Rightarrow y = \frac{\lambda D}{4d}, \frac{3\lambda D}{4d}, \frac{5\lambda D}{4d}, \frac{7\lambda D}{4d} \dots$$

$$= 2.5 \times 10^{-4} \text{ m}, 7.5 \times 10^{-4}, 12.5 \times 10^{-4}$$

12. Two slits emit equal to intensity

Sol. $I_{\max} = (\sqrt{I_1} + \sqrt{I_2})^2$

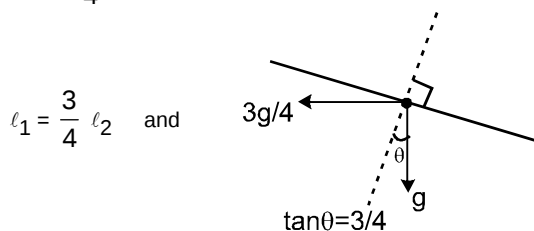
$$I_{\min} = (\sqrt{I_1} - \sqrt{I_2})^2$$

$$\beta = \frac{\lambda D}{d}$$

13. A container is filled with a liquid.....

Sol. for point A from top surface $P_A = \rho g \cdot \ell_1$ and from right wall

$$P_A = \frac{\rho 3g}{4} \cdot \ell_2$$



$$\ell_1 = \frac{3}{4} \ell_2 \text{ and}$$

14. Ideal liquid of density ρ is.....

Sol. $h_0 = \frac{h}{2}$

$$y = \frac{\omega^2 R^2}{2g} \Rightarrow \frac{h}{2} = \frac{\omega^2 R^2}{2g}$$

$$\omega = \sqrt{\frac{gh}{R^2}}$$

$$\frac{dp}{dx} = \rho \omega^2 x$$

$$\frac{dp}{dy} = -\rho g$$

17. The wavelength of K_α X-rays.....

Sol. $\lambda_{K_2} = \frac{4}{3R(Z-1)^2}$

$$\lambda_1 = \lambda_2 = \lambda_3$$

18. Consider an atom made up of a protons.....

Sol. Rydberg $\propto$ mass of electron.

$$\frac{1}{\lambda} = 3R \left[\frac{1}{n_2} - \frac{1}{3^2} \right] \quad n = 1, 2$$

$$\frac{1}{\lambda} = 3R \left[\frac{1}{(1)} - \frac{1}{9} \right]$$

$$\frac{1}{\lambda_2} = 3R \left[\frac{1}{(2)^2} - \frac{1}{9} \right]$$

$$\frac{1}{\lambda_3} = 3R \left[\frac{1}{(1)^2} - \frac{1}{(2)^2} \right]$$

19. The electron in hydrogen atom.....

Sol. Time period $T_n = \frac{2\pi r_n}{V_n}$

$$T \propto \frac{n^2}{1/n} \text{ i.e., } T \propto n^3$$

$$n_1 = 2n_2$$

$$\text{Hence, } n_1 = 2n_2$$

Choice (b) and (c) are wrong.

20. In young's double slit experiment.....

Sol. $I \propto E^2$

21. Choose the correct.....

Sol. Using equation of continuity $A_1 V_1 = A_2 V_2$

$$(12 \text{ cm}^2) V_A = (6 \text{ cm}^2) (8.0 \text{ m/s})$$

$$V_A = 4.0 \text{ m/s}$$

22. Choose the correct

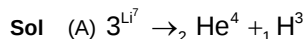
Sol. Applying Bernoulli's principle between point A and C that are at same horizontal level

$$\frac{1}{2} \rho V_A^2 + P_A = \frac{1}{2} \rho V_C^2 + P_{\text{atm}}$$

$$\Rightarrow P_A = (1.01 \times 10^5 \text{ N/m}^2) + \frac{1}{2} \times 13,600 (8^2 - 4^2)$$

$$= 4.27 \times 10^5 \text{ N/m}^2$$

23. The incorrect statement.....

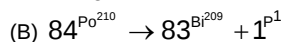


$$\Delta m = [M_{\text{Li}} - M_{\text{He}} - M_{\text{H}^3}]$$

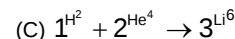
$$= [6.01513 - 4.002603 - 3.016050]$$

$$= -1.003523\text{u}$$

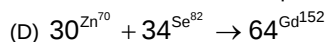
Δm is negative so reaction is not possible.



Δm is negative so reaction is not possible.

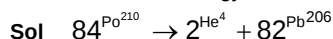


Δm is Positive so reaction is possible.



Δm is Neagative so reaction is not possible.

24. The kinetic energy.....



$$\Delta m = [M_{\text{Po}} - M_{\text{He}} - M_{\text{Pb}}] = 0.008421\text{ u}$$

$$Q = 0.008421 \times 932\text{ MeV} = 5422\text{ KeV}$$

$$K_{\alpha} = \frac{206}{210} \times 5422\text{ KeV}$$

$$= 5320\text{ KeV}$$

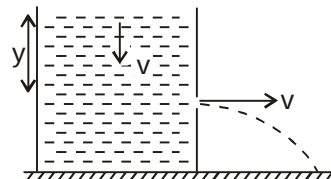
26. The duration of time.....

Sol. The initial velocity of water coming out of hole is horizontal

and hole is at a height $\frac{h}{4}$ from ground. Hence time taken by

water to reach ground is $t = \sqrt{\frac{2(h/4)}{g}}$ which remains

constant.



$\therefore x = vt$ where v is velocity of efflux....
Since v decreases with time x will decrease.

Let y be the height of water surface above hole

$$\therefore -\frac{dy}{dt} = \frac{av}{A} = \frac{a\sqrt{2gy}}{A}$$

$$\therefore \int_{3h/4}^0 \frac{dy}{\sqrt{2gy}} = \int_0^t -\frac{a}{A} dt \quad \therefore t = \frac{A}{a} \sqrt{\frac{3h}{2g}}$$

28. The ratio of active nuclei.....

Sol. (27 to 28)



$$A_0 = \lambda_X N_X(0) = \lambda_Y N_Y(0)$$

$$\text{where } \lambda_X = \frac{\ell \ln 2}{2}, \lambda_Y = \frac{\ell \ln 2}{1}$$

Putting these values in the given equation for N_Y , we get, (at $t = 0$)

$$C_1 = -\frac{A_0}{2}$$

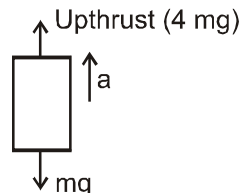
From equation (i)

$$N_Y = \frac{1}{\lambda_Y - \lambda_X} \left[A_0 e^{-\lambda_X t} - \frac{A_0}{2} e^{-\lambda_Y t} \right]$$

$$\frac{N_Y(t=4)}{N_Y(t=0)} = \frac{\frac{A_0}{\ell \ln 2} \left[\frac{2}{4} - \frac{1}{16} \right]}{\frac{A_0}{\ell \ln 2} [2-1]}$$

29. The acceleration of.....

Sol.



30. Choose the.....

Sol. The density of liquid is four times that of cylinder, hence in equilibrium position one fourth of the cylinder is submerged.

So as the cylinder is released from initial position, it moves by $\frac{3\ell}{4}$ to reach its equilibrium position. The upward motion in this

time is SHM. Therefore required velocity is $v_{\max} = \omega A$. $\omega =$

$$\sqrt{\frac{4g}{\ell}} \text{ and } A = \frac{3\ell}{4}. \text{ Therefore } v_{\max} = \frac{3}{2} \sqrt{g\ell}$$

The required time is one fourth of time period of SHM. Therefore

$$t = \frac{\pi}{2\omega} = \frac{\pi}{4} \sqrt{\frac{\ell}{g}}$$

31. Chose the.....

$$\text{Sol. } \beta = \frac{\lambda D}{n_2 d} = \frac{3000 \times 10^{-10} \times 1 \times 2}{3 \times 1 \times 10^{-3}}$$

$$= 2 \times 10^{-4} \text{ m} = 0.2 \text{ mm.}$$

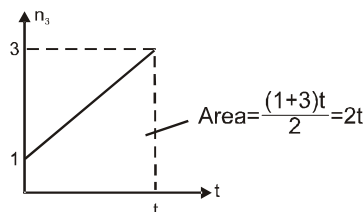
Path difference,

$$\Delta x = n_1 SS_2 + n_2 S_2 P -$$

$$\left[(n_1 SS_1 + n_2 S_1 P) - \int_0^t (n_3 - n_2) dx \right]$$

$$= n_1 (SS_2 - SS_1) + n_2 (S_2 P - S_1 P) - \int_0^t n_3 dx + n_2 t$$

In order to get central maxima at centre of screen -



$$0 = \frac{2 \times (1 \times 10^{-3})^2}{2 \times 1} + 0 - 2t + \frac{3t}{2}$$

$$0.5 t = 1 \mu\text{m.}$$

$$t = 2 \mu\text{m.}$$

32. If thickness of the slab is.....

Sol. From previous equation :

$$0 = 1 \mu\text{m} + \frac{3y_d}{2D} - 0.5 t$$

$$\frac{3 y_d}{2 D} = -0.5 \mu\text{m}$$

$$y = -\left(\frac{10^{-6}}{3}\right)\left(\frac{1\text{m}}{1 \times 10^{-3}}\right)$$

$$= \frac{10^{-3}}{3} = \frac{-1}{3} \text{ mm, below centre.}$$

33. Choose the.....

Sol. Total energy released from $\text{Au}^{198} \rightarrow \text{Hg}^{198}$ in ground state

$$= (\Delta m_{\text{loss}}) c^2$$

$$= (197.9682 - 197.9662) (930)$$

$$= 1.86 \text{ MeV}$$

Energy released from ^{198}Hg in first excited state $\rightarrow \text{Hg}$ in ground state

$$= (-1.6) - (-2) \text{ MeV}$$

$$= 0.4 \text{ MeV}$$

$\Rightarrow$ Energy released from $\text{Ag}^{198} \rightarrow \text{Hg}^{198}$ second excited state

$$= 1.86 - 0.4 = 1.46 \text{ MeV} = \text{max. K.E. of } \beta_2 \text{ particle}$$

34. The wave length

$$\text{Sol. } \lambda_{\gamma_1} < \lambda_{\gamma_3} < \lambda_{\gamma_2}$$

35. Select current

Sol. For Balmer series, $n_1 = 2$, $n_2 = 3, 4, \dots$
(lower) (higher)

$\therefore$ In transition (VI), Photon of Balmer series is absorbed.

$$n_1 = 2, \quad n_2 = 3, 4, \dots$$

Sol. In transition II

$$E_2 = -3.4 \text{ eV}, E_4 = -0.85 \text{ eV}$$

$$\Delta E = 2.55 \text{ eV}$$

$$\Delta E = \frac{hc}{\lambda} \quad \Rightarrow \quad \lambda = \frac{hc}{\Delta E}$$

$$\lambda = 487 \text{ nm.}$$

36. Which transition involves.....

Sol. For longest wavelength, energy difference should be minimum.

So in visible portion of hydrogen atom, minimum energy is in transition VI.

37. If the distance between.....

Sol. Fringe width will become double.

38. If the distance between the.....

$$\text{Sol. Shift} = \frac{t(\mu - 1)}{\lambda} \beta$$

$$= \frac{2.2 \times 10^{-6} \times 0.5}{4 \times 10^{-7}} \beta$$

$$= \frac{11}{4} \beta$$

$$\text{So, intensity will become } \frac{I_0}{2}$$

39. The time after which.....

$$\text{Sol. } \lambda_{\text{th}} = \frac{hc}{\phi} = 6200 \text{ \AA}$$

$$\lambda \leq \lambda_{\text{th}} \text{ for } t = 0 \text{ to } t = 80 \text{ sec}$$

40. Choose the **CORRECT**.....

Sol. Number of photons incident at any time t ($0 \leq t \leq 80$) in interval dt

$$dn_p = \frac{P dt}{\left(\frac{hc}{\lambda}\right)}$$

$$n_p = \int_{t=0}^{t=80} \frac{\lambda P dt}{hc} \quad (P = 100 \text{ W}) = 1.855 \times 10^{20}$$

Number of photons emitted in one hour

$$= \left(\frac{60 \text{ min}}{3 \text{ min}}\right) \times n_p$$

Number of photoelectrons emitted in one hour –

$$= (20 n_p) \times 0.01 = 3.71 \times 10^{21}$$

CHEMISTRY

1. Which of the following

Sol. For ideal solution

$$\Delta H_{\text{solution}} = 0$$

$$\Delta V_{\text{solution}} = 0$$

$$\Delta S_{\text{solution}} > 0$$

$$\Delta G_{\text{mix}} < 0$$

2. Statement -1 : Net work

Sol. (A) $W_T = W_{1 \rightarrow 2} + W_{2 \rightarrow 3} + W_{3 \rightarrow 1}$

$$= 0 + (-P\Delta V) + \left(-2.303 nRT \log \frac{V_2}{V_1}\right) = 184.22 \text{ cal}$$

process is cyclic

$$\Delta U = 0, \quad q = -184.22 \text{ cal}$$

(B) $W_T = W_{1 \rightarrow 2} + W_{2 \rightarrow 3} + W_{3 \rightarrow 1} \Rightarrow$

$$(-1 \times 22.4) + [0] + \left(-2.303 \times RT \log \frac{22.4}{44.8}\right)$$

$$= -166.9 \text{ cal}$$

$$q = +166.9 \text{ cal}$$

(C) $W_T = \frac{1}{2} \times (20 - 10)(3 - 1) \text{ L-atm} = -241.19 \text{ cal}$

$$q = 241.19 \text{ cal}$$

(D) $W_T = W_{1 \rightarrow 2} + W_{2 \rightarrow 3} + W_{3 \rightarrow 4} + W_{4 \rightarrow 1}$

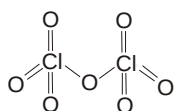
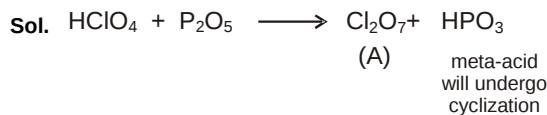
$$= -5.6 \text{ L-atm} = -138.18 \text{ cal}$$

$$q = +138.18 \text{ cal}$$

3. Which of the following

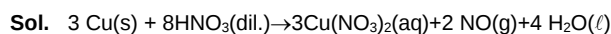
Sol. The expression is for reversible adiabatic process only.
Thermostat is necessary for an isothermal process.

4. Consider the following

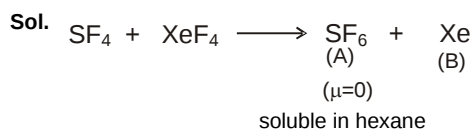


six bonds are equal

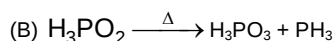
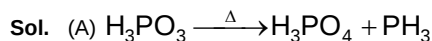
5. $\text{Cu(s)} + \text{dil HNO}_3 \longrightarrow \text{X (g)} + \dots$



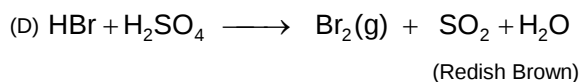
6. Consider the following



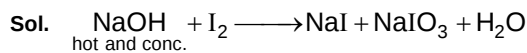
7. In which of the following



(yellow)

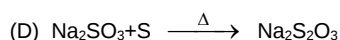
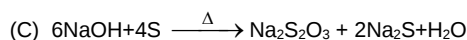


8. Select the correct



9. Sodium thiosulphate

Sol. Preparation:



10. Iodine can be obtained

Sol. Stronger oxidising halogen can displace the other halogen from its salt solution.

11. Consider a setup of two.....

Sol. (A) Osmotic pressures of the two solutions are $\pi_1 = C_1RT$ and $\pi_2 = C_2RT$. So, if we apply these external pressures on both solutions, they will not show osmosis with a pure solvent since they both will be in equilibrium with pure solvent (as far as osmotic flow is concerned). This implies that for these values of external pressures, both solutions will also be in equilibrium with each other and osmosis will not occur between them.
If we add or subtract any common value of pressure from their values in option (A), the two solutions will still remain in equilibrium. In option (B), we have subtracted C_1RT from each side's external pressure of option (A). In option (D), we have added C_1RT on both sides (starting from option (A)), and the two solutions remain in equilibrium.

12. The swimming pool inside

Sol. Energy for heating the water

$$\text{Volume of water : } V_{\text{water}} = 22.5 \text{ m}^3$$

$$n_{\text{water}} = V_{\text{water}} \rho_{\text{water}} (M_{\text{water}})^{-1} = 22.5 \text{ m}^3 \times 10^6 \text{ g m}^{-3} \times (18 \text{ g mol}^{-1})^{-1} = 1.25 \times 10^6 \text{ mol}$$

$$E_{\text{water}} = n_{\text{water}} \times C_p \times \Delta T = 1.25 \times 10^6 \text{ mol} \times 75 \text{ J K}^{-1} \text{ mol}^{-1} \times 16 \text{ K} = 1500 \text{ MJ}$$

Energy for heating the air

Volume of the house is

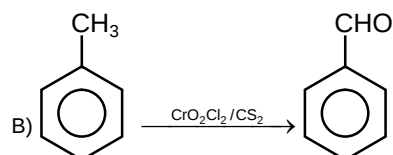
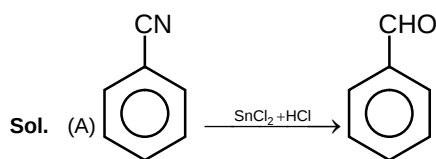
$$V_{\text{air}} = (15 \text{ m} \times 8 \text{ m} \times 3 \text{ m}) + 0.5 \times (15 \text{ m} \times 8 \text{ m} \times 2 \text{ m}) = 480 \text{ m}^3$$

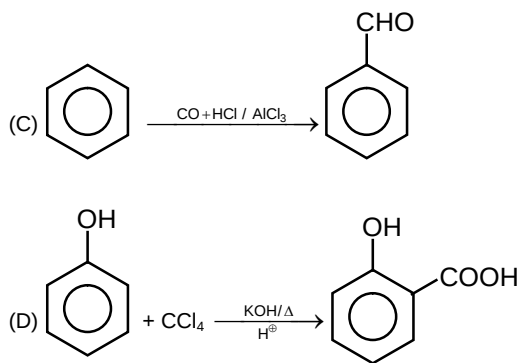
$$n_{\text{air}} = pV/RT = 1.013 \times 10^5 \text{ Pa} \times 480 \text{ m}^3 / (8.314 \text{ J (K mol)}^{-1} \times 283 \text{ K}) = 2.06 \times 10^4 \text{ mol}$$

$$C_p(\text{air}) = 3.5R = 29.1 \text{ J K}^{-1} \text{ mol}^{-1} \text{ (as both gases are diatomic)}$$

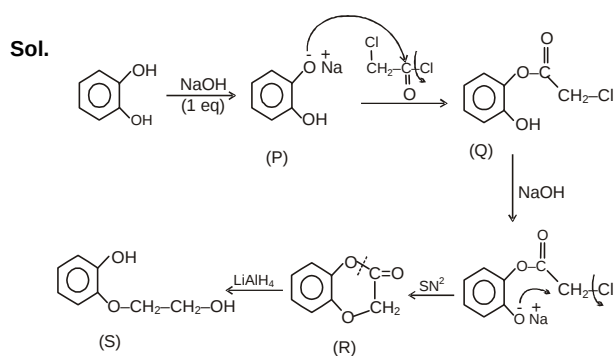
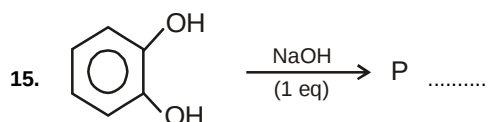
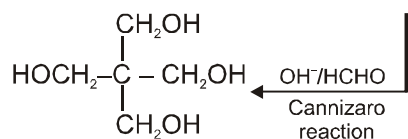
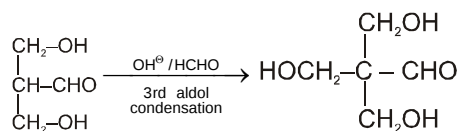
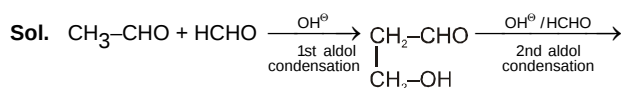
$$E_{\text{air}} = n_{\text{air}} \times C_p(\text{air}) \times \Delta T = 2.06 \times 10^4 \text{ mol} \times 29.1 \text{ J K}^{-1} \text{ mol}^{-1} \times 20 \text{ K} \approx 12 \text{ MJ}$$

13. In which of the following

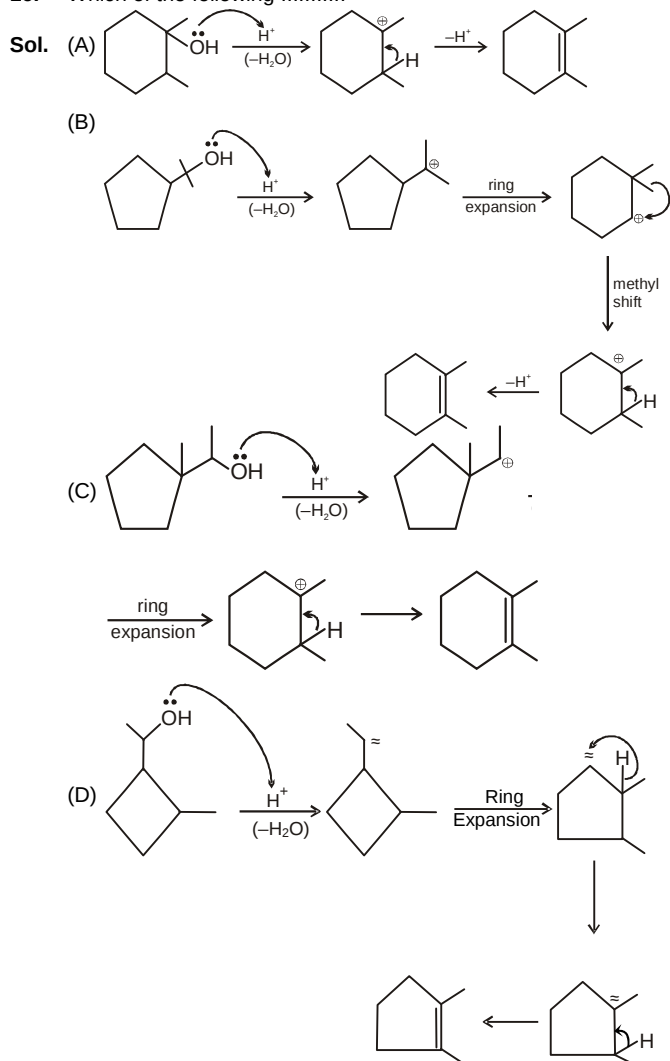




14. Observe the following



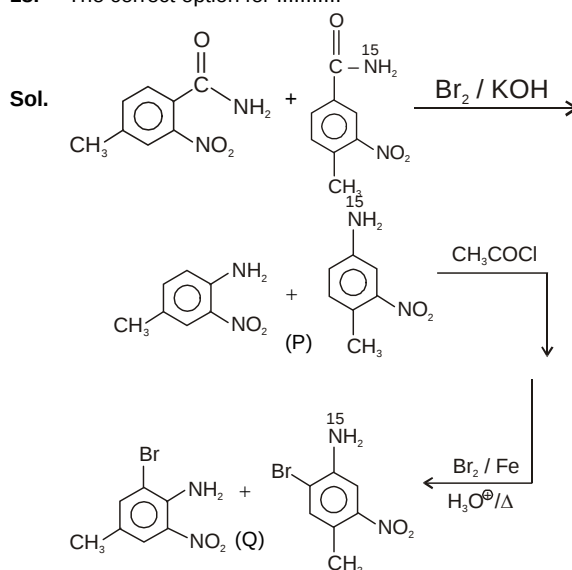
16. Which of the following



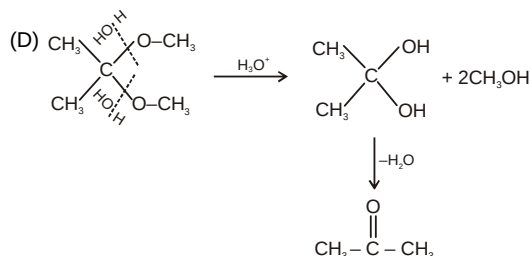
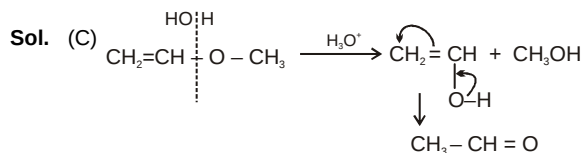
17. In which of the following

Sol. (A) Tollen's reagent does not oxidise $\text{C}=\text{C}$
(B) Perkin reaction
(C) E1Cb Mechanism

18. The correct option for



19. Which of the following



21. If temperature at point

Sol. Process CA is isochoric $P_A = 2P_C$ so $T_A = 2T$
 And process AB is isothermal $T_A = T_B = 2T$

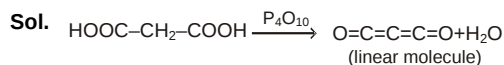
22. What will be the value.....

Sol. Overall process is cyclic so $\Delta E = \Delta H = 0$

24. Compound T is used

Sol. $P = B$; $Q = \text{BCl}_3$; $R = \text{B}(\text{OH})_3$; $S = \text{B}_2\text{H}_6$; $T = \text{NaBH}_4$

28. Which of the following



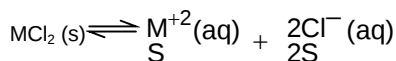
Oxidation state of carbon is +2 and zero

29. A saturated solution of a

Sol. Relative lowering in vapour pressure = mole fraction of solute

$$\frac{P_A^0 - P_s}{P_A^0} = \frac{3S}{3S + 55.55}$$

for MCl_2 the solubility is as



Since the solution is very dilute $3S + 55.55 \approx 55.55$

$$\text{or } \frac{32 - 31.973}{32} = \frac{3S}{55.55}$$

$$\therefore S = \frac{1}{64}$$

$$\text{Thus, the } K_{sp} = S \times (2S)^2 = 4 \times \left(\frac{1}{64}\right)^3$$

Now in $\frac{1}{6.4}$ M NaCl, solubility of $\text{MCl}_2 = 6.25 \times 10^{-4}$ M

30. Freezing point of 1000 g

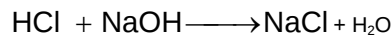
$$\text{Sol. } |\Delta T_f| = K_f m = 1.89 \times \frac{125}{180} \times \frac{1000}{875} = 1.5$$

So freezing point = -1.5°C .

32. Which of the following

$$\text{Sol. Molarity of HCl} = \frac{100 \text{ m mole}}{1000 \text{ mL}} = 0.1 \text{ M}$$

pH = 1 change in pH = 6



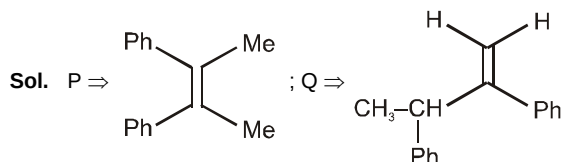
(P) (Q)

Q gives Cl_2 on electrolysis

33. Aldol condensation

Sol. α -H hydrogen is present.

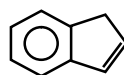
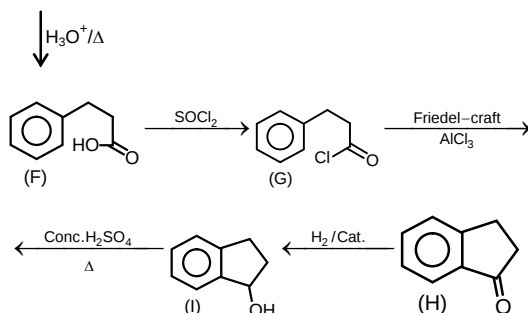
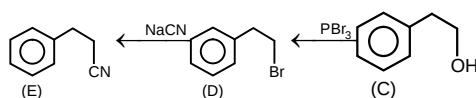
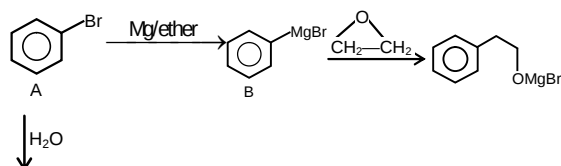
36. What is/are true about the



37. A may be

38. Find the correct

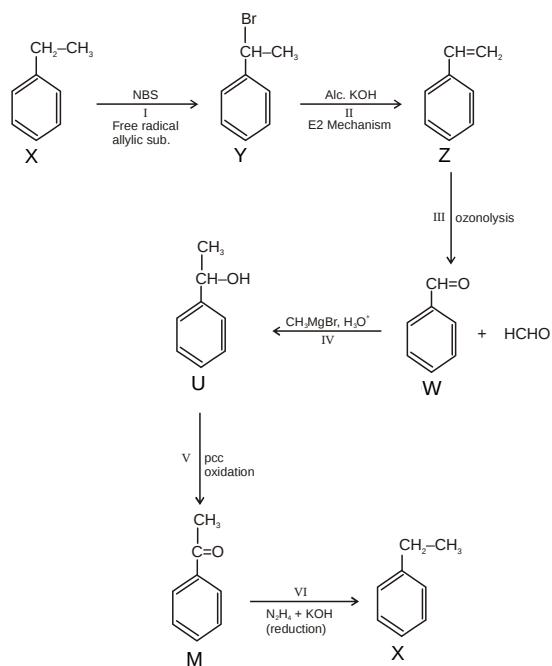
Sol. (Q.37 & Q.38)



39. Which of the following

40. Which of the following

Sol. (39) & (40)



DATE : 11-02-2018

ANSWER KEY

CODE - 0

MATHEMATICS

- | | | | | | | |
|-----------|----------|------------|------------|------------|----------|----------|
| 1. (AD) | 2. (A) | 3. (ACD) | 4. (AB) | 5. (BC) | 6. (AC) | 7. (ABD) |
| 8. (ABCD) | 9. (ACD) | 10. (ABCD) | 11. (AD) | 12. (CD) | 13. (AC) | 14. (B) |
| 15. (AD) | 16. (AC) | 17. (AD) | 18. (ABCD) | 19. (ABCD) | 20. (A) | 21. (B) |
| 22. (D) | 23. (B) | 24. (C) | 25. (B) | 26. (C) | 27. (AD) | 28. (BC) |
| 29. (BC) | 30. (B) | 31. (B) | 32. (C) | 33. (A) | 34. (BD) | 35. (AC) |
| 36. (B) | 37. (D) | 38. (D) | 39. (A) | 40. (C) | | |

PHYSICS

- | | | | | | | |
|-----------|----------|----------|-----------|------------|-----------|-----------|
| 1. (A) | 2. (BC) | 3. (AC) | 4. (AC) | 5. (AC) | 6. (ABD) | 7. (AB) |
| 8. (ABCD) | 9. (ABC) | 10. (BC) | 11. (ABC) | 12. (ABCD) | 13. (ABC) | 14. (BCD) |
| 15. (ABC) | 16. (BC) | 17. (AD) | 18. (BCD) | 19. (AD) | 20. (AC) | 21. (A) |
| 22. (AC) | 23. (AD) | 24. (A) | 25. (BC) | 26. (A) | 27. (AC) | 28. (D) |
| 29. (C) | 30. (AC) | 31. (AC) | 32. (B) | 33. (BD) | 34. (A) | 35. (AD) |
| 36. (D) | 37. (AD) | 38. (A) | 39. (B) | 40. (AD) | | |

CHEMISTRY

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|-----------|-----------|-----------|------------|------------|-----------|------------|
| 1. (ABC) | 2. (ABD) | 3. (ABD) | 4. (ABCD) | 5. (AB) | 6. (AC) | 7. (CD) |
| 8. (ABCD) | 9. (BD) | 10. (AB) | 11. (ABD) | 12. (CD) | 13. (ABC) | 14. (ABCD) |
| 15. (ACD) | 16. (ABC) | 17. (ABC) | 18. (BC) | 19. (ABCD) | 20. (AB) | 21. (BD) |
| 22. (AB) | 23. (ABC) | 24. (D) | 25. (AC) | 26. (AB) | 27. (ACD) | 28. (AB) |
| 29. (AC) | 30. (B) | 31. (BC) | 32. (BCD) | 33. (ABC) | 34. (BD) | 35. (D) |
| 36. (ABC) | 37. (B) | 38. (ABC) | 39. (ABCD) | 40. (AC) | | |

DATE : 11-02-2018

ANSWER KEY

CODE - 1

MATHEMATICS

- | | | | | | | |
|-----------|----------|------------|------------|------------|----------|----------|
| 1. (AB) | 2. (A) | 3. (ABC) | 4. (AD) | 5. (BC) | 6. (AD) | 7. (ACD) |
| 8. (ABCD) | 9. (BCD) | 10. (ABCD) | 11. (BD) | 12. (CD) | 13. (AD) | 14. (B) |
| 15. (BD) | 16. (AC) | 17. (BD) | 18. (ABCD) | 19. (ABCD) | 20. (B) | 21. (A) |
| 22. (C) | 23. (A) | 24. (D) | 25. (C) | 26. (A) | 27. (AD) | 28. (AC) |
| 29. (AC) | 30. (D) | 31. (C) | 32. (D) | 33. (A) | 34. (AD) | 35. (BC) |
| 36. (C) | 37. (D) | 38. (A) | 39. (B) | 40. (A) | | |

PHYSICS

- | | | | | | | |
|-----------|----------|----------|-----------|------------|-----------|-----------|
| 1. (C) | 2. (AB) | 3. (BC) | 4. (BC) | 5. (BD) | 6. (BCD) | 7. (BC) |
| 8. (ABCD) | 9. (ABC) | 10. (AB) | 11. (ACD) | 12. (ABCD) | 13. (ABC) | 14. (ABD) |
| 15. (ABC) | 16. (AD) | 17. (BC) | 18. (ACD) | 19. (CD) | 20. (AB) | 21. (B) |
| 22. (BC) | 23. (BD) | 24. (C) | 25. (AB) | 26. (B) | 27. (AB) | 28. (B) |
| 29. (A) | 30. (AD) | 31. (AB) | 32. (C) | 33. (AD) | 34. (C) | 35. (BD) |
| 36. (B) | 37. (BD) | 38. (B) | 39. (D) | 40. (BD) | | |

CHEMISTRY

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|-----------|-----------|-----------|------------|------------|-----------|------------|
| 1. (BCD) | 2. (ABD) | 3. (ABC) | 4. (ABCD) | 5. (BC) | 6. (AB) | 7. (CD) |
| 8. (ABCD) | 9. (CD) | 10. (AD) | 11. (ABD) | 12. (CD) | 13. (ACD) | 14. (ABCD) |
| 15. (ABD) | 16. (ABD) | 17. (ABC) | 18. (BC) | 19. (ABCD) | 20. (AC) | 21. (AD) |
| 22. (AB) | 23. (ABD) | 24. (A) | 25. (BC) | 26. (AD) | 27. (ACD) | 28. (AC) |
| 29. (AB) | 30. (B) | 31. (AC) | 32. (BCD) | 33. (ACD) | 34. (BD) | 35. (B) |
| 36. (ACD) | 37. (B) | 38. (BCD) | 39. (ABCD) | 40. (AB) | | |

DATE : 11-02-2018

ANSWER KEY

CODE - 2

MATHEMATICS

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|-----------|----------|------------|------------|------------|----------|----------|
| 1. (AD) | 2. (A) | 3. (ACD) | 4. (AB) | 5. (BC) | 6. (AC) | 7. (ABD) |
| 8. (ABCD) | 9. (ACD) | 10. (ABCD) | 11. (AD) | 12. (CD) | 13. (AC) | 14. (B) |
| 15. (AD) | 16. (AC) | 17. (AD) | 18. (ABCD) | 19. (ABCD) | 20. (A) | 21. (B) |
| 22. (D) | 23. (B) | 24. (C) | 25. (B) | 26. (C) | 27. (AD) | 28. (BC) |
| 29. (BC) | 30. (B) | 31. (B) | 32. (C) | 33. (A) | 34. (BD) | 35. (AC) |
| 36. (B) | 37. (D) | 38. (D) | 39. (A) | 40. (C) | | |

PHYSICS

- | | | | | | | |
|-----------|----------|----------|-----------|------------|-----------|-----------|
| 1. (A) | 2. (BC) | 3. (AC) | 4. (AC) | 5. (AC) | 6. (ABD) | 7. (AB) |
| 8. (ABCD) | 9. (ABC) | 10. (BC) | 11. (ABC) | 12. (ABCD) | 13. (ABC) | 14. (BCD) |
| 15. (ABC) | 16. (BC) | 17. (AD) | 18. (BCD) | 19. (AD) | 20. (AC) | 21. (A) |
| 22. (AC) | 23. (AD) | 24. (A) | 25. (BC) | 26. (A) | 27. (AC) | 28. (D) |
| 29. (C) | 30. (AC) | 31. (AC) | 32. (B) | 33. (BD) | 34. (A) | 35. (AD) |
| 36. (D) | 37. (AD) | 38. (A) | 39. (B) | 40. (AD) | | |

CHEMISTRY

- | | | | | | | |
|-----------|-----------|-----------|------------|------------|-----------|------------|
| 1. (ABC) | 2. (ABD) | 3. (ABD) | 4. (ABCD) | 5. (AB) | 6. (AC) | 7. (CD) |
| 8. (ABCD) | 9. (BD) | 10. (AB) | 11. (ABD) | 12. (CD) | 13. (ABC) | 14. (ABCD) |
| 15. (ACD) | 16. (ABC) | 17. (ABC) | 18. (BC) | 19. (ABCD) | 20. (AB) | 21. (BD) |
| 22. (AB) | 23. (ABC) | 24. (D) | 25. (AC) | 26. (AB) | 27. (ACD) | 28. (AB) |
| 29. (AC) | 30. (B) | 31. (BC) | 32. (BCD) | 33. (ABC) | 34. (BD) | 35. (D) |
| 36. (ABC) | 37. (B) | 38. (ABC) | 39. (ABCD) | 40. (AC) | | |

DATE : 11-02-2018

COURSE : VIJAY (01JR)

ANSWER KEY

CODE- 3

MATHEMATICS

- | | | | | | | |
|-----------|----------|------------|------------|------------|----------|----------|
| 1. (AB) | 2. (A) | 3. (ABC) | 4. (AD) | 5. (BC) | 6. (AD) | 7. (ACD) |
| 8. (ABCD) | 9. (BCD) | 10. (ABCD) | 11. (BD) | 12. (CD) | 13. (AD) | 14. (B) |
| 15. (BD) | 16. (AC) | 17. (BD) | 18. (ABCD) | 19. (ABCD) | 20. (B) | 21. (A) |
| 22. (C) | 23. (A) | 24. (D) | 25. (C) | 26. (A) | 27. (AD) | 28. (AC) |
| 29. (AC) | 30. (D) | 31. (C) | 32. (D) | 33. (A) | 34. (AD) | 35. (BC) |
| 36. (C) | 37. (D) | 38. (A) | 39. (B) | 40. (A) | | |

PHYSICS

- | | | | | | | |
|-----------|----------|----------|-----------|------------|-----------|-----------|
| 1. (C) | 2. (AB) | 3. (BC) | 4. (BC) | 5. (BD) | 6. (BCD) | 7. (BC) |
| 8. (ABCD) | 9. (ABC) | 10. (AB) | 11. (ACD) | 12. (ABCD) | 13. (ABC) | 14. (ABD) |
| 15. (ABC) | 16. (AD) | 17. (BC) | 18. (ACD) | 19. (CD) | 20. (AB) | 21. (B) |
| 22. (BC) | 23. (BD) | 24. (C) | 25. (AB) | 26. (B) | 27. (AB) | 28. (B) |
| 29. (A) | 30. (AD) | 31. (AB) | 32. (C) | 33. (AD) | 34. (C) | 35. (BD) |
| 36. (B) | 37. (BD) | 38. (B) | 39. (D) | 40. (BD) | | |

CHEMISTRY

- | | | | | | | |
|-----------|-----------|-----------|------------|------------|-----------|------------|
| 1. (BCD) | 2. (ABD) | 3. (ABC) | 4. (ABCD) | 5. (BC) | 6. (AB) | 7. (CD) |
| 8. (ABCD) | 9. (CD) | 10. (AD) | 11. (ABD) | 12. (CD) | 13. (ACD) | 14. (ABCD) |
| 15. (ABD) | 16. (ABD) | 17. (ABC) | 18. (BC) | 19. (ABCD) | 20. (AC) | 21. (AD) |
| 22. (AB) | 23. (ABD) | 24. (A) | 25. (BC) | 26. (AD) | 27. (ACD) | 28. (AC) |
| 29. (AB) | 30. (B) | 31. (AC) | 32. (BCD) | 33. (ACD) | 34. (BD) | 35. (B) |
| 36. (ACD) | 37. (B) | 38. (BCD) | 39. (ABCD) | 40. (AB) | | |