16/11/2025

Set-2_Online

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

MM : 180

AIATS For One Year JEE(Advanced)-2026 (XII Studying)_Test-2A_Paper-2_ONLINE

Time : 180 Min.

CHEMISTRY

Section-I

1. (B)

2. (A)

3. (C)

4. (C)

Section-II

5. (A,C,D)

6. (A,C,D)

7. (B,D)

Section-III

8. (18)

9. (3)

10. (2)

11. (0)

12. (5)

13. (6)

Section-IV

14. (00.00)

15. (01.00)

16. (01.00)

17. (09.00)

MATHEMATICS

Section-I

18. (D)

19. (C)

20. (A)

21. (B)

Section-II

22. (A,B,C,D)

23. (B,C)

24. (A,D)

Section-III

25. (B)

26. (0)

27. (2)

28. (0)

29. (2)

30. (2)

Section-IV

31. (63.00)

32. (02.00)

33. (01.00)

34. (00.00)

PHYSICS

Section-I

35. (D)

36. (D)

37. (C)

38. (A)

Section-II

39. (A,B,C)

40. (A,C)

41. (A,C)

Section-III

42. (16)

43. (6)

44. (0)

45. (15)

46. (10)

47. (52)

Section-IV

48. (00.75)

49. (06.00)

50. (90.00)

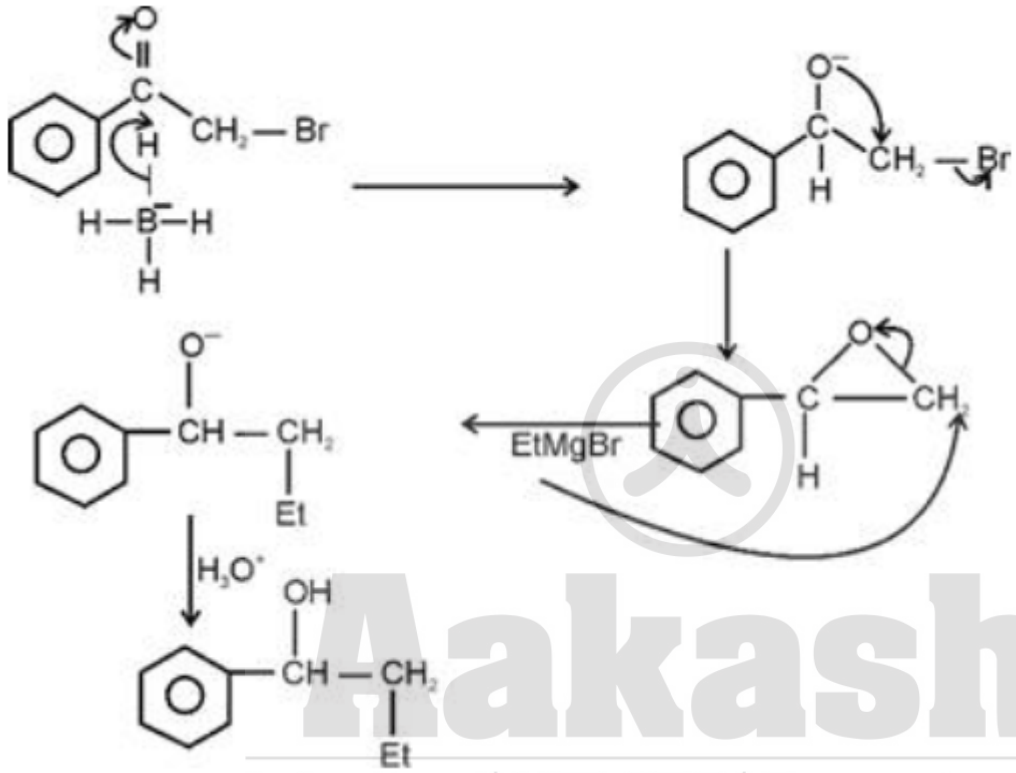
51. (67.50)

Hints and Solutions

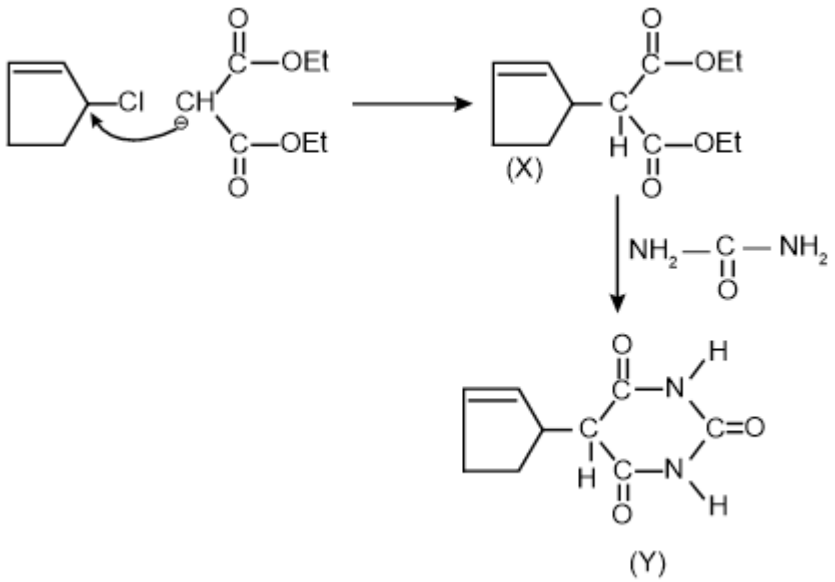
CHEMISTRY

Section-I

(1) **Answer :** (B)
Hint:
Ring opening of less hindered C-atom
Solution:



(2) **Answer :** (A)
Hint:
It is S_N reaction
Solution:

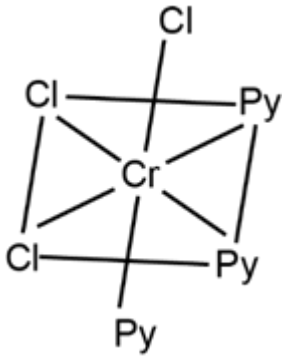


(X)

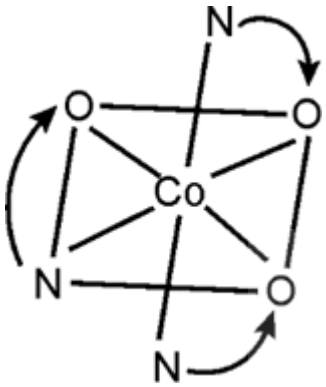
(Y)

(3) **Answer :** (C)

Hint:
$Ni(dmg)_2$ is square planar.
Solution:
$Ni(dmg)_2$ is square planar. $[Ni(dmg)_2]$ is a square planar complex
So no optical isomerism.



Fac-$[CrCl_3(Py)_3]$ has plane of symmetry



trans $[Co(gly)_3]$ has chirality-exists as d –l pair

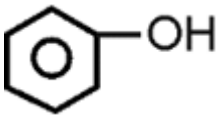
⇒ [Zn(en)(gly)]Cl is tetrahedral complex lacking chirality

(4) **Answer :** (C)
Hint:
Symmetrical molecules have compact packing and hence higher melting point.
Solution:

Compound	M. pt.
Phenol	43°C
Catechol	105°C
Resorcinol	110°C
Quinol	170°C

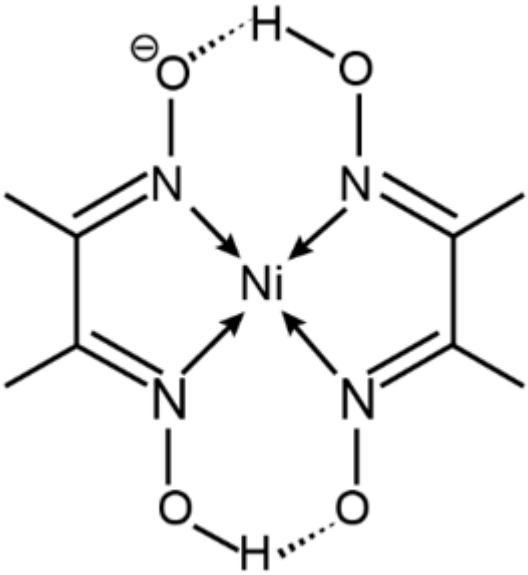
Section-II

(5) **Answer :** (A,C,D)
Hint:
Phenol is most acidic.
Solution:



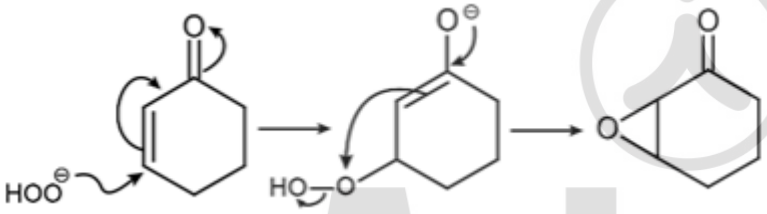
does not react with HCl, but it is soluble in NaOH. It decolorises Br_2 water.

(6) **Answer :** (A,C,D)
Hint:
CFSE depends on metal and ligands both
Solution:
As one moves from Ni $\rightarrow$ Pd $\rightarrow$ Pt, keeping the ligand same, Δ_0 (crystal field splitting energy increases)



dmg is stronger ligand than en – one of the reason is formation of rings due to intramolecular H-boding.

(7) **Answer :** (B,D)
Hint:
1, 4-addition.
Solution:



⇒ H_2O_2 H_2O
$pk_a = 11.6$ $pk_a = 15.4$

Section-III

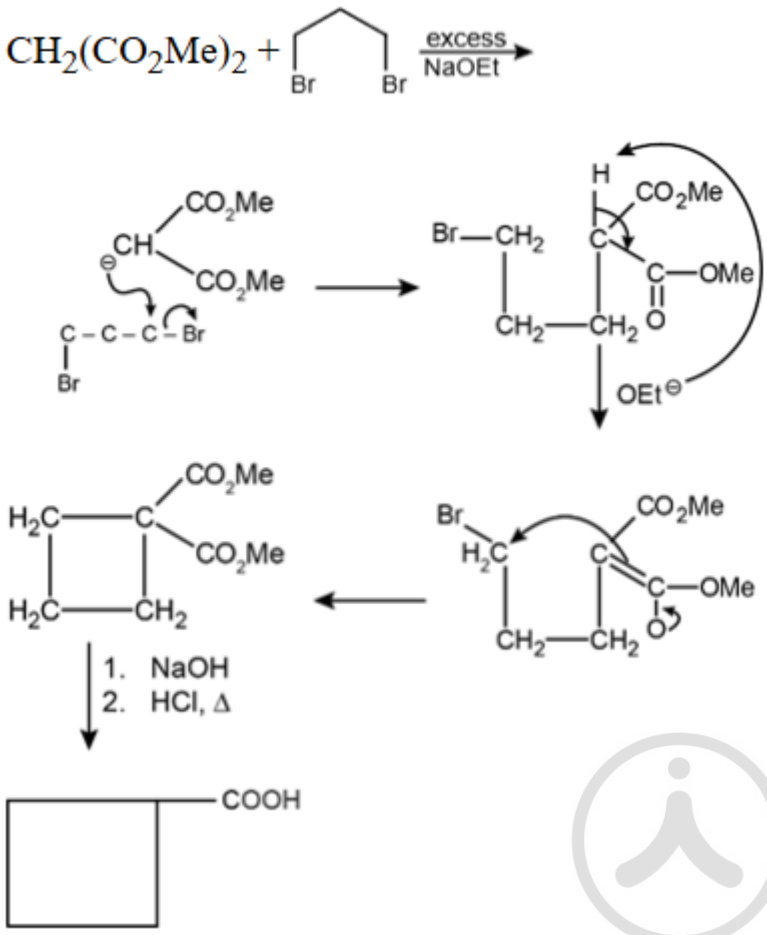
(8) **Answer :** 18
Hint:
sp^3d^2 hybridised
Solution:

$[Ni(dmg)_3]^-$ $\Rightarrow t_{2g}^6 e_g^2$

k = 6
l = 2

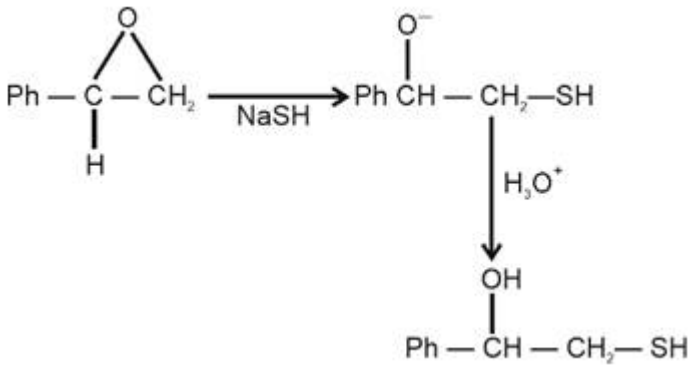
So, $\frac{4\times6^2}{2^3} = 18$

(9) **Answer :** 3
Hint:
$CH_2(CO_2Me)_2$ contains acidic H.
Solution:



Number of sp^3 hybridised C = 4 = x
Degree of unsaturation = 2 = y
So, x + y = 6
So, $1+\frac{x}{y}=1+\frac{4}{2}$ = 3

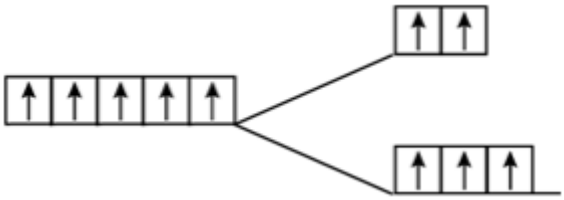
(10) **Answer :** 2
Hint:
Ring opening takes place at less hindered C-atom.
Solution:



(11) **Answer :** 0
Hint:

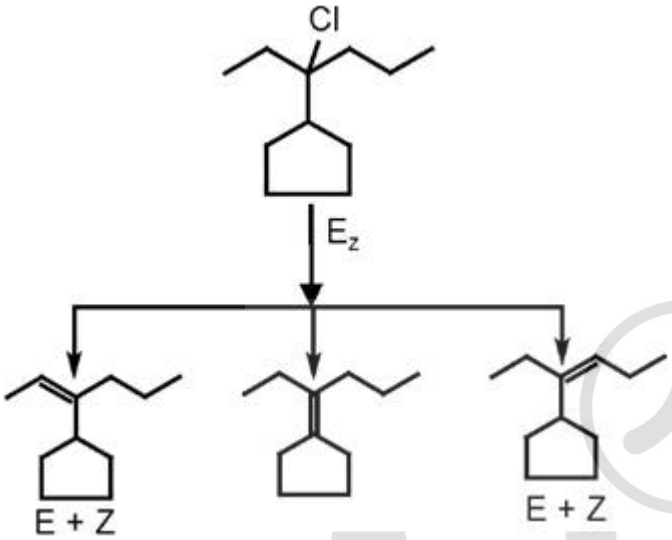
It is $t_{2g}^3 e_g^2$ complex.
Solution:
$2KMnO_4 + 5H_2S + 3H_2SO_4 \rightarrow 5S + K_2SO_4 + \underbrace{2MnSO_4 + 8H_2O}_{light\ pink}$

$Mn^{2+} \rightarrow 3d^5 4s^0$

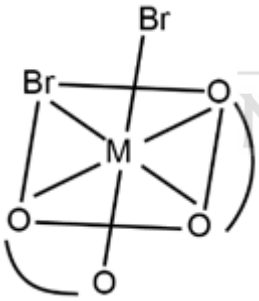


CFSE = $-3 \times 0.4\Delta_0 + 2 \times 0.6\Delta_0$
= 0

(12) Answer : 5
Hint:
5 isomers are formed.
Solution:



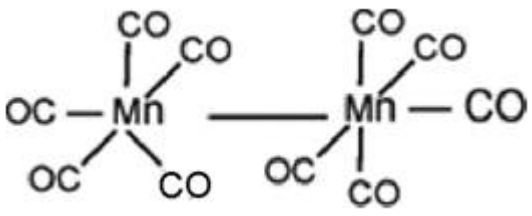
(13) Answer : 6
Solution:



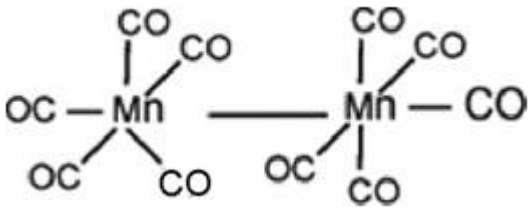
For each of two Br-atoms 3 such angles are possible.

Section-IV

(14) Answer : 00.00
Solution:

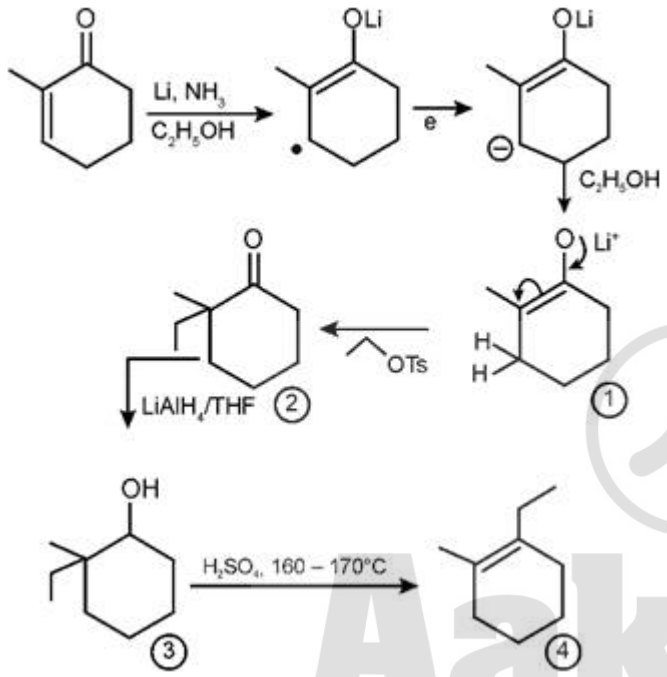


(15) Answer : 01.00
Solution:

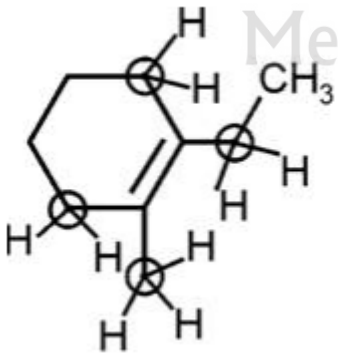


Number of M – M bond = 1.

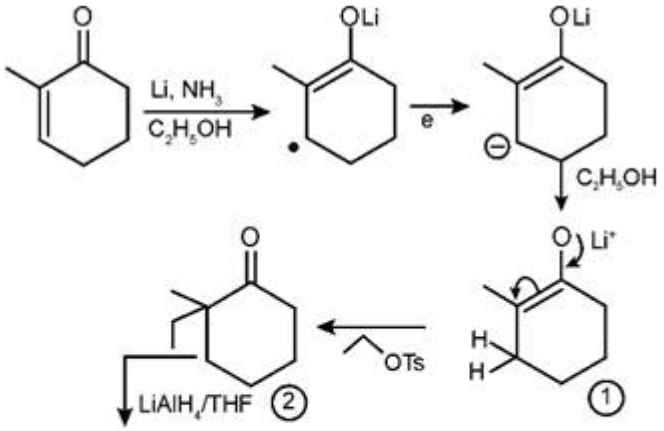
(16) **Answer :** 01.00
Hint:
nucleophilic addition
Solution:

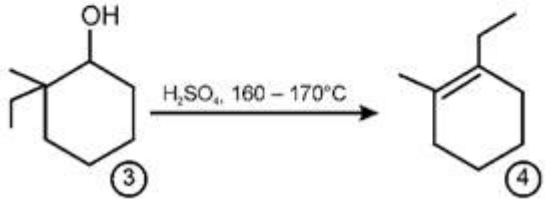


Double bond equivalent of (3) is 1. Hyperconjugative hydrogen atoms in (4) is (9)

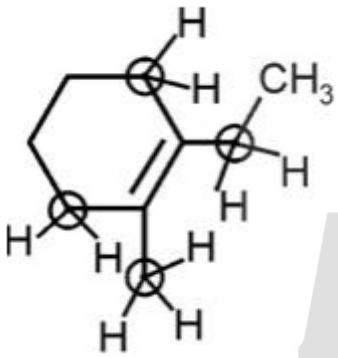


(17) **Answer :** 09.00
Hint:
Nucleophilic addition
Solution:





Double bond equivalent of (3) is 1 Hyperconjugative hydrogen atoms in (4) is (9)



MATHEMATICS

Section-I

(18) **Answer :** (D)

Hint:

Let x + 1 = *t*

Solution:

Let *x* + 1 = *t*

dx = *dt*

$$= \int_1^e \frac{e^{\frac{(t-1)^2+2(t-1)-1}{2}}}{t}\,dt + \int_1^e x\log x\, e^{\frac{x^2-2}{2}}\,dx$$

$$= \int_1^e \frac{e^{\frac{x^2-2}{2}}}{x}\,dx + \int_1^e x\log x\, e^{\frac{x^2-2}{2}}\,dx$$

$$= e^{\frac{x^2-2}{2}}\int_1^e \frac{dx}{x} + \int_1^e \left(\frac{d}{dx}\left(e^{\frac{x^2-2}{2}}\right)\int_1^e \frac{1}{x}dx\right)dx +$$

$$\int_1^e x \log x \, e^{\frac{x^2-2}{2}} dx$$

$$= \left[e^{\frac{x^2-2}{2}} \log |x| \right]_1^e - \int_1^e e^{\frac{x^2-2}{2}} . \, x \log x$$

$$+ \int_1^e x \log x \, e^{\frac{x^2-2}{2}}$$

$$= e^{\frac{e^2-2}{2}} \log e$$

$$= e^{\frac{e^2-2}{2}} = (\sqrt{e})^{e^2-2}$$

(19) Answer : (C)

Hint:

$f(x) = \tan \frac{x}{2} + 4$

Solution:

$$\int \frac{dx}{1 + \cos x} = \int \frac{dx}{2\cos^2 \frac{x}{2}} = \int \frac{1}{2} \sec^2 \frac{x}{2} dx$$

$f(x) = \int \frac{1}{2} \sec^2 \frac{x}{2} dx$

$= \tan \frac{x}{2} + C$

$f(0) = 4$

$\Rightarrow C = 4$

$\therefore f(x) = \tan \frac{x}{2} + 4$

$f\left(\frac{\pi}{2}\right) = \tan\left(\frac{\pi}{4}\right) + 4 = 1 + 4 = 5$

(20) Answer : (A)

Hint:

$h'(x) = f'(x) - g'(1-x) \geq 0$

Solution:

$h'(x) = f'(x) - g'(1-x) \geq 0$

$\Rightarrow f'(x) - f''(x) \geq 0$

$\Rightarrow \frac{d}{dx} \left(e^{-x} f'(x)\right) \leq 0$

$\Rightarrow e^{-x} f'(x)$ is decreasing function

$\Rightarrow e^{-x} f'(x) \leq e^{-0} f'(0)$ for $x \geq 0$

$\Rightarrow f'(x) \leq 0 \ \forall \ x \geq 0.$

$\therefore g'(1-x) \leq 0 \ \forall \ x \geq 0$

(21) Answer : (B)

Hint:

write, $3x^2 + 4x - 1 = 4x^2 + 4x - x^2 - 1$

Solution:

$$\int \frac{3x^2 + 4x - 1}{(x^2 + 1)\sqrt{x+1}} = \int \frac{4x^2 + 4x - x^2 - 1}{(x^2 + 1)^2 \sqrt{x+1}} dx$$

$$= 4 \int \frac{x(x+1)dx}{(x^2+1)^2 \sqrt{x+1}} - \int \frac{dx}{(x^2+1)\sqrt{x+1}}$$

$$= 4 \int \frac{x(x+1)dx}{(x^2+1)^2 \sqrt{x+1}} - \frac{2\sqrt{x+1}}{x^2+1}$$

$$= \frac{-2\sqrt{x+1}}{x^2+1} + C$$

Section-II

(22) Answer : (A,B,C,D)

Hint:

$\frac{dy}{dx} = \frac{1}{3x^{2/3}} [4x - 1]$

Solution:

$y = x^{1/3}(x - 1)$

$\frac{dy}{dx} = \frac{4}{3}x^{\frac{1}{3}} - \frac{1}{3}.\frac{1}{x^{2/3}} = \frac{1}{3x^{2/3}}[4x-1]$

Hence function is increasing for $x > \frac{1}{4}$ and decreasing for $x < \frac{1}{4}$.

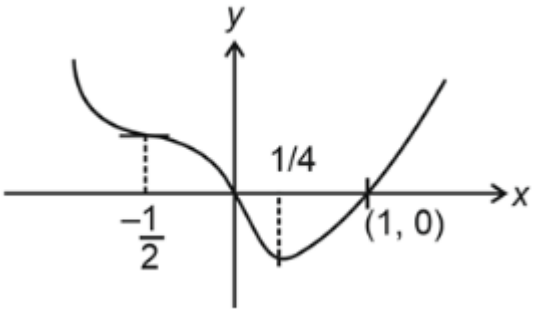
$\therefore x = \frac{1}{4}$ is the point of minima.

$f'(0)$ does not exist as $f(x)$ is a vertical tangent here.

$f''(x) = \frac{4}{9}.\frac{1}{x^{2/3}} + \frac{1}{3}.\frac{2}{3}.\frac{1}{x^{5/3}}$

$= \frac{2}{9x^{2/3}}\left[2+\frac{1}{x}\right] = \frac{2}{9x^{2/3}}\left[\frac{2x+1}{x}\right]$

$f''(x) = 0$ at $x = -\frac{1}{2}$ (inflection point)



(23) Answer : (B,C)

Hint:

$\Rightarrow e^{-f(x)}f'(x) - e^{-g(x)}g'(x) = 0$

Solution:

$f'(x) = \left(e^{(f(x)-g(x))}\right)g'(x)\ \forall x \in R$

$\Rightarrow e^{-f(x)}f'(x) - e^{-g(x)}g'(x) = 0$

$\Rightarrow \int\left(e^{-f(x)}f'(x) - e^{-g(x)}g'(x)\right)dx = C$

$\Rightarrow -e^{-f(x)} + e^{-g(x)} = C$

$\Rightarrow -e^{-f(1)} + e^{-g(1)} = -e^{-f(2)} + e^{-g(2)}$

$\Rightarrow -\frac{1}{e} + e^{-g(1)} = -e^{f(2)} + \frac{1}{e}$

$\Rightarrow e^{-f(2)} + e^{-g(1)} = \frac{2}{e}$

$\therefore e^{-f(2)} < \frac{2}{e}$ & $e^{-g(1)} < \frac{2}{e}$

$\Rightarrow -f(2) < \ln 2 - 1$ & $-g(1) < \ln 2 - 1$

$\Rightarrow f(2) > 1 - \ln 2$ & $g(1) > 1 - \ln 2$

(24) Answer : (A,D)

Hint:

$I_n + I_{n-2} = \frac{1}{n-1}$

Solution:

$I_n = \int_0^{\pi/4} \tan^n x\,dx$, when n is even

$I_n = \frac{\tan^{n-1}x}{n-1}\Big|_0^{\pi/4} - I_{n-2}$

$\Rightarrow I_n + I_{n-2} = \frac{1}{n-1}$

$I_4 = \frac{\tan^3 x}{3}\Big|_0^{\frac{\pi}{4}} - (\tan x - x)\Big|_0^{\pi/4}$

$= \frac{1}{3} - \left(1 - \frac{\pi}{4}\right) = \frac{\pi}{4} - \frac{2}{3}$

Section-III

(25) Answer : B

Hint:

$f(x) = \cos x$

Solution:

$$f(x) = \lim_{\theta \to 0} \frac{\left(\cos\left(x+4\theta\right) + \cos x\right) - 4(\cos\left(x+3\theta\right) + \cos\left(x+\theta\right)) + 6\cos\left(x+2\theta\right)}{\theta^4}$$

$$= \lim_{\theta \to 0} \frac{2\cos\left(x+2\theta\right).\cos 2\theta - 8\cos\left(x+2\theta\right).\cos\theta + 6\cos\left(x+2\theta\right)}{\theta^4}$$

$$= \lim_{\theta \to 0} \frac{2\cos\left(x+2\theta\right).\left((\cos 2\theta) - 4\cos\theta + 3\right)}{\theta^4}$$

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

$$\lim_{\theta \to 0} 4\cos\left(x + 2\theta\right)\frac{\left(1-\cos\theta\right)^2}{\theta^4} = \cos x$$

Maximum value of $f(x) = 1$ and minimum value of $f(x) = -1$
$\therefore$ Difference $= 1 - (-1) = 2$

(26) **Answer :** 0
Hint:
$x = \frac{1}{t} \Rightarrow dx = \frac{-dt}{t^2}$
Solution:

$$I = \underbrace{\int_{\frac{1}{5}}^{5} \frac{1}{x}\left\{\frac{x}{4x^2-2x+9}\right\}dx}_{I_1} + \underbrace{\int_{\frac{1}{5}}^{5} \frac{1}{x}\left\{\frac{-x}{9x^2-2x+4}\right\}dx}_{I_2}$$

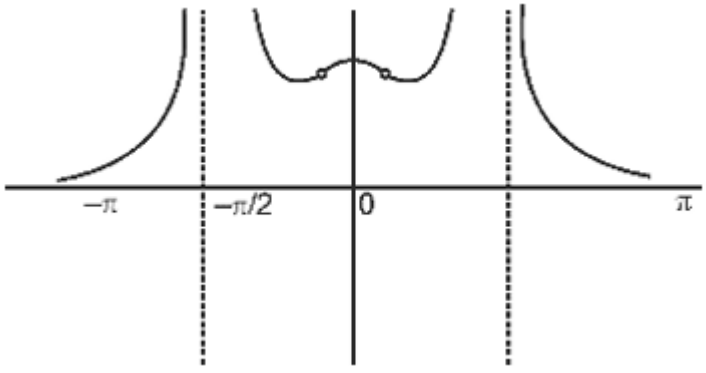
$$I_2 = \int_{1/5}^{5} \frac{1}{x}\left\{\frac{-x}{9x^2-2x+4}\right\}dx$$

Putting $x = \frac{1}{t} \Rightarrow dx = \frac{-dt}{t^2}$

$$I_2 = \int_{1/5}^{5} t\left\{\frac{-1/t}{9/t^2 - 2/t + 4}\right\}\frac{dt}{t^2} = \int_{1/5}^{5} \frac{1}{t}\left\{\frac{-t}{4t^2-2t+9}\right\}dt$$

Now, $I_2 = -I_1$

(27) **Answer :** 2
Hint:
Draw the graph
Solution:
Function is not differentiable in $(-\pi, \pi)$ at exactly 2 points



(28) **Answer :** 0
Hint:
$g'\left(\frac{x^2}{2}\right) - f'\left(6 - x^2\right) > 0$ when $x < -2$ or $x > 2$
Solution:
$g(x) = 2f\left(\frac{x^2}{2}\right) + f\left(6 - x^2\right)$

$\Rightarrow g'(x) = 2f'\left(\frac{x^2}{2}\right)x - 2xf'\left(6 - x^2\right)$

$\Rightarrow g'(x) = 2x\left(f'\left(\frac{x^2}{2}\right) - f'\left(6 - x^2\right)\right)$

$f'\left(\frac{x^2}{2}\right) > f'(6-x^2)$ $\left(\text{if } \frac{x^2}{2} > 6 - x^2\right)$

$\because f'(x)$ is increasing

$\frac{x^2}{2} > 6 - x^2 \Rightarrow x^2 > 4$

$\Rightarrow f'\left(\frac{x^2}{2}\right) - f'\left(6 - x^2\right) > 0$ when $x < -2$ or $x > 2$

$\Rightarrow g'(x) > 0$ when $x \in (-2, 0) \cup (2, \infty)$

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

(29) Answer : 2

Hint:

Put $1 + \cot^5 x = t$

Solution:

$$I = \int \frac{\cos^4 x\, dx}{\sin^3 x\left(\sin^5 x + \cos^5 x\right)^{3/5}}$$

$$= \int \frac{\cos^4 x\, dx}{\sin^6 x\left(1 + \cot^5 x\right)^{3/5}} \{\text{put } 1 + \cot^5 x = t\}$$

$$= -\frac{1}{5}\int \frac{dt}{t^{3/5}}$$

$$= -\frac{1}{2}\left(1 + \cot^5 x\right)^{2/5} + C$$

$$\therefore AB = 5 \times \frac{2}{5} = 2$$

(30) Answer : 2

Hint:

$\sin 3\theta = 3\sin\theta - 4\sin^3\theta = \sin\theta(1 + 2\cos 2\theta)$

Solution:

$\sin 3\theta = 3\sin\theta - 4\sin^3\theta = \sin\theta(1 + 2\cos 2\theta)$

$$\Rightarrow \sin x = \sin\frac{x}{3}\left(1 + 2\cos\frac{2x}{3}\right)$$

$$\sin\frac{x}{3} = \sin\left(\frac{x}{3^2}\right)\left(1 + 2\cos\frac{2x}{3^2}\right) \text{ \& So on multiplying all}$$

$$\sin x = \sin\left(\frac{x}{3^n}\right)\prod_{r=1}^{n}\left(1 + 2\cos\frac{2x}{3^r}\right)$$

$$\Rightarrow \frac{\sin x}{x} = \lim_{n\to\infty}\frac{\sin\left(\frac{x}{3^n}\right)}{\left(\frac{x}{3^n}\right)} \cdot \prod_{r=1}^{n}\frac{\left(1 + 2\cos\frac{2x}{3^r}\right)}{3}$$

$\Rightarrow f(x) = \frac{\sin x}{x}$

Thus $|xf(x)| = |\sin x|$ is not differentiable at 2 points in $(0, 3\pi)$

Section-IV

(31) Answer : 63.00

Hint:

$$\int_0^6 \left(x^2 + [x]\right) d(|3 - x|) = \int_0^3 \left(x^2 + [x]\right) d(3-x) + \int_3^6 \left(x^2 + [x]\right) d(x - 3)$$

Solution:

$$\int_0^6 \left(x^2 + [x]\right) d(|3 - x|) = \int_0^3 \left(x^2 + [x]\right) d(3-x)$$

$$+ \int_3^6 \left(x^2 + [x]\right) d(x - 3)$$

$= -\int_0^3 (x^2 + [x])\,dx + \int_3^6 (x^2 + [x])\ dx$

$\Rightarrow \int_0^6 (x^2 + [x])\ d|3 - x| =$

$-\int_0^3 x^2 dx + \int_3^6 x^2 dx - \int_0^3 [x]dx + \int_3^6 [x]\,dx$

$\frac{-x^3}{3}\Big]_0^3 + \frac{x^3}{3}\Big]_3^6 - \int_0^3 [x]dx + \int_3^6 [x]\,dx$

$= -9 + (72 - 9)\ 3 + 12$

= 63

(32) Answer : 02.00

Hint:

$\int_{-2}^{3} [|x|] d\left|x\right| = \int_{-2}^{0} [-x]\,d(-x) + \int_0^3 [x]\,dx$

Solution:

$\int_{-2}^{3} [|x|] d\left|x\right| = \int_{-2}^{0} [-x]\,d(-x) + \int_0^3 [x]\,dx$

$= -\int_{-2}^{-1} [-x]dx + \int_{-1}^{0} [-x]dx + \int_0^3 [x]dx$

= –1 + 3 = 2

(33) Answer : 01.00

Hint:

$f(x) \le 0$ and $F'(x) = f(x)$

Solution:

$f(x) \le 0$ and $F'(x) = f(x)$

$\Rightarrow f(x) \ge CF(x) \Rightarrow \frac{d}{dx}\left(e^{-Cx}.F(x)\right) \ge 0$

$\Rightarrow e^{-Cx}F(x)$ is an increasing function

$\Rightarrow e^{-Cx}F(x) \ge e^{-(0)}F(0)$

$\Rightarrow F(x) \ge 0 \Rightarrow f(x) \ge 0$

$\Rightarrow f(x) = 0$

Also, $\frac{d}{dx}\left(e^{-x}g(x)\right) < 0$

$\Rightarrow e^{-x}\,g(x)$ is a decreasing function

$\Rightarrow e^{-x}\,g(x) < e^{-(0)}\,g(0)$

$\Rightarrow g(x) < 0$ (as $g(0) = 0$)

$\because f(x) = g(x)$ has one solution $x = 0$

(34) Answer : 00.00

Hint:

$x^2 - x - 6 = (x - 2)(x + 3)$

Solution:

$|x^2 + x - 6| = f(x) + g(x)$

$x^2 + x - 6 = (x - 2)(x + 3)$

Roots of this quadratic equation are $x = 2$ and $x = -3$.

For $0 \le x < 2$, $|x^2 + x - 6| = 6 - x^2 - x$

$x \ge 2$, $|x^2 + x - 6| = x^2 + x - 6$

$\because g(x) \le 0$ & $g(0) = 0$

$\therefore f(x) + g(x) \le g(x) \quad \forall\ x \ge 0$

For $0 \le x < 2$

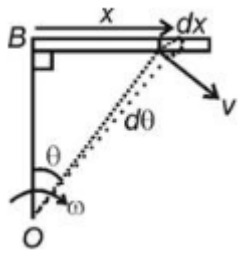
$6 - x^2 - x \ge 0$

This is positive, while $f(x) + g(x) \le 0$.
No solution
For $x \ge 2$
$x^2 + x - 6 \ge 0$
This is also positive, while $f(x) + g(x) \le 0$
No solution

PHYSICS

Section-I

(35) **Answer :** (D)
Hint:
E = *Bvl*
Solution:



$\text{emf} = \int \left(d\vec{x} \times \vec{v}\right).\vec{\beta}$

$\left(d\vec{x} \times \vec{v}\right) = \omega r dx \sin\theta$

$\left(d\vec{x} \times \vec{v}\right).\vec{B} = B\omega(r\sin\theta)dx = B\omega x dx$

$E = \omega B \int_0^l x dx = \frac{B\omega l^2}{2}$

(36) **Answer :** (D)
Hint:
$I_0 = \frac{V}{\sqrt{R^2 + \left(\frac{1}{\omega_0 C}\right)^2}}$
Solution:
$\frac{I_0}{2} = \frac{v}{\sqrt{R^2 + \left(\frac{3}{\omega_0 c}\right)^2}}$

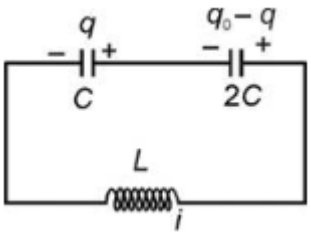
$4\left(R^2 + \frac{1}{C^2\omega^2}\right) = R^2 + \frac{9}{C^2\omega^2}$

$\frac{1}{C^2\omega^2} = \frac{3}{5}R^2$

$\frac{1}{\omega CR} = \sqrt{\frac{3}{5}}$

$\omega CR = \sqrt{\frac{5}{3}}$

(37) **Answer :** (C)
Hint:
Oscillation
Solution:
$\frac{q_0 - 2}{2C} - \frac{Ldi}{dt} - \frac{q}{C} = 0$
$q = \frac{q_0}{3}$



$\frac{1}{2}Li^2 + \frac{\left(\frac{2q_0}{3}\right)^2}{2 \times 2C} + \frac{\left(\frac{q_0}{3}\right)^2}{2C} = \frac{{q_0}^2}{2 \times 2C}$

$i = \frac{q_0}{\sqrt{6\,LC}}$

(38) Answer : (A)

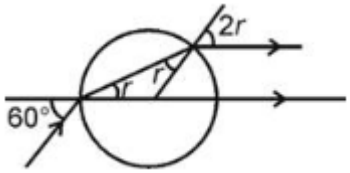
Hint:

$\mu_1 \sin i = \mu_2 \sin r$

Solution:

At $\mu = \mu_{min}$

Emergent ray must parallel to *x*-axis



$1 \sin 60° = \mu . \sin r$

$\mu \sin r = 1 . \sin 2r$

$\sin 2r = \sin 60°$

$r = 30°$

$\mu = \sqrt{3}$

Section-II

(39) Answer : (A,B,C)

Hint:

$\frac{Ldi}{dt} + \frac{q}{C} = V$

Solution:

$\frac{Ldi}{dt} + \frac{q}{C} = V$

$\frac{Ld^2i}{dt^2} = \frac{-i}{C}$

$i = i_0 \sin(\omega t)$ $\omega = \frac{1}{\sqrt{LC}}$

$q = \frac{i_0}{\omega}(1 - \cos \omega t)$

$q_{max} \Rightarrow V q_{max} = \frac{q_{max}^2}{2C}$

$q_{max} = 2CV$

$i_0 = q_0 \omega$

$i_0 = 2CV . \frac{1}{\sqrt{LC}} = 2V\sqrt{\frac{C}{L}}$

(40) Answer : (A,C)

Hint:

$\theta_C = 30°$

Solution:

$\theta_C = 30°$

$\sin 30° = \frac{\mu_1}{\mu_2}$

$\frac{\mu_1}{\mu_2} = \frac{1}{2}$

$\delta_{max} = 180 - 2\theta_C$

$= 120°$

(41) Answer : (A,C)

Hint:

$\frac{I}{C} = \frac{1}{2}\varepsilon_0 E_0^2$

Solution:

$\frac{I}{C} = \frac{1}{2}\varepsilon_0 E_0^2$

$\frac{1 \times 10^3 \times 2}{6\pi \times 3 \times 10^8 \varepsilon_0} = E_0^2$

$\frac{4\pi \times 10^3 \times 2 \times 9 \times 10^9}{6\pi \times 3 \times 10^8} = E_0^2$

$4 \times 10^4 = E_0^2$

E_0 = 200 N/C

$\frac{E_0}{B_0} = C$

$B_0 = \frac{200}{3 \times 10^8} = \frac{2}{3} \times 10^{-6}$

Section-III

(42) **Answer :** 16

Hint:

ε = *Bvl*

Solution:

ε = *Bvl*

$i = \frac{BVl}{R}$

$F = Bil = \frac{B^2 l^2 v}{R}$

$-\frac{mdV}{dt} = \frac{B^2 l^2 v}{R}$

$\frac{mdv}{dt} \cdot \frac{ds}{dt} = \frac{-B^2 l^2 v}{R}$

$S = \frac{Rmv_0}{B^2 l^2} = 8$

(43) **Answer :** 6

Hint:

$\varphi_S = Mi_P$

Solution:

$\varphi_S = Mi_P$

$\varepsilon_5 = \frac{d\phi_s}{dt} = i_s R$

$\int \frac{d\phi_s}{R} = \int i_s dt$

$\frac{\Delta\phi_s}{R} = Q$

$\frac{4 \times 3}{2} = Q$

Q = 6 C

(44) **Answer :** 0

Hint:

τ → ∞

Solution:

$X_C = \frac{1}{100 \times 200 \times 10^{-6}} = 50\Omega$

x_L = 0.5 × 100 = 50 Ω

z = ∞

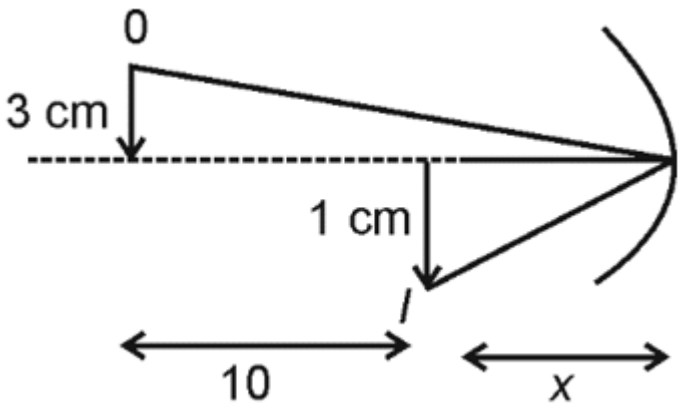
i = 0

(45) **Answer :** 15

Hint:

$\frac{1}{v} + \frac{1}{v} = \frac{1}{f}$

Solution:



$\frac{x}{1} = \frac{x+10}{3} \Rightarrow x = 5$

$\frac{1}{f} = \frac{1}{-5} + \frac{1}{-15} = \frac{-4}{15}$

$f = \frac{15}{4}$

(46) Answer : 10

Hint:

Total energy $E = \frac{1}{2}mv^2 + \frac{1}{2}kx^2 + \frac{q^2}{2C}$

Solution:

Total energy E = $\frac{1}{2}mv^2 + \frac{1}{2}kx^2 + \frac{q^2}{2C}$

$BvI = \frac{q}{C}$

$\frac{dv}{dt} = -\left(\frac{k}{m + B^2l^2C}\right)x$

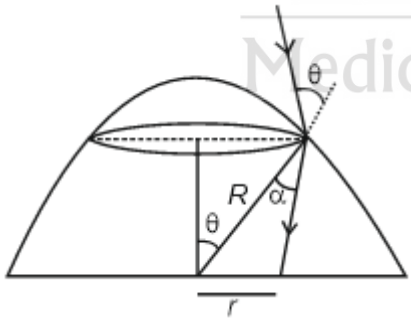
$\tau = 2\pi\sqrt{\frac{m + B^2l^2C}{k}} = \frac{\pi}{10}$

(47) Answer : 52

Hint:

$\mu_1 \sin i = \mu_2 \sin r$

Solution:



$\sin\theta \Rightarrow \theta = 37°$

$\sin\theta = \frac{3}{2}\sin\alpha \quad \sin\alpha = \frac{2}{5}$

$\frac{R}{\sin(180 - 53 - \alpha)} = \frac{r}{\sin\alpha}$

$r = \frac{2}{5}\frac{R}{\sin(104^\circ)}$

$r = \frac{2}{\sin(104^\circ)}$

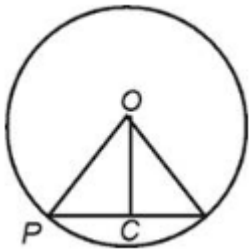
Section-IV

(48) Answer : 00.75

Hint:

$\varepsilon = \frac{d\phi}{dt}$

Solution:



Consider triangle *PCO*.

$\varepsilon = \frac{d\phi}{dt} = \frac{1}{2} . OC . PC . \frac{dB}{dt}$

$= \frac{1}{2} . \frac{\sqrt{3}}{2} R . \frac{R}{2} . 2$

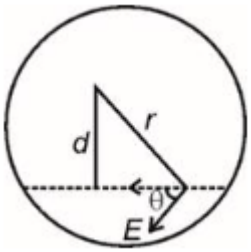
$= \frac{\sqrt{3}}{4} R^2$

(49) **Answer :** 06.00

Hint:

ε = $\frac{d\phi}{dt}$

Solution:



$E = \frac{r}{2} \frac{dB}{dt} = r$

$a = \frac{qE\cos\theta}{m}$

$a = \frac{q.(r)\left(\frac{d}{r}\right)}{m}$

$a = \frac{qd}{m}$

$\frac{1}{2} . \frac{qd}{m} t^2 = R$

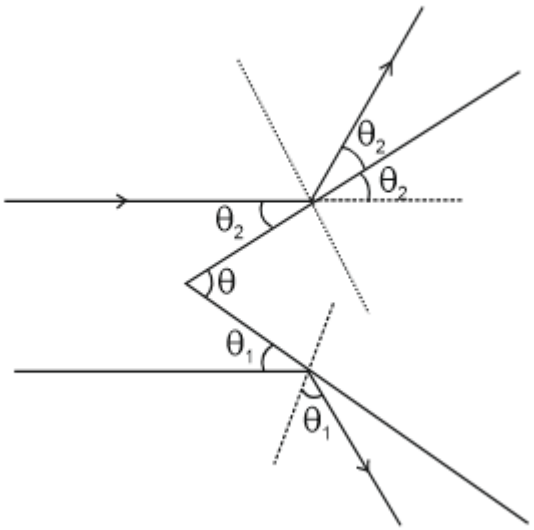
$t = \sqrt{\frac{2m}{\sqrt{3}q}}$

(50) **Answer :** 90.00

Hint:

δ = *i* + ρ – *A*

Solution:



$\delta_1 = \left(\frac{\theta}{2}\right) \times 2$

So $\varphi = 2\delta_1 = 2\theta = 90°$

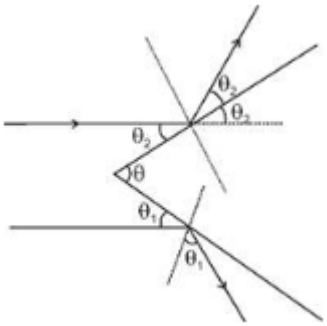
And $i = 90 - 22.5 = 67.5°$

(51) **Answer :** 67.50

Hint:

$\delta = i + \rho - A$

Solution:



$\delta_1 = (\theta 2) \times 2$

So $\varphi = 2\delta_1 = 2\theta = 90°$

And $i = 90 - 22.5 = 67.5°$