FIITJEE

ALL INDIA TEST SERIES

PART TEST – II

JEE (Main)-2025

TEST DATE: 01-12-2024

ANSWERS, HINTS & SOLUTIONS

Physics

PART – A

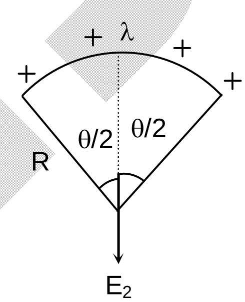
SECTION – A

1. B

Sol. Use principle of superposition,

$$E_2 = \left(\frac{2K\lambda}{R}\right)\sin\left(\frac{\theta}{2}\right)$$

$$= \frac{2K\lambda}{R} \times \frac{1}{2}\hat{i} = \frac{K\lambda}{R}\hat{i}$$



2. C

Sol. $dq = (2\pi x dx)\sigma$

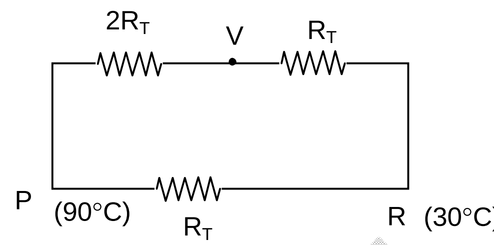
$$di = \frac{dq}{dt} = \frac{2\pi x\sigma dx \times \omega}{2\pi} = \omega\sigma x dx$$

$$dB = \frac{\mu_0}{4\pi} \times \frac{2(\omega\sigma\pi x^3 dx)}{(y^2 + x^2)^{3/2}}$$

$$B = \frac{\mu_0\sigma\omega}{2}\left(\frac{r^2 + 2y^2}{\sqrt{r^2 + y^2}} - 2y\right)$$

3. D

Sol. Equivalent circuit is



4. C

Sol. by solving

$$Q = KA\frac{dT}{dx} \Rightarrow \frac{Q}{A}\int_0^x dx = K_0\int_0^T (1+T)dT$$

$$\Rightarrow \frac{Q}{A}x = K_0\left(T + \frac{T^2}{2}\right)_0^T$$

By solving

$$\frac{Q}{A}x = K_0\left(T + \frac{T^2}{2}\right)$$

$$\text{So, } \frac{Q}{A}x_0 = K_0\left(300 + \frac{(300)^2}{2}\right)$$

So, at $x = 2x_0$ temperature $T \approx 425$ K

5. B

Sol. $P = VI$

6. B

Sol. Let x be the temperature of block. In steady state

$$\frac{x-10}{R} + \frac{x-5}{R} + \frac{x-3}{R} = 0 \Rightarrow x = 6°C$$

7. C

Sol. Now, $\frac{n_1(4)}{n_2(32)} = \frac{1}{4} \Rightarrow n_1 = 2n_2$

$$\text{Now, } C_v = \frac{n_1\left(\frac{3}{2}R\right) + n_2\left(\frac{5}{2}R\right)}{n_1 + n_2} = \frac{11}{6}R$$

$$C_P = C_V + R = \frac{17}{11}R$$

$$\therefore \gamma = \frac{C_P}{C_V} = \frac{17}{11} = 1 + \frac{6}{11}$$

8. D

Sol. $\frac{d\phi}{dt} = B\cdot\frac{\omega R^2}{2}$

Where, $\frac{\omega R^2}{2}$ is area swept in unit time perpendicular to the magnetic field.

9. D

Sol. The voltage across the resistor R is equal to the voltage across the coil

$U_R = U_L$

Voltage across the resistor

$U_R = I_R.R$

Voltage across the inductor coil:

$$U_L = L\frac{dI_L}{dt}$$

Current through a resistor

$$I_R = \frac{dq_R}{dt}$$

Then

$$\frac{dq_R}{dt}R = L\frac{dL_L}{dt} \leftrightarrow RdqR = LdI_L$$

According to Kirchhoff's second law

$$\varepsilon = I_{NCT} + I_R \cdot R$$

Then the current through the resistor at the moment of opening

$$I_R = \frac{\varepsilon - \frac{\varepsilon}{(2R)r}}{3r} = \frac{\varepsilon}{6r}$$

Then the current through the coil from Kirchhoff's first law:

$$I_L = I_{NCT} - I_R = \frac{\varepsilon}{2r} - \frac{\varepsilon}{6r} = \frac{\varepsilon}{3r}$$

We sum (integrate) (1)

$$R\int_0^{q_R} dq_R = L\int_0^{I_L} dIL \Rightarrow Rq_R = LI_L$$

Taking into account (2)

$$q_R = \frac{L}{R}\frac{\varepsilon}{3r} = \frac{\varepsilon L}{9r^2}$$

10. D

Sol. $i = \frac{2}{10}$

$$V_{BD} = 6\left(\frac{2}{10}\right) = \frac{12}{10} = 1.2\ V$$

11. C

Sol. $\frac{X}{R_0} = \frac{40}{60}$ $\Rightarrow$ **R′ = 6Ω**

and $6 = \frac{78R_1}{R_t + 78}$ $\Rightarrow$ **R_t= 6.5 Ω**

$$\alpha = \frac{R_t - R_0}{R_0 t} = 8.3 \times 10^{-4} K^{-1}$$

12. B

Sol. $R = 37 \times 10^2 \pm 5\%$

$= = (3700 \pm 185)\Omega$

13. D
Sol. Potential difference A and C = 4V

Current in above circuit = $\frac{6}{5+1} = 1\,A$

So, resistance of AD = 4Ω
Hence length = 80 cm

14. C

Sol. $V_C = \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{R} - \frac{q}{2R} + \frac{q}{3R}\right] = \frac{1}{4\pi\varepsilon_0}\left(\frac{5q}{6R}\right)$

15. C

Sol. $\frac{1}{R} = \frac{1}{20} + \frac{1}{20} + \frac{1}{30} + \frac{1}{30}$

16. A
Sol. $\vec{E}_q + \vec{E}_{8q} = \vec{0}$

$\Rightarrow \frac{Kqx}{(R^2+x^2)^{3/2}} = \frac{K(8q)x}{(16R^2+x^2)^{3/2}}$

$\Rightarrow$ **x = 2R**

$\therefore \frac{1}{2}mv^2 = -\frac{Kq\times q}{\sqrt{(R^2+x^2)}} + \frac{K(8q)\times q}{\sqrt{(16R^2+x^2)}}$

v = 20 m/s

17. A

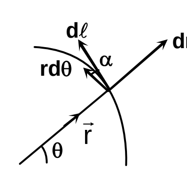
Sol. $E_x = \frac{3}{\sqrt{\pi\varepsilon_0}}$, $E_y = \frac{4}{\sqrt{\pi\varepsilon_0}}$

$\therefore E_{net} = \frac{5}{\sqrt{\pi\varepsilon_0}}$

$\therefore U = \frac{1}{2}\varepsilon_0 E^2\left(\frac{4}{3}\pi R^3\right) = 0.45\,J$

18. A

Sol. $dB = \frac{\mu_0}{4\pi}\frac{id\ell\sin(90^\circ+\alpha)}{r^2}$



$dB = \frac{\mu_0 i}{4\pi r^2}d\ell\cos\alpha$

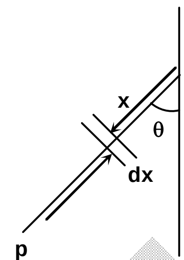
$dB = \frac{\mu_0 i}{4\pi r^2}rd\theta = \frac{\mu_0 id\theta}{4\pi r}$

$dB = \frac{\mu_0 id\theta}{4\pi\left(b+\frac{c}{\pi}\theta\right)}$

$\Rightarrow \int_0^B dB = \int_0^{\pi/2}\frac{\mu_0 I_0 d\theta}{4\pi\left(b+\frac{c}{\pi}\theta\right)} = \frac{\mu_0 I_0}{4c}\ell n\left(1+\frac{c}{2b}\right)$

19. C

Sol. $d\varepsilon = B\omega\sin^2\theta\int_0^{\ell} x dx$



$\varepsilon = \int d\varepsilon = (B\omega\sin^2\theta)\frac{l^2}{2}$

$= = 4\times1\times\frac{1}{2}\times\frac{1}{2} = 1$

20. A

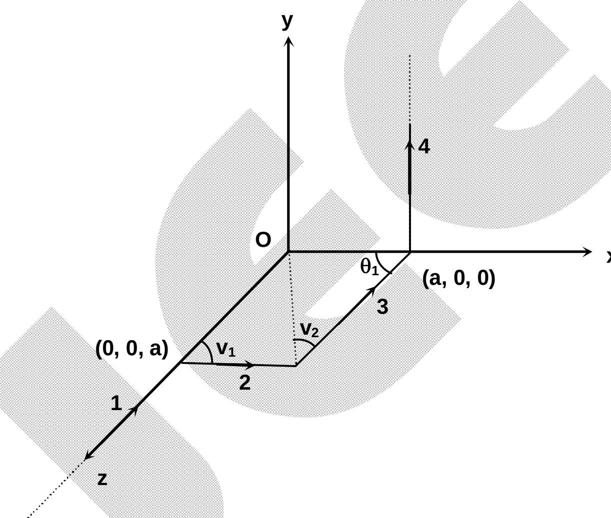
Sol. $\vec{B} = \vec{B}_1 + \vec{B}_2 + \vec{B}_3 + \vec{B}_4$

$\vec{B}_2 = \vec{B}_3 = \frac{\mu_0 i}{4\pi a}(\cos\theta_1 + \cos\theta_2)\hat{j}$

$\vec{B}_2 = \vec{B}_3 = \frac{\mu_0 i}{4\sqrt{2}\pi a}\hat{j}$

$\vec{B}_4 = \frac{\mu_0 i}{4\pi a}\hat{k}$

$\Rightarrow \vec{B} = \frac{\mu_0 i}{4\pi a}(\sqrt{2}\hat{j} + \hat{k})$



SECTION – B

21. 2

Sol. Let us consider a cube of double side length of same density. Also, $V \propto \frac{Q}{r}$ and V becomes 4 times on doubling the side length. Let the potential at center due to $\frac{1}{8}$ of this cube is V_1. This point lies at corner of each of eight cubes of original size.

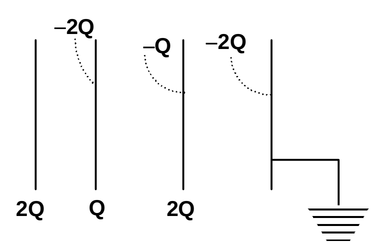
22. 8

Sol. Potential of plate 4 is zero

$\Rightarrow (V_3 - V_4) = V_3$

$(V_3 - V_4) = \left(\frac{2Q}{A\varepsilon_0}\right)2d = 4\left(\frac{Qd}{A\varepsilon_0}\right)$

$V_3 = 8$ volt



23. 4

Sol. $H = i^2Rt$

$200 = 2^2 \times R \times 1$

$\Rightarrow 200 = 4R$

$H_2 = 1^1 \times R \times 8 = 400$ Joule

24. 3

Sol. $B = \frac{\mu_0 J}{2} + \frac{\mu_0 J}{2} = \mu_0 J$

$U = \frac{B^2}{2\mu_0} \times 6L^3 = 3\mu_0 J^2 L^3$

25. 9

Sol. Hint: According to stefan's law, the power radiated by a black body at absolute temperature T is given by

$\theta = \sigma A T^4$ …(i)

According to wein's displacement law

$\lambda_m T = b \Rightarrow T = \frac{b}{\lambda_m}$

From (1) and (2)

$\theta = \sigma A \left(\frac{b}{\lambda_m}\right)^4 = \frac{\sigma A b^4}{\lambda_m^2}$

For a sphere of radius r, $A = 4\pi r^2$

Hence $\theta = \frac{\sigma b^4 4\pi r^2}{\lambda_m^2} = K\frac{r^2}{\lambda_m^2}$

Where $K = 4\pi\sigma b^4$ is a constant.

Hence $\theta_1 = K\frac{4_1^2}{\left(\lambda_m^2\right)_1}$

$\theta_2 = K\frac{r_2^2}{\left(\lambda_m^4\right)_2}$

$\frac{\theta_1}{\theta_2} = \left(\frac{r_1}{r_2}\right)^2 \cdot \left(\lambda_m^4\right)_2 = \left(\frac{3}{5}\right)^2 \times \left(\frac{500}{300}\right)^4 = \left(\lambda_m^4\right)_1 = \left(\frac{5}{3}\right)^2$

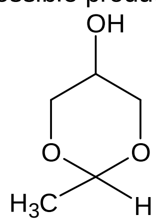
Chemistry

PART – B

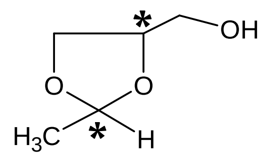
SECTION – A

26. B

Sol. Possible products



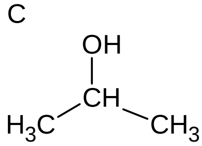
Plane of symmetry (Optically inactive)



Two chiral centres (4-isomers)

27. C

Sol.



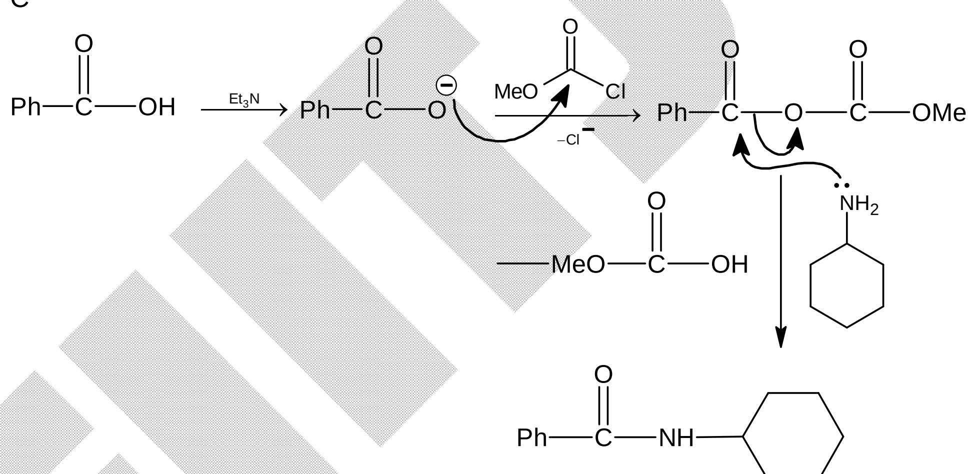
It gives yellow ppt. of CHI_3 with $I_2 + NaOH$.

Q

(2° alcohol)

28. C

Sol.



29. A

Sol. Factual

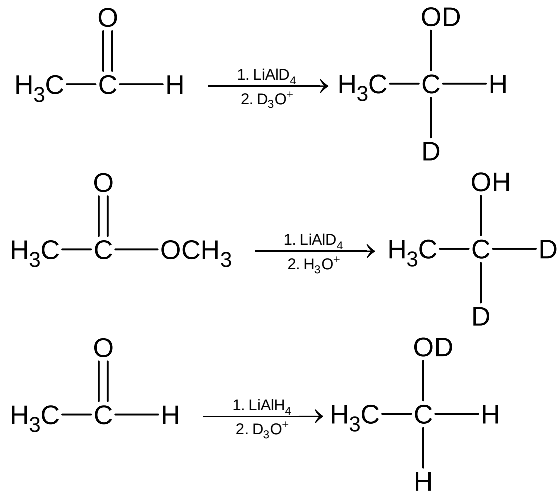
30. D

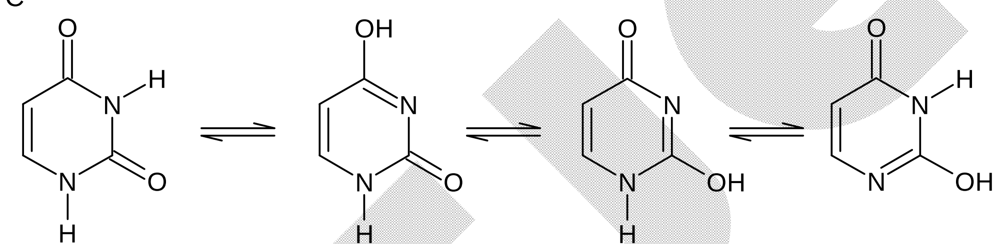
Sol.

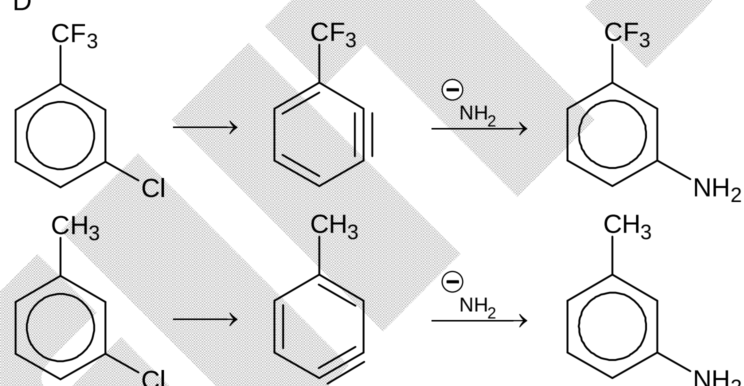
(i) (ii) (iii) (iv)

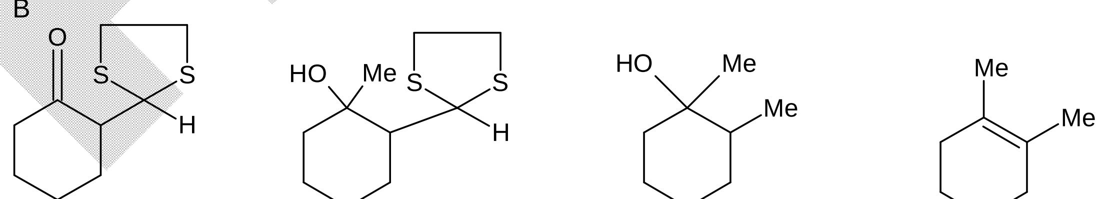
(iii) and (iv) are non-superimposable mirror image.

31. A
Sol. Factual

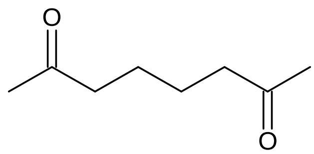
32. B
Sol.


33. C
Sol.


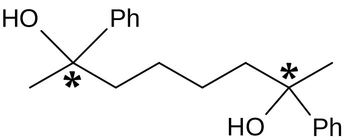
34. D
Sol.


35. B
Sol.


(A) (B) (C) (D)



(E)



(F)

Symmetrical (3-isomers)

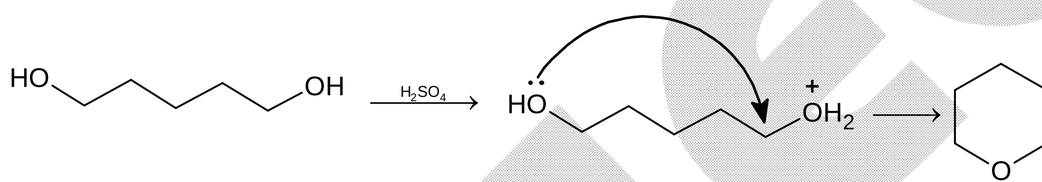
36. C

Sol. $N\equiv C-C\equiv N \xrightarrow{\text{Hydrolysis}} \begin{array}{c} COOH \\ | \\ COOH \end{array}$

Cyanogen Oxalic acid

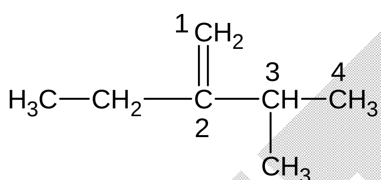
37. C

Sol.



38. D

Sol.



2-ethyl-3-methyl but-1-ene

39. C

Sol. Order of electron withdrawing nature

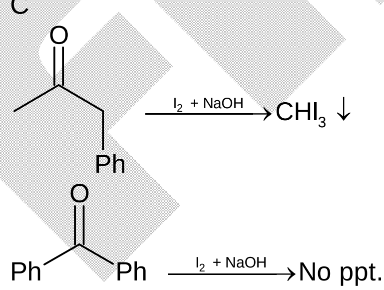
$NO_2 > -OCH_3 > -H$

40. A

Sol. Enolate in option 'A' will form a stable six membered compound.

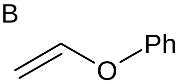
41. C

Sol.



42. B

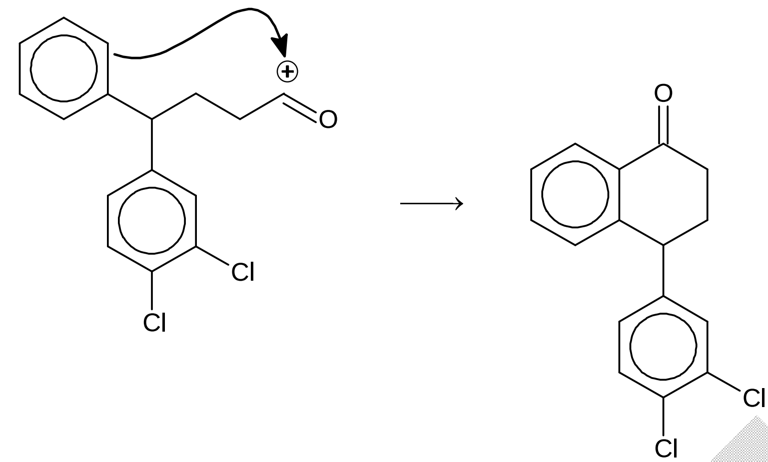
Sol.



can't be synthesized

43. C

Sol.



44. C

Sol.

(i) $H_3C-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH=CH-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$

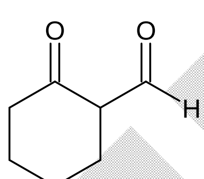
(ii) $Ph-CH_2-CH=CH-CH_3$

(iii) $H_2C=CH-CH_2-Ph$

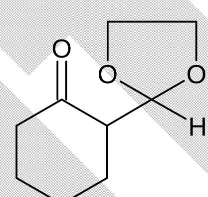
(iv) $Cl-CH_2-CH=CH-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$

45. A

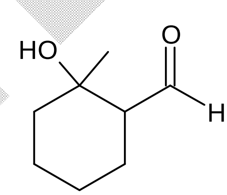
Sol.



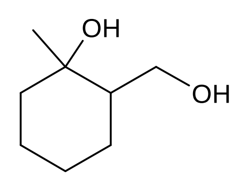
(A)



(B)



(C)



(D)

SECTION – B

46. 3

Sol.

$$H_3C-\underset{Cl}{\overset{Cl}{C}}-\underset{Cl}{\overset{Cl}{C}}-H + 2Zn \xrightarrow{\Delta} \underset{0.02\ \text{mol}}{CH_3-C\equiv C-H} + 2ZnCl_2$$

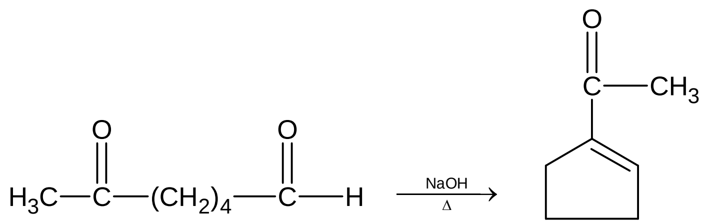
0.02 mol

$$\underset{0.02\ \text{mol}}{CH_3-C\equiv C-H} + AgNO_3 + NH_4OH \longrightarrow \underset{0.02\ \text{mol}}{CH_3-C\equiv CAg} + NH_4NO_3 + H_2O$$

Moles of $CH_3-C\equiv CAg = 0.02$

Mass of $CH_3-C\equiv CAg = 0.02\times 147 = 2.94 \approx 3$ g

47. 4
Sol.

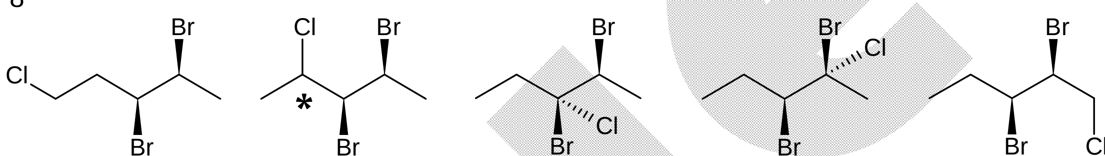


Number of – CH_2 – unit ‘4’.

48. 20
Sol. Number of H-bond between A and T are 2.
Number of H-bond between G and C are 3.
The complimentary strand is “TATACGCG”
Total H-bond = 4 × 2 + 4 × 3 = 20

49. 4
Sol. Copolymers are Bakelite, Buna-S, Melamine, Terylene.

50. 8
Sol.



(1) (2) (2) (2) (1)

Mathematics PART – C

SECTION – A

51. D

Sol. $x_1^2 + (x_2+1)^2 = 0$

$x_1 = 0, x_2 = -1$

$(y_1+1)^2 + (y_2+1)^2 = 0$

$y_1 = -1, y_2 = -1$

52. A

Sol. Since B_iC_i is parallel to B_0C_0 triangles AB_iC_i are similar to ΔAB_0C_0. So area of ΔAB_iC_i is $\left(\frac{41-i}{41}\right)^2$ of the area $\frac{1}{41-i}$ of the area of ΔAB_iC_i. So the area of $\Delta B_iC_i C_{i+1}$ is $\frac{1}{41-i}\left(\frac{41-i}{41}\right)^2 = \frac{41-i}{41^2}$.

The sum of all triangles $\Delta B_iC_i C_{i+1}$ is then $\sum_{i=1}^{41}\frac{i}{41^2} = \frac{\frac{41\times 42}{2}}{41^2} = \frac{21}{41}$. The height of ΔAB_0C_0 is $\sqrt{41^2-9^2} = 40$, so its area is $\frac{1}{2}\times 40\times 18 = 360$.

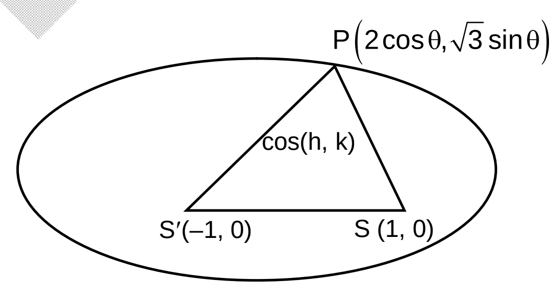
Hence total area $\frac{21}{41}\times 360 = \frac{7560}{41}$.

53. D

Sol. $\frac{x^2}{4}+\frac{y^2}{3} = 1$

$\therefore$ 3h = 2cosθ, $3k = \sqrt{3}\sin\theta$

$\frac{x^2}{\frac{4}{9}}+\frac{y^2}{1/3} = 1.$

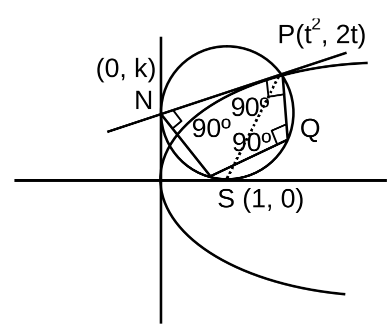


54. C

Sol. yt = x + t^2

$\ell_{pQ} = \ell_{SN} = \sqrt{1+t^2} = \sqrt{10}$

$\Rightarrow$ t = 3, – 3.



55. B

Sol. $y^2 = 8x \Rightarrow y^3 = -8 \Rightarrow y = -2,\ x = ½$
equation of tangent is $y + 2 = -2(x - ½)$
y intercept = – 1
$y' = \cos(x + y)(1 + y')$
$-2 = \cos(x + y)(-1)$
$\cos(x + y) = 2$ not possible.

56. C

Sol. $x^2 + y^2 - 25 + \lambda y = 0$

$$\left|\frac{0+\frac{\lambda}{2}+c}{\sqrt{1+2}}\right| = \sqrt{\frac{\lambda^2}{4}+25}$$

$\Rightarrow\quad \lambda^2 - 2\lambda c + 150 - 2c^2 = 0$
λ_1 and λ_2 are the roots of equation

$$2\left(0+\frac{\lambda_1\lambda_2}{4}\right) = -50,\ \lambda_1\lambda_2 = -100$$

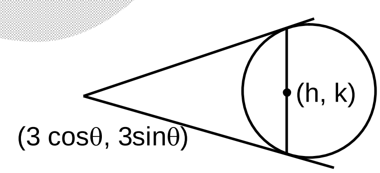
$\Rightarrow\quad 2c^2 = 250 \Rightarrow c^2 = 125 \Rightarrow c = 5\sqrt{5} \Rightarrow [c] = 11.$

57. D

Sol. $x^2 + y^2 = 8$

$x(3\cos\theta) + y(3\sin\theta) = 8$ … (i)

Also, $hx + ky = h^2 + k^2$ … (ii)



$$\frac{3\cos\theta}{h} = \frac{3\sin\theta}{k} = \frac{8}{h^2+k^2}$$

$$\Rightarrow\quad \cos\theta = \frac{8h}{3(h^2+k^2)},\ \sin\theta = \frac{8k}{3(h^2+k^2)}$$

Locus is $S : x^2 + y^2 = \left(\frac{8}{3}\right)^2$

The given line mult pass through centre of circle
$\therefore\quad c = 2$
$hx + ky = 1$ touches the ellipse

$$\therefore\quad \frac{1}{k^2} = \frac{h^2}{k^2} + 8$$

The locus is $x^2 + 8y^2 = 1$
Eccentricity of conjugates hyperbola 3.

58. A

Sol. The equation of tangent at (x_1, y_1) is $\frac{xx_1}{a^2} - \frac{yy_1}{b^2} = 1$

It passes through (0, – b), so

$0 + \frac{y_1}{b} = 1 \Rightarrow y_1 = b$

Normal at (x_1, y_1) is $\frac{a^2x}{x_1} + \frac{b^2y}{y_1} = a^2e^2$

It passes through $\left(2\sqrt{2}a, 0\right)$ so

$$x_1 = \frac{2\sqrt{2}a}{e^2}$$

Now x_1, y_1 lies one hyperbola

$$\therefore \quad \frac{8a^2}{e^4a^2} - \frac{b^2}{b^2} = 1$$

$\Rightarrow \quad e^4 = 4, \Rightarrow e^2 = 2.$

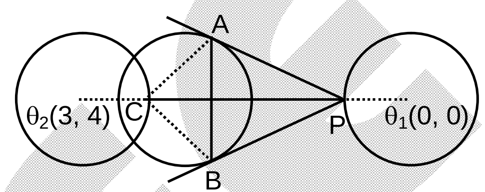
59. C

Sol. Quadrilateral PACB is cyclic and PC will be the diameter of any circle passing through any of given 4 points.

$\therefore$ diameter will be PC

Locus of C is $(x - 3)^2 + (y - 4)^2 = 1$

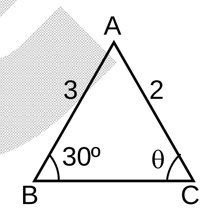
Minimum distance $O_1O_2 - r_1 - r_2 = 3$.



60. B

Sol. By using cosine formula we get,

$$a^2 - 3\sqrt{3}a + 5 = 0 \Rightarrow \frac{a_2}{a_1} = \frac{17 + 3\sqrt{21}}{10}$$



61. D

Sol. Let the variable line be lx + my + n = 0

$$P_1 = \frac{\frac{3al\alpha_1}{a+b+c} + \frac{3am\beta_1}{a+b+c} + n}{\sqrt{l^2 + m^2}}$$

$$P_2 = \frac{\frac{3bl\alpha_2}{a+b+c} + \frac{3bm\beta_2}{a+b+c} + n}{\sqrt{l^2 + m^2}}$$

$$P_3 = \frac{\frac{3cl\alpha_3}{a+b+c} + \frac{3cm\beta_3}{a+b+c} + n}{\sqrt{l^2 + m^2}}$$

$P_1 + P_2 + P_3 = 0$

$$\Rightarrow \frac{3l\left(a\alpha_1 + b\alpha_2 + c\alpha_3\right)}{a+b+c} + \frac{3m\left(a\beta_1 + b\beta_2 + c\beta_3\right)}{a+b+c} + 3n = 0$$

62. B

Sol. Let $\sqrt{768} = 32\cos\theta$

$16\sqrt{3} = 32\cos\theta$

$\cos\theta = \frac{\sqrt{3}}{2} \quad \Rightarrow \theta = \frac{\pi}{6}$

$$\sqrt{4 + \sqrt{8 - \sqrt{32 + 32\cos\frac{\pi}{6}}}}$$

$= \sqrt{4+\sqrt{8-8\cos\frac{\pi}{12}}}$

$= \sqrt{4+4\sin\frac{\pi}{24}}$

$= \sqrt{4+4\cos\frac{11\pi}{24}}$

$= 2\sqrt{2}\cos\frac{11\pi}{48} \;\therefore\; \frac{b}{a}=24$

63. D

Sol. The tangent 3x + 4y – 25 = 0 is tangent at vertex and axis is 4x – 3y = 0
so PS = a = 5
L.R = 20

64. D

Sol. $m^3 + (2p + 5)\,m^2 - 6m - 2p = 0$
$m_1 + m_2 + m_3 = -(2p + 5)$
$\Sigma m_1m_2 = -6$
$m_1m_2m_3 = 2p$
For A
$$P + \sum_{i=1}^{3} m_i = -1$$
$\Rightarrow\; P - 2P - 5 = -1 \;\Rightarrow P = -4$
$\Rightarrow\; m_1m_2m_3 = -8$
$\Rightarrow\; m_1 = 1,\ m_2 = -2,\ m_3 = 4$
For B
$\Rightarrow\; P - 2P - 5 = -5 \;\Rightarrow P = 0$
$\Rightarrow\; m_1m_2m_3 = 0$
$\Rightarrow\; m_1 = 1,\ m_2 = 0,\ m_3 = -6$
For D
P + 2P = 32 not possible.

65. A

Sol. $2x^2 + 2xy + 3y^2 - \left(\frac{3x+6y}{P}\right)^2 = 0$

$\Rightarrow\; 2P^2 - 9 + 3P^2 - 36 \;\Rightarrow\; P^2 = 9$

66. B

Sol. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Tangent at P(asecθ, btanθ)

$\frac{x\sec\theta}{a} - \frac{y\tan\theta}{b} = 1$

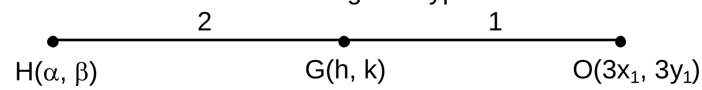
$y = \pm\frac{b}{a}x$

$M = [a(\sec\theta - \tan\theta), -b(\sec\theta - \tan\theta)]$
$N = [a(\sec\theta + \tan\theta), b(\sec\theta + \tan\theta)]$
$\Rightarrow\; ON = \sqrt{a^2+b^2}\,(\sec\theta + \tan\theta) = ae(\sec\theta + \tan\theta)$ and $OM = ae(\sec\theta - \tan\theta)$
$\Rightarrow\; OM + ON = 2ae\sec\theta$

$SP + S'P = e\left(a\sec\theta - \frac{a}{e}\right) + e\left(a\sec\theta + \frac{a}{e}\right)$ = 2ae secθ

67. C

Sol. Orthocentre lies on the rectangular hyperbola and



$\therefore\ h = \frac{2\times 3x_1 \times \alpha}{3}, k = \frac{2\times 3y_1\times\beta}{3}$

$\alpha = 3h - 6x_1$, $\beta = 3k - 6y_1$

$9(h - 2x_1)^2 - 9(k - 2y_1)^2 = 36\ \therefore \lambda = 4$

68. C

Sol. $l_1l_2 = 2$ and $t_1 + t_2 + t_3 = 0$ and $a = 2$

Let the circumcentre be (h, k)

$h = \frac{at_1t_2 + at_3^2}{2} \Rightarrow h = 2 + t_3^2$

$k = \frac{a(t_1 + t_2) + 2at_3}{2} \Rightarrow k = t_3$

$\therefore h = 2 + k^2$

$y^2 = x - 2$

69. D

Sol. Let A be the vertex

$AR = \sqrt{a^2t_2^4 + 4a^2t_2^2} = |at_2|\sqrt{t_2^2 + 4}$

$a = 1$

$|t_2| = \left|-t_1 - \frac{2}{t_1}\right| \geq 2\sqrt{2}$

$AR \geq 4\sqrt{6}$

70. B

Sol. ΔATC is isosceles, BHFC is cyclic

$\angle$BFH = $\angle$BHC. Then ΔTBF ~ ΔTHC

Since ΔTBF is isosceles, so ΔTHC

Area = $\frac{1}{2}\times 10\times\sqrt{63} = 15\sqrt{7}$

SECTION – B

71. 0

Sol. Let $\theta = \frac{\pi}{28}$

$$\frac{\cos 2\theta}{\sin 3\theta} + \frac{\cos 6\theta}{\sin 9\theta} + \frac{\cos 18\theta}{\sin 27\theta}$$

$$= \frac{1}{2}\left[\frac{2\cos 2\theta\cdot\sin\theta}{\sin\theta\cdot\sin\theta} + \frac{2\cos 6\theta\cdot\sin 3\theta}{\sin 9\theta\cdot\sin 3\theta} + \frac{2\cos 18\theta\cdot\sin 9\theta}{\sin 27\theta\cdot\sin 9\theta}\right]$$

$$= \frac{1}{2}\left[\frac{\sin 3\theta - \sin\theta}{\sin\theta\cdot\sin\theta} + \frac{\sin 9\theta - \sin 3\theta}{\sin 9\theta\cdot\sin 3\theta} + \frac{\sin 27\theta - \sin 9\theta}{\sin 27\theta\cdot\sin 9\theta}\right]$$

$= \frac{1}{2}$ [cosecθ – cosec3θ + cosec3θ – cosec9θ + cosec9θ – cosec27θ]

$= \frac{1}{2}$ [cosecθ – cosec27θ] = 0

72. 2

Sol. $\frac{\sin x}{\sin y} = \frac{1}{2} \Rightarrow \frac{\sin x + \sin y}{\sin x - \sin y} = \frac{3}{-1}$

$$\Rightarrow \frac{2\sin\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)}{2\cos\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)} = -3$$

$$\frac{\cos x}{\cos y} = \frac{3}{2}$$

$$\Rightarrow \frac{\cos x + \cos y}{\cos x - \cos y} = \frac{3+2}{3-2}$$

$$\Rightarrow \frac{2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)}{2\sin\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)} = -5$$

$$\Rightarrow \tan^2\left(\frac{x+y}{2}\right) = \frac{3}{5}$$

k = 2

73. 2

Sol. $m^2\sin^2\theta - 2m\tan\theta + \tan^2\theta + \cos^2\theta = 0$

$m_1 + m_2 = \frac{2\tan\theta}{\sin^2\theta}$

$m_1m_2 = \frac{\tan^2\theta + \cos^2\theta}{\sin^2\theta}$

$m_1 - m_2 = \sqrt{(m_1+m_2)^2 - 4m_1m_2}$

$= \sqrt{\frac{4\tan^2\theta}{\sin^4\theta} - \frac{4\tan^2\theta + 4\cos^2\theta}{\sin^2\theta}}$

$= \frac{2}{\sin^2\theta}\sqrt{\tan^2\theta - (\tan^2\theta + \cos^2\theta)\sin^2\theta} = 2$

74. 1

Sol. $\frac{1}{\sin 1^\circ}\left[\frac{\sin(46^\circ - 45^\circ)}{\sin 45^\circ \sin 46^\circ} + \frac{\sin(48^\circ - 47^\circ)}{\sin 49^\circ \sin 48^\circ} + \frac{\sin(50^\circ - 49^\circ)}{\sin 49^\circ \sin 50^\circ} + ... + \frac{\sin(134^\circ - 133^\circ)}{\sin 133^\circ \sin 134^\circ}\right]$

$= \frac{1}{\sin 1^\circ}[\cot 45^\circ - \cot 46^\circ + \cot 47^\circ - \cot 48^\circ + \cot 49^\circ - \cot 50^\circ + ... + \cot 133^\circ - \cot 134^\circ] = \frac{1}{\sin 1^\circ}$

75. 0

Sol. Perpendicular distance = 2

Now $\sec^2\theta + 2\text{cosec}^2\theta = 2$

No value of θ is possible.