Answer Key

Other (130 Questions)

Q1. (B)	Q2. (A)	Q3. (A)	Q4. (A)	Q5. (B)
Q6. (D)	Q7. (D)	Q8. (A)	Q9. (C)	Q10. (A)
Q11. (B)	Q12. (B)	Q13. (B)	Q14. (A)	Q15. (D)
Q16. (D)	Q17. (D)	Q18. (B)	Q19. (C)	Q20. (A)
Q21. (B)	Q22. (A)	Q23. (D)	Q24. (D)	Q25. (D)
Q26. (D)	Q27. (A)	Q28. (B)	Q29. (A)	Q30. (D)
Q31. (A)	Q32. (B)	Q33. (B)	Q34. (B)	Q35. (B)
Q36. (A)	Q37. (D)	Q38. (D)	Q39. (A)	Q40. (B)
Q41. (D)	Q42. (A)	Q43. (D)	Q44. (D)	Q45. (C)
Q46. (B)	Q47. (C)	Q48. (C)	Q49. (D)	Q50. (D)
Q51. (A)	Q52. (B)	Q53. (D)	Q54. (B)	Q55. (C)
Q56. (A)	Q57. (B)	Q58. (A)	Q59. (B)	Q60. (C)
Q61. (C)	Q62. (D)	Q63. (C)	Q64. (C)	Q65. (D)
Q66. (A)	Q67. (A)	Q68. (A)	Q69. (C)	Q70. (B)
Q71. (B)	Q72. (B)	Q73. (C)	Q74. (D)	Q75. (B)
Q76. (A)	Q77. (B)	Q78. (A)	Q79. (A)	Q80. (C)
Q81. (A)	Q82. (A)	Q83. (B)	Q84. (B)	Q85. (D)
Q86. (D)	Q87. (A)	Q88. (D)	Q89. (C)	Q90. (C)
Q91. (A)	Q92. (B)	Q93. (C)	Q94. (A)	Q95. (D)
Q96. (C)	Q97. (A)	Q98. (B)	Q99. (D)	Q100.(B)
Q101.(A)	Q102.(D)	Q103.(A)	Q104.(B)	Q105.(C)

Q106.(A)	**Q107.(B)**	**Q108.(B)**	**Q109.(B)**	**Q110.(D)**
Q111.(C)	**Q112.(C)**	**Q113.(A)**	**Q114.(B)**	**Q115.(A)**
Q116.(D)	**Q117.(D)**	**Q118.(D)**	**Q119.(D)**	**Q120.(B)**
Q121.(D)	**Q122.(A)**	**Q123.(D)**	**Q124.(B)**	**Q125.(C)**
Q126.(D)	**Q127.(B)**	**Q128.(D)**	**Q129.(B)**	**Q130.(A)**

Solutions

Q1. Solution

Correct Answer: (B)

Given, $\frac{dy}{dx} = \frac{y^2}{xy - x^2}$

Put $y = vx$

$\Rightarrow \quad \frac{dy}{dx} = v + x \frac{dv}{dx}$

$\therefore v + x \frac{dv}{dx} = \frac{v^2x^2}{vx^2 - x^2}$

$\Rightarrow x \frac{dv}{dx} = \frac{v^2 - 1}{v - 1} - v$

$\Rightarrow x \frac{dv}{dx} = \frac{v}{v - 1}$

$\Rightarrow \left(1 - \frac{1}{v}\right) dv = \frac{dx}{x}$

$\Rightarrow v - \log v = \log x + \log k$ [integrating]

$\Rightarrow \frac{y}{x} = \log x \; k \; \frac{y}{x}$

$\Rightarrow \frac{y}{x} = \log ky$

$\Rightarrow ky = e^{y/x}$

Q2. Solution

Correct Answer: (A)

Given eq ^{n} is $\left(x^2 + 2\right)^2 + 8x^2 = 6x\left(x^2 + 2\right) \Rightarrow x^4 + 4x^2 + 4 + 8x^2 = 6x^3 + 12x$

$\Rightarrow x^4 - 6x^3 + 12x^2 - 12x + 4 = 0$ $\left(x^2 + 2\right)^2 + 8x^2 = 6x\left(x^2 + 2\right) \Rightarrow x^4 + 4x^2 + 4 + 8x^2 = 6x^3 + 12x$

$\Rightarrow x^4 - 6x^3 + 12x^2 - 12x + 4 = 0$ This can be factorised into $\left(x^2 - 4x + 2\right)\left(x^2 - 2x + 2\right) = 0$ Consider, $x^2 - 2x + 2 = 0$ Roots are $\frac{-(-2) \pm \sqrt{(-2)^2 - 4(2)(1)}}{2(1)} = \frac{2 \pm \sqrt{4 - 8}}{2} = \frac{2 \pm \sqrt{-4}}{2} = \frac{2 \pm 2i}{2} = 1 \pm i$ Also, this equation is satisfied by $1 \pm i$. Hence, required roots are $1 \pm i$.

Q3. Solution

Correct Answer: (A)

We have, $\sin^{-1}\left(x - \frac{x^2}{2} + \frac{x^3}{4} - \frac{x^4}{8} + \ldots\right) = \frac{\pi}{6} \Rightarrow \sin^{-1}\left(\frac{x}{1 - \left(\frac{-x}{2}\right)}\right) = \frac{\pi}{6} \quad \left[\because S_\infty = \frac{a}{1 - r}\right]$

$\Rightarrow \quad \sin^{-1}\left(\frac{2x}{2 + x}\right) = \frac{\pi}{6} \Rightarrow \frac{2x}{2 + x} = \sin\frac{\pi}{6} \Rightarrow \frac{2x}{2 + x} = \frac{1}{2} \Rightarrow \quad 4x = 2 + x \quad \Rightarrow \quad 3x = 2 \quad \Rightarrow \quad x = \frac{2}{3}$

Q4. Solution

Correct Answer: (A)

Given that $z-\frac{25}{z} \geq |z|-\frac{25}{|z|} \Rightarrow 24 \geq |z|-\frac{25}{|z|}$

$\Rightarrow -24 \leq |z|-\frac{25}{|z|} \leq 24$

or $-24|z| \leq |z|^2-25 \leq 24\, z$

$\therefore \; |z|^2+24|z|-25 \geq 0$ and $|z|^2-24|z|-25 \leq 0$

$\Rightarrow \; (|z|+25)(|z|-1) \geq 0$ and $(|z|-25)(|z|+1) \leq 0$

$\therefore \; |z|-1 \geq 0$ and $|z|-25 \leq 0$

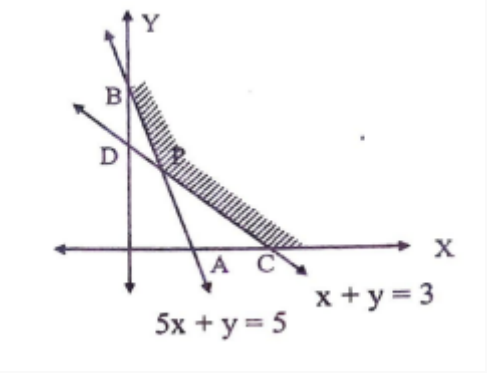
Hence, $1 \leq |z| \leq 25$

or $1 \leq |z-0| \leq 25$

Q5. Solution

Correct Answer: (B)

Feasible area is shaded. Point of intersection of given lines is $\mathrm{P} \equiv \left(\frac{1}{2}, \frac{5}{2}\right)$ Co-ordinates of points are as follows : $C \equiv (3,0); P \equiv \left(\frac{1}{2}, \frac{5}{2}\right)$ and $B \equiv (0,5)$ We have $Z=7x+y$ $Z_{(c)}=21+0=21 \therefore \quad Z_{(B)}=0+5=5$



$Z_{(P)}=\frac{7}{2}+\frac{5}{2}=6$ Thus minimum value is 5.

Q6. Solution

Correct Answer: (D)

$3^{2008}=3\left(3^{2007}\right)=3\left(3^{3\times 669}\right)$

$=3\times 27^{669}=3\times(28-1)^{669}=3(28\lambda-1)$

$=\; 7\mu–3=7(\mu–1)+4$

$\therefore$ Remainder $=4$

Q7. Solution

Correct Answer: (D)

$\log_2\left(9^{x-1}+7\right)-\log_2\left(3^{x-1}+1\right)=2 \Rightarrow \quad \log_2\left(\frac{9^{x-1}+7}{3^{x-1}+1}\right)=2\log_2 2 \Rightarrow \quad \log_2\left(\frac{9^{x-1}+7}{3^{x-1}+1}\right)=\log_2 2^2$
$\Rightarrow \quad \left(\frac{9^{x-1}+7}{3^{x-1}+1}\right)=4 \Rightarrow \quad \frac{\left(3^2\right)^{x-1}+7}{\left(3^{x-1}+1\right)}=4 \Rightarrow \quad \frac{\left(3^{x-1}\right)^2+7}{3^{x-1}+1}=4$ Let $\quad 3^{\mathrm{x}-1}=\mathrm{y} \therefore \quad \frac{y^2+7}{y+1}=4$
$\Rightarrow \quad \mathrm{y}^2+7=4\mathrm{y}+4 \Rightarrow \quad y^2-4y+3=0 \Rightarrow \quad y^2-3y-y+3=0 \Rightarrow y(y-3)-1(y-3)=0$
$\Rightarrow \quad (\mathrm{y}-3)(\mathrm{y}-1)=0 \Rightarrow \quad y=3,1$ If $y=3$, then $3^{x-1}=3 \Rightarrow \quad x-1=1 \Rightarrow x=2$ If $\mathrm{y}=1$, then $3^{x-1}=3^0 \Rightarrow \quad x-1=0 \Rightarrow x=1 \therefore \quad x=1,2$

Q8. Solution

Correct Answer: (A)

Points of intersection due to
7 straight lines $= \ {}^7\mathrm{C}_2-3=18$
Two concentric circles can intersect these 7 lines at
maximum $=14+14=28$ points
Third circle can intersect the given system at
maximum $=14+2+2=18$
Fourth circle can intersect the system at maximum
$=14+2+2+2=20$ points
for fifth circle $=14+2+2+2+2=22$
maximum no. of points of intersection
$=18+28+18+20+22=106$

Q9. Solution

Correct Answer: (C)

Since, $(2\tan\theta+2)^2=\tan\theta(3\tan\theta+3)$

$\Rightarrow 4\tan^2\theta+8\tan\theta+4=3\tan^2\theta+3\tan\theta$

$\Rightarrow \tan^2\theta+5\tan\theta+4=0$

$\Rightarrow (\tan\theta+4)(\tan\theta+1)=0$

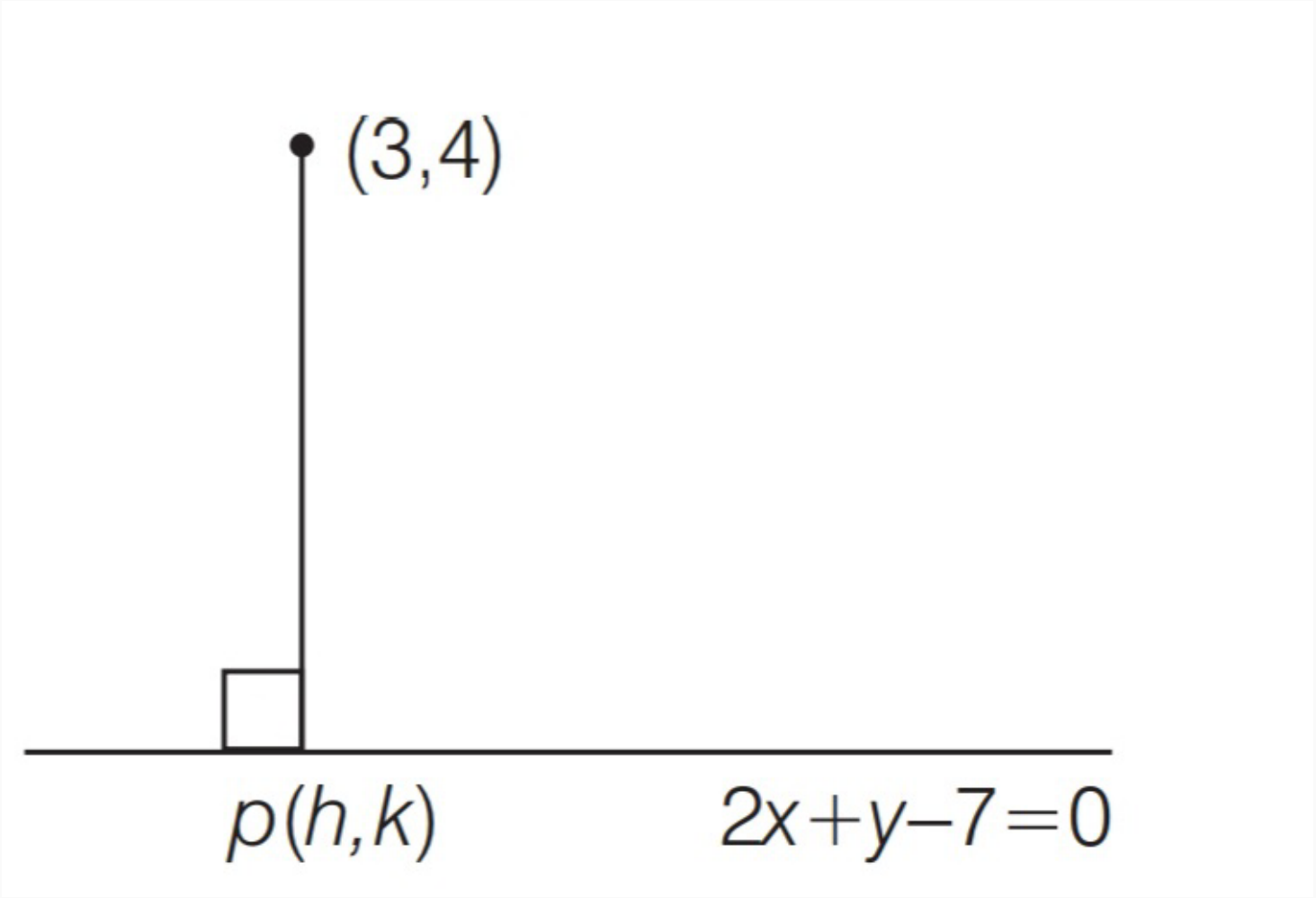
$\Rightarrow \tan\theta=-4(\because \tan\theta\neq-1$ because $2\tan\theta+2\neq0)$

$\therefore \frac{7-5\cot\theta}{9-4\sqrt{\tan^2\theta}}=\frac{7+\frac{5}{4}}{9-4(+4)}=-\frac{33}{28}$

Q10. Solution

Correct Answer: (A)

We know that foot of the perpendicular (h, k) from (x_1, y_1) to the line $ax + by + c = 0$ is given by



$\frac{h-x_1}{a} = \frac{k-y_1}{b} = \frac{-(ax_1+by_1+c)}{a^2+b^2}$ Here, point $(x_1, y_1) = (3, 4)$ and $ax + by + c = 2x + y - 7 = 0$

$\therefore \quad a = 2, b = 1, c = -7$ then, from Eq. (i) $\frac{h-3}{2} = \frac{k-4}{1} = \frac{-(2\times3+1\times4-7)}{2^2+1^2} \Rightarrow \quad \frac{h-3}{2} = \frac{k-4}{1} = \frac{-3}{5}$

$\Rightarrow \quad h = \frac{+9}{5} \quad$ and $\quad k = \frac{17}{5}$

Q11. Solution

Correct Answer: (B)

The most accurate description of the situation is “The constraints are short in number.” This statement correctly identifies the fundamental characteristic of the problem. When the number of variables (4) exceeds the number of constraints (3), the system is mathematically referred to as underdetermined. This means the constraints are insufficient to define a single, unique solution ~

Q12. Solution

Correct Answer: (B)

$= \tan A + 2\tan 2A + 4\tan 4A + 8 \times \frac{1-\tan^2 4A}{2\tan 4A} = \tan A + 2\tan 2A + 4\tan 4A + \frac{4(1-\tan^2 4A)}{\tan 4A}$

$= \tan A + 2\tan 2A + \frac{4\tan^2 4A + 4 - 4\tan^2 4A}{\tan 4A} = \tan A + 2\tan 2A + \frac{4}{\tan 4A} = \tan A + 2\tan 2A + 4\cot 4A$

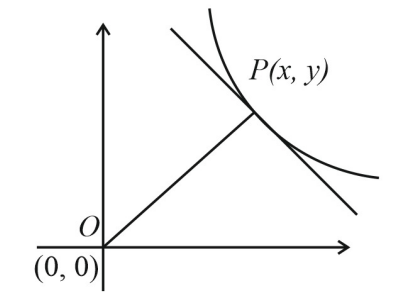
$= \tan A + 2\tan 2A + 4 \times \frac{1-\tan^2 2A}{2\tan 2A} = \tan A + 2\tan 2A + \frac{2(1-\tan^2 2A)}{\tan 2A}$

$= \tan A + \frac{2\tan^2 2A + 2 - 2\tan^2 2A}{\tan 2A} = \tan A + \frac{2}{\tan 2A} = \tan A + 2\cot 2A = \frac{2(1-\tan^2 A)}{2\tan A} = \tan A + \frac{1-\tan^2 A}{\tan A}$

$= \frac{\tan^2 A + 1 - \tan^2 A}{\tan A} = \frac{1}{\tan A} = \cot A$,

Q13. Solution

Correct Answer: (B)



Slope of $OP = 2\left(\frac{dy}{dx}\right)_P$

$\Rightarrow \frac{y}{x} = 2\frac{dy}{dx}$

$\Rightarrow 2\int \frac{dy}{y} = \int \frac{dx}{x}$

$\Rightarrow 2\ln y = \ln x + \ln c$

$\Rightarrow y^2 = cx$

As it passes through $(4, 2) \Rightarrow c = 1$

$\therefore$ the equation of the curve is $y^2 = x$ ~

Q14. Solution

Correct Answer: (A)

$\int_0^{\pi/4} \frac{\sin x + \cos x}{3 + \sin 2x} dx = \int_0^{\pi/4} \frac{(\sin x + \cos x)}{4 - (1 - \sin 2x)} dx = \int_0^{\pi/4} \frac{(\sin x + \cos x)}{4 - (\sin x - \cos x)^2} dx$ Put $\quad t = (\sin x - \cos x)$

$dt = (\cos x + \sin x)dx = \int_{-1}^{0} \frac{dt}{(4 - t^2)} = \int_{-1}^{0} \frac{\mathrm{dt}}{(2+\mathrm{t})(2-\mathrm{t})} = \frac{1}{4}\int_{-1}^{0} \left[\frac{1}{2+t} + \frac{1}{2-t}\right] dt$

$$= \frac{1}{4}\left[\log\left(\frac{2+\mathrm{t}}{2-\mathrm{t}}\right)\right]_{-1}^{0}$$

$= \frac{1}{4}[\log(2+t) - \log(2-t)]_{-1}^{0}$ $= \frac{1}{4}\left[\log(1) - \log\left(\frac{1}{3}\right)\right]$,

$$= \frac{1}{4}\log 3$$

Q15. Solution

Correct Answer: (D)

The conversion from spherical coordinates (r, θ, φ) to cartesian coordinates (x, y, z) is $\begin{aligned} x &= r\cos\varphi\sin\theta \\ y &= r\sin\varphi\sin\theta \\ z &= r\cos\theta \end{aligned}$

$\mathrm{A(x=2, y=3, z=-1)}$ and $\mathrm{B}\ (\mathrm{r}=4, \theta=30^{\circ}, \varphi=120^{\circ})$ Point A is given in cartesian coordinates and Point B is given in spherical coordinates. By converting the given spherical coordinates to cartesian coordinates,

$x=4 \times \cos 120 \sin 30=-1$

$y=4 \times \frac{\sqrt{3}}{2} \times \frac{1}{2}=\sqrt{3}$

$z=4 \times \frac{\sqrt{3}}{2}=2 \sqrt{3}$

The distance between the points A and B is,

$\mathrm{A}(2,3,-1), \mathrm{B}(-1, \sqrt{3}, 2 \sqrt{3})$

$AB=\sqrt{3^2+(3-\sqrt{3})^2+(-1-2 \sqrt{3})^2}=5.53$.

Q16. Solution

Correct Answer: (D)

(a) If a and b are perpendicular to each other, then

$\mathbf{a} \cdot \mathbf{b}=0$

Now consider,

$|\mathbf{a}+\mathbf{b}|^2=(\mathbf{a}+\mathbf{b}) \cdot(\mathbf{a}+\mathbf{b})$

$=|\mathbf{a}|^2+|\mathbf{b}|^2$

So, option (a) is always true.

(b) If $\mathbf{a}$ and $\mathbf{b}$ are perpendicular to each other, then

$\mathbf{a} \cdot \mathbf{b}=0$

Now consider,

$|\mathbf{a}+\lambda \mathbf{b}|^2=(\mathbf{a}+\lambda \mathbf{b}) \cdot(\mathbf{a}+\lambda \mathbf{b})$

$=|\mathbf{a}|^2+\lambda^2|\mathbf{b}|^2$

$\Rightarrow|\mathbf{a}+\lambda \mathbf{b}|=\sqrt{|\mathbf{a}|^2+\lambda^2|\mathbf{b}|^2}$

$\geq|\mathbf{a}|$ for all $\lambda \in R$

So, option (b) is always true.

(c) Consider,

$a+b|^2+|a-b|^2=(a+b) \cdot(a+b)+(a-b) \cdot(a-b)$

$=|\mathbf{a}|^2+\mathbf{a} \cdot \mathbf{b}+\mathbf{b} \cdot \mathbf{a}+|\mathbf{b}|^2+|\mathbf{a}|^2-\mathbf{a} \cdot \mathbf{b}-b \cdot a+|b|^2$

$=2\left(|\mathbf{a}|^2+|\mathbf{b}|^2\right)$

So, option (c) is always true.

(d) Consider.

$\mathbf{a}=-\mathbf{b}$ and $\mathbf{b} \neq 0$

Then, $|\mathbf{a}+\lambda \mathbf{b}| \geq|\mathbf{a}|$

$\Rightarrow|-\mathbf{b}+\lambda \mathbf{b}| \geq|-\mathbf{b}|$

$\Rightarrow \quad|\mathbf{b}||\lambda-1| \geq|\mathbf{b}| \Rightarrow|\lambda-1| \geq 1$

which is not true for all λ, as we consider $\lambda=\frac{1}{2}$, then it is not true

Hence, option (d) is not always true. ^

Q17. Solution

Correct Answer: (D)

$\frac{dy}{dx} = (4x + y + 1)^2 \quad \ldots (\mathrm{i})$

Put $4x + y + 1 = v$

$\Rightarrow \frac{dy}{dx} = \frac{dv}{dx} - 4$

$\frac{dv}{dx} - 4 = v^2 \quad (\because$ From equation$(\mathrm{i}))$

$\Rightarrow \frac{dv}{v^2+4} = dx$

This is the variable separable type of differential equation. Integrating both sides, we have

$\int \frac{dv}{v^2+4} = \int dx$

$\Rightarrow \frac{1}{2}\tan^{-1}\left(\frac{v}{2}\right) = x + C$

Replacing v by $(4x + y + 1)$, we have

$\Rightarrow \tan^{-1}\left(\frac{4x+y+1}{2}\right) = 2x + C$

$4x + y + 1 = 2\tan(2x + C)$

∧

Q18. Solution

Correct Answer: (B)

Let $\vec{s}$ be equal to $x\hat{i} + y\hat{j} + z\hat{k}$.

$\vec{s} = \left(t^2 + 2\right)\hat{i} + (4t - 5)\hat{j} + \left(2t^2 - 6t\right)\hat{k}$

$\frac{d\vec{s}}{dt} = 2t\hat{i} + 4\hat{j} + (4t - 6)\hat{k}$

Let the tangent vector at $t = 2$ be $\vec{r}$.

$\vec{r} = 4\hat{i} + 4\hat{j} + 2\hat{k}$

$\hat{r} = \frac{1}{3}\left(2\hat{i} + 2\hat{j} + \hat{k}\right)$

∧

Q19. Solution
Correct Answer: (C)

Here, $P(A) = 0.4$ and $P\left(\overline{A}\right) = 1 - 0.4 = 0.6$

Probability that the event A happens at least once $= 1 - P(\text{event a does not happen in all three trials})$

$= 1 - (0.6)^3$

$= 1 - 0\ .216$

$= 0.784$

!

Q20. Solution
Correct Answer: (A)

$\Rightarrow \int \left(\frac{x-3}{x+4}\right)^{\frac{-6}{7}} \frac{1}{(x+4)^2} dx \quad \ldots (\text{i})$

Let $\frac{x-3}{x+4} = t^7$,

$\frac{7}{(x+4)^2} dx = 7t^6 dt \ldots \ (\text{ii})$

In (i) from (ii) $\int t^{-6} t^6 dt = t + C$

,

Q21. Solution
Correct Answer: (B)

Machine time constraint: Each unit of A takes 3 hours, and each unit of B takes 5 hours. The total machine hours must not exceed 80: $3x + 5y \leq 80$ Carpenter time constraint: Each unit of A and B takes 3 hours each. Total carpenter hours must not exceed 50: $3x + 3y \leq 50$ Non-negativity constraints: You can't manufacture negative units: $x \geq 0, \quad y \geq 0$

Q22. Solution

Correct Answer: (A)

Plane P contains line $\mathrm{L}_1: \frac{\mathrm{x}-1}{1}=\frac{\mathrm{y}-2}{2}=\frac{\mathrm{z}-3}{3}$

and is parallel to line $\mathrm{L}_2: \frac{\mathrm{x}}{1}=\frac{\mathrm{y}}{1}=\frac{\mathrm{z}}{4}$

$$\Rightarrow \text{d.r. of normal to } \mathrm{P} \equiv \begin{vmatrix} \mathrm{i} & \mathrm{j} & \mathrm{k} \\ 1 & 2 & 3 \\ 1 & 1 & 4 \end{vmatrix} = 5\mathrm{i}-\mathrm{j}-\mathrm{k}$$

Equation of P is $5x-y-z+d=0$

But P passes through $(1,2,3)$

$\Rightarrow d=0$

Eq. of P is $5x-y-z=0$

Clearly,Point $(1,0,5)$ satisfies it

Q23. Solution

Correct Answer: (D)

The statement can be written as per the statement

$P=$ suman is brilliant, $R=$ Suman is honest

so dishonest is represented by, $\sim R$

Suman is brilliant and dishonest $P \wedge \sim R$

Suman is brilliant and dishonest if and only if Suman is rich,$P \wedge \sim R \Leftrightarrow Q$ and negation of $(P \wedge \sim R) \Leftrightarrow Q$ is $\sim[Q \leftrightarrow (P \wedge \sim R)]$

Q24. Solution

Correct Answer: (D)

Middle number $=[(10.5 \times 6+11.4 \times 6)-10.9 \times 11]$
$=(131.4-119.9)=11.5$

Q25. Solution

Correct Answer: (D)

Given, $\left(1+x+x^2+x^3\right)^n=\sum_{r=0}^{3n} a_r x^r$ and n is an odd positive integer.

$\Rightarrow \quad \left[(1+x)\left(1+x^2\right)\right]^n=\sum_{r=0}^{3n} a_r x^r$

$\Rightarrow \quad (1+x)^n\left(1+x^2\right)^n=\sum_{r=0}^{3n} a_r x^r$

If we take $n=1$, $\left(1+x+x^2+x^3\right)=\sum_{r=0}^{3} a_r x^r$

$=a_0+a_1 x+a_2 x^2+a_3 x^3$

On comparing both sides, $a_0=1, a_1=1, a_2=1, a_3=1 \ldots (i)$ If we take $n=3$,

$$
\begin{aligned}
&(1+x)^3\left(1+x^2\right)^3=\sum_{r=0}^{9} a_r x^r \\
&\left(1+x^3+3x^2+3x\right)\left(1+x^6+3x^4+3x^2\right) \\
&=\sum_{r=0}^{9} a_r x^r\left(1+x^3+3x^2+3x+x^6+x^9\right. \\
&\quad +3x^8+3x^7+3x^4+3x^7+9x^6 \\
&\quad \left.+9x^5+3x^2+3x^5+9x^4+9x^3\right) \\
&=\sum_{r=0}^{9} a_r x^r\left(1+3x+6x^2+10x^3+12x^4\right. \\
&\quad \left.+12x^5+10x^6+6x^7+3x^8+x^9\right) \\
&=\sum_{r=0}^{9} a_r x^r
\end{aligned}
$$

On comparing the coefficient of x on both sides; $a_0=1, a_1=3, a_2=6, a_3=10, a_4=12, a_5=12$, $a_6=10, a_7=6, a_8=3, a_9=1$ From Eq. (i), we see that, $a_0-a_1+a_2-a_3=0$, when $n=1$ From Eq. (ii), we see that, $a_0-a_1+a_2-a_3+a_4-a_5+a_6-a_7+a_8-a_9=0$ when $n=3$, Similarly, for each odd terms: $a_0-a_1+a_2-a_3+\ldots-a_{3n}=0$

Q26. Solution

Correct Answer: (D)

The total number of arrangements of 2 letters of English alphabet $=26 \times 26$ The total number of arrangements of 4 digits number in which first digit is not zero $=9 \times 10 \times 10 \times 10 \therefore$ The total number of vehicles with distinct registration number

$$
\begin{aligned}
&=26 \times 26 \times 9 \times 10 \times 10 \times 10 \\
&=26^2 \times 9 \times 10^3
\end{aligned}
$$

Q27. Solution

Correct Answer: (A)

Given set $A=\{1,2,3,4\}$ and relation, xRy if x divides y. $\Rightarrow$ Relation $=\{(1,1),(2,2),(3,3),(4,4),(1,2),(1,3),,(1,4),(2,4)\}$ Reflexive We have, $xRy \Leftrightarrow y/x$ for $x, y \in A$ For any $x \in A$, we have $x/x \Rightarrow xRx$. Thus, xRx for all $x \in A$. So, R is reflexive on A. Symmetry R ia not symmetry because, if y/x, then x may not divide y. For example $4/2$ but $2/4$. Transitive, Let $x, y, z \in A$, such that xRy and yRz. Then, xRy and $yRz \Rightarrow \frac{y}{x}$ and $\frac{z}{y} \Rightarrow \frac{z}{x}$. So, R is a transitive relation on A.

Q28. Solution

Correct Answer: (B)

$\lim_{x\to 0} \frac{\cos(\sin x)-\cos x}{x^4}$

$= \lim_{x\to 0} \frac{2\sin\left(\frac{x+\sin x}{2}\right)\sin\left(\frac{x-\sin x}{2}\right)}{x^4}$

$= 2\lim_{x\to 0}\left[\frac{\sin\left(\frac{x+\sin x}{2}\right)}{\left(\frac{x+\sin x}{2}\right)} \times \frac{\sin\left(\frac{x-\sin x}{2}\right)}{\left(\frac{x-\sin x}{2}\right)}\right.$

$\left.\times \left(\frac{x+\sin x}{2x}\right)\left(\frac{x-\sin x}{2x^3}\right)\right]$

$= 2\lim_{x\to 0}\left[\frac{\sin\left(\frac{x+\sin x}{2}\right)}{\frac{x+\sin x}{2}} \times \frac{\sin\left(\frac{x-\sin x}{2}\right)}{\frac{x-\sin x}{2}}\right.$

$= \lim_{x\to 0} \frac{x-\sin x}{x^3} = \lim_{x\to 0} \frac{x-\left(x-\frac{x^3}{3!}+\frac{x^5}{5!}-\ldots\right)}{x^3}$

$= \lim_{x\to 0}\left(\frac{1}{3!}-\frac{x^2}{5!}+\ldots\right) = \frac{1}{6}$

Q29. Solution

Correct Answer: (A)

$(\sin x + \sin 5x) + \sin 3x = 0$

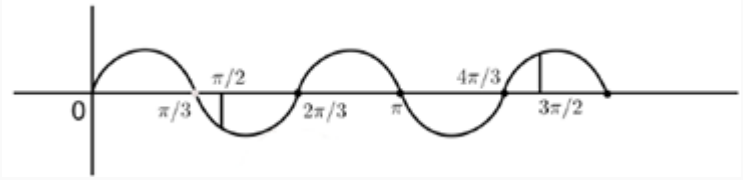
$2 \sin 3x \cos 2x + \sin 3x = 0$

$\sin 3x(2 \cos 2x + 1) = 0$

$\sin 3x = 0$ and $2 \cos 2x + 1 = 0$

$\sin 3x = 0$

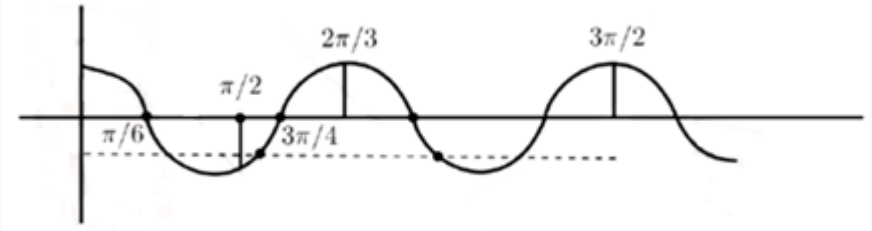
Graph f(x) = sin 3x



$x = \frac{2\pi}{3}$ or $x = \pi$ or $x = \frac{4\pi}{3}$,

$\therefore \sin 3x = 0$ have 3 solutions

Graph f(x) = cos 2x



$\cos 2x = -\frac{1}{2}$

$\therefore x = \frac{2\pi}{3}\ and \frac{4\pi}{3}$

So the solution of given equation in $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ are $\frac{2\pi}{3}\ and\ \frac{4\pi}{3}$

Q30. Solution

Correct Answer: (D)

Given that: Equation of Hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

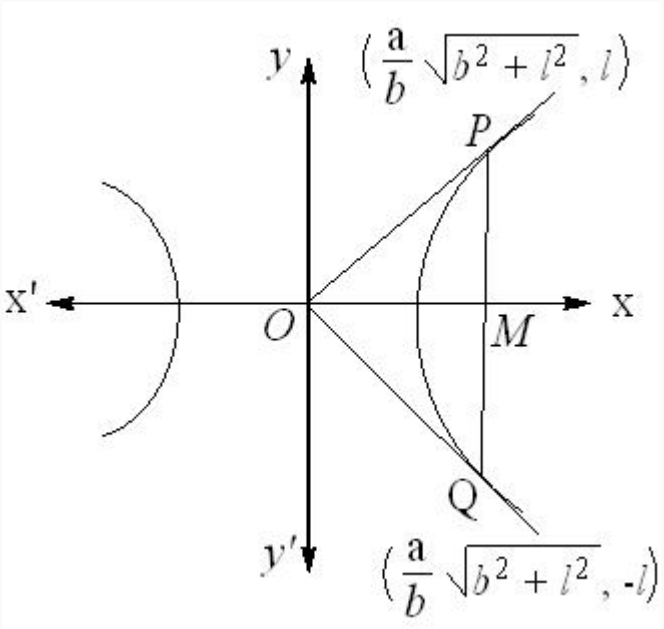
$\because PQ$ Is the double ordinate. Let $MP = MQ = l$.

Given that ΔOPQ is an equilateral, then $OP = OQ = PQ$

$\Rightarrow (OP)^2 = (OQ)^2 = (PQ)^2$

$\Rightarrow \frac{a^2}{b^2}\left(b^2 + l^2\right) + l^2 = \frac{a^2}{b^2}\left(b^2 + l^2\right) + l^2 = 4l^2$

$\Rightarrow \frac{a^2}{b^2}\left(b^2 + l^2\right) = 3l^2$



$\Rightarrow a^2 = l^2\left(3 - \frac{a^2}{b^2}\right)$

$\Rightarrow\ l^2 = \frac{a^2b^2}{(3b^2 - a^2)} > 0$

$\therefore\ 3b^2 - a^2 > 0$

$\Rightarrow\ 3b^2 > a^2$

$\Rightarrow 3a^2\left(e^2 - 1\right) > a^2$

$\therefore\ e > \frac{2}{\sqrt{3}}$

Q31. Solution

Correct Answer: (A)

Given, $f(x)=\lim_{n\to\infty}\frac{\left(x^2+2x+3+\sin\pi x\right)^n+1-2}{\left(x^2+2x+3+\sin\pi x\right)^n+1}$

$\Rightarrow f(x)=\lim_{n\to\infty}\left(1-\frac{2}{\left(x^2+2x+3+\sin\pi x\right)^n+1}\right)$

$\because x^2+2x+3+\sin\pi x=\left(x+1\right)^2+2+\sin\pi x>1$

$\Rightarrow f(x)=1-\frac{2}{\infty}=1-0=1\left[\because\lim_{n\to\infty}y^n=\infty \text{ if } |y|>1\right]$

$\therefore f(x)=1=$constant function $\forall\ x\in R$

So, it is continuous for all $x\in R$.

Also, $f'(x)=\frac{d}{dx}(1)=0=$constant function $\forall\ x\in R$

So, it is differentiable for all $x\in R$.

Q32. Solution

Correct Answer: (B)

Given $f(x)=e^x$ and $g(x)=\sin^{-1}x$ and $h(x)=f[g(x)]$

$\Rightarrow h(x)=f\left(\sin^{-1}x\right)=e^{\sin^{-1}x}$

$\therefore\ \ h(x)=e^{\sin^{-1}x}$

$\Rightarrow h'(x)=e^{\sin^{-1}x}\times\frac{1}{\sqrt{1-x^2}}$

$\Rightarrow\frac{h'(x)}{h(x)}=\frac{1}{\sqrt{1-x^2}}$

Q33. Solution

Correct Answer: (B)

Let $\vec{\mathbf{r}}=l\left(\vec{\mathbf{b}}\times\vec{\mathbf{c}}\right)+m\left(\vec{\mathbf{c}}\times\vec{\mathbf{a}}\right)+n\left(\vec{\mathbf{a}}\times\vec{\mathbf{b}}\right)$

$\vec{\mathbf{r}}\cdot\vec{\mathbf{a}}=l\left[\vec{\mathbf{a}}\vec{\mathbf{b}}\vec{\mathbf{c}}\right]$

$\Rightarrow l=1$

Similarly, we get $m=2,\ n=3$

Hence $\vec{r}=\vec{\mathbf{b}}\times\vec{\mathbf{c}}+2\vec{\mathbf{c}}\times\vec{\mathbf{a}}+3\vec{\mathbf{a}}\times\vec{\mathbf{b}}$

Q34. Solution

Correct Answer: (B)

$A^{-1}adjB^{-1}adj\left(3A^{-1}\right) = |A|^{-1}\ adjB^{-1}\ \ adj\left(3A^{-1}\right)$

$= \frac{1}{|A|}\ B^{-1}\ ^2 \times\ 3A^{-1}\ ^2$

$= \frac{1}{|A|} \times \frac{1}{|B|^2} \times \frac{3^6}{|A|^2}$

$= \frac{3^6}{3^3 \times 2^2} = \frac{27}{4}$

Q35. Solution

Correct Answer: (B)

For the given system of equations, $D = \begin{matrix} 1 & -2 & 1 \\ 2 & 1 & -2 \\ 1 & 3 & -3 \end{matrix}$

Expand with respect to R_1,

$D = 1(-3+6) + 2(-6+2) + 1(6-1)$

$= 3 - 8 + 5 = 0$

For the given system of equations to be consistent $D_1 = D_2 = D_3$ must be zero as $D = 0$.

$\Rightarrow D_1 = \begin{matrix} a & -2 & 1 \\ b & 1 & -2 \\ c & 3 & -3 \end{matrix} = 0$

$\Rightarrow a(-3+6) + 2(-3b+2c) + (3b-c) = 0$

$\Rightarrow a - b + c = 0$

$\Rightarrow D_2 = \begin{matrix} 1 & a & 1 \\ 2 & b & -2 \\ 1 & c & -3 \end{matrix} = 0$

$\Rightarrow a - b + c = 0$

$\Rightarrow D_3 = \begin{matrix} 1 & -2 & a \\ 2 & 1 & b \\ 1 & 3 & c \end{matrix} = 0$

$\Rightarrow a - b + c = 0$

Q36. Solution

Correct Answer: (A)

Using integration by parts on 1st and 2nd terms seperately

$\int e^{\sin x}(x\cos x - \sec x\tan x)dx$

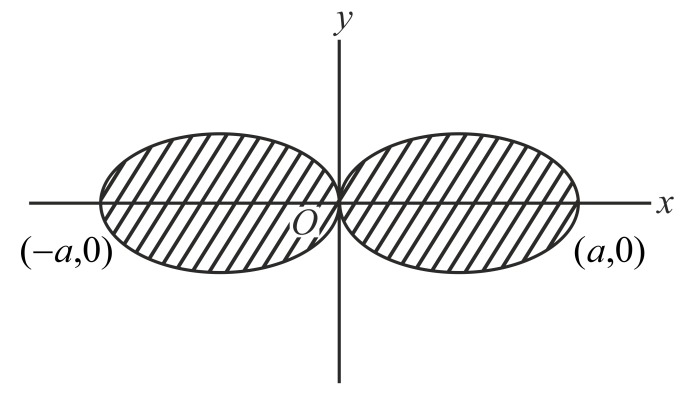
$= x\int e^{\sin x}\cos x\, dx - \int e^{\sin x}dx - \left[\left(\sec x.\ e^{\sin x}\right) - \int e^{\sin x}dx\right]$

$= e^{\sin x}(x - \sec x) + C$

Q37. Solution

Correct Answer: (D)

The curve has two loops is symmetrical about the $x-$axis and $y-$axis.



Required area is

$A = 4\int_0^a \frac{x}{a}\sqrt{a^2 - x^2}dx$

Let $a^2 - x^2 = t^2 \Rightarrow xdx = -tdt$

$A = -\frac{4}{a}\int_a^0 t^2 dt$

$= \frac{4}{a}\int_0^a t^2 dt$

$= \frac{4}{3a}\left[t^3\right]_0^a$

$= \frac{4}{3}a^2$ sq. units

Q38. Solution

Correct Answer: (D)

Let the GP be $a,\ ar,\ ar^2,\ \ ar^3,\ \ldots\ldots\ldots ar^{n-1}$

Where $a =$ Frist term and $r =$ Common ratio

According to question

We have $\quad t_1 + t_2 = 12 \ \Rightarrow a + ar = 12 \ \ldots(i)$

$$t_3 + t_4 = 48 \ \Rightarrow \ ar^2 \ + \ ar^3 \ = \ 48 \quad \ldots..(ii)$$

Divide the equations (i) & (ii)

$\frac{ar^2+ar^3}{a+ar} = \frac{48}{12}$

$\Rightarrow \frac{ar^2(1+r)}{a(1+r)} = \frac{48}{12} \Rightarrow r^2 = 4$

$\therefore \ r = \pm 2$

But the terms are alternately positive and negative,

$\therefore r = -2$

Now using equation $(i) a = \frac{12}{1+r} = \frac{12}{1-2} = \frac{12}{-1} = -12$

Q39. Solution

Correct Answer: (A)

Since, the semi latusrectum of a parabola is the HM of segments of a focal chord.

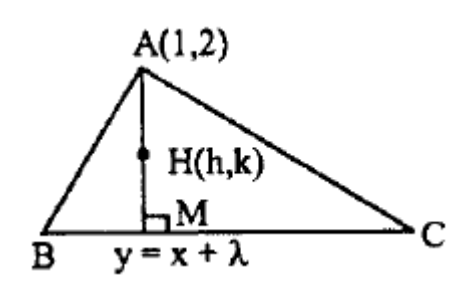
Semi latus rectum $(2a) = \frac{2SP_1.SP_2}{SP_1+SP_2}$

$\Rightarrow 2a = \frac{2.3.2}{3+2} = \frac{12}{5}$

Hence length of the latus rectum of the parabola $4a = \frac{24}{5}$

Q40. Solution

Correct Answer: (B)



Clearly $\mathrm{m_{MA}} \times \mathrm{m_{BC}} = -1$

$\Rightarrow \frac{k-2}{h-1} \times 1 = -1$

$\Rightarrow \quad k - 2 = 1 - h$

$\therefore$ Locus of $\mathrm{H(h, k)}$ is $\mathrm{x + y = 3}$

Hence y-intercept of locus of orthocenter is 3

Q41. Solution

Correct Answer: (D)

(Let $X = \left[\mathrm{ML^{-1}\ T^{-1}}\right]$ Percentage error in X is $\frac{\Delta X}{X} \times 100 = \left(\frac{\Delta M}{M} + \frac{\Delta L}{L} + \frac{\Delta T}{T}\right) \times 100$ Here, $\frac{\Delta M}{M} \times 100 = 1\%$, $\frac{\Delta L}{L} \times 100 = 1.5\%$ and $\frac{\Delta T}{T} \times 100 = 3\%$

$\therefore \quad \frac{\Delta X}{X} \times 100 = 1\% + 1.5\% + 3\% = 5.5\%$

Q42. Solution

Correct Answer: (A)

When brakes are on, there is no rolling of the wheels and the wheels slide. The sliding friction is greater than the rolling friction. Thus it is difficult to move a cycle along the road with its breaks on.

Q43. Solution

Correct Answer: (D)

Moment of inertia of circular loop, $I = mr^2$ Given, $\begin{matrix} I_Q = 8I_D \\ mr_Q^3 = 8m_p r_D^2 \end{matrix}$ $\begin{matrix} m_p \times (nr_p)^2 = 8m_p \times r_p^2 \\ n^2 = 8 \Rightarrow n = 2\sqrt{2} \end{matrix}$

Q44. Solution

Correct Answer: (D)

Suppose both collide at the point P after time t . Time taken for the particles to collide, $\mathrm{t}=\mathrm{d} / \mathrm{v}_{\mathrm{rel}}=100 / 100=1 \mathrm{~s}$ Speed of wood just before collision $=\mathrm{gt}=10 \mathrm{~m} / \mathrm{s}$ Speed of bullet just before collision $v-g t=100-10=90 \mathrm{~m} / \mathrm{s}$ Before $0.03 \mathrm{~kg} \downarrow 10 \mathrm{~m} / \mathrm{s} \quad 0.02 \mathrm{~kg} \uparrow 90 \mathrm{~m} / \mathrm{s}$ After $\uparrow \mathrm{v} \quad 0.05 \mathrm{~kg}$ Now, the conservation of linear momentum just before and after the collision $-(0.03)(10)+(0.02)(90)=(0.05) v \Rightarrow v=30 \mathrm{~m} / \mathrm{s}$ The maximum height reached by the body $a=v^2 / 2 g$ $=(30)^2 / 2(10)=45 \mathrm{~m} \quad(100-\mathrm{h})=1 / 2 \mathrm{gt}^2=1 / 2 \times 10 \times \mathrm{l} \Rightarrow \mathrm{h}=95 \mathrm{~m}$ Height above tower $=40 \mathrm{~m}$ Answer: (d) 40 m

Q45. Solution

Correct Answer: (C)

Time period of magnet in vibration magnetometer, $T=2 \pi \sqrt{\frac{I}{M H}}$ First case, $T_1=2 \pi \sqrt{\frac{I_1+I_2}{M^{\prime} H}}$ where, $M=$ resultant magnetic moment of two magnets Here, two identical magnets are placed perpendicular to each other. $\therefore \quad I_1=I_2=I$ (Let) and $\quad M^{\prime}=\sqrt{M^2+M^2}=M \sqrt{2} \therefore \quad T_1=2 \pi \sqrt{\frac{2 I}{\sqrt{2} M H}} \quad 2^{5 / 4}=2 \pi \sqrt{\frac{2 I}{\sqrt{2} M H}} \ldots$ (i) When one magnet is removed, then time period, $T_2=2 \pi \sqrt{\frac{I}{M H}}$ ...(ii) On dividing Eq. (i) by Eq. (ii), we get $\frac{2^{5 / 4}}{T_2}=\sqrt{\frac{2}{\sqrt{2}}}=\sqrt{\sqrt{2}} \quad \frac{2^{5 / 4}}{T_2}=2^{1 / 4} \quad T_2=\frac{2^{5 / 4}}{2^{1 / 4}}=2 \mathrm{~s}$

Q46. Solution

Correct Answer: (B)

We know that $\frac{dQ}{dt} = kA\frac{d\theta}{dx}$

In steady state flow of heat

$d\theta = \frac{dQ}{dt}.\frac{1}{kA}dx$

$\Rightarrow \theta_H - \theta = k'x$

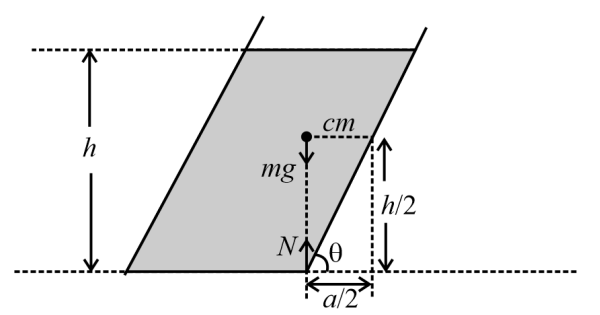
$\Rightarrow \theta = \theta_H - k'x$

Equation $\theta = \theta_H - k'x$ represents a straight line.

Q47. Solution

Correct Answer: (C)

The cylinder topples when the weight of the water in the tilted vessel can produce a torque about the rightmost edge of the base of the cylinder in the clockwise direction.



That is, the cylinder will start toppling or about topple when the centre of the gravity of the water in the vessel crosses or reaches the position vertically above the rightmost edge of the base of the cylinder.

i.e., $\tan\theta = \frac{\frac{h}{2}}{\frac{a}{2}}$,

$\therefore h = a\tan\theta$.

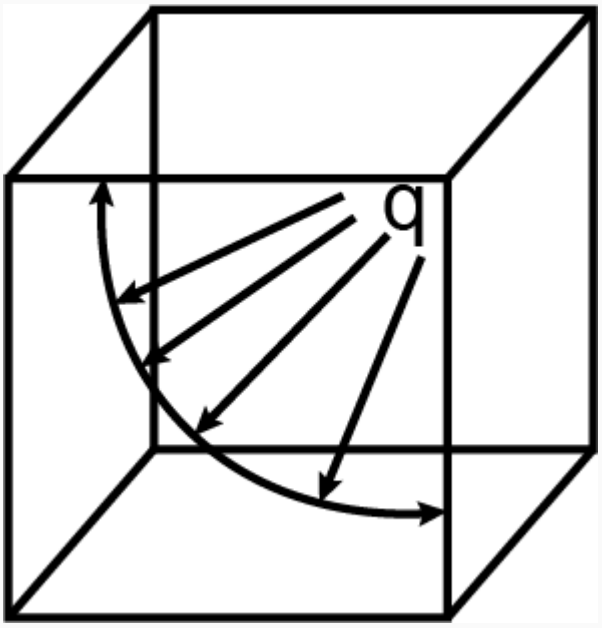
Q48. Solution

Correct Answer: (C)

- Precision Resistors: In precision resistors, it is essential that the resistance remains consistent regardless of temperature changes. Any fluctuation in resistance due to temperature variations can lead to inaccuracies in measurements and signals. Manganin's low TCR ensures that the resistors maintain their specified resistance value over a wide temperature range, providing reliable and accurate performance. - Temperature-Sensitive Applications: In applications where temperature changes are expected or unavoidable, materials with low TCR are preferred. Manganin's low TCR minimizes the effect of temperature changes on the resistance, making it ideal for use in environments where temperature stability is critical. This property is particularly beneficial in strain gauges and other sensors where precise measurements are required.

Q49. Solution

Correct Answer: (D)

Consider the diagram 

In above the flux coverage of three face is shown in figure. Which is like a quadrant in any plane. So, flux will be $\phi = \frac{1}{4} \times \frac{q}{6\varepsilon_0} = \frac{q}{24\varepsilon_0}$

Q50. Solution

Correct Answer: (D)

Speed upstream = 7.5 kmph : Speed downstream = 10.5 kmph.

$\therefore$ Total time taken $= \left(\frac{105}{7.5} + \frac{105}{10.5}\right)$ hours = 24 hours

Q51. Solution

Correct Answer: (A)

The Michelson-Morley experiment tests the speed of light in vacuum. It aimed to determine the Earth's motion through the hypothetical luminiferous ether by measuring the interference of two light beams traveling perpendicular to each other.

Q52. Solution

Correct Answer: (B)

For a transformer, Input voltage, $V_1 = 220$ V Input current, $I_1 = 0.6$ A Output power, $P_2 = 100$ W From, input power, $P_1 = V_1 I_1 = 220 \times 0.6 = 132$ W We know that, efficiency of transformer, $\eta = \frac{P_2}{P_1} = \frac{100}{132} = 0.7576 = 75.76\% \simeq 76\%$

Q53. Solution

Correct Answer: (D)

If frequency of source be f_s, then $f_{\text{approach}} - f_{\text{recession}} = \frac{2}{100} \times f_o \Rightarrow \quad f_s\left(\frac{v+v_s}{v}\right) - f_s\left(\frac{v-v_s}{v}\right) = \frac{f_s}{50}$

$\Rightarrow \quad \frac{2v_s}{v} = \frac{1}{50} \Rightarrow \frac{2v_s}{300} = \frac{1}{50} \Rightarrow \quad v_s = \frac{300}{2\times 50} = 3 \text{ ms}^{-1}$

Q54. Solution

Correct Answer: (B)

Let the velocity of a particle be v where mass m is double the rest mass i.e., $\mathrm{m} = 2\ \mathrm{m}_0$ then

$\mathrm{m}_0 = \mathrm{m}\sqrt{1 - \frac{\mathrm{v}^2}{\mathrm{c}^2}} \Rightarrow \mathrm{m}_0 = 2\ \mathrm{m}_0\sqrt{1 - \frac{\mathrm{v}^2}{\mathrm{c}^2}}\ \frac{1}{2} = \sqrt{1 - \frac{\mathrm{v}^2}{\mathrm{c}^2}} \Rightarrow \frac{1}{4} = 1 - \frac{\mathrm{v}^2}{\mathrm{c}^2} \Rightarrow \frac{\mathrm{v}^2}{\mathrm{c}^2} = 1 - \frac{1}{4} = \frac{3}{4}$

$\Rightarrow \mathrm{v} = \sqrt{\frac{3}{4}}\mathrm{c}$

Q55. Solution

Correct Answer: (C)

$$\begin{aligned}\text{Heat produced } &= \frac{1}{2} \times \text{KE of the bullet} \\ &= \frac{1}{2}\left(\frac{1}{2}mv^2\right) \\ &= \frac{1}{4} \times 10 \times 10^{-3} \times (300)^2 \\ &= 2.5 \times 10^{-3} \times 9 \times 10^4 \\ &= 225\ \text{J}\end{aligned}$$

$m = 10\ \text{g} = 10 \times 10^{-3}\ \text{kg}, v = 300\ \text{m/s}$ From

$$\begin{aligned}Q &= ms\Delta t \\ 225 &= 10 \times 10^{-3} \times 150 \times \Delta t \\ \Delta t &= \frac{225}{10 \times 10^{-3} \times 150} \\ &= \frac{225}{1.5} \\ &= 150^\circ\text{C}\end{aligned}$$

Q56. Solution

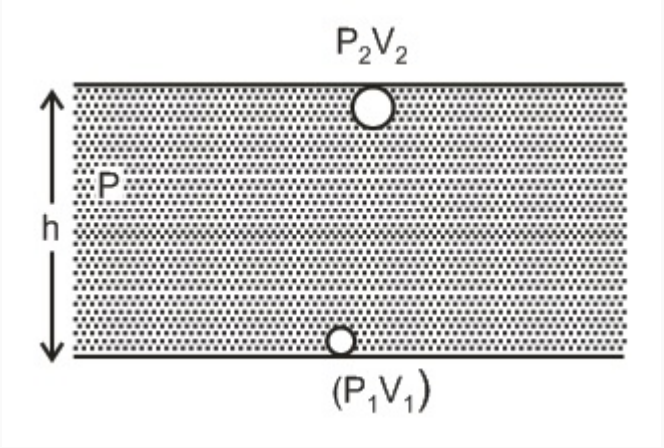
Correct Answer: (A)

When a wire is suspended from the ceiling and stretched under the action of a weight (F) suspended from its other end, the force exerted by the ceiling on it is equal and opposite to the weight. However, the tension at any cross-section A of the wire is just F and not 2F . Hence, tensile stress which is equal to the tension per unit area is equal to $\frac{\mathrm{F}}{\mathrm{A}}$.

Q57. Solution

Correct Answer: (B)

According to Boyle's law, pressure and volume are inversely proportional to each other i.e. $\mathrm{p} \propto \frac{1}{\mathrm{v}}$



$\Rightarrow \mathrm{P_1V_1} = \mathrm{P_2V_2}$

$\Rightarrow (\mathrm{P_0} + \mathrm{h\rho_w g})\mathrm{V_1} = \mathrm{P_0V_2}$

$\Rightarrow \mathrm{V_2} = \left(1 + \frac{\mathrm{h\rho_w g}}{\mathrm{P_0}}\right)\mathrm{V_1}$

$V_2 = (1 + \frac{47.6*1*1000*10}{70*10^{-2}*13.6*1000*10})$

$[As\ P_2 = P_0 = 70\ cm\ of\ Hg = 70*10^{-2}*13.6*1000*10]$ $\Rightarrow \mathrm{V_2} = (1+5)50\mathrm{cm}^3 = 300\mathrm{cm}^3$

Q58. Solution

Correct Answer: (A)

Key Idea According to Faraday's second law of electromagnetic induction the induced emf is given by rate of change of magnetic flux linked with the circuit. Here, $B = 0.04\ \mathrm{T}$ and $\frac{-\mathrm{dr}}{\mathrm{dt}} = 2\mathrm{mms}^{-1}$ Induced emf, $\mathrm{e} = \frac{-\mathrm{d}\phi}{\mathrm{dt}} = \frac{-\mathrm{BdA}}{\mathrm{dt}} = -\mathrm{B}\frac{\mathrm{d}(\pi \mathrm{r}^2)}{\mathrm{dt}} = -\mathrm{B}\pi 2\mathrm{r}\frac{\mathrm{dr}}{\mathrm{dt}}$ Now, if $\mathrm{r} = 2\ \mathrm{cm}$ $\mathrm{e} = -0.04 \times \pi \times 2 \times 2 \times 10^{-2} \times 2 \times 10^{-3}$ $= 3.2\pi\mu\mathrm{V}$

Q59. Solution

Correct Answer: (B)

The length of the antenna should be $\frac{\lambda}{4}$

Given, $\upsilon = 20\ MH_z$

$\lambda = \frac{c}{\upsilon} = \frac{3\times10^8}{20\times10^6} = \frac{3}{2} \times 10 = 15m$

So, $\frac{\lambda}{4} = \frac{15}{4} = 3.75m$

$\lambda = \frac{c}{\upsilon}$

Q60. Solution

Correct Answer: (C)

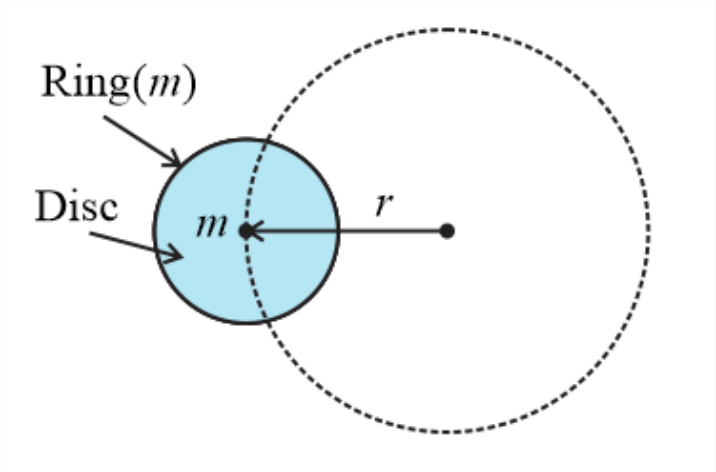
From the above circuit of the gate, which is the combination of NOT gate is which is used as invert the result, two OR gate, and one final OR gate,

A	B	E
0	0	0
0	1	1
1	0	0
1	1	1

Q61. Solution

Correct Answer: (C)

As given in the question, a ring of mass m is clamped on the periphery of a light circular disc and a small particle having equal mass is clamped at the centre of the disc and centre of the system is rotating in a circle of radius r with uniform speed v.



The centre of mass of the ring coincides with the centre of disc, therefore, the total mass of system rotating in the circle is $2m$.

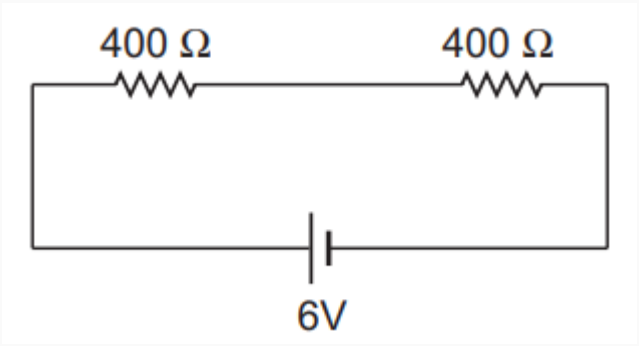
The external force must be acting on the system to provide the centripetal force required for rotation.

$F_{\text{ext}} = F_{\text{c}}$

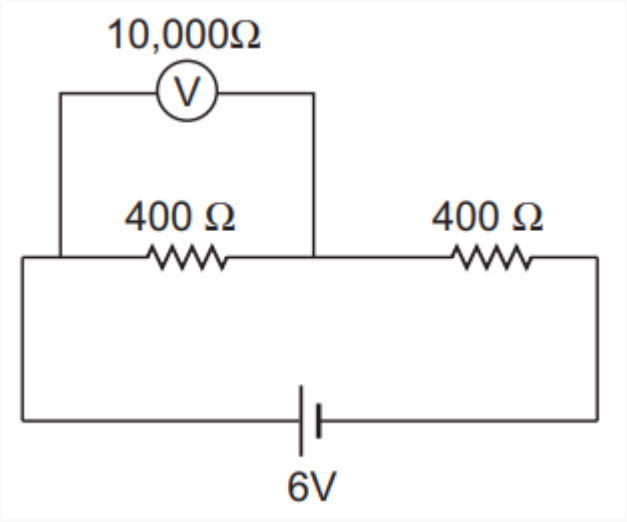
$\therefore\ F_{\text{ext}} = \frac{(2m)v^2}{r}$

Q62. Solution

Correct Answer: (D)



$R_1 = 400\Omega, R_2 = 800\Omega$



PD across 400Ω resistance (when voltmeter is not connected) $V_1 = \frac{6}{(400+800)} \times 400 = \frac{6\times400}{1200} = 2$ V when voltmeter is connected Total resistance of the circuit, $R = \left(\frac{10000\times400}{10000+400}\right) + 800 = \frac{10000\times400}{10400} + 800$ $= \frac{40000}{104} + 800 = \frac{40000+83200}{104} = \frac{123200}{104} = \frac{30800}{26} = \frac{15400}{13}$ New PD across 400Ω resistance, $V_2 = 6 - 800\left(\frac{6}{15400/13}\right) = 6 - \frac{800\times13\times6}{15400} = 6 - 4.052 = 1.95$ V $\therefore$ Error $= V_1 - V_2 = 2 - 1.95 = 0.05$

Q63. Solution

Correct Answer: (C)

$V = 100$ volt Given, $\lambda_0 =$ de-Broglie wavelength of proton $\therefore \quad \lambda_0 = \frac{h}{\sqrt{2m_pq_pV}}$ de-Broglie wavelength of α-particle $\lambda = \frac{h}{\sqrt{2m_\alpha q_\alpha V}}$ (Mass of α-particle is four times of proton) $q_\alpha = 2q_p$ (Charge of α-particle is twice of proton) $m_\alpha = 4m_p$

$$\therefore \quad \lambda = \frac{h}{\sqrt{2\,(4m_p)\,(2q_p)V}}$$

$$= \frac{1}{\sqrt{8}}\frac{h}{\sqrt{2m_pq_pV}} = \frac{\lambda_0}{\sqrt{8}} = \frac{\lambda_0}{2\sqrt{2}}$$

Q64. Solution

Correct Answer: (C)

Sensitivity of the galvanometer=θ/I where θ is deflection and I=current:
also sensitivity θ/I=NAB/k

where N=number of turns of the coil , A=area, B=magnetic field and k is torsional constant of its suspension

so from formula we can say Current sensitivity of the galvanometer can be increased by increasing the magnetic field.

placing a suitable magnetic material as a core inside the coil increases magnetic field

but reason is false as soft magnet can be easily magnetized or demagnetized

Q65. Solution

Correct Answer: (D)

The displacement of particle, executing SHM $y = 5 \sin\left(4t + \frac{\pi}{3}\right) \quad \ldots(\text{i})$

$$\left(\frac{dy}{dt}\right) = \frac{5d}{dt}\sin\left(4t + \frac{\pi}{3}\right)$$

Velocity of particle $= 5\cos\left(4t + \frac{\pi}{3}\right) \cdot 4$ Velocity at $t = \left(\frac{T}{4}\right)$ $\left(\frac{dy}{dt}\right)_{t=\frac{T}{4}} = 20\cos\left(4 \times \frac{T}{4} + \frac{\pi}{3}\right)$

$= 20\cos\left(4t + \frac{\pi}{3}\right)$

or $u = 20\cos\left(T + \frac{\pi}{3}\right) \quad \ldots(\text{ii})$

Comparing the given equation with standard equation of SHM, given by We get $y = a\sin(\omega t + \phi)$ $\omega = 4$ As $\omega = \frac{2\pi}{T}$

$\Rightarrow \quad T = \frac{2\pi}{\omega}$

or $T = \frac{2\pi}{4}$ Now, putting value of T in Eq. (ii), we get

or $T = \left(\frac{\pi}{2}\right)$

$$u = 20\cos\left(\frac{\pi}{2} + \frac{\pi}{3}\right)$$
$$= -20\sin\frac{\pi}{3}$$
$$= -20 \times \frac{\sqrt{3}}{2}$$
$$= -10 \times \sqrt{3}$$

The kinetic energy of particle,

$$\text{KE} = \frac{1}{2}mu^2$$
$$\because \quad m = 2\text{ g} = 2 \times 10^{-3}\text{ kg}$$
$$= \frac{1}{2} \times 2 \times 10^{-3} \times (-10\sqrt{3})^2$$
$$= 10^{-3} \times 100 \times 3$$
$$= 3 \times 10^{-1}$$
$$\text{KE} = 0.3\text{ J}$$

Q66. Solution

Correct Answer: (A)

According to work energy theorem,

$$W = \Delta \mathrm{K \cdot E.} \quad \Rightarrow W = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

$$\Rightarrow F \cdot dx = \mathrm{K \cdot E \cdot} f - \frac{1}{2} \times 10 \times 100$$

$$\Rightarrow F \cdot dx = \mathrm{K \cdot E \cdot} f - 500$$

$$\Rightarrow \int_{20}^{30} -0.1x dx = \mathrm{K \cdot E \cdot} f - 500$$

$$\Rightarrow -0.1\left[\frac{x^2}{2}\right]_{20}^{30} = \mathrm{K \cdot E \cdot} f - 500$$

$$\Rightarrow -0.1\left[\frac{900 - 400}{2}\right] = \mathrm{K \cdot E \cdot} f - 500$$

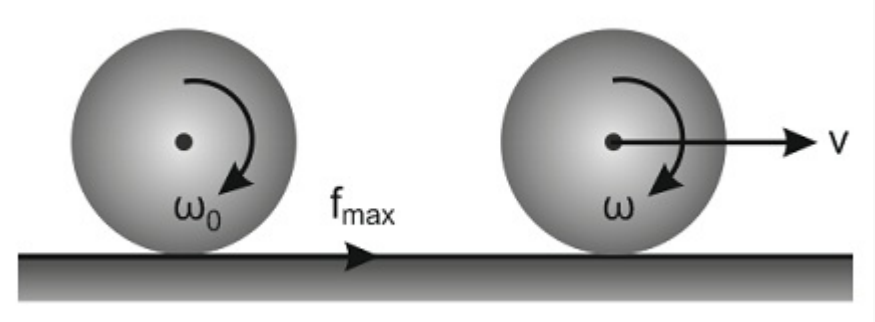
$\Rightarrow \mathrm{K.E.}_f = 500 - 25 = 475 \text{ J}$

Q67. Solution

Correct Answer: (A)

Let m be the mass of the sphere.

Since, it is a case of backward slipping, force of friction is in forward direction. Limiting friction will act in this case.



Linear acceleration $a = \frac{f}{m} = \frac{\mu \mathrm{mg}}{m} = \mu g$

Angular retardation $\alpha = \frac{\tau}{I} = \frac{f \cdot r}{\frac{2}{5}mr^2} = \frac{5}{2}\frac{\mu g}{r}$

Slipping will be stopped when $v = r\omega$

$at = r(\omega_0 - \alpha t)$

$\mu g t = r\left(\omega_0 - \frac{5}{2}\frac{\mu g t}{r}\right)$

$\frac{7}{2}\mu g t = r\omega_0$

$t = \frac{2}{7}\frac{r\omega_0}{\mu g}$

Q68. Solution

Correct Answer: (A)

It is clear that B and C are repelling each other, so they must have same type of charges which can only be positive as it is given that at least two charges must be positively charged. A and B are attracting each other. As B is positively charged, so A can be negatively charged or neutral.

Q69. Solution

Correct Answer: (C)

X-rays: Frequency range is 10^{16} to 10^{21} Hz. Microwaves: Frequency range is 10^{9} to 10^{11} Hz. Radiowaves: Frequency range is 5×10^{5} to 10^{9} Hz. Gamma rays (γ-rays): Frequency range is 10^{18} to 10^{22} Hz.

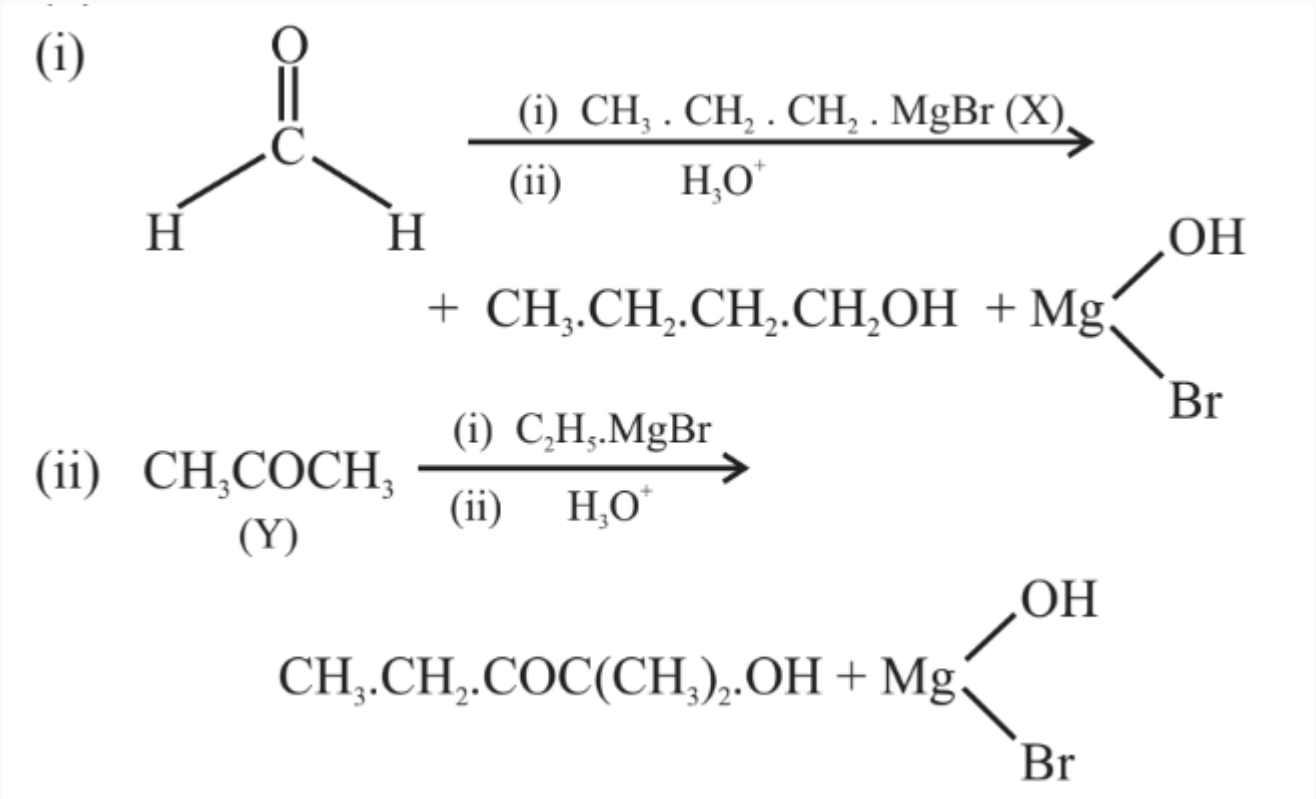
Q70. Solution

Correct Answer: (B)

Gravitational force is a conservative force, hence work done in a complete cycle will be zero due to zero displacement. Again, since, work done, $W = \mathbf{F} \cdot d\mathbf{r} = m\mathbf{a} \cdot d\mathbf{r}$ If $\mathbf{a} \perp d\mathbf{r}$, then $W = 0$ Clearly, the moments when displacement vector makes 90° angle with acceleration, work done will be zero.

Q71. Solution

Correct Answer: (B)



Q72. Solution

Correct Answer: (B)

Fluorine, being most electronegative element, always show the oxidation state of -1. Other halogens can show higher positive oxidation state in addition to negative oxidation of -1. Therefore, option (2) is the correct answer.

Q73. Solution

Correct Answer: (C)

$$\begin{array}{lcccc} & CH_3NH_2 & + HCl & \rightarrow & CH_3\overset{\oplus}{N}H_3\overset{\ominus}{Cl} \\ \text{at } t=0 & 0.12 & 0.08 & & - \\ \text{at } t=t & 0.04 & - & & 0.08 \end{array}$$

$$pOH = pK_b + \log\frac{[CH_3NH_3^+]}{[(CH_3NH_2)]}$$
$$= 3.3 + \log\frac{0.08}{0.04} = 3.6$$
$$\therefore pH = 10.4$$

Q74. Solution

Correct Answer: (D)

The correct choice is (4).

The reactions(i), (ii) and (iii) gives benzaldehyde as product but choice (iv) does not give benzaldehye as product as it gives acetophenone.

(i) Toluene undergoes oxidation reaction with acetic anhydride in the presence of chromium trioxide forms compound benzylidene diacetate which on hydrolysis with dilute hydrochloric acid gives benzaldehyde.

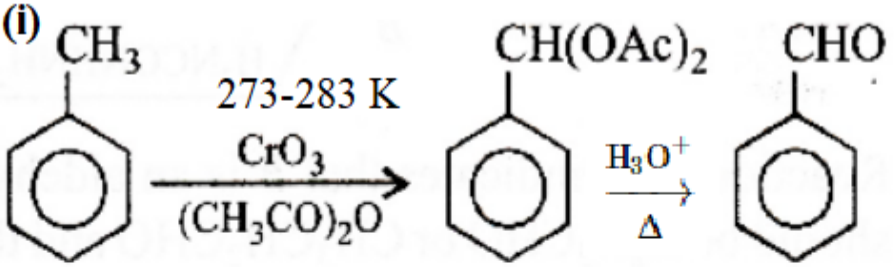
(ii) Toluene reacts with chlorine in the presence of light forms benzylidene chloride which on heating gives benzaldehyde.

(iii) This is Gattermann-Koch reaction, where benzene reacts with $\mathrm{CO} + \mathrm{HCl}$ in the presence of aluminium chloride gives benzaldehyde.

(iv) But this reaction benzoyl chloride reacts with dimethyl cadmium in the presence of ether gives acetophenone, and not benzaldehyde.

The reactions for the above reactions are:

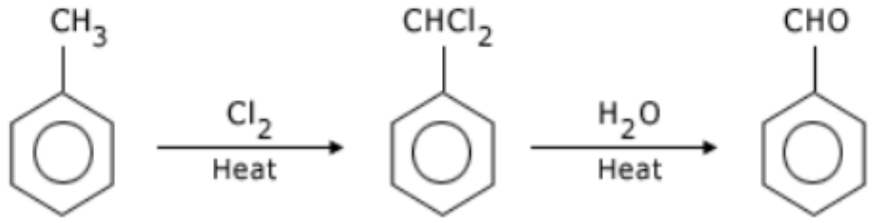
(i)



Toluene

Benzaldehyde

(ii)

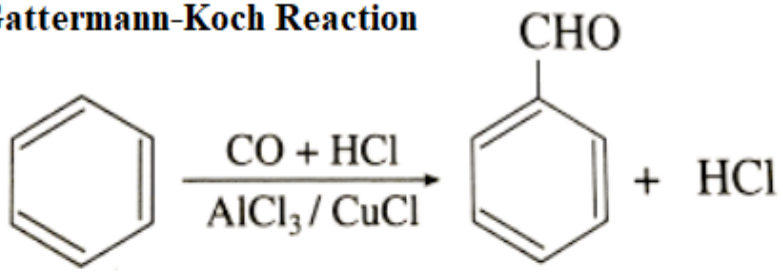


Toluene

Benzylidene Chloride

Benzaldehyde

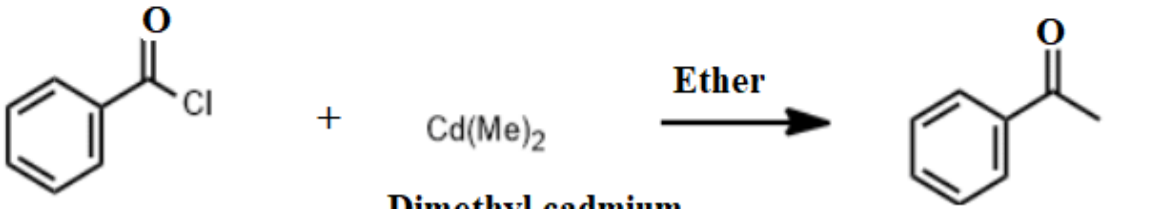
(iii) Gattermann-Koch Reaction



Benzene

Benzaldehyde

(iv)



Benzoyl chloride

Dimethyl cadmium

Acetophenone

Q75. Solution

Correct Answer: (B)

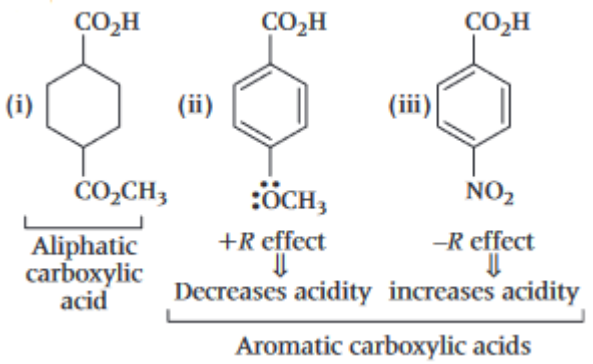
The rusting of iron involves oxidation of iron.

Higher the oxidation potential, higher the tendency to get oxidised. The oxidation potential of $\mathrm{Fe} \quad \mathrm{Fe}^{2+}$ and $\mathrm{Zn} \quad \mathrm{Zn}^{2+}$ are $0.44\ \mathrm{V}$ and $0.76\ \mathrm{V}$ respectively.

Thus, the oxidation potential of Zn is higher than Fe. That's why Zn will get oxidised and Fe will remain protected.

Q76. Solution

Correct Answer: (A)



Aromatic carboxylic acids are stronger to aliphatic carboxylic acids. Acidic strength order: (iii) $>$ (ii) $>$ (i) [Option-(a)] * If (i) is 4-ethylbenzoic acid, answer will be option-(c), but it is not given in (i).

Q77. Solution

Correct Answer: (B)

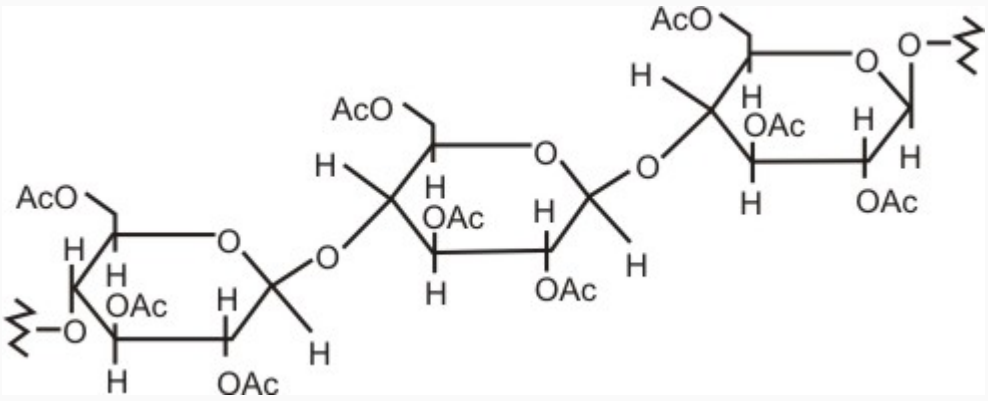
The higher the charge on the metal ion, smaller is the ionic size and more is the complex forming ability. Thus, the degree of complex formation decreases in the order

$M^{4+} > MO_2^{2+} > M^{3+} > MO_2^{+}$

The higher tendency of complex formation of MO_2^{2+} as compared to M^{3+} is due to high concentration of charge on metal atom M.

Q78. Solution

Correct Answer: (A)



Cellulose is a poly saccharide. In this process, firstly cellulose is swelled with acetic acid and then in the second step it is acetylated with acetic anhydride in the presence of sulphuric acid as catalysts.

Q79. Solution

Correct Answer: (A)

Let the apparent molecular weight $= m_0$

Osmotic pressure $\pi = \frac{n}{V}RT = \frac{w}{m_0} \times \frac{1}{V} \times RT$

Or $0.3092 \times 10^5 = \frac{3 \times 10^{-3}}{m_0} \times \frac{1}{10^{-3}} \times 8.314 \times 298$

Observed molecular weight, $m_0 = 240.4 \times 10^{-3}$ kg

Normal molecular weight$= 252.61 \times 10^{-3}$ Kg

Since, $\frac{\text{Number of particles after dissociation}}{\text{Number of particles before dissociation}} = \frac{\text{Normal molecular weight}}{\text{Observed molecular weight}}$

$$\underset{1-\alpha}{Hg(CN)_2} \rightleftharpoons \underset{\alpha}{Hg^{2+}} + \underset{2\alpha}{2CN^-}$$

Number of particles after dissociation

$= (1 - \alpha) + \alpha + 2\alpha = 1 + 2\alpha$

i.e., $\frac{1+2\alpha}{1} = \frac{252.61 \times 10^{-3}}{240.2 \times 10^{-3}}$

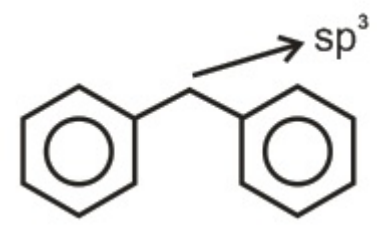
$\alpha = 0.02457$ or 2.4567%

Q80. Solution

Correct Answer: (C)

Coplanar = carbon should have sp^2 hybridised. That means if anyone of the atom is non-planar sp^3 hybridized.

So in below structure we can see one non-planar carbon and therefore below structure is non-planar.



Q81. Solution

Correct Answer: (A)

As a medication calcium gluconate is used by injection into a vein to treat low blood calcium, high blood potassium, and magnesium toxicity.

For calcium phosphate the absorption is not easy. Its overdose symptoms may include nausea, vomiting, decreased appetite, constipation, confusion, delirium, stupor, and coma.

Q82. Solution

Correct Answer: (A)

Those pollutants that cannot be converted into a simpler and harmless form by nature are known as non-biodegradable pollutants.

An example of a non-biodegradable pollutant is DDT.

Q83. Solution

Correct Answer: (B)

In a closed container at a constant temperature

$\mathrm{PV} = \mathrm{nRT}\ (\mathrm{V}\ \&\ \mathrm{T}\ \text{constant})$

Pressure $\mathrm{P} \propto \mathrm{n}$ (Number of moles)

The initial total pressure is $3\ \mathrm{atm}$ and the partial pressures of $\mathrm{NO_2}$ and $\mathrm{F_2}$ will be in $2:1$ ratio.

$$2\,\mathrm{NO_2(g)} \quad + \quad \mathrm{F_2(g)} \quad \rightarrow \quad 2\,\mathrm{NO_2\,F(g)} \quad \mathrm{t}=0 \quad 2\ \mathrm{atm} \qquad\qquad 1\ \mathrm{atm} \quad \mathrm{t}=\infty \quad - \qquad\qquad -$$

Since the reaction is completed, so the total pressure after completion is due to $\mathrm{NO_2\,F}$ only and it will be $2\ \mathrm{atm}$.

Q84. Solution

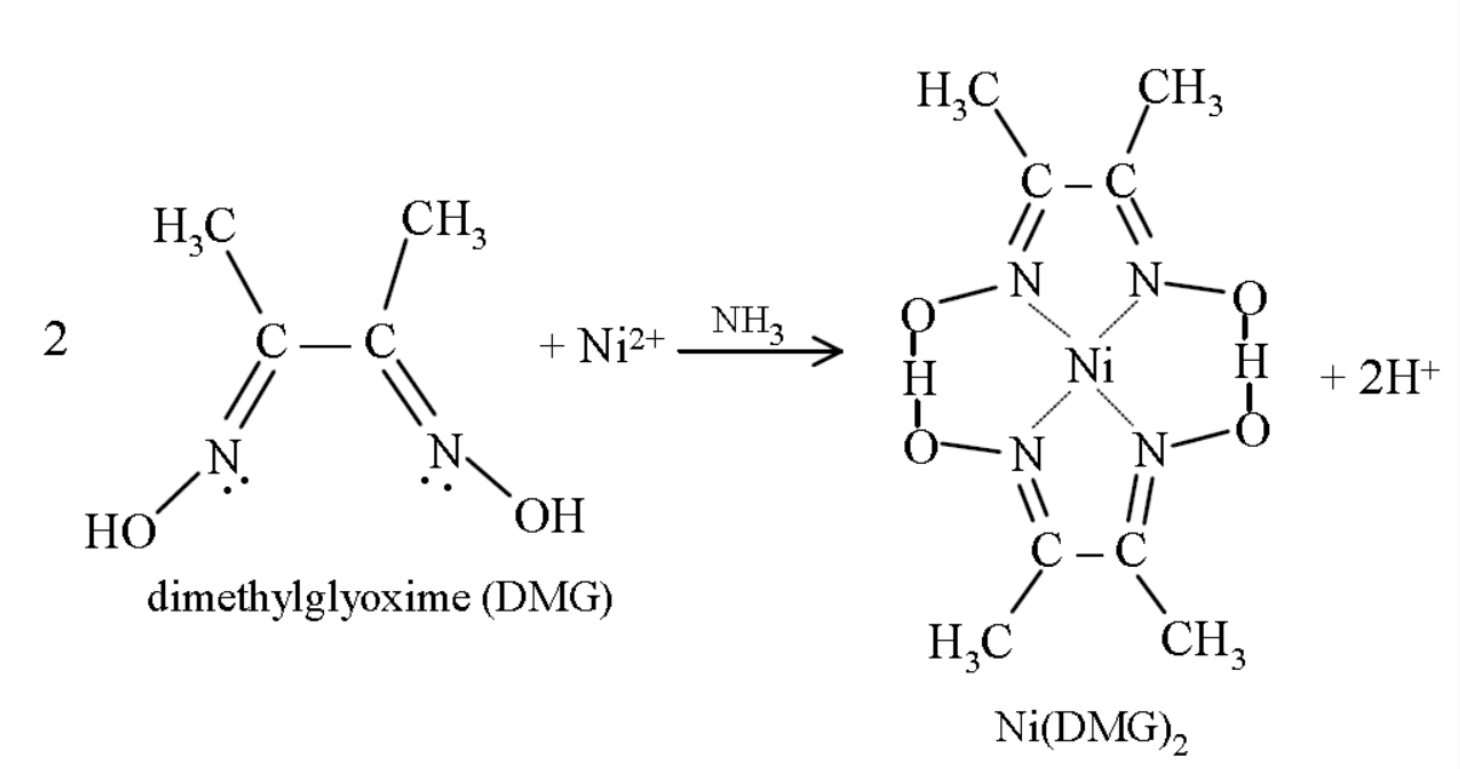
Correct Answer: (B)

$\mathrm{BF_3}$ forms complex halides of the type $\left[\mathrm{BF_4^-}\right]$ in which B atom has C.N. 4 , it cannot extend its C.N. beyond 4 due to the nonavailability of *d*-orbitals in its configuration. Hence, $\mathrm{BF_6^{3-}}$ ion $\left(sp^3d^2\right.$ hybridisation) is not formed. On the other hand, Al can extend its C.N. beyond 4 due to the availability of *d*-orbitals in its configuration.

Q85. Solution

Correct Answer: (D)

Nickel(II) forms a precipitate with the organic compound dimethylglyoxime, $C_4H_6(NOH)_2$. The formation of the red chelate occurs quantitatively in a solution in which the pH is buffered in the range of 5 to 9 . The chelation reaction that occurs is illustrated below.



The reaction is performed in a solution buffered by either an ammonia or citrate buffer to prevent the pH of the solution from falling below 5 . If the pH does become too low the equilibrium of the above reaction favors the formation of nickel(II) ion, causing the dissolution of $Ni(DMG)_2$ back into the mother liquor.

Q86. Solution

Correct Answer: (D)

$P = Ke^{-\Delta H/RT}$

$\ln P = \ln K - \frac{\Delta H}{RT}$

$\frac{d}{dT}\ln P = \frac{\Delta H_v}{RT^2}$

$\therefore \frac{d\ln P}{dT} = \frac{\Delta H_v}{RT^2}$

Q87. Solution

Correct Answer: (A)

Phenol is a white crystalline solid with the smell of a disinfectant. It is to be handled with great care because it can cause immediate white blistering on the skin.

Q88. Solution

Correct Answer: (D)

Two intermediate states imply three activated complexes corresponding to three peaks and two intermediates be at the valley of these in the form of two minima and $(\Delta G)_{Prod} - (\Delta G)_{Reac} = +ve(\Delta G_{reac})$. These conditions statisfied by.

Q89. Solution

Correct Answer: (C)

$A_{x-2}[B(C)_x]_2 \longrightarrow (x-2)A^{+2} + [B(C)_x]^{-(x-2)}$

$A_{x-2}\,[B(C)_x] \cdot A^{+2}$ and $[B(C)_2]^{-(x-2)}$

$i = 1 - \alpha + x\alpha - 2\alpha + 2\alpha$

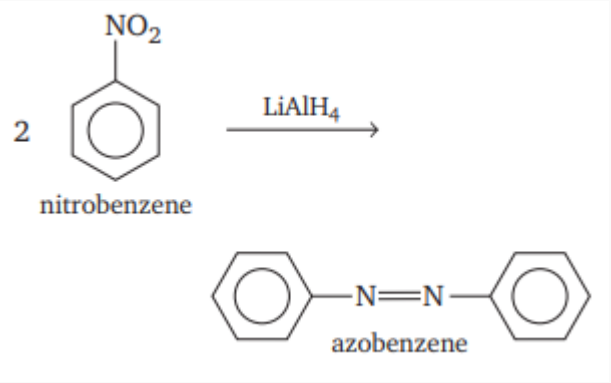
$(x-1)\alpha = 3$ or $x - 1 = \frac{3}{\alpha}$

$\alpha = 0.75, i = 4, x = 5$

Q90. Solution

Correct Answer: (C)

Nitrobenzene on reduction with lithium aluminium hydride $(LiAlH_4)$ gives azobenzene.



Q91. Solution

Correct Answer: (A)

The order of reduction potential or the tendency to gain electron is in the order $z > y > x$.

Since, $y + x^- \rightarrow x + y^-$, $E_{cell} = E_{y/y^-} - E_{x/x^-} = +ve$

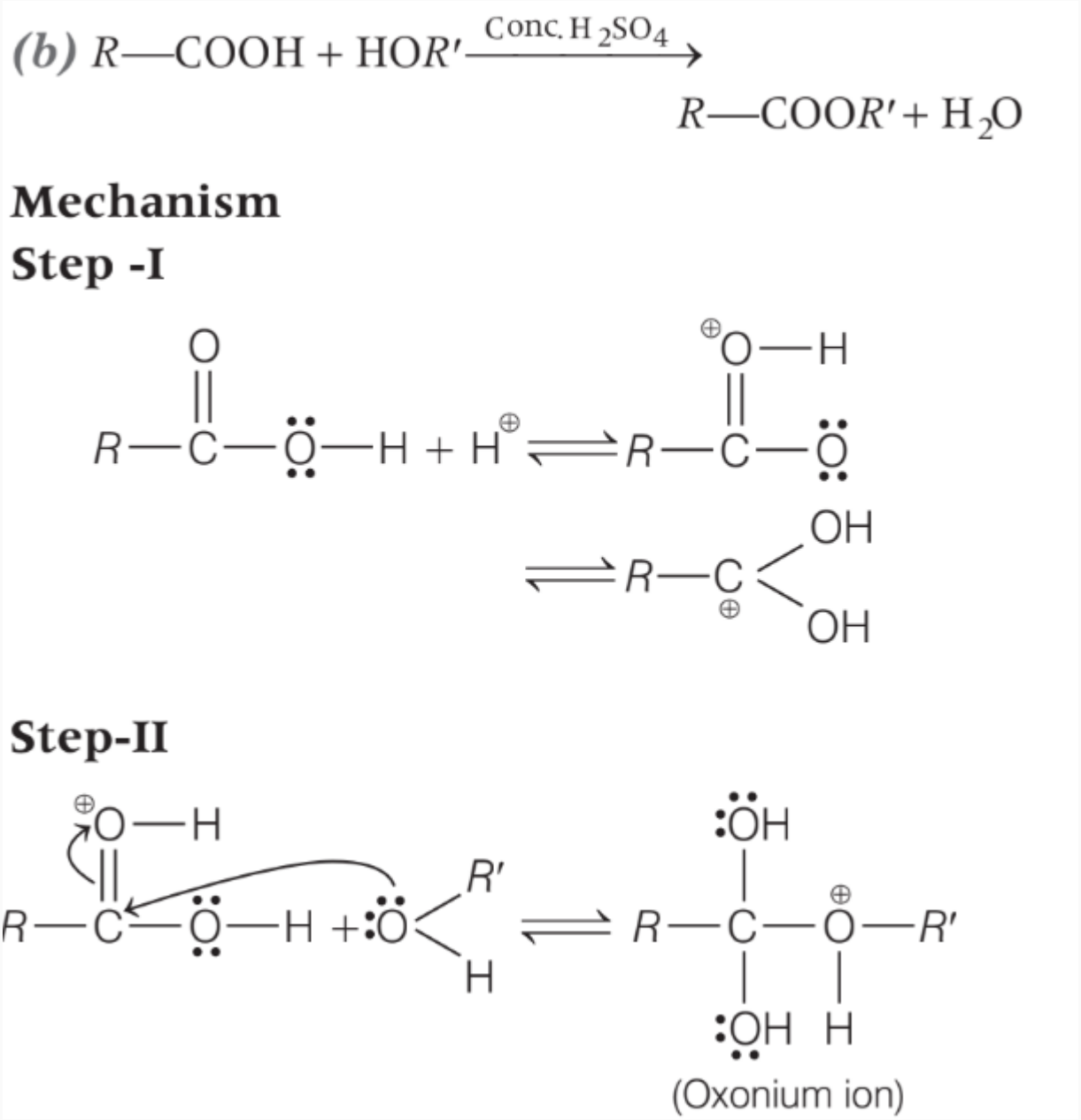
Thus, y can oxidize x.

Also, $y + z^- \rightarrow y^- + z$, $E_{cell} = E_{y/y^-} - E_{z/z^-} = -ve$

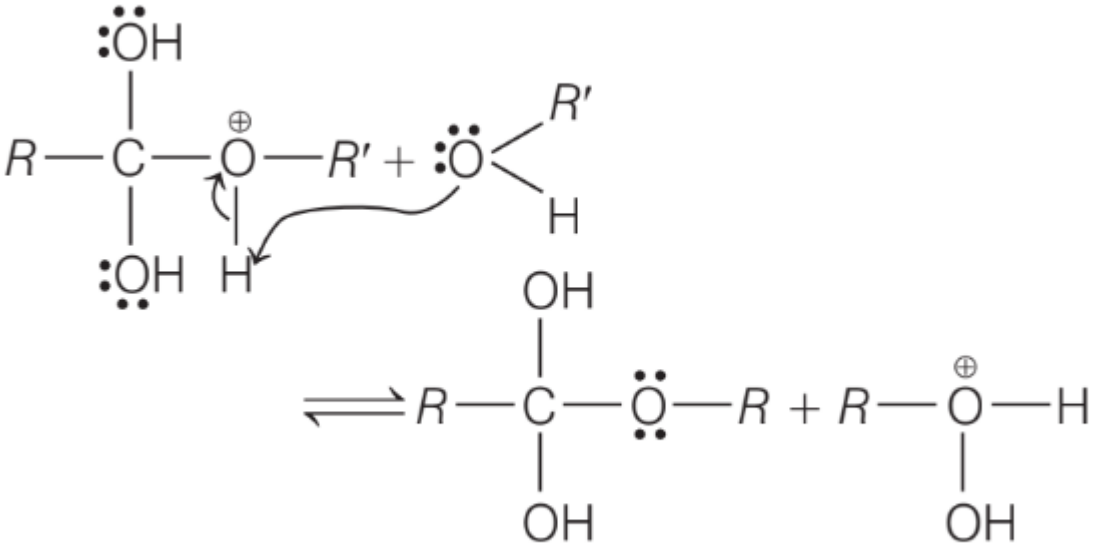
Thus, y cannot oxidize z.

Q92. Solution

Correct Answer: (B)

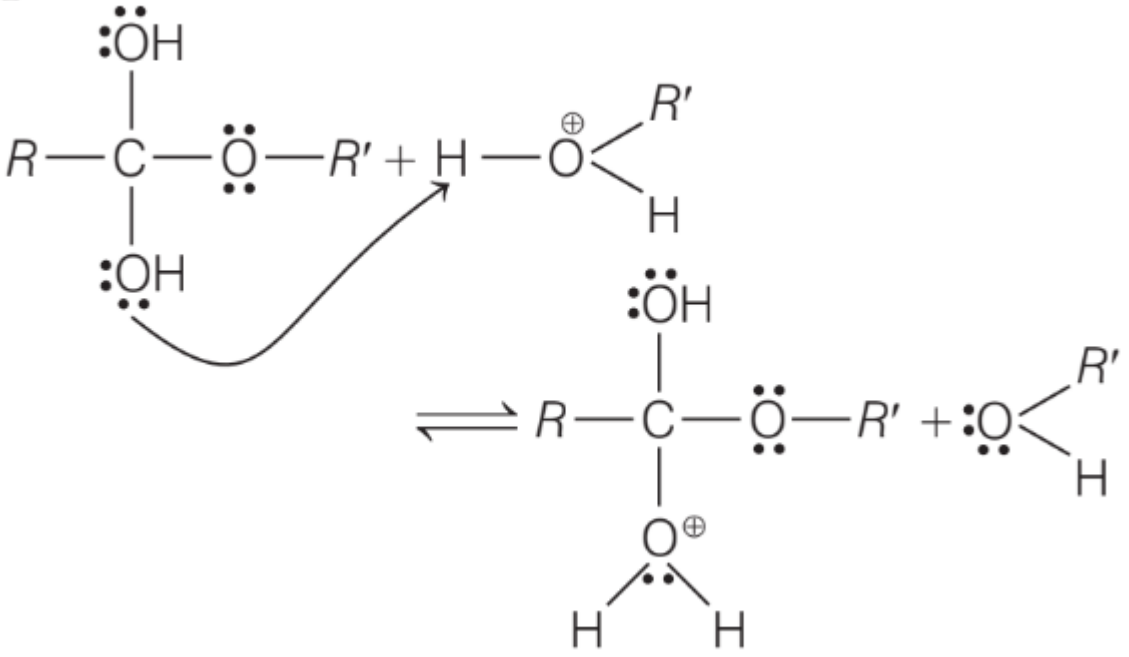


Step -III

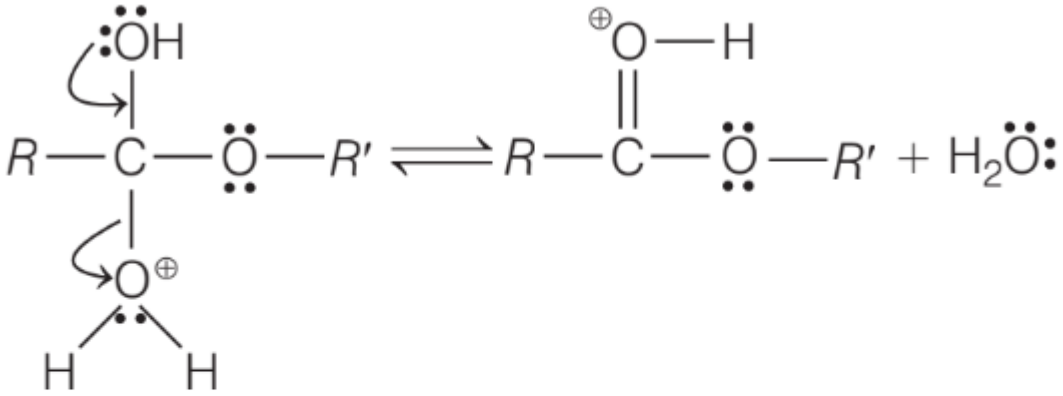


Tetrahedral intermediate

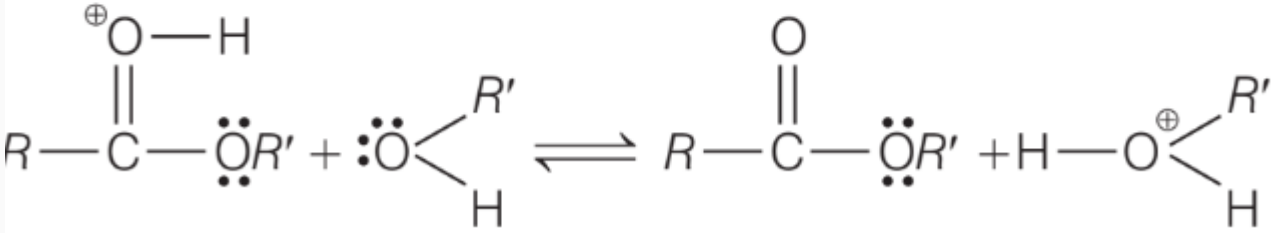
Step -IV



Step-V



Step-VI



Hence, option (b) is the correct answer.

Q93. Solution

Correct Answer: (C)

$\Delta G^{\circ}=\Delta H^{\circ}-T \Delta s^{\circ}$

$=\left(-1860 \times 10^{3}\right)-298(-550)$ Thus, the reaction is Spontaneous as ΔG° is negative. Now, Since the system

$=-1696.1 \mathrm{~kJMol}^{-1}$

loses the heat, the surrounding must gain it and therefore, $\Delta H^{\circ}{ }_{\text{Surrounding}}=+1860 \times 10^{3} \mathrm{~J} \mathrm{~mol}^{-1}$.

$\Rightarrow \Delta S^{\circ}_{\text{surrounding}}=\frac{\Delta H^{\circ}_{\text{surrounding}}}{T}$

$=\frac{+1860 \times 10^{3}}{298}$

$=6241.6 \mathrm{~J}$

$\Rightarrow \Delta S^{\circ}_{\text{total}}=\Delta S^{\circ}_{\text{system}}+\Delta S^{\circ}_{\text{surrounding}}$

$=(-550)+(6241.6)$

$=+5692 \mathrm{~J} \mathrm{~mol}^{-1} \mathrm{~K}^{-1}$.

Q94. Solution

Correct Answer: (A)

To solutions are isotonic, if their osmotic pressure are same. Here, $0.01\text{M}\,BaCl_2$ and $0.015\text{M}\,NaCl$ will have same value of osmotic pressure. We know, $\pi = CRT$ Here, R and T are constant and their value is same for both the solutions. $\pi = C_{\text{effective}}\,RT$ If $C_{\text{effective}}$ of two solutions are equal then their osmotic pressures will also be equal.

$\mathbf{BaCl_2}$ $\quad\quad$ $\mathbf{NaCl}$

(a) $C_{\text{effective}} = 0.01 \times 3 = 0.03$ and $0.015 \times 2 = 0.03$

$\mathbf{Al_2(SO_4)_3}$ $\quad\quad$ $\mathbf{BaCl_2}$

(b) $C_{\text{effective}} = 0.001 \times 5 = 0.005$ and $0.01 \times 3 = 0.03$

$\mathbf{CaCl_2}$ $\quad\quad$ $\mathbf{Al_2(SO_4)_3}$

(c) $C_{\text{effective}} = 0.001 \times 3 = 0.003$ and
$0.001 \times 5 = 0.005$

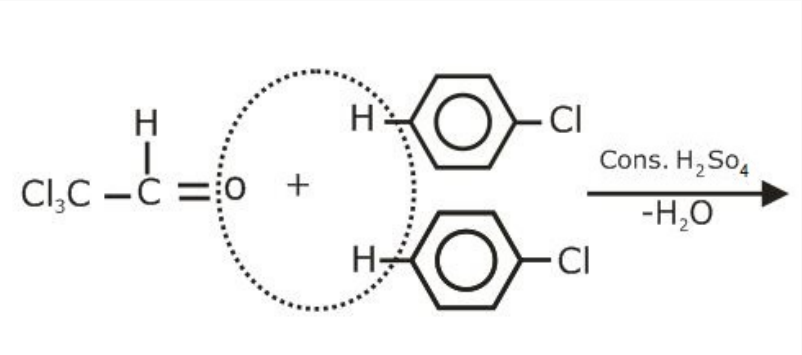
$\mathbf{BaCl_2}$ $\quad\quad$ $\mathbf{CaCl_2}$

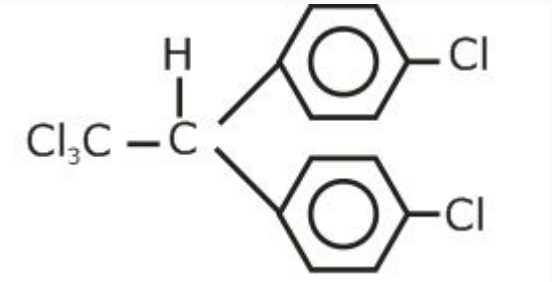
(d) $C_{\text{effective}} = 0.01 \times 3 = 0.03$ and $0.001 \times 3 = 0.003$

So, option (a) has equal value of $C_{\text{effective}}$ and hence, this pair will be isotonic.

Q95. Solution

Correct Answer: (D)





Q96. Solution

Correct Answer: (C)

$(c)\ N_2 \quad +3H_2 \quad \underset{1\ V}{\longrightarrow} NH_3$

$22.4\ L \quad 22.4 \times 3 \quad 2\ V$ According to Gay-Lussac's law, 3 volumes of H_2 will give 2 vol. of NH_3.

$= 224\ L \quad = 67.2\ L \quad = 44.8\ L$

$\therefore 67.2\ L of H_2$ will give $= \frac{2 \times 67.2}{3} = 44.8\ L of NH_3$ At the same time, 3 vol. of H_2 will react $= 1$ vol. of N_2.

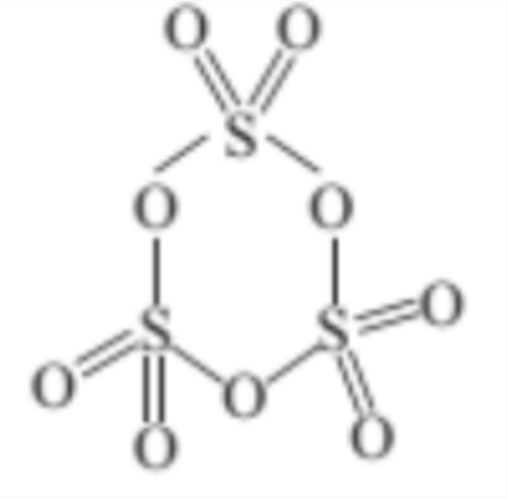
$\therefore 67.2\ L of H_2$ will react $= \frac{1}{3} \times 67.2\ L of N_2$ 67.2 L of H_2 and 22.4 L of N_2 are required to form 34 g of NH_3

$= 224\ L$ of N_2

. So, for 3.4 g of NH_3 6.72 L and 2.24 L of H_2 and N_2 gas are required respectively.

Q97. Solution

Correct Answer: (A)



$(SO_3)_3 \rightarrow$ Trimer form of sulphur trioxide.

Each sulphur atom is bonded with four oxygen atoms. Therefore, option (1) is the correct answer.

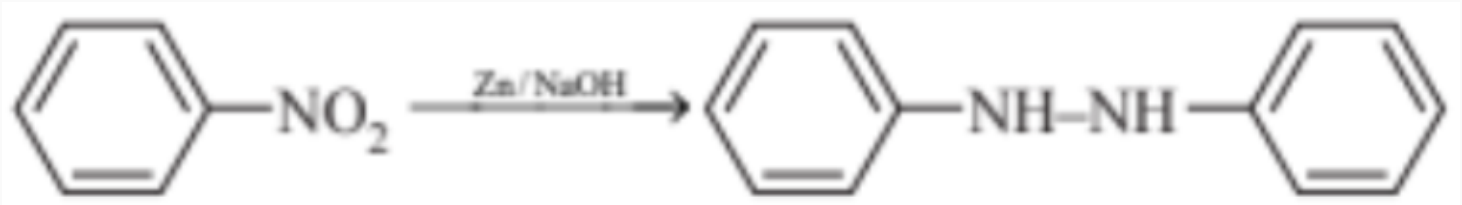
Q98. Solution

Correct Answer: (B)

A carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol. This process is known as keto-enol tautomerism.

Q99. Solution

Correct Answer: (D)



Therefore, option (4) is the correct answer.

Q100. Solution
Correct Answer: (B)

$XeF_4 + O_2\ F_2 \rightarrow XeF_6 + O_2$ (x) $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$ (1 mole) (y) $XeF_6 =$ distorted octahedral shape. $XeOF_4 =$ Square pyramidal shape.

Q101. Solution
Correct Answer: (A)

The author in the passage discusses meritocracy from all the above perspectives except choice 1. Choice 1 speaks of what an ideal team comprises of, but the idea of ?ideal team? has not even come in the passage. To critique something means to evaluate that thing. The author evaluates meritocracy from different perspectives. Choice 2 can be seen in the first para of the passage where the author says: The multidimensional or layered character of complex problems also undermines the principle of meritocracy. Choice 3 is substantiated from the sentences that come in the second para where the author says: Even with a knowledge domain, no test or criteria applied to individuals will produce the best team. In other words, there cannot be a test to assess merit in any field of knowledge. Choice 4 can be found in the first sentence of the second paragraph: Believers in a meritocracy might grant that teams ought to be diverse but then argue that meritocratic principles should apply within each category. Thus we see that meritocracy has been discussed from all of the above perspectives except 1. The composition of an ideal team has not been discussed anywhere in the passage.

Q102. Solution
Correct Answer: (D)

The last sentence of the second last para says: Programmers also boost the forest ?cognitively? by training trees on the hardest cases ? those that the current forest gets wrong. This ensures even more diversity and accurate forests. Thus, if we want to weaken the efficacy of a random decision forest, we should train a large number of decision trees on data derived from easy cases. Thus option 1 directly weakens the argument. There is no need to test the other choices.

Q103. Solution
Correct Answer: (A)

Turncoat is the most appropriate answer to the given sentence.

Turncoat means a person who deserts one party or cause in order to join an opposing one. Arrogant means having or revealing an exaggerated sense of one's own importance or abilities. Confederate means a group joined by an agreement or treaty. Firm means having a solid, almost unyielding surface or structure.The only word that means opposite to Confidant is Turncoat.

Hence, turncoat is the right answer.

Q104. Solution
Correct Answer: (B)

In 19th-century boxing, a challenger signalled readiness to fight by literally tossing his hat into the prize ring; today the phrase means volunteering / declaring oneself a contender for any competition or position.

Q105. Solution
Correct Answer: (C)

The correct part is: ... saying that he has an urgent business...
The actual sentence started with the past tense. But the second part talks about the present event that is to be held this evening. So, the fact about the present event will always be in present tense. And, as 'he' is a third person, singular noun, the verb will also be singular, 'has'.

Q106. Solution
Correct Answer: (A)

Why? With adverbs such as "Hardly," "Scarcely," or "No sooner," the standard inversion pattern is Hardly/ Scarcely/No sooner + had + subject + past participle + when/than ... Hence, "Hardly had the professor begun the lecture when ..." is the only option that follows the required inverted word order and tense.

Q107. Solution
Correct Answer: (B)

- The original sentence is in the passive voice. - To change it to active voice, we need to identify the subject (the one performing the action) and make it the doer of the action. - In this case, "Many things" is the subject in the passive sentence. - When we convert it to active voice, it becomes "They." - Now, we need to add a suitable verb. The original verb is "may be accomplished," and we can change it to "may accomplish" to maintain the meaning. - Additionally, we need to rearrange the sentence for proper word order. Therefore, the correct answer is "option 2".

Q108. Solution
Correct Answer: (B)

After months of drought, the long-awaited monsoon rains fell in torrents across the valley, drenching parched fields and cheering anxious farmers.

Q109. Solution
Correct Answer: (B)

According to the question, the word cynosure it is a noun and it means to be a centre of attraction. When someone is very beautiful or any of her/his feature is very attractive then this word can be used.

Q110. Solution

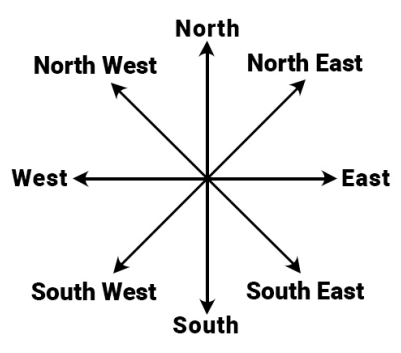
Correct Answer: (D)

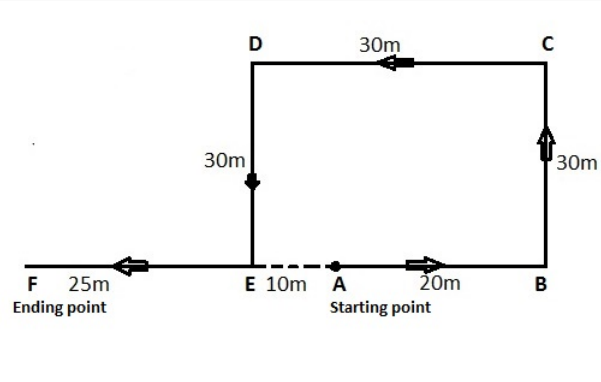
According to the given sentence, the word 'outskirts' is correct. The outskirts of a city (here 'Hyderabad') or town are the part that is farthest away from its centre.

Q111. Solution

Correct Answer: (C)

Direction diagram,





Here, we have to find the direction and distance of woman now with reference to her starting position.

By observing the above diagram, it is clear that the woman is in the west direction with reference to her starting position.

Now,

Distance between the woman now with reference to her starting position.

Starting point is A and the final point is F.

$AF = FB - AB$

$FB = FE + EB \quad (EB = CD = 30\ m)$

$FB = (25 + 30)\ m = 55\ m$

Therefore,

$AF = (55 - 20)\ m$

$= \ 35\ m$

Hence, now the woman is $35\ m$ West with reference to her starting point.

Q112. Solution

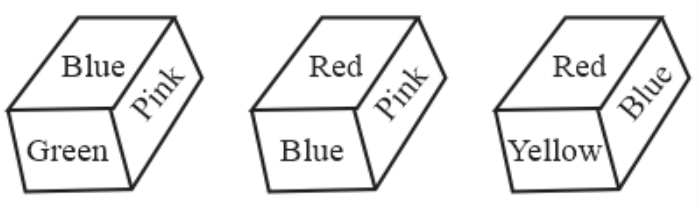
Correct Answer: (C)

Se the general pattern is $n^2\times$ (even number sequence starting from 0 or 2, where the multiplier is $2(n-1)$). Term n : $n^2 \times (2(n-1))$ - Term 1: $1^2 \times (2(1-1)) = 1 \times 0 = 0$ - Term 2: $2^2 \times (2(2-1)) = 4 \times 2 = 8$ - Term 3: $3^2 \times (2(3-1)) = 9 \times 4 = 36$ - Term 4 (missing): $4^2 \times (2(4-1)) = 16 \times 6 = 96$ - Term 5: $5^2 \times (2(5-1)) = 25 \times 8 = 200$ - Term 6: $6^2 \times (2(6-1)) = 36 \times 10 = 360$ - Term 7: $7^2 \times (2(7-1)) = 49 \times 12 = 588$ The missing term is 96.

Q113. Solution

Correct Answer: (A)

Given figure:



From the given figures, it can be observed that Blue is adjacent to Red, Green, Pink, and Yellow.

And we know that adjacent faces cannot be opposite in a dice.

So, all these faces will not be opposite to the Blue face.

Now, if we consider the first and the third figure. Both of them have a common face i.e blue, and we know that if there is only one common face in two positions of dice, then the face opposite to the common face will be that which is not given in the figure.

So, the color opposite to Blue is Black.

Hence, this is the correct answer.

Q114. Solution

Correct Answer: (B)

Add 27 in digits of odd number place and subtract 7 from even number place.

Q115. Solution

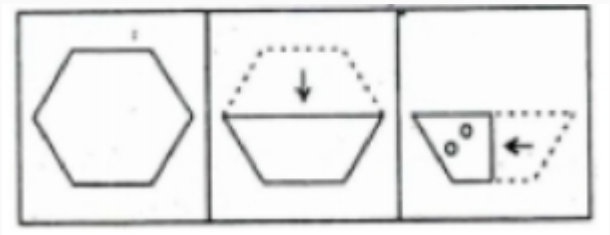
Correct Answer: (A)

Known words from the codes: - this $\rightarrow$ ar - is $\rightarrow$ st - and $\rightarrow$ yu - how $\rightarrow$ unknown (new word) So the code should include ar, st, yu + one new code.

Q116. Solution

Correct Answer: (D)

As given in this series:



As we can observe that the last part of the given figure having a small two circles.
In option A, there are more than two circles which can not make the perfect design.
In option B, there are two circles but the direction of two circles not perfect to complete this figure.
In option C, there are two circles but the direction of the two circles not perfect to complete this figure.
Hence, option D is the correct answer.

Q117. Solution

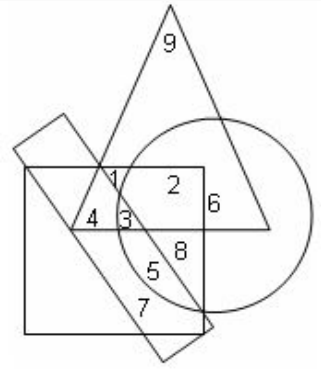
Correct Answer: (D)

Anti-clockwise rotation along the two adjacent sides and diagonal containing square and = sign.

Q118. Solution

Correct Answer: (D)

In the diagram,



I) The triangle represents children.

II) The circle represents the rural population.

III) The rectangle represents school-going population.

IV) The square represents boys.

To find rural children who are not school going;

Consider triangle, circle but not rectangle;

Those numbers which are coming under circle and triangle, and outside the rectangle.

Here only numbers $2, 6$ are following this concept.

Hence, this is correct.

Q119. Solution

Correct Answer: (D)

Kavya's birthday is on Tuesday 4th July. On the day of the week will be Anika's birthday in the same year, if Anika was born of 15th August?

4th July is Tuesday (Kavya's birthday)

Now, after every 7 days, Tuesday is on 11 July, 18 July, 25 July, 1 August, 8 August, and 15 August.

Therefore, Anika's birthday is on Tuesday 15 August.

So, the required day is Tuesday.

Hence, this is the correct answer.

Q120. Solution

Correct Answer: (B)

In the given question, we have to match the figure matrix I with figure matrix II. The corresponding letters A and G follows the pattern has to be followed with the word letters 'BEE'. The given figure matrix for the word letters 'BEE' is shown below:

Option	B	E	E
(1)	12	15	31
(2)	12	21	15
(3)	12	15	33
(4)	21	12	22

Option	B	E	E
(1)	12	15	31
(2)	12	21	15
(3)	12	15	33
(4)	21	12	22

B = 12

E =21,15

Hence, the correct answer is option (b).

Q121. Solution

Correct Answer: (D)

1. First Differences: $12, 15, 16, 29, 40, 71, 100, ?$ 2. Second Differences: (Alternating sub-sequences) - Sequence 1: $3 \rightarrow 13 \rightarrow 31 \rightarrow 57$ (adds 10, then adds 18, then adds 26 (i.e., $18 + 8$)) - Sequence 2: $1 \rightarrow 11 \rightarrow 29 \rightarrow$ next in sequence 1 (adds 10, then adds 18) The next second difference (which follows 29) is 57. 3. Next First Difference: $100 + 57 = 157$ 4. Next Term: $286 + 157 = 443$ The next term is 443.

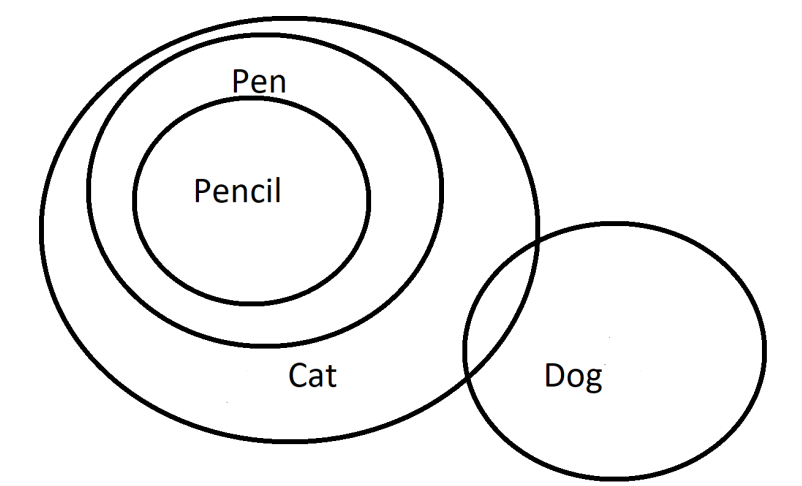
Q122. Solution

Correct Answer: (A)

All pencils and pen are cat.

Some cats are dogs.

From the above statements we can make a diagram as follows:



I. Some cats are dog.

From the above diagram it is clear that some portion of cat is inside dog. Therefore, some cats are dog is correct.

Hence, conclusion I, follows.

II. All cats are pencil.

From the above diagram it is clear that all cats are pencil is a possibility.

Therefore, all cats are pencil is not correct.

Hence, conclusion II, does not follow.

Thus, only conclusion I, follow.

Q123. Solution
Correct Answer: (D)

Savings

$= 26000 \text{ of } 22\%$

$=₹ \left(\frac{26000 \times 22}{100}\right) =₹ 5720$

Amount spend on purchasing gold:

$₹ \left(\frac{5720 \times 65}{100}\right)$

$=₹ 3718$

So, Mahesh spends ₹ 3718 on purchasing gold.

Hence, the correct answer is ₹ 3718.

Q124. Solution
Correct Answer: (B)

$\begin{matrix} \bullet & \bullet & \bullet & \bullet & \bullet \\ E & B & A & C & D \end{matrix}$ Therefore, A is sitting in between B and C.

Q125. Solution
Correct Answer: (C)

Observe the pattern of 'A', 'B' and 'N'

Q126. Solution
Correct Answer: (D)

Small cubes with exactly two painted faces sit on the edges, excluding the eight corners. - 6 little cubes per edge - 4 of them (6-2 corners) have two colours - 12 edges $\times 4 = 48$ Answer = D (If the big cube were only $3 \times 3 \times 3$ you'd get 12. Always link "216" $\rightarrow 6^3$ in your head.)

Q127. Solution
Correct Answer: (B)

A mirror image is a reflected duplication of an object that appears almost identical but is reversed in the direction perpendicular to the mirror surface. The Mirror image of the given figure is,

.

Hence,'b' is the correct answer.

Q128. Solution
Correct Answer: (D)

According to the question, Ameya's rank in a class of 35 children is sixth from the top and Annie is seven ranks below Ameya.

So, Annie's rank from the top $= 6 + 7 = 13^{th}$

Annie's rank from the bottom $= 35 - 13 + 1 = 23^{rd}$

Hence, correct option is 23.

Q129. Solution
Correct Answer: (B)

- $A \Delta B \rightarrow A$ is the son of B - B£C $\rightarrow$ B is the mother of C - C $ D $\rightarrow$ C is the father of D So, A is the son of B, who is the mother of $C \rightarrow A$ is the grandson of C C is the father of D $\rightarrow$ A is the uncle of D

Q130. Solution
Correct Answer: (A)

The odd word is 5467 because there is a difference of 1 between the first and second digits, and 1 between the second and third digits, and 1 between the third and fourth digits in options B, C, and D. However, option A has a difference of 1 between the first and second digits, 2 between the second and third digits, and 1 between the third and fourth digits.