10/05/2026

Code-A_ONLINE

Aakash
Medical | IIT-JEE | Foundations

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MM : 180

AIATS For One Year JEE(Advanced)-2026 (XII Studying/XII Passed)-Test-8A_Paper-1_Online

Time : 180 Min.

CHEMISTRY

Section-I

1. (A)

2. (A)

3. (D)

4. (B)

Section-II

5. (B,C)

6. (A,D)

7. (B)

Section-III

8. (16.00)

9. (02.32)

10. (00.50)

11. (05.00)

12. (14.00)

13. (41.50)

Section-IV

14. (A)

15. (A)

16. (A)

MATHEMATICS

Section-I

17. (B)

18. (D)

19. (A)

20. (A)

Section-II

21. (A,C,D)

22. (A,C)

23. (A,B,C,D)

Section-III

24. (37.00)

25. (25.00)

26. (595.00)

27. (24.00)

28. (03.00)

29. (3030.00)

Section-IV

30. (D)

31. (B)

32. (B)

PHYSICS

Section-I

33. (C)

34. (A)

35. (D)

36. (B)

Section-II

37. (B,D)

38. (B,D)

39. (A,C)

Section-III

40. (03.00)

41. (48.90,49.20)

42. (06.28)

43. (04.00)

44. (08.00)

45. (07.00)

Section-IV

46. (C)

47. (B)

48. (C)

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Hints and Solutions

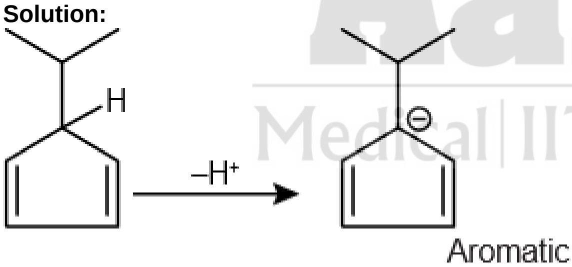
CHEMISTRY

Section-I

(1) **Answer :** (A)
Hint:
$N_2O \xrightarrow{500^\circ C\text{–}900^\circ C} 2N_2 + O_2$
Solution:
(A) $N_2O \xrightarrow{500^\circ C\text{–}900^\circ C} 2N_2 + O_2$
(B) $2NO \xrightarrow{800^\circ C} N_2 + O_2$
(C) $N_2O_3 \xrightarrow{R.T.} NO_2 + NO$
(D) $2NO_2 \xrightarrow{620^\circ C} 2NO + O_2$

(2) **Answer :** (A)
Hint:
Stronger is the ligand greater the value of Δ_o.
Solution:
Stronger is the ligand greater the value of Δ_o.

(3) **Answer :** (D)
Hint:
$KMnO_4$ is a strong oxidising agent.
Solution:
$8\,MnO_4^- + 3\,S_2O_3^{2-} + H_2O \rightarrow 8\,MnO_2 + 6\,SO_4^{2-} + 2\overline{O}H$

(4) **Answer :** (B)
Hint:
Carbanion is aromatic.
Solution:


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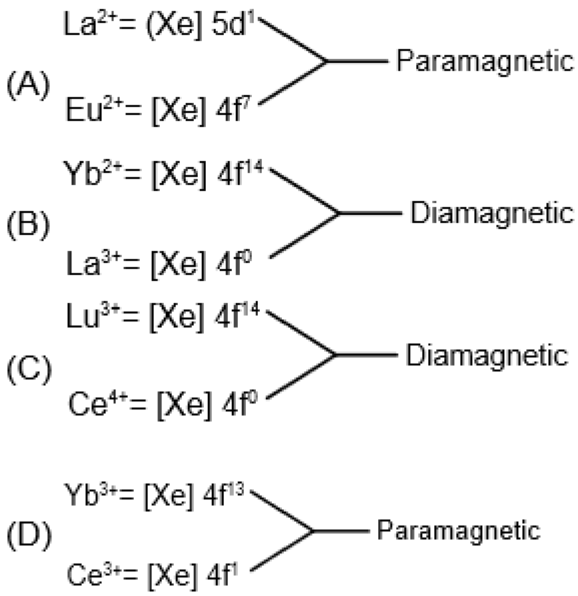
Section-II

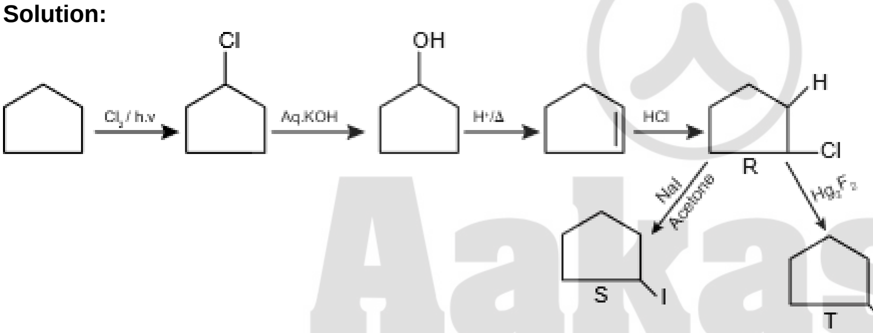
(5) **Answer :** (B,C)
Hint:
BO = $\frac{N_b - N_a}{2}$
Solution:
(A) → BO = $\frac{N_b - N_a}{2} = \frac{4-4}{2} = 0$
(B) → $F_2 \Rightarrow \sigma 1s^2, \sigma^* 1s^2\ \sigma 2s^2\ \sigma^* 2s^2\ \sigma 2p_x^2\ \pi 2p_x^2 = \pi 2p_y^2$
$\pi^* 2p_x = \pi^* 2p_y\ \sigma^* 2p_x$
LUMO of F_2 is σ-type
(C) → B.O. of N_2^+ = 2.5, B.O. of N_2 = 3
B.E α B.O
(D) → B.O. of O_2^+ = 2.5, B.O of O_2 is = 2
$B.\ O. \propto \frac{1}{\text{Bond length}}$

(6) **Answer :** (A,D)
Hint:

Unpaired e^- ⇒ paramagnetism
Solution:



(7) **Answer :** (B)
Hint:
Acid strength HI > HCl > HF
Solution:



A. Bond length: C–F < C–Cl < C–I
T < R < S
B. Bond enthalpy: T > R > S
C. Reactivity towards S_N1= C–I > (C–Br) > C–Cl
D. pK_a of conjugate Acid = HF > HCl > HI

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Section-III

(8) **Answer :** 16.00
Hint:
$MnO_4^- + H^+ \rightarrow Mn^{2+}$
$Mn^{+7} + 5e^- \rightarrow Mn^{+2}$
Solution:
$MnO_4^- + H^+ \rightarrow Mn^{2+}$
$Mn^{+7} + 5e^- \rightarrow Mn^{+2}$
Q = I × t
1 × 5 × 96500 = 500 t
t = 965 sec
= 16.08 minutes
= 16 minutes

(9) **Answer :** 02.32
Hint:
$\sqrt{K_1c_1 + K_2c_2}$
Solution:
[HX] = $\frac{1}{2} \times 1$ = 0.5 mol L^{-1}
[HY] = $\frac{1}{2} \times 1$ = 0.5 mol L^{-1}

$[H^+] = \sqrt{k_1 c_1 + k_2 c_2}$
$[H^+] = \sqrt{3 \times 10^{-5} \times 0.5 + 1.5 \times 10^{-5} \times 0.5}$
$[H^+] = \sqrt{2.25 \times 10^{-5}}$
$(H^+) = 4.74 \times 10^{-3}$ M
pH = –log [4.74×10^{-3}]
= 3 – log 4.74
= 3 – 0.676
= 02.32

(10) **Answer :** 00.50
Hint:
van der Waal equation.
$\left(P + \frac{an^2}{v^2}\right)(V - nb)$ = nRT
Solution:
van der Waals equation.
$\left(P + \frac{an^2}{v^2}\right)(V - nb)$ = nRT
volume of gas is negligible V – nb ≈ V
$\left(P + \frac{an^2}{v^2}\right).V = nRT$
PV + $\frac{an^2}{V}$ = nRT
0.1V + $\frac{1000 \times (.03)^2}{V}$ = 0.03 × 20
0.1V + $\frac{0.9}{V} = 0.6$
$0.1V^2$ – 0.6v + 0.9 = 0
V^2 – 6V + 9 = 0
$(V – 3)^2$ = 0
V = 3
Z = $\frac{PV}{nRT}$ = $\frac{0.1 \times 3}{0.03 \times 20}$ = 0.5

(11) **Answer :** 05.00
Hint:
Work done = $-P_{ext}.\Delta V$
Solution:
Total moles of H_2 & Cl_2 produced = 1 mole + 1 mole = 2 mole
Volume of gas = $\frac{2 \times R \times 300}{P}$
= $\frac{600\,R}{P}$
Work done = $-P_{ext}.\Delta v$
= –P. $\left[\frac{600\,R}{P} - 0\right]$
= 600 R
= 600 × 8.3
= –49805
= –4.98 kJ

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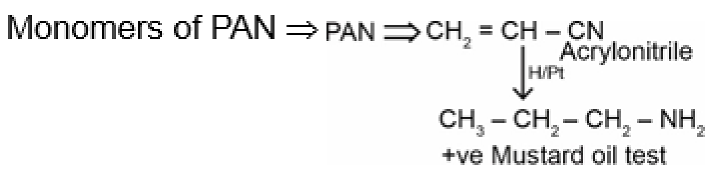
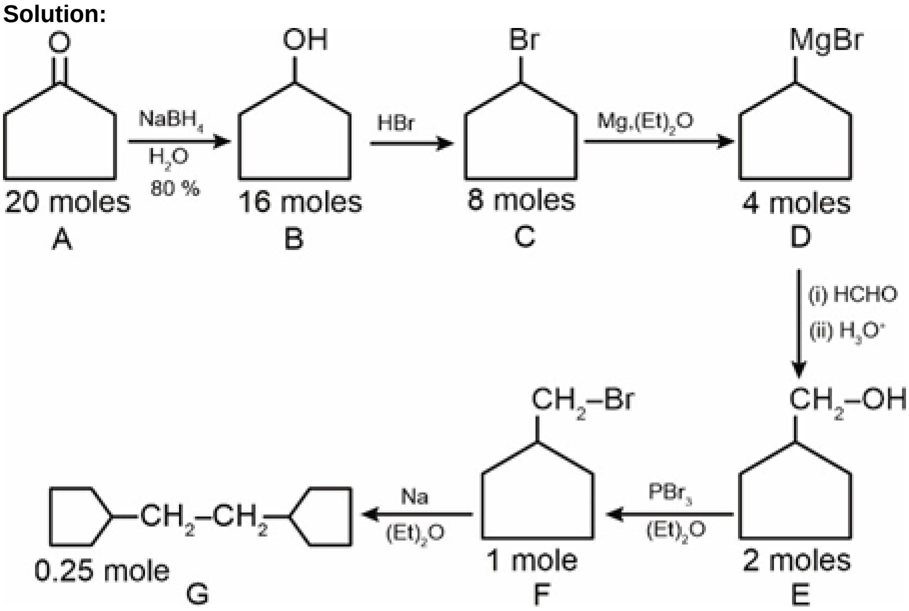
(12) **Answer :** 14.00
Hint:
Monomer is acrylonitrile.
Solution:



$$\begin{matrix} CH_3 - CH_2 - CH_2 - NH_2 & \rightarrow & N_2 \\ 1 \text{ mole} & & 0.5 \text{ moles} \end{matrix}$$
Mass of N_2 = 0.5 × 28 = 14 g

(13) **Answer :** 41.50

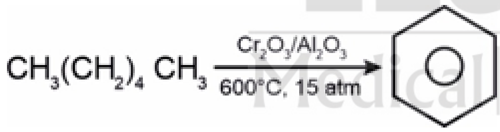
Hint:
$NaBH_4$ reduces ketone to 2° alcohol.
Solution:



Section-IV

(14) **Answer :** (A)
Hint:
$Al(OH)_3$ → white
CdS → yellow
Solution:
$Al(OH)_3$ → white
CdS → yellow
$[Fe(H_2O)_5NO]SO_4$ → Brown
CuS → Black
$Cr(OH)_3$ → Green

(15) **Answer :** (A)
Hint:



Solution:

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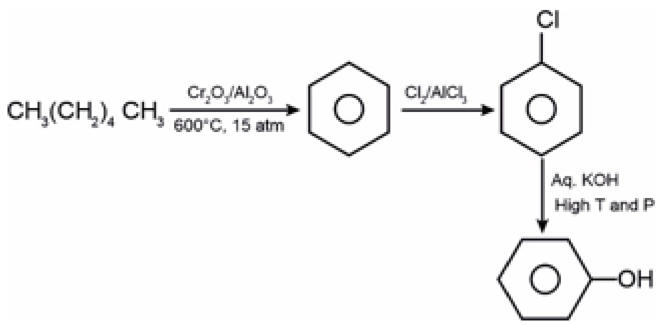
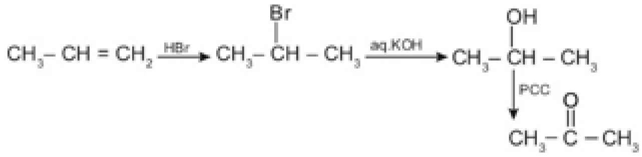
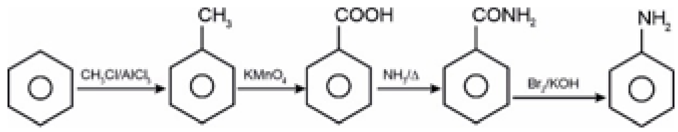
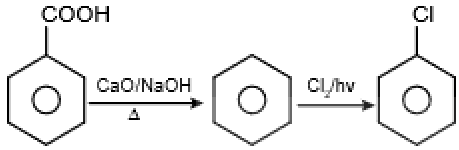
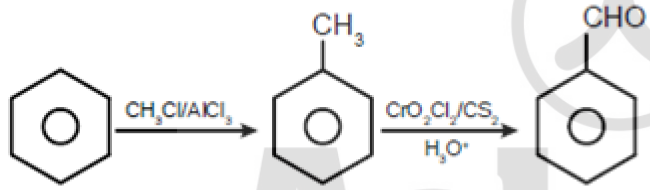
(1) 

(2) 

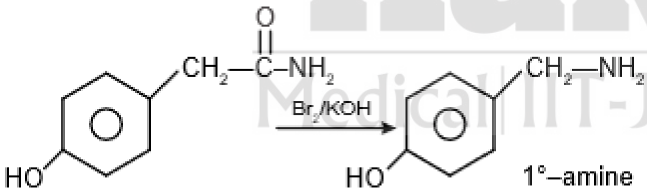
(3) 

(4) 

(5) 

(16) Answer : (A)

Hint:



Solution:

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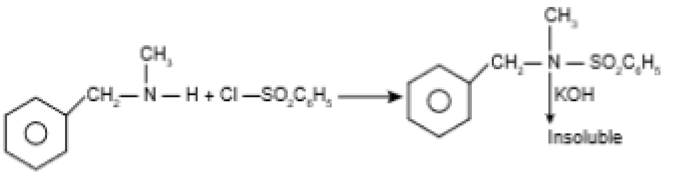
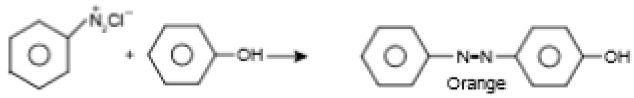
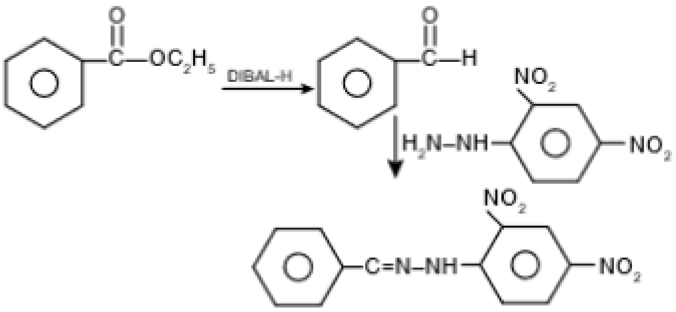
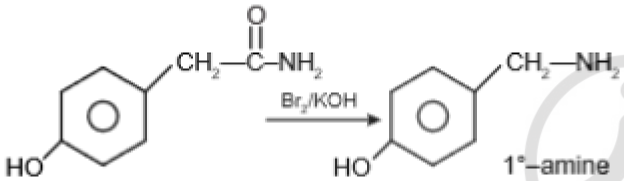
(1) 

(2) 

(3) 

(4) 

MATHEMATICS

Section-I

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(17) **Answer :** (B)

Hint:

Replacement property

Solution:

$g(x) = \frac{3e^{4x}}{e^{4x}+e^2}$ …(1)

$g(1–x) = \frac{3e^{4(1-x)}}{e^{4(1-x)}+e^2}$

$g(1–x) = \frac{3e^4 \cdot e^{-4x}}{e^4e^{-4x}+e^2} = \frac{3e^4}{e^4+e^{2+4x}}$

$= \frac{3e^2}{e^2+e^{4x}}$ …(2)

Adding (1) and (2)

$g(x) + g(1–x) = \frac{3e^{4x}}{e^{4x}+e^2} + \frac{3e^2}{e^2+e^{4x}}$

$= \frac{3(e^{4x}+e^2)}{(e^{4x}+e^2)} = 3$

$\therefore g(x) + g(1–x) = 3$

$\therefore g\left(\frac{1}{50}\right) + g\left(\frac{49}{50}\right) = 3$

$g\left(\frac{2}{50}\right) + g\left(\frac{48}{50}\right) = 3$

Remaining term will be $g\left(\frac{25}{50}\right) = g\left(\frac{1}{2}\right) = \frac{3}{2}$

$\therefore$ Sum = 24(3) + $\frac{3}{2}$

= 72 + $\frac{3}{2}$

$\Rightarrow \frac{147}{2}$

(18) Answer : (D)

Hint:

$\lim_{x\to0^+} g(x) = g(0)$

Solution:

For continuity at '0'

$\lim_{x\to0^+} g(x) = g(0)$

$\lim_{x\to0^+} \frac{x\ln(1+\tan^2 x)}{\beta\tan^2 x}\cdot\frac{\tan^2 x}{\sin^3 x} = -\alpha$

$\lim_{x\to0^+} \frac{x\cdot x^2}{\beta\cdot x^3}\left(\frac{\tan x}{x}\right)^2\cdot\left(\frac{x}{\sin x}\right)^3 = -\alpha$

$\Rightarrow -\alpha = \frac{1}{\beta}$

$\Rightarrow \alpha\beta = -1$

$\Rightarrow -\alpha\beta = 1$

$\Rightarrow 7 - \alpha\beta = 8$

(19) Answer : (A)

Hint:

$\Rightarrow P\left(\frac{R}{Box\ 1}\right) \times P\left(\frac{R}{Box\ 2}\right) + P\left(\frac{G}{Box\ 1}\right) \times P\left(\frac{R}{Box\ 2}\right) = \frac{59}{90}$

Solution:

Box 1 = {5 R, 4 G}

Box 2 = {n R, 3 G}

$P(R) = \frac{59}{90}$

$\Rightarrow P\left(\frac{R}{Box\ 1}\right) \times P\left(\frac{R}{Box\ 2}\right) + P\left(\frac{G}{Box\ 1}\right) \times P\left(\frac{R}{Box\ 2}\right) = \frac{59}{90}$

$\Rightarrow \frac{5}{9}\left(\frac{n+1}{n+4}\right) + \frac{4}{9}\left(\frac{n}{n+4}\right) = \frac{59}{90}$

$\Rightarrow n = 6$

(20) Answer : (A)

Hint:

By using the properties of product of matrices and using the given information we can get the required answer as

$AB = BA^3 \Rightarrow B = A^{-1}BA^3$

Solution:

$AB = BA^3$ ...(1) (Given)

$\Rightarrow B = A^{-1}BA^3$

$B^2 = I$ ...(2) (Given)

$\Rightarrow (A^{-1}BA^3)(A^{-1}BA^3) = I$

$\Rightarrow A^{-1}BA^2BA^3 = I$ ...(3)

$\Rightarrow A^{-1}BA\ AB\ A^3 = I$

$\Rightarrow A^{-1}BA\ BA^3.A^3 = I$

$\Rightarrow A^{-1}\ BA\ BA^6 = I$

$\Rightarrow A^{-1}.B\ BA^3\ A^6 = I$

$\Rightarrow A^{-1}.B^2.A^9 = I$

$\Rightarrow A^{-1}.(I).A^9 = I$

$\Rightarrow A^8 = I$

Section-II

(21) Answer : (A,C,D)

Hint:

$\frac{a}{4-0} = \frac{b}{1+1} = \frac{c}{-2+2}$

Solution:

Since the point $A(4, 1, -2)$ is the mirror image of the point $B(0, -1, -2)$ with respect to plane

$ax + by + cz = d$

$\Rightarrow \frac{a}{4-0} = \frac{b}{1+1} = \frac{c}{-2+2}$

$\Rightarrow \frac{4}{4} = \frac{b}{2} = \frac{c}{0}$

$\Rightarrow c = 0, a = 2b$ …(1)

∴ Also Mid point of AB *i.e.* (2, 0, –2) lie on $ax + by + cz = d$

$2a - 2c = d$ …(2)

Also given $a + c = 2$
$\Rightarrow a = 2, b = 1, d = 4$

(22) **Answer :** (A,C)
Hint:
$\sqrt{(x-2)^2+(y-4)^2} = 3\sqrt{x^2+(y-6)^2}$
Solution:
$w_1 = 2 + 4i$
$w_2 = 0 + 6i$
$\therefore \sqrt{(x-2)^2+(y-4)^2} = 3\sqrt{x^2+(y-6)^2}$
Squaring both sides
$[(x-2)^2 + (y-4)^2 = 9(x^2 + (y-6)^2]$
$\Rightarrow x^2 - 4x + 4 + y^2 - 8y + 16 = 9x^2 + 9y^2 - 108y + 324$
$\Rightarrow -8x^2 - 8y^2 - 4x + 100y - 304 = 0$
$\Rightarrow x^2 + y^2 + \frac{x}{2} - \frac{25}{2}y + 38 = 0$
$\Rightarrow \left(x+\frac{1}{4}\right)^2+\left(y-\frac{25}{4}\right)=\frac{18}{16}=\frac{9}{8}$
$\therefore$ Center : $\left(\frac{-1}{4},\frac{25}{4}\right)$
Radius $\Rightarrow \sqrt{\frac{9}{8}} = \frac{3}{2\sqrt{2}} \Rightarrow \frac{3\sqrt{2}}{4}$

(23) **Answer :** (A,B,C,D)
Hint:
Differentiating both sides w.r.t. x

$xg(x) + \int_0^x g(t)dt + (1-x)g(x) = 4x^3 + 2x$

Solution:

$\int_0^x (x-t+1)\ g(t)dt = x^4 + x^2$

Differentiating both sides w.r.t. x

$xg(x) + \int_0^x g(t)dt + (1-x)g(x) = 4x^3 + 2x$

Again differentiating w.r.t 'x'
$g'(x) + g(x) = 12x^2 + 2$

Now $\int_0^1 \frac{108}{g'(x)+g(x)+34}dx = \int_0^1 \frac{108dx}{12x^2+36}$

$= \int_0^1 \frac{9dx}{x^2+3}$

$\Rightarrow \frac{9}{\sqrt{3}}\left(\tan^{-1}\frac{x}{\sqrt{3}}\right)_0^1$
$\Rightarrow 3\sqrt{3}\tan^{-1}\frac{1}{\sqrt{3}}$
$\Rightarrow 3\sqrt{3}\left(\frac{\pi}{6}\right)$
$\Rightarrow \frac{\sqrt{3}\pi}{2}$
$\therefore b = 2, a = 3$

Section-III

(24) **Answer :** 37.00
Hint:
Projection of $\vec{x}$ on $\vec{y}$ is $\frac{\vec{x}\cdot\vec{y}}{|\vec{y}|}$

Solution:

$\frac{\vec{a}\cdot\vec{c}}{|\vec{c}|}=\frac{10}{3}$

$\Rightarrow \frac{\alpha+6+2}{\sqrt{1+4+4}}=\frac{10}{3}$

$\Rightarrow \alpha=2$

$\vec{b}\times\vec{c}=\begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ 3 & -\beta & 4\\ 1 & 2 & -2\end{vmatrix}=-6\hat{i}+10\hat{j}+7\hat{k}$

$\Rightarrow \beta=1$

$\therefore \alpha^5+5\beta=(2)^5+5(1)\ =32+5\ =37$

(25) Answer : 25.00

Hint:

$\lim_{x\to 0}\frac{\ln(1+\sin^2 x)}{\sin^2 x}=1$

Solution:

$\lim_{x\to 0}\frac{x\int_0^x g(t)dt}{\ln(1+\sin^2 x)}=\alpha$

$\lim_{x\to 0}\frac{x\int_0^x g(t)dt}{\ln\frac{(1+\sin^2 x)}{\sin^2 x}.\sin^2 x}=\alpha$

$\lim_{x\to 0}\frac{x\int_0^x g(t)dt}{\sin^2 x}=\alpha \qquad \left(\because \lim_{x\to 0}\frac{\ln(1+\sin^2 x)}{\sin^2 x}=1\right)$

$\Rightarrow \lim_{x\to 0}\frac{x\int_0^x g(t)dt}{\frac{\sin^2 x}{x^2}x^2}=\alpha$

$\Rightarrow \lim_{x\to 0}\frac{\int_0^x g(t)dt}{x}=\alpha$

Applying L'Hospital Rule

$g(x)=\alpha$

$g(0)=\alpha$

$\frac{1}{5}=\alpha$

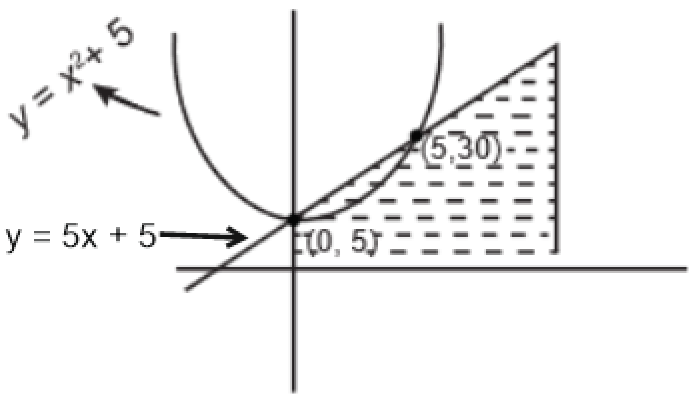
$\therefore 125\alpha=25$

(26) Answer : 595.00

Hint:

$A=\int_0^5(x^2+5)dx+\int_5^6(5x+5)dx$

Solution:



$\therefore A = \int_0^5 (x^2+5)dx + \int_5^6 (5x+5)dx$

$A = \left(\frac{x^3}{3}+5x\right)_0^5 + 5\left(\frac{x^2}{2}+x\right)_5^6$

$A = \frac{125}{3}+25+5\left[(18+6)-\left(\frac{25}{2}+5\right)\right]$

$A = \frac{595}{6}$

$\therefore 6A = 595$

(27) **Answer :** 24.00

Hint:

$\cos^2\theta = \frac{1+\cos 2\theta}{2}$

Solution:

$16\cos^2\theta - 2\cos^2 2\theta = 14$

$\Rightarrow 16\left(\frac{1+\cos 2\theta}{2}\right) - 2\cos^2 2\theta = 14$

$\Rightarrow 8 + 8\cos 2\theta - 2\cos^2 2\theta = 14$

$\Rightarrow 2\cos^2 2\theta - 8\cos 2\theta + 6 = 0$

$\Rightarrow \cos^2 2\theta - 4\cos 2\theta + 3 = 0$

$\Rightarrow (\cos 2\theta - 1)(\cos 2\theta - 3) = 0$

$\Rightarrow \cos 2\theta = 1, \cos 2\theta = 3$

↓ Rejected

$\therefore$ sum of root = 6 $(\cos 2\theta + \sec 2\theta)$

= 6

As $\cos 2\theta = 1$

$\theta = \pi, 2\pi$ (two equations will be formed)

$\therefore$ sum of roots of equations = 12 + 12 = 24

(28) **Answer :** 03.00

Hint:

Let $\cot y = t$

Solution:

$\text{cosec } y \frac{dy}{dx} + 2x\cos y = x^3 \sin y$

$\Rightarrow \text{cosec}^2 y \frac{dy}{dx} + 2x\cot y = x^3$ ... (1)

Let $\cot y = t$

$-\text{cosec}^2 y \frac{dy}{dx} = \frac{dt}{dx}$

$\therefore$ from (1)

$-\frac{dt}{dx} + 2xt = x^3$

$\Rightarrow \frac{dt}{dx} - 2xt = -x^3$

I. F. $= e^{-\int 2x dx}$

$= e^{-x^2}$

$t \cdot e^{-x^2} = \int e^{-x^2}(-x^3)\, dx$

Put $-x^2 = z$

$-2x\frac{dx}{dz} = \frac{dz}{dx}$

$t \cdot e^z = -\frac{1}{2}\int e^z z\, dz$

$t \cdot e^z = -\frac{1}{2}\left[ze^z - e^z\right] + c$

$\Rightarrow \cot y\, e^{-x^2} = -\frac{1}{2}\left[-x^2 e^{-x^2} - e^{-x^2}\right] + c$ ... (2)

As $y(1) = \frac{\pi}{4}$

$\Rightarrow e^{-1} = \frac{-1}{2}\left[-e^{-1} - e^{-1}\right] + c$

$\Rightarrow e^{-1} = e^{-1} + c$

$\Rightarrow c = 0$

$\therefore$ Put $x = 0$ in (2)

$\cot y = \frac{-1}{2}[-1] + 0$

$\cot y = \frac{1}{2}$

$\therefore y = \cot^{-1}\left(\frac{1}{2}\right)$
$\therefore m + n = 3$

(29) **Answer :** 3030.00
Hint:
$S_{2020} = \frac{2020}{n}\left[x_1 + x_{2020}\right]$
Solution:
$x_1 + x_4 + x_7 + x_{10} + \ldots + x_{2017} + x_{2020} = 1011$
in an A.P. sum of terms equidistant form ends is equal
$\therefore \underbrace{x_1 + x_{2020} = x_4 + x_{2017} = x_7 + x_{2014}}_{337 pairs}$
$\Rightarrow 337(x_1 + x_{2020}) = 1011$
$\Rightarrow x_1 + x_{2020} = 3$
Hence, $S_{2020} = \frac{2020}{2}[x_1 + x_{2020}]$
$= 1010\ (3)$
$= 3030$

Section-IV

(30) **Answer :** (D)
Hint:
$\left[\vec{p}\ \vec{q}\ \vec{r}\right] = \left[\vec{q}\ \vec{p}\ \vec{r}\right] = \left[\vec{r}\ \vec{q}\ \vec{p}\right]$
Solution:
$\vec{p} + \vec{q} + \vec{r} = \vec{0}$
$\vec{p} + \vec{q} = -\vec{r}$
$\left|\vec{p} + \vec{q}\right| = \left|-\vec{r}\right|$
$\left|\vec{p} + \vec{q}\right|^2 = \left|\vec{r}\right|^2$
$\left|\vec{p} + \vec{q}\right|^2 = 1\ \left[\vec{p}, \vec{q}, \vec{q} \text{ are unit vectors}\right]$
$\left|\vec{p}\right|^2 + \left|\vec{q}\right|^2 + 2\vec{p}\cdot\vec{q} = 1$
$\Rightarrow 2 + 2\vec{p}.\vec{q} = 1$
$\Rightarrow \vec{p}.\vec{q} = \frac{-1}{2}$
$\Rightarrow \left|\vec{p}\right|\left|\vec{q}\right|\cos\theta = \frac{-1}{2}$
$\Rightarrow \sin\theta = \sqrt{1 - 1/4} = \frac{\sqrt{3}}{2}$
$\Rightarrow 4\sin^2\theta = 3$
$\left[\vec{p}\times\vec{q}\quad \vec{q}\times\vec{r}\quad \vec{r}\times\vec{p}\right] = \left[\vec{p}\quad \vec{q}\quad \vec{r}\right]^2$
$= (5)^2 = 25$
$\left[\vec{p}-\vec{q}\quad \vec{q}-\vec{r}\quad \vec{r}-\vec{p}\right] = 0$
$\left[\vec{p}+\vec{q}\quad \vec{q}+\vec{r}\quad \vec{r}+\vec{p}\right] = 2[\vec{p}\ \vec{q}\ \vec{r}]$

(31) **Answer :** (B)
Hint:
Variance $(\sigma^2) = \frac{\sum f_i {x_i}^2}{\sum f_i} - (\bar{x})^2$
Solution:

Value (x_i)	f_i	cf	$f_i x_i$
4	5	5	20
5	a	$5 + a$	20
6	1	$6 + a$	6
8	b	$6 + a + b$	24

9	2	8 + *a* + *b*	18
11	3	11 + *a* + *b*	33
12	1	12 + *a* + *b*	12
	12+ *a* + *b*		$\sum f_i x_i = 133$

Given
12 + *a* + *b* = 19 Median = 6
a + *b* = 7
⇒ 6 + a = 10 ⇒ *a* = 4, *b* = 3
Also
6*a* + 8*b* = 24 + 24 = 48

Median = $\left(\frac{N+1}{2}\right)^{th}$ term = $\left(\frac{19+1}{2}\right)^{th}$ term = 10^{th} term

Mean $(\bar{x})$ = $\frac{\sum f_i x_i}{\sum f_i}$ = $\frac{133}{9}$ = 7

Mean deviation about mean (α) = $\sum f_i \frac{|x_i - \bar{x}|}{\sum f_i}$

= $\frac{5(3)+4(2)+(1)(1)+3(1)+(2)(2)+3(4)+1(5)}{19}$

$\alpha = \frac{48}{19}$
⇒ 38α = 96
similarly:
Mean deviation about Median
(β) = $\sum f_i \frac{|x_i - M|}{\sum f_i}$

β = $\frac{47}{19}$
⇒ 57β = 141

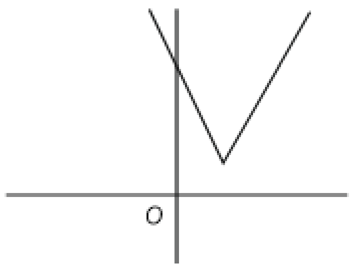
Variance (σ^2) = $\frac{\sum f_i {x_i}^2}{\sum f_i} - (\bar{x})^2$

= $\frac{(5)(16)+(4)(25)+36+(3)(64)+2(81)+3(121)+144}{19} - (7)^2$

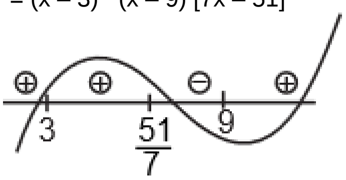
= $\frac{146}{19}$

(32) **Answer :** (B)
Solution:
(P) $f(x) = |x-1| + |7x-20|$

$$f\left(x\right) = \begin{cases} -8x+21, & x < 1 \\ -6x+19, & 1 \le x < \frac{20}{7} \\ 8x-21, & x \ge \frac{20}{7} \end{cases}$$

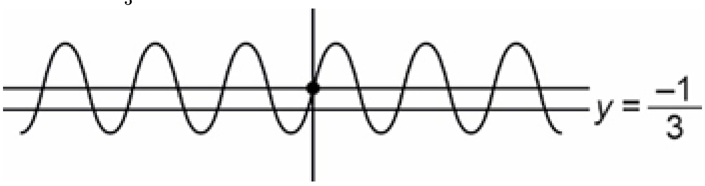


f(*x*) has one point of minima
(Q) *f*(*x*) = $(x-3)^5 (x-9)^2$
$f'(x) = (x-3)^4 (x-9)[5x - 45 + 2x - 6]$
$= (x-3)^4 (x-9)\ [7x - 51]$

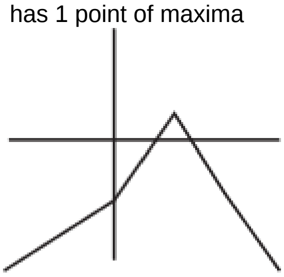


∴ $f(x) = (x-3)^5(x-9)^2$ has one point of maxima and one point of minima

(R) $f(x) = 3\cos x - x$
$f'(x) = -3\sin x - 1$
$\Rightarrow \sin x = \frac{-1}{3}$



Has infinite point of minima
(S) $f(x) = |x| - |5x - 3|$
has 1 point of maxima



PHYSICS

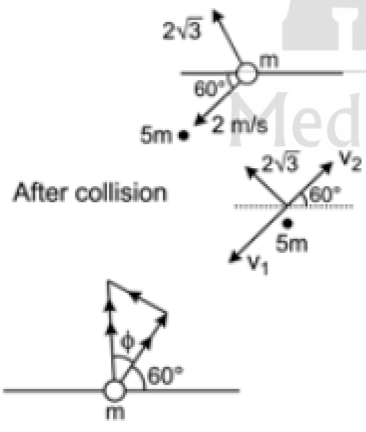
Section-I

(33) Answer : (C)
Solution:

$$\frac{3}{4}\mathrm{MR}^2 w^2 + \frac{1}{2}m(2\,\mathrm{wR})^2 + \frac{1}{2}K(\mathrm{R}\theta)^2 + \frac{K}{2}(2\mathrm{R}\theta)^2 = E$$

$$\frac{\mathrm{dE}}{\mathrm{dt}} = 0 \Rightarrow \left(\frac{3}{2}M + 4m\right)R^2\alpha + 5\,\mathrm{KR}^2\,\theta = 0$$

(34) Answer : (A)
Solution:



Along the line of impact:
$2m = 5mv_1 - mv_2$
$e(2) = v_1 + v_2$
$v_1 = 1/2,\ v_2 = 1/2$
$\tan\phi = \frac{2\sqrt{3}}{1/2} = 4\sqrt{3}$
Deviation $= 120^\circ - \tan^{-1}(4\sqrt{3})$

(35) Answer : (D)
Solution:

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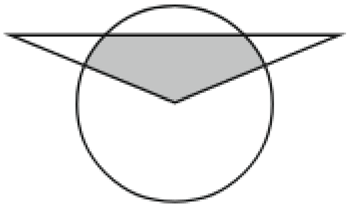


$\varepsilon = A\frac{dB}{dt} = A\alpha$

$A = \left(\frac{\pi R^2}{3}\right) - \left(\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right)R^2$

$A = \left(\frac{\pi}{6} + \frac{\sqrt{3}}{4}\right)R^2$

$\varepsilon = \left(\frac{\pi}{6} + \frac{\sqrt{3}}{4}\right)\alpha R^2$

(36) Answer : (B)
Solution:
+ve zero error = 6 division.
Least count = $\frac{0.5\ \text{mm}}{50} = 0.01\ \text{mm}$
Thickness of glass sheet = $5 + (0.01)35 - 0.01 \times 6$
$5 + 0.01(29)$
= $5.29\ \text{mm}$

Section-II

(37) Answer : (B,D)
Solution:
$E \times 2\pi r = \frac{B\pi R^2}{\Delta t} \rightarrow$
$\tau = qEr$
$\tau\Delta t = \Delta L = I\omega = qEr\Delta t$
$\Rightarrow \left(mr^2\right)\omega = \lambda\left(2\pi r\right)\left(\frac{BR^2}{2r\Delta t}\right)r\Delta t$
$\omega = \left(\frac{\lambda\pi BR^2}{mr}\right)$

(38) Answer : (B,D)
Solution:
$V_{rms} = \frac{50}{\sqrt{2}} = 20\sqrt{2}V$
Current $I_{rms} = 25A$
Reading of Voltmeter = $25V$

(39) Answer : (A,C)
Solution:
$f_0 = \frac{\sqrt{T}}{2L\sqrt{\mu}} = \frac{\sqrt{(M-\alpha t)g}}{2L\sqrt{\mu}}$
$\frac{df_0}{dt} = \frac{\alpha g}{2\sqrt{(M-\alpha t)g}} \times \frac{1}{2L\sqrt{\mu}} = \frac{\alpha}{4L}\sqrt{\frac{g}{\mu(M-\alpha t)}}$

Section-III

(40) Answer : 03.00
Solution:
$N_{min} = mg - m\omega^2 d$
$N_{min} = mg - Kd\ \left(\omega^2 = \frac{k}{m}\right)$
$N_{max} = mg + Kd$
$\frac{N_{max}}{N_{min}} = \frac{mg + {mg}/{2}}{{mg}/{2}} = 3$

(41) Answer : 48.90,49.20
Solution:
Radiation pressure = $\frac{2I}{c} = \frac{2P}{Ac}$
Force = $\frac{2P}{c}$
Must be equal to weight of cylinder.

$\Rightarrow \frac{2P}{c} = \rho Ahg$

$\Rightarrow h = \frac{2P}{\rho Agc} = \frac{2\times4.6}{1200\times\pi\times\frac{(2.6)^2}{4}\times10^{-6}\times9.8\times3\times10^8}$

= 490 nm

(42) **Answer :** 06.28
Solution:
By COAM; $m\omega r^2$ = const.
$\Rightarrow d\omega \times r^2 + \omega \times 2rdr = 0$
$\Rightarrow d\omega = \frac{-2\omega dr}{r}$ …(i)
∴ Restoring force: $\Delta F = d(m\omega^2 r)$
$\Rightarrow \Delta F = m[2\omega d\omega r + \omega^2 dr]$
$= m(-3\omega^2 dr)$
$\therefore\ \frac{d^2x}{dt^2} = -\frac{3m\omega^2}{(M+m)} \times x$
$\Rightarrow T = 2\pi\sqrt{\frac{M+m}{3m\omega^2}}$
$T = \frac{2\pi}{\omega}$ = 6.28 sec.

(43) **Answer :** 04.00
Solution:
$\frac{dQ}{dt} = -ms\frac{dT}{dt}$
$r_1 = \frac{a^3}{\frac{4}{3}\pi a^2} r_2$

(44) **Answer :** 08.00
Solution:

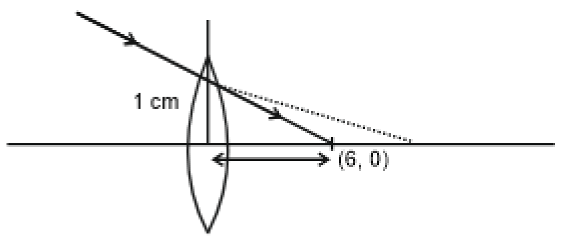
$\frac{dQ}{dt} = \frac{KA(T_1-T)}{l} = \sigma A\left(T^4 - T_0^4\right)$

$\Rightarrow \frac{K}{l}\left(T_1 - T\right) = \sigma\left((T_0+\Delta T)^4 - T_0^4\right)$

$= 4\sigma T_0^3\left(T - T_0\right)$

$\Rightarrow T = \frac{KT_1 + 4\sigma l T_0^4}{K + 4\sigma l T_0^3}$

(45) **Answer :** 07.00
Solution:
Incident ray $y = 0 \Rightarrow x = 10\ \text{cm}$ and $x = 0 \Rightarrow y = 1\ \text{cm}$
$u = +10\ \text{cm},\ f = 15\ \text{cm}$
$v = \frac{fu}{f+u} = \frac{15\times10}{25} = 6\ \text{cm}$



Equation of refracted ray $\Rightarrow y = -\frac{x}{6} + 1$

$m = -\frac{1}{6},\ c = 1$

$c - \frac{1}{m} = 1 - \left(-6\right) = 7$

Section-IV

(46) Answer : (C)

Solution:

$\mu N_1 = N_2$ —(i)

$N_1 + \mu N_2 = mg$ —(ii)

$\tau = \frac{mr^2}{2}\alpha = \mu\left(N_1 + N_2\right)r$ —(iii)

$t = \frac{\omega_0}{\alpha} = \frac{\omega_0 r\left(1+\mu^2\right)}{2\mu(1+\mu)g}$

$\theta = \frac{\omega t}{2} = \frac{{\omega_0}^2 r\left(1+\mu^2\right)}{4g\mu(1+\mu)}$

(47) Answer : (B)

Solution:

(P) Ball achieves terminal speed when drag force balances gravity

(Q) Fluid height difference give the pressure in manometer.

(R) In capillary rise, surface tension balances weight of liquid column.

(S) Rotating fluid experiences centrifugal force, pushing liquid outward, lowering height at centre.

(48) Answer : (C)

Solution:

(P) $I = \frac{100}{R_{eq}}$, $R_{eq} = 200 + 200$

V = 50 V, A = $\frac{1}{6}A = \frac{2}{3}I$

(Q) $R_{eq} = 200 + 200$

V = 50 V, $I = \frac{1}{4}A$

(R) $R_{eq} = 300 + \frac{300}{2}$

$I = \frac{2}{9}A$, $V = \frac{100}{3}$, $A = \frac{1}{6}A$

(S) $R_{eq} = 300 + 300 + 600$

$I = \frac{1}{12}A = A$

V = I x 600 = 50 V

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