# Solutions All India Test Series

# Test-3

| PHYSICS | | CHEMISTRY | | MATHEMATICS | |
|---|---|---|---|---|---|
| 1. | (1) | 31. | (4) | 61. | (4) |
| 2. | (4) | 32. | (3) | 62. | (2) |
| 3. | (2) | 33. | (3) | 63. | (3) |
| 4. | (1) | 34. | (4) | 64. | (2) |
| 5. | (1) | 35. | (2) | 65. | (2) |
| 6. | (1) | 36. | (4) | 66. | (3) |
| 7. | (4) | 37. | (3) | 67. | (4) |
| 8. | (1) | 38. | (3) | 68. | (4) |
| 9. | (3) | 39. | (3) | 69. | (2) |
| 10. | (4) | 40. | (2) | 70. | (4) |
| 11. | (4) | 41. | (3) | 71. | (4) |
| 12. | (1) | 42. | (2) | 72. | (3) |
| 13. | (3) | 43. | (1) | 73. | (4) |
| 14. | (3) | 44. | (2) | 74. | (2) |
| 15. | (2) | 45. | (4) | 75. | (1) |
| 16. | (4) | 46. | (2) | 76. | (4) |
| 17. | (1) | 47. | (4) | 77. | (3) |
| 18. | (2) | 48. | (1) | 78. | (1) |
| 19. | (4) | 49. | (1) | 79. | (1) |
| 20. | (4) | 50. | (3) | 80. | (2) |
| 21. | (4) | 51. | (1) | 81. | (1) |
| 22. | (2) | 52. | (1) | 82. | (4) |
| 23. | (4) | 53. | (3) | 83. | (2) |
| 24. | (1) | 54. | (1) | 84. | (2) |
| 25. | (3) | 55. | (1) | 85. | (3) |
| 26. | (2) | 56. | (2) | 86. | (1) |
| 27. | (2) | 57. | (3) | 87. | (2) |
| 28. | (3) | 58. | (2) | 88. | (2) |
| 29. | (1) | 59. | (2) | 89. | (3) |
| 30. | (4) | 60. | (3) | 90. | (2) |



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# PHYSICS

1. Answer (1)

Velocity leads the displacement by phase $\frac{\pi}{2}$.

Phase of velocity = $100\pi t + \frac{\pi}{4} + \frac{\pi}{2}$

$= 100\pi t + \frac{3}{4}\pi$

2. Answer (4)

$$T = 2\pi\sqrt{\frac{l}{g}} \qquad \ldots(i)$$

$$T' = 2\pi\sqrt{\frac{l}{g - \frac{g}{4}}} = 2\pi\sqrt{\frac{4l}{3g}} = \frac{2}{\sqrt{3}}T$$

3. Answer (2)

4. Answer (1)

$$\frac{I_{max}}{I_{min}} = \left(\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}}\right)^2 = 9 : 1$$

5. Answer (1)

6. Answer (1)

$$y = 0.2\sin\left(\frac{\pi}{9}x\right)\cos(20\pi t)$$

$$K = \frac{\pi}{9} \Rightarrow \frac{2\pi}{\lambda} = \frac{\pi}{9} \Rightarrow \lambda = 18 \text{ cm}$$

$\therefore$ Distance between two consecutive nodes = $\frac{\pi}{2}$

= 9 cm.

7. Answer (4)

$W_{ab} = -P_0V_0$ $\quad W_{de} = 0$

$W_{bc} = 0$ $\quad W_{ef} = 3P_0V_0$

$W_{cd} = 4P_0V_0$

$\therefore$ $W_{abcdef} = 6P_0V_0$

8. Answer (1)

$\Delta Q = \Delta u + \Delta W$

$\Delta u = \Delta Q - \Delta W$

$\Rightarrow$ $\Delta u = 500000 - 10^5 \times 2$

$\Rightarrow$ $\Delta u = 3 \times 10^5$ J

9. Answer (3)

10. Answer (4)

Efficiency of engine = $\eta = 1 - \frac{T_2}{T_1} = 1 - \frac{300}{900} = \frac{2}{3}$

$\therefore$ Useful work done is $W = \eta \times 1500$

$= \frac{2}{3} \times 1500 = 1000$ J

11. Answer (4)

$$V = \sqrt{\frac{\gamma P}{\rho}} \text{ and } V_{rms} = \sqrt{\frac{3P}{\rho}}$$

$$\Rightarrow V = \sqrt{\frac{\gamma}{3}}\, V_{rms}$$

$$\Rightarrow V = \sqrt{\frac{5}{9}}\, V_{rms}$$

$$\Rightarrow 3V = \sqrt{5}\, V_{rms}$$

12. Answer (1)

$$\frac{1}{2}K_1x_1^2 = \frac{1}{2}K_2x_2^2$$

$$\frac{x_1}{x_2} = \sqrt{\frac{K_2}{K_1}}$$

13. Answer (3)

Velocity of wave is = $\frac{20}{5}$ = 4 m/s along positive $x$-axis

$\therefore$ Distance travelled by wave in positive $x$ direction, in 5 seconds is = 4 × 5 = 20 m

14. Answer (3)

$P = P_1 + P_2 = 3 \times 10^5 + 2.5 \times 10^5$

$= 5.5 \times 10^5$ Pa = 5.5 atm

15. Answer (2)

$$P = \frac{1}{2}\frac{mn}{V}C^2$$

$$P' = \frac{1}{2}\frac{(3m)n}{V}\left(\frac{C}{2}\right)^2$$

$$P' = \frac{3}{4}\left(\frac{1}{2}\frac{mn}{V}C^2\right) = \frac{3}{4}P$$

16. Answer (4)

$$F_{min} = \frac{n_1F_1 + n_2F_2}{n_1 + n_2} = \frac{3+5}{2} = 4$$

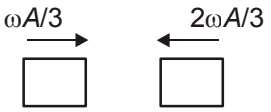
$\gamma$ $= 1 + \frac{2}{F} = 1.5$

17. Answer (1)
18. Answer (2)
19. Answer (4)
20. Answer (4)
21. Answer (4)
22. Answer (2)

After collision combined mass is $2m$, and $k_{ef} = 2k$

Therefore, time period remains unchanged.

23. Answer (4)




From conservation of linear momentum

$$\frac{m\omega A}{3} - \frac{2m\omega A}{3} = (2m)V$$

$$V = \frac{\omega A}{6}$$

$$\frac{\omega A}{6} = \omega' A'$$

$$A' = \frac{A}{6}$$

24. Answer (1)

$$E = \frac{1}{2}(2m)\frac{\omega^2 A^2}{36} = \frac{m\omega^2 A^2}{36}$$

or

$$E = \frac{1}{2}(2K)\frac{A^2}{36} = \frac{m\omega^2 A^2}{36}$$

25. Answer (3)

Time period is $\frac{2L}{v} = \frac{2\pi\sqrt{\frac{m}{K}}}{2}$

26. Answer (2)
27. Answer (2)
28. Answer (3)

From superposition principle

$$y = a\sin\omega t + a\sin(\omega t + 45°) + a\sin(\omega t + 90°)$$

$$a\left[\sin\omega t + \sin(\omega t + 90°)\right] + a\sin(\omega t + 45°)$$

$$2a\sin(\omega t + 45°)\cos 45° + a\sin(\omega t + 45°)$$

$$= \left(\sqrt{2} + 1\right)a\sin(\omega t + 45°)$$

$$E = \frac{1}{2}m\omega^2 A^2$$

$$\frac{E_{resultant}}{E_{single}} = \left(\frac{A}{a}\right)^2 = \left(\sqrt{2} + 1\right)^2 = 3 + 2\sqrt{2}$$

29. Answer (1)

$B\cos 2\omega t + B\sin(2\omega t)$

$$\Rightarrow \quad \sqrt{2}B\sin(2\omega t + 45°)$$

30. Answer (4)

$$m(L + S\Delta\theta_1) = 100S(\Delta\theta_2)$$

$$\Delta\theta_2 = 90 - 24 = 66\,°C$$

$$\Delta\theta_1 = 100 - 90 = 10\,°C$$

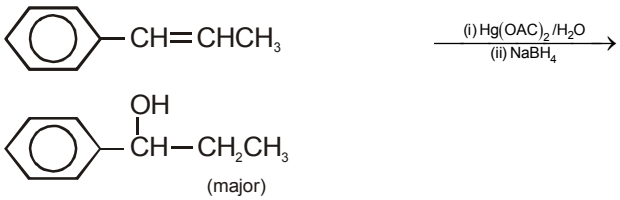
$$m = \frac{(100)(1)(66)}{540 + 1\times 10} = 12\text{ g}$$

# CHEMISTRY

31. Answer (4)


has a plane of symmetry.

32. Answer (3)




33. Answer (3)

"$-CH_3$" group is electron donating group

34. Answer (4)

$$(\underset{3.23}{\text{Org compd}}) \xrightarrow{\text{Duma's}} N_2(g)$$

$$^{n}N_2 = \frac{\frac{720}{760}\times 0.3}{0.0821\times 300}$$

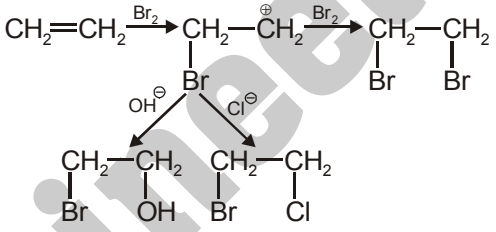
$$\therefore \text{ mass} = \frac{72\times 0.3\times 28}{76\times 0.0821\times 300}$$

$$\%N_2 = \frac{72\times 0.3\times 28\times 100}{76\times 0.0821\times 300\times 3.23} = 10$$

35. Answer (3)

1° Ally is also stable than 2° alkyl carbocation

36. Answer (4)




37. Answer (3)

38. Answer (3)

39. Answer (3)

40. Answer (2)

Molar mass of acid $= n\left(\frac{w\times 108}{x} - 107\right)$

$$= 2\left(\frac{0.76\times 108}{0.463} - 107\right)$$

$= 140.5 \text{ g mol}^{-1}$

41. Answer (3)

42. Answer (2)

$\because$ The given compound does not have a symmetric structure. Hence meso isomer is zero.

43. Answer (1)

Due to +R effect.

44. Answer (2)

It is because of electron withdrawing effect 
group attached to ring 1.

45. Answer (4)

–I effect increases reactivity towards $E_2$.

46. Answer (2)

47. Answer (4)

These compounds shows only optical isomerism. So, the statement-1 is false.

48. Answer (1)

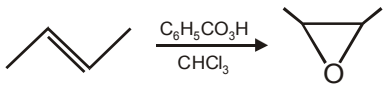
49. Answer (1)

50. Answer (3)

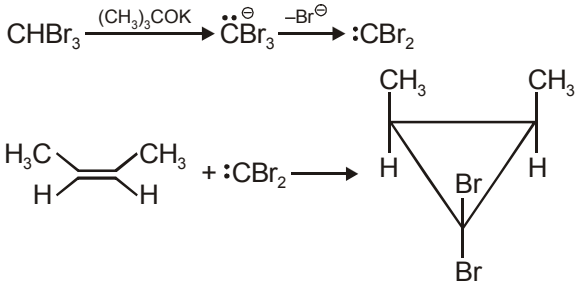
Two oximes are formed due to geometrical isomerism arised in product.

51. Answer (1)

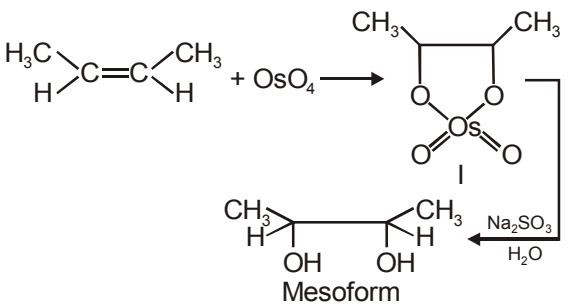
52. Answer (1)




53. Answer (3)




54. Answer (1)




55. Answer (1)

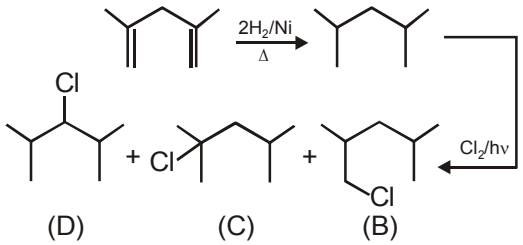
$$\text{Concentration (C)} = \frac{(0.2 \times 150)}{1000}$$

$$= 0.03 \text{ g/ml}$$

$$[\alpha]_D^+ = \frac{\alpha}{l \times c} = \frac{0.2}{2 \times 0.03}$$

$$= 3.33^\circ$$

56. Answer (2)



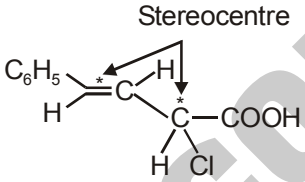

57. Answer (3)

58. Answer (2)

Blood red colour given by those compound which have C, N and S atom.

59. Answer (2)

60. Answer (3)




## MATHEMATICS

61. Answer (4)

Applying A.M.-G.M. inequality,

$$\frac{\sqrt{x^2+x+1}+\dfrac{\sec^2\alpha}{\sqrt{x^2+x+1}}}{2} \geq \left(\sqrt{x^2+x+1}\cdot\frac{\sec^2\alpha}{\sqrt{x^2+x+1}}\right)^{\frac{1}{2}}$$

$$\sqrt{x^2+x+1}+\frac{\sec^2\alpha}{\sqrt{x^2+x+1}} \geq -2\sec\alpha$$

as $\alpha \in \left(\frac{\pi}{2}, \pi\right)$

62. Answer (2)

63. Answer (3)

Required area

$$= \frac{1}{2}\begin{vmatrix}\alpha & \beta\gamma & 1\\ \beta & \gamma\alpha & 1\\ \gamma & \alpha\beta & 1\end{vmatrix} = \frac{1}{2}\begin{vmatrix}\alpha-\beta & \gamma(\beta-\alpha) & 0\\ \beta-\gamma & \alpha(\gamma-\beta) & 0\\ \gamma & \alpha\beta & 1\end{vmatrix}$$

$$= \frac{1}{2}\left|(\alpha-\beta)(\beta-\gamma)(\gamma-\alpha)\right|$$

64. Answer (2)

Equation of tangent to circle is

$$y = m(x-2) \pm \sqrt{1+m^2} \quad \text{...(i)}$$

(i) passes through (4, 0)

$$0 = 2m \pm \sqrt{1+m^2}$$

$$4m^2 = 1 + m^2$$

$$m^2 = \frac{1}{3}$$

$$m = \pm\frac{1}{\sqrt{3}}$$

65. Answer (2)

$$a_1 + a_2 + \ldots\ldots + a_{45} = \frac{45 \times 2 \times 45}{2}$$

$$= 2025$$

66. Answer (3)

67. Answer (4)

$P(x_1, y_1)$, $Q(x_2, y_2)$

Let $x_1$, $x_2$ be roots of

$x^2 + 2a_1x - a_2^2 = 0$

$\therefore x_1 + x_2 = -2a_1$, $x_1x_2 = -a_2^2$

and $y_1$, $y_2$ be roots of

$x^2 + 2a_3x - a_4^2 = 0$

$y_1 + y_2 = -2a_3$, $y_1y_2 = -a_4^2$

Now $PQ = \sqrt{(x_1-x_2)^2 + (y_1-y_2)^2}$

$$= 2\sqrt{a_1^2 + b_1^2 + c_1^2 + d_1^2}$$

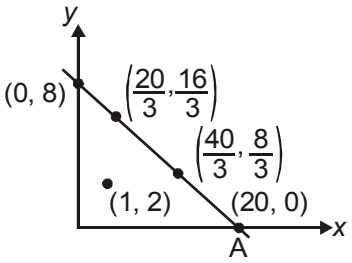
68. Answer (4)

$$\frac{1}{2}\left(1+1+\frac{3}{4}+\frac{4}{8}+....\right)$$

$$= \frac{1}{2}\left(\frac{1}{1-\frac{1}{2}}+\frac{1\cdot\frac{1}{2}}{\left(1-\frac{1}{2}\right)^2}\right)$$

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

69. Answer (2)




The equation of given line is

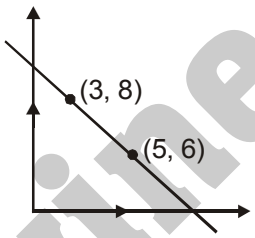
$$\frac{x}{20}+\frac{y}{8}=1$$

The equations of required lines are

$$y-2=\frac{2}{37}(x-1)$$

and $y-2=\frac{10}{17}(x-1)$

70. Answer (4)




$y - 6 = \tan150(x - 5) \Rightarrow y - 6 = -\frac{1}{\sqrt{3}}(x-5)$

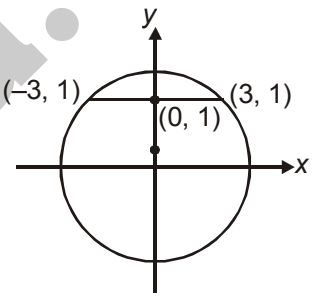
71. Answer (4)
72. Answer (3)
73. Answer (4)
74. Answer (2)
75. Answer (1)
76. Answer (4)
77. Answer (3)
78. Answer (1)
79. Answer (1)
80. Answer (2)
81. Answer (1)
82. Answer (4)
83. Answer (2)
84. Answer (2)

**Solution of Q. No. 82 to Q No. 84**

Possible vertices are

$\left(0,-\frac{1}{2}\right)$ and $\left(0,\frac{5}{2}\right)$

equations of required parabola are




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

and

$$x^2 = -6\left(y-\frac{5}{2}\right)$$

85. Answer (3)
86. Answer (1)
87. Answer (2)
88. Answer (2)
89. Answer (3)
90. Answer (2)