19/04/2026

Code-A

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 & XII Passed)_Test-5A_Paper-1_Online

Time : 180 Min.

CHEMISTRY

Section-I

1. (D)

2. (D)

3. (D)

4. (C)

Section-II

5. (B,C,D)

6. (A,C)

7. (A,B,C)

Section-III

8. (78.30,78.90)

9. (01.00)

10. (55.21)

11. (06.00)

12. (00.34)

13. (12.00)

Section-IV

14. (A)

15. (B)

16. (D)

MATHEMATICS

Section-I

17. (A)

18. (D)

19. (C)

20. (B)

Section-II

21. (B,C)

22. (A,B,D)

23. (A,B,C,D)

Section-III

24. (07.00)

25. (25.00)

26. (33.00)

27. (01.00)

28. (24.00)

29. (02.00)

Section-IV

30. (D)

31. (C)

32. (B)

PHYSICS

Section-I

33. (B)

34. (D)

35. (D)

36. (D)

Section-II

37. (B,D)

38. (B,C)

39. (A,B)

Section-III

40. (00.00)

41. (02.00)

42. (12.00)

43. (12.00)

44. (04.00)

45. (05.00)

Section-IV

46. (D)

47. (C)

48. (A)

Hints and Solutions

CHEMISTRY

Section-I

(1) **Answer :** (D)
Hint:
Since Ni^{2+} is present at octahedral voids hence octahedral splitting will take place. NiO is antiferromagnetic substance having zero magnetic moment.
Solution:
P is NiO
$Ni^{2+} \Rightarrow 3d^8$
n = 2
$\mu = \sqrt{2(2+2)} = \sqrt{8}$ = 2.83 BM
Since Ni^{2+} is present at octahedral voids hence octahedral splitting will take place. NiO is antiferromagnetic substance having zero magnetic moment.

(2) **Answer :** (D)
Hint:
Fluorides of alkaline earth metals are sparingly soluble in water.
Solution:
• The crystal structures of MgO, CaO and SrO are rock salt type, in which O^{2-} form ccp and metal ions are at all octahedral void.
• Order of density : Ca < Mg < Be < Sr < Ba
• Fluorides of alkaline earth metals are sparingly soluble in water.

(3) **Answer :** (D)
Hint:
For adiabatic process, q = 0
Solution:
ΔU = q + W
For adiabatic process
q = 0
ΔU = W
For real gases
$\Delta U = -n^2 a\left[\frac{1}{V_2} - \frac{1}{V_1}\right]$
$W = n^2 a\left[\frac{1}{V_2} - \frac{1}{V_1}\right]$
For ideal gas
W = –PdV
Due to interparticle forces in real gas the internal energy decreases more during expansion compared to an ideal gas.

(4) **Answer :** (C)
Hint:

Red P_4 + alkali $\rightarrow \left(Z\right)$ $H_4\overset{+4}{P_2}O_6$

Solution:

$P_2O_3 + H_2O \rightarrow (X)$ $H_3\overset{+3}{P}O_3$

White P_4 + alkali $\rightarrow$ (Y) $H_3\overset{+1}{P}O_2$

Red P_4 + alkali $\rightarrow \left(Z\right)$ $H_4\overset{+4}{P_2}O_6$

Section-II

(5) **Answer :** (B,C,D)
Hint:
$KMnO_4$ is an oxidising agent oxidises $Fe^{2+} \rightarrow Fe^{3+}$
Solution:

$KMnO_4$ is an oxidising agent oxidises $Fe^{2+} \rightarrow Fe^{3+}$

Meq of Fe^{2+} = Meq of $KMnO_4$

m.moles × nf = N × V

m.moles × 1 = 0.1 × 50

Millimoles of Fe^{2+} = 0.1 × 50 = 5 mmol

Mass of ion in ore = $5 \times 10^{-3} \times 56 = 0.28$ g

% of Fe in ore = $\frac{0.28}{0.56} \times 100 = 50\%$

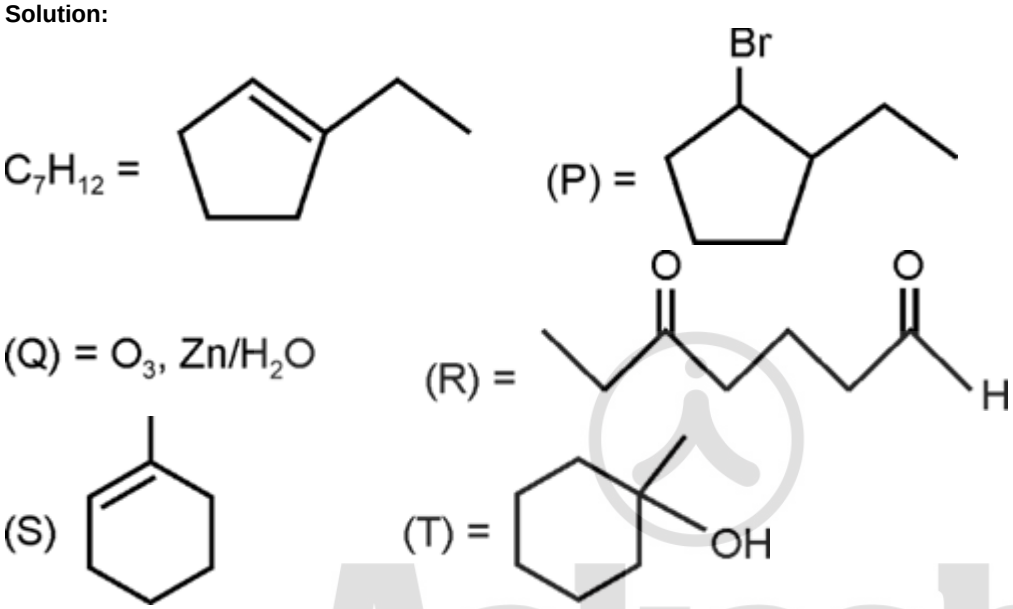
Molarity of $KMnO_4$ used = $\frac{N}{n_f}$ = $\frac{0.1}{5}$ = 0.02 M

(6) **Answer :** (A,C)

Hint:

HBr is presence of R_2O_2 follow Anti-Markovnikov rule.

Solution:

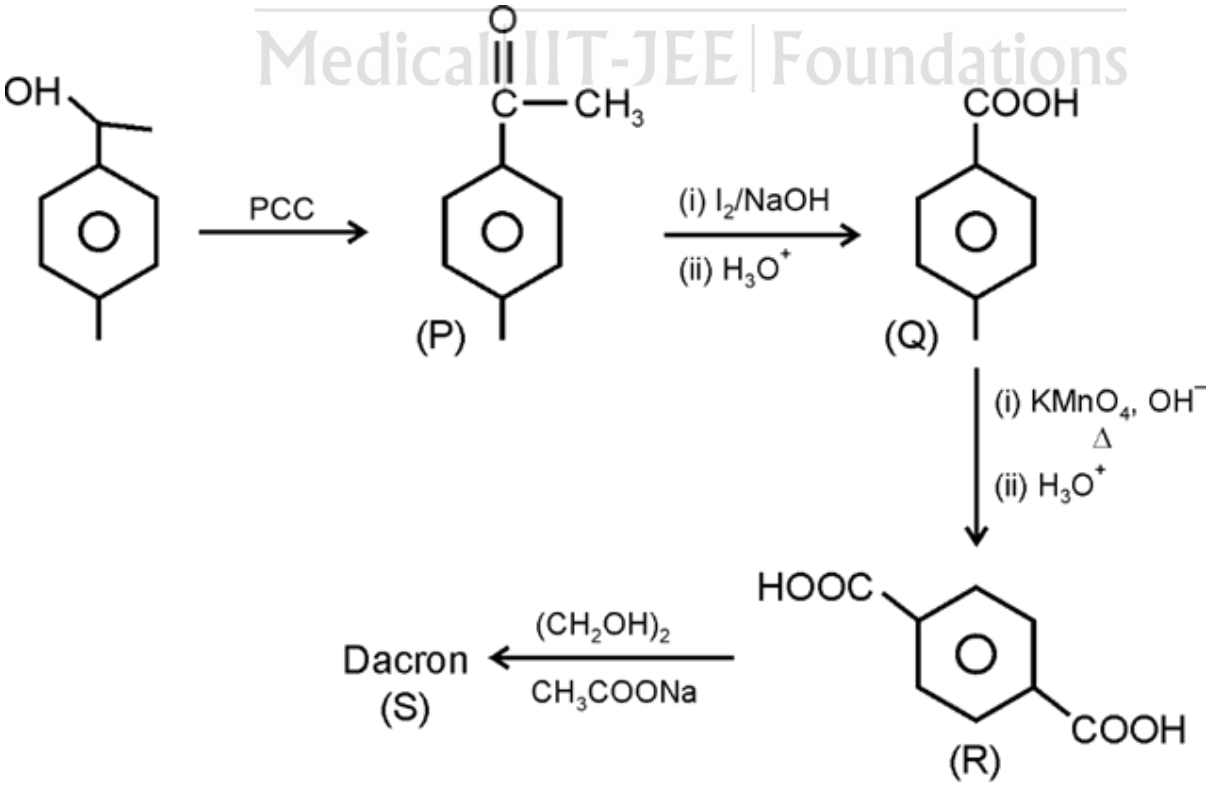


(7) **Answer :** (A,B,C)

Hint:

Dacron is a polymer of ethylene glycol and terephthalic acid.

Solution:



Section-III

(8) **Answer :** 78.30,78.90

Hint:

$K_b = \frac{M_{solvent} \times RT_b^2}{1000 \times \Delta H_{vap}}$

Solution:

$K_b = \frac{M_{solvent} \times RT_b^2}{1000 \times \Delta H_{vap}}$

$K_b = \frac{78 \times 8.3 \times 353 \times 353}{1000 \times 30800}$ K kg mol^{-1}

$K_b = 2.62$ K kg mol^{-1}

$\Delta T_b = 1$ K

$\Delta T_b = K_b \times m$

$1 = 2.62 \times \frac{3}{M \times 100} \times 1000$

M = 2.62 × 3 × 10

M = 78.6 g/mol

(9) **Answer :** 01.00

Hint:

The brown solution M is due to I_2

Solution:

$Cr_2O_7^{2-} + 14H^+ + 6I^- \rightarrow 2Cr^{3+} + 7H_2O + 3I_2$

The brown solution M is due to I_2

$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$

Meq of $Cr_2O_7^{2-}$

= Meq of $S_2O_3^{2-}$

$\left(n \times n_f\right)_{Cr_2O_7^{2-}} = \left(n \times n_f\right)_{S_2O_3^{2-}}$

n × 6 = 6 × 1

n = 1

Millimoles of $Cr_2O_7^{2-}$ = 1

(10) **Answer :** 55.21

Hint:

$\Delta G = -RT\ln K_{eq}$

Solution:

	$N_2(g)$	+	$3H_2(g)$	$\rightleftharpoons$	$2NH_3(g)$
t = 0	3×10^{-2} mol		5×10^{-2} mol		–
t = eq	$(3-1) \times 10^{-2}$ mol		$(5-3) \times 10^{-2}$ mol		$1 \times 10^{-2} \times 2 = 2 \times 10^{-2}$ mol

$K_{eq} = \frac{\left(\frac{2}{2} \times 10^{-2}\right)^2}{\left(\frac{2}{2} \times 10^{-2}\right)^3 \left(\frac{2}{2} \times 10^{-2}\right)}$

$K_{eq} = \frac{10^{-4}}{10^{-6} \times 10^{-2}} = 10^4$

$\Delta G^o = -RT\ln K_{eq}$

$\Delta G^o = -8.3 \times 723 \times \ln 10^4$

$\Delta G^o = -4 \times 8.3 \times 723 \ln 10$

$\Delta G^o = -4 \times 8.3 \times 723 \times 2.3$ J/mol

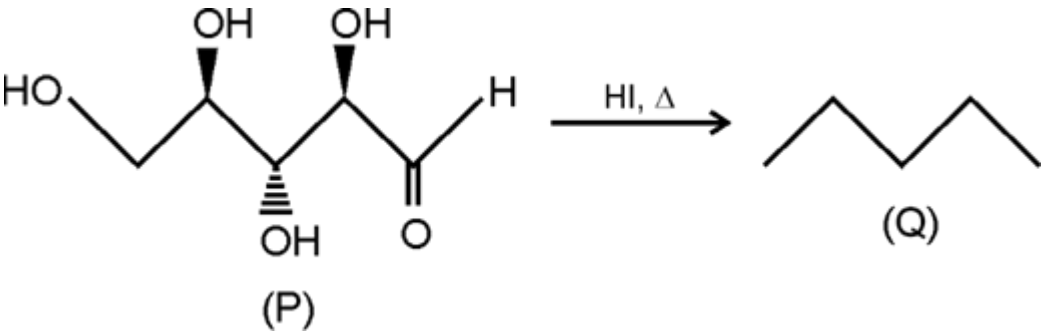
$\Delta G^o = -55.21$ kJ/mol

(11) **Answer :** 06.00

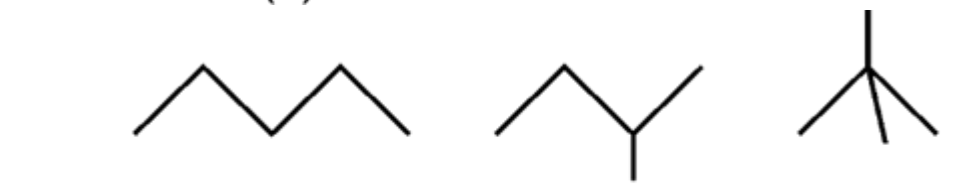
Hint:

A is n-pentane, B is 2-methyl butane and C is 2,2-dimethyl propane.

Solution:

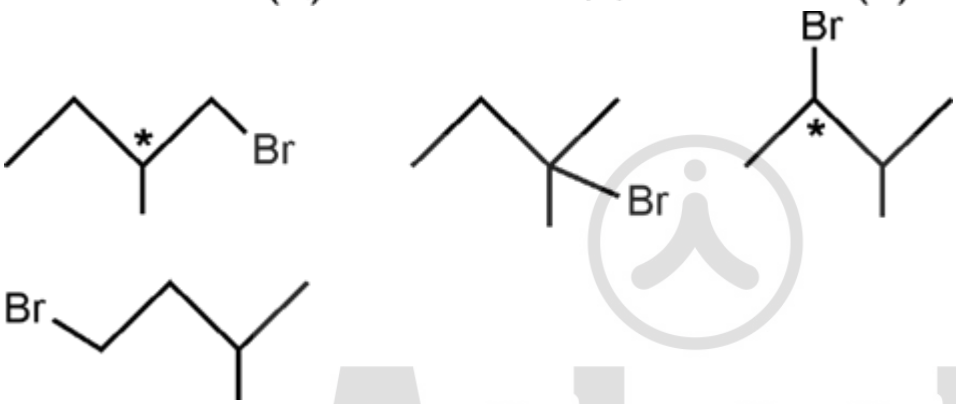


(P) (Q)



BP 309.1 K 300.9 K 282.5 K

(Q) (B) (C)



(12) **Answer :** 00.34

Hint:

Kjeldahl's method is not applicable to compounds containing nitrogen in nitro and azo group as nitrogen of these compounds does not change to ammonium sulphate under the condition.

Solution:

Kjeldahl's method is not applicable to compounds containing nitrogen in nitro and ozo group as nitrogen of these compounds does not change to ammonium sulphate under the condition.

Mole of X = $\frac{3.02}{302} = 10^{-2}$ mol

Mole of ammonia produced = 2×10^{-2} mol

Mass of ammonia = $0.02 \times 17 = 00.34$ g

(13) **Answer :** 12.00

Hint:

X = $_{11}Na$

Y = $_{12}Mg$

Z = $_{13}Al$

Solution:

X = $_{11}Na$

Y = $_{12}Mg$

Z = $_{13}Al$

r_{met} = Na > Mg > Al

$\Delta_i H_1$ = Mg > Al > Na

Ae = Na > Al > Mg

Section-IV

(14) **Answer :** (A)

Hint:

$(NH_4)_2CO_3$ in the presence of NH_4OH group-V reagent $\Rightarrow Ca^{2+}$ precipitates

Solution:

Adding dil HCl group-I reagent ⇒ Pb^{2+} precipitates

NH_4OH in presence of NH_4Cl group-III reagent ⇒ Fe^{3+} precipitates

Passing H_2S in the presence of NH_4OH group-IV reagent ⇒ Ni^{2+} precipitates

$(NH_4)_2CO_3$ in the presence of NH_4OH group-V reagent ⇒ Ca^{2+} precipitates

(15) Answer : (B)

Hint:

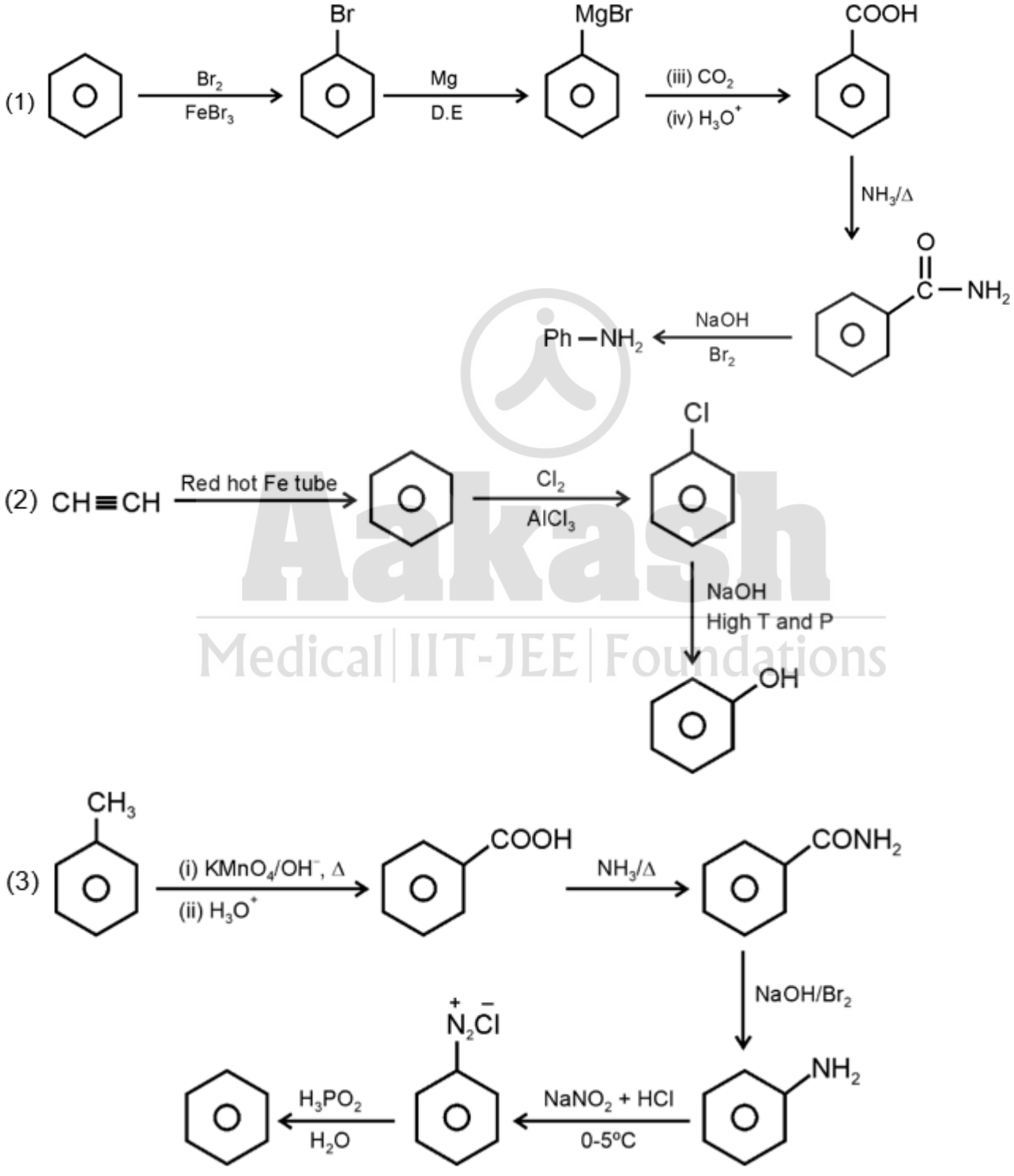
Reactant of P is phenol

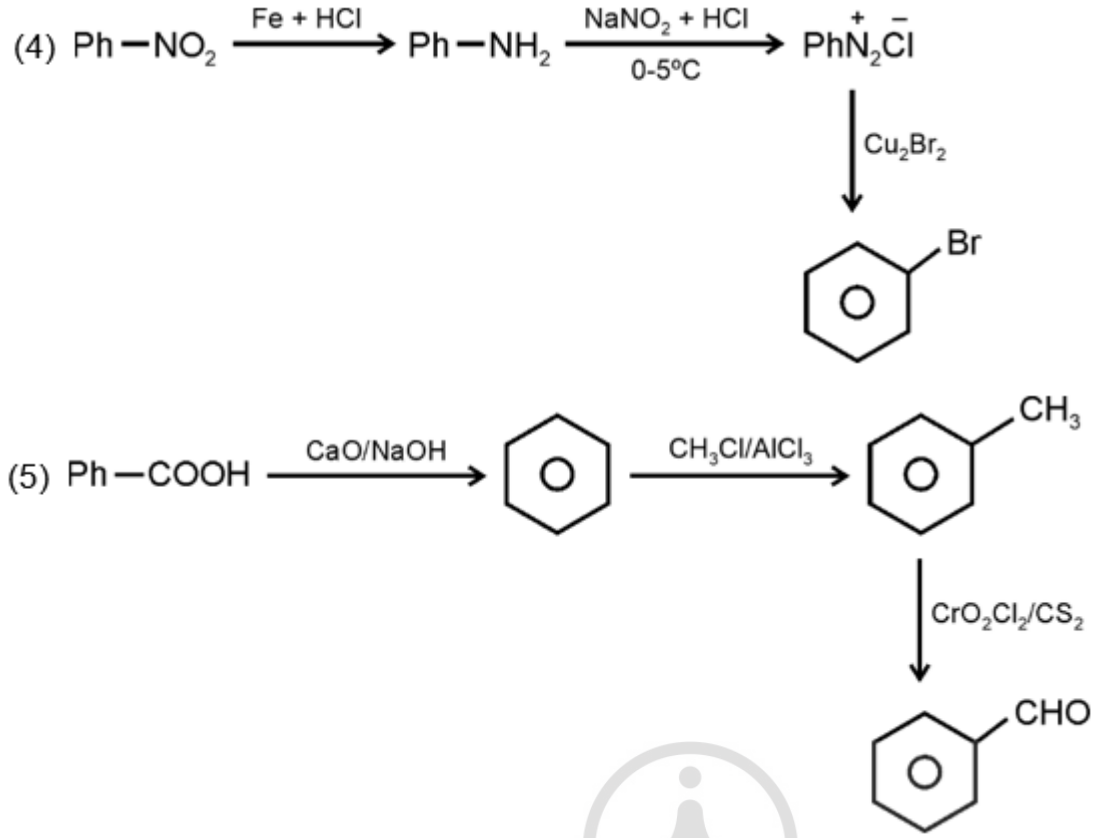
Reactant of Q is aryl halide

Reactant of R is benzene

Reactant of S is aniline

Solution:





(16) **Answer :** (D)

Hint:

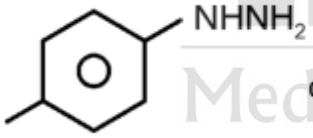
α-amino acid can give ninhydrin test, but absence of phenolic –OH group so, can't give violet colour with $FeCl_3$

Solution:

(P) α-amino acid can give ninhydrin test, but absence of phenolic –OH group can't give violet colour with $FeCl_3$

(Q) After hydrolysis 2-amino acid is formed, which can give ninhydrin test, due to presence of phenolic –OH group can give phthalein test.

(R) Aniline can form yellow dye with diazonium salt

(S)  can react with $-\overset{\overset{O}{\|}}{C}$ group of aldehyde to form hydrazone.

MATHEMATICS

Section-I

(17) **Answer :** (A)

Hint:

$(a, a) \in T \Rightarrow$ reflexive

Solution:

$\because (1, 2) \in S$ but $(2, 1) \notin S$

$\Rightarrow S$ is not equivalence

$T : \{(x, y) : x - y$ is an integer$\}$

$\because (a, a) \in T \Rightarrow$ reflexive

$(a, b) \Rightarrow (b, a) \Rightarrow$ symmetric

$(a, b) \in I \Rightarrow a - b \in I$

$(b, c) \Rightarrow b - c \in I$

$\Rightarrow a - c \in 2I \in I' \Rightarrow$ transitive

$\Rightarrow T$ is an equivalence relation.

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

Hint:

$x_1 + x_2 + x_3 = 75$

$\Rightarrow\ x_1+x_2+x_3=72$

Solution:

As AM = 25 ⇒ Sum = 75

$\therefore\ x_1+x_2+x_3=75 \qquad x_1\geq 1,\ x_2\geq 1,\ x_3\geq 1$

$\Rightarrow\ x_1+x_2+x_3=72$

Number of non-negative integral solution = ${}^{72+3-1}C_{3-1}$ = ${}^{74}C_2$ = ${}^{74}C_{72}$

Total outcome = $(100)^3$

$\Rightarrow\ P(E)=\frac{{}^{74}C_{72}}{100^3}$

(19) Answer : (C)

Hint:

$x\to\frac{\pi}{2}^+[\cot x]=-1$

Solution:

$x\to\frac{\pi}{2}^+[\cot x]=-1$

$\therefore\ \lim\limits_{x\to\frac{\pi}{2}^+} f(x)=e^{-1}=\frac{1}{e}$

at $x\to\frac{\pi}{2}^-[\cot x]=0$

$\Rightarrow\ \lim\limits_{x\to\frac{\pi}{2}^-} f(x)=e^0=1$

(20) Answer : (B)

Hint:

M′AM is 1 × 1

Solution:

M is *n* × 1

M′ is 1 × *n*

A is *n* × *n*

∴ *M′AM* is 1 × 1

Let *M′AM* = *k*

(*M′AM*)′ = *k*

M′A′M = *k*

∵ *A′* = –*A*

⇒ *M′AM* = *k*

∴ *k* = –*k* ⇒ *k* = 0

Section-II

(21) Answer : (B,C)

Hint:

l + *m* – 2*n* + 3 = 0

Solution:

Let the co-ordinates of point(s) be *l*, *m* and *n*

∴ Line : $\frac{x-l}{1}=\frac{y-m}{-5}=\frac{z-n}{-2}$

$$\begin{vmatrix} 1 & -5 & -2 \\ 1 & 1 & 1 \\ l & m+5 & n+1 \end{vmatrix}=0 \Rightarrow l+m-2n+3=0 \qquad \ldots(1)$$

Similarly 11*l* + 15*m* – 32*n* + 55 = 0 …(2)

Solving (1) & (2)

(2, –3, 1) and (1, 2, 3)

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

Hint:

f(*x*) is discontinuous and bijective function

Solution:

$$f(x)=\begin{cases} \frac{1}{1+x} & , \quad 0\leq x<1 \\ \frac{2}{x} & , \quad 1\leq x<2 \\ \frac{3}{x-1} & , \quad 2\leq x<\frac{5}{2} \end{cases}$$

Clearly *f*(*x*) is discontinuous and bijective function.

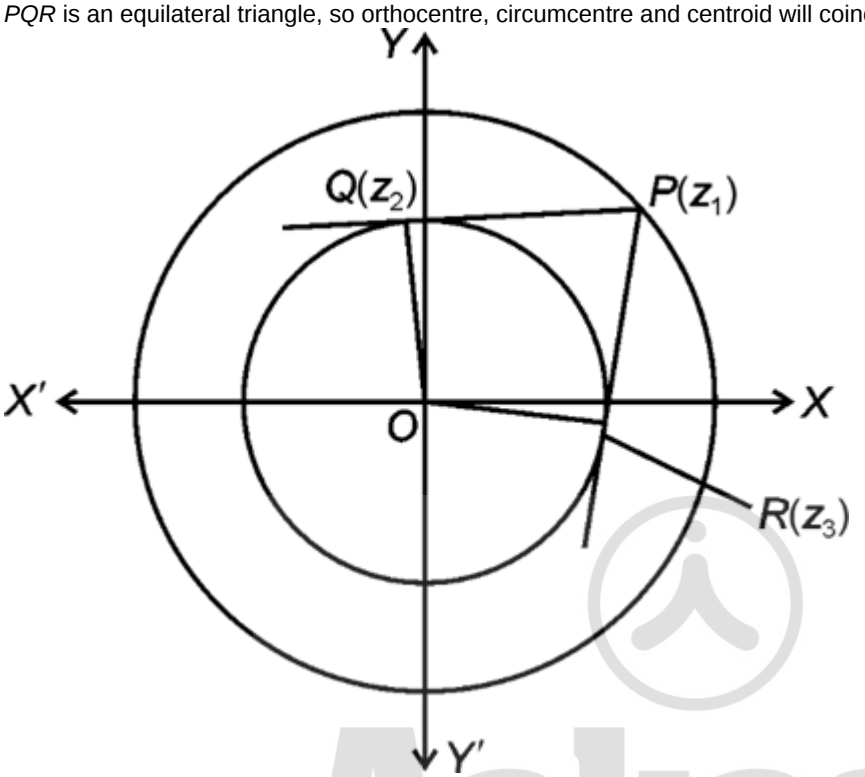
$\lim\limits_{x\to 1^-} f(x)=\frac{1}{2} \qquad \lim\limits_{x\to 1^+} f(x)=2$

$\min\left(\lim\limits_{x\to 1^-} f(x),\ \lim\limits_{x\to 1^+} f(x)\right)=\frac{1}{2}\neq f(1)$

$\lim_{x\to 2^-} f(x) = 1, \quad \lim_{x\to 2^+} f(x) = 3$

$\max\left(\lim_{x\to 2^-} f(x), \lim_{x\to 2^-} f(x)\right) = 3 = f(2)$

(23) **Answer :** (A,B,C,D)
Hint:
PQR is an equilateral triangle
Solution:
PQR is an equilateral triangle, so orthocentre, circumcentre and centroid will coincide.



$f(z) = g(z)(z - i)(z + i) + az + b$; where $a, b \in C$
$f(i) = i \Rightarrow ai + b = i$ …(1)
$f(-i) = 1 + i \Rightarrow a(-i) + b = 1 + i$ …(2)
From equation (1) and (2), we get
$a = \frac{i}{2}, \ b = \frac{1}{2} + i$
Hence, required remainder = $az + b = \frac{1}{2}iz + \frac{1}{2} + i$
(B) $\left|\frac{z_1+z_2+z_3}{3}\right| = 1 \ \Rightarrow \ |z_1 + z_2 + z_3|^2 = 9$
$\Rightarrow \ (z_1 + z_2 + z_3)(\bar{z}_1 + \bar{z}_2 + \bar{z}_3) = 9$
$\Rightarrow \ \left(\frac{4}{\bar{z}_1} + \frac{1}{\bar{z}_2} + \frac{1}{\bar{z}_3}\right)\left(\frac{4}{z_1} + \frac{1}{z_2} + \frac{1}{z_3}\right) = 9$
(C) $\angle QOR = 120^\circ$

Section-III

(24) **Answer :** 07.00
Hint:
{(1, 1), (2, 2), (3, 3), (2, 1), (3, 2), (1, 3), (3, 1)}
Solution:
{(1, 1), (2, 2), (3, 3), (2, 1), (3, 2), (1, 3), (3, 1)}

(25) **Answer :** 25.00
Hint:
$\vec{a} \cdot \vec{b} = 0 \ \Rightarrow \ x_1 + x_2 + x_3 = 0$
Solution:
$\vec{a} \cdot \vec{b} = 0 \ \Rightarrow \ x_1 + x_2 + x_3 = 0$
$\Rightarrow$ Coefficient of x^0 | $(x^{-3} + x^{-2} + x^{-1} + x^0 + x^1 + x^2)^3$
$x^0 \left| \left(\frac{1+x+x^2+x^3+x^4+x^5}{x^3}\right)^3 \right.$
$\Rightarrow \ x^a$ in $(1 - x^6)^3(1 - x)^{-3}$

= $^{11}C_9 - 3 \cdot {}^5C_3$ = 25

(26) **Answer :** 33.00

Hint:

Median = 46 which lies in 40-50 class

Solution:

Median = 46 which lies in 40-50 class

Median = $l + h\frac{\left\{\frac{N}{2} - Cf\right\}}{f}$

$46 = 40 + 10\left\{\frac{\frac{195+x}{2} - \left(x+42\right)}{65}\right\}$ $\Rightarrow x = 33$

{$\because x$ is an integer}

(27) **Answer :** 01.00

Hint:

$f\left(0\right) = \lim\limits_{x \to 0} f\left(x\right) = \lim\limits_{x \to 0} \frac{\cos(\sin x) - \cos x}{x^4}$

Solution:

$f\left(0\right) = \lim\limits_{x \to 0} f\left(x\right) = \lim\limits_{x \to 0} \frac{\cos(\sin x) - \cos x}{x^4}$

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

$-2\lim\limits_{x \to 0} \frac{\sin\left(\frac{\sin x + x}{2}\right)\sin\left(\frac{\sin x - x}{2}\right)\left(\frac{\sin x + x}{2}\right)\left(\frac{\sin x - x}{2}\right)}{\left(\frac{\sin x + x}{2}\right)\left(\frac{\sin x - x}{2}\right) \cdot x^4}$ = $\frac{1}{6}$

(28) **Answer :** 24.00

Hint:

$\Sigma T_n = \Sigma n^3 + \Sigma 3n^2 + \Sigma 2n$

Solution:

$N^r : 1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + ...$

$T_n = n(n+1)(n+2)$

$\Sigma T_n = \Sigma n^3 + \Sigma 3n^2 + \Sigma 2n$

= $\left(\frac{n(n+1)}{2}\right)^2 + \frac{3n(n+1)(2n+1)}{6} + n(n+1)$

$D^r = 1 \cdot 2 + 2 \cdot 3 + ...$

$T_n = n(n+1)$

$\Sigma T_n = \Sigma n^2 + \Sigma n$

$= \frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2}$

$\lim\limits_{h \to \infty} \left[\frac{\left(\frac{n(n+1)}{2}\right)^2 + \frac{n(n+1)(2n+1)}{2} + n(n+1)}{n\left[\frac{n(n+1)}{2} + \frac{n(n+1)(2n+1)}{6}\right]}\right]$ = $\frac{3}{4}$ $\Rightarrow k = 3$

(29) **Answer :** 02.00

Hint:

dividing by x^3y

$\frac{2dx}{x} + \frac{2dy}{y} + \frac{3y^2x^4dy - 2y^3x^3dx}{x^6} = 0$

Solution:

$(2x^2y - 2y^4)dx + (2x^3 + 3xy^3)dy = 0$

dividing by x^3y

$\frac{2dx}{x} + \frac{2dy}{y} + \frac{3y^2x^4dy - 2y^3x^3dx}{x^6} = 0$

$2\int \frac{dx}{x} + 2\int \frac{dy}{y} + \int \frac{3y^2x^2dy - 2xy^3dx}{x^4} = 0$

$2\ln\left|x\right| + 2\ln\left|y\right| + \frac{y^3}{x^2} = c$

$\because c = 1$

$f(x, y) = 2\ln\left|x\right| + 2\ln\left|y\right| + \frac{y^3}{x^2} - 1$

$f(1, -1) = -2$

Section-IV

(30) Answer : (D)

Hint:

If a set contain n elements then number of subsets equal to 2^n

Solution:

(P) Required number of subsets

= Total number of subsets – Number of subsets containing no even number

$= 2^7 - 2^4$

$= 128 - 16$

$= 112$

(Q) Prime factorization of 105 is $3 \cdot 5 \cdot 7$

We have to assign 3 to any of y_1, y_2 or y_3 similarly 5, 7 can be assign with 3 ways.

Thus number of given equation is $3 \times 3 \times 3 = 27$

(R) We cannot use 0 at any place. The required number of six digit numbers is equal to number of ways of selecting 6 digit out of 9

$^9C_6 = {}^9C_3 = \frac{9 \cdot 8 \cdot 7}{3 \cdot 2 \cdot 1} = 84$

(S) The number of function from

{1, 2, 3,…n} to {1, 2, 3…m}

Where $n < m$ is m^n

Option (D) is correct

(31) Answer : (C)

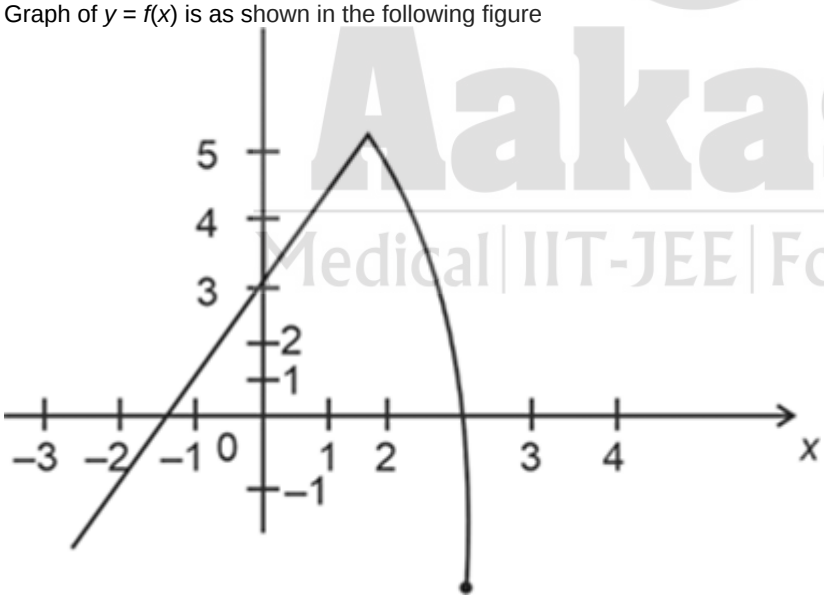
Hint:

$$f(x) = \begin{cases} 2x+3, & x \le 1 \\ -x^2+6, & x > 1 \end{cases}$$

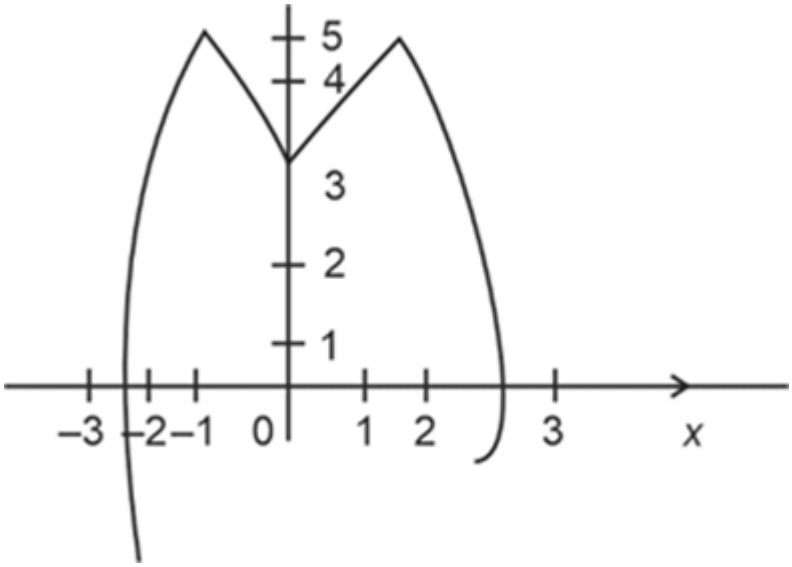
Solution:

$$f(x) = \begin{cases} 2x+3, & x \le 1 \\ -x^2+6, & x > 1 \end{cases}$$

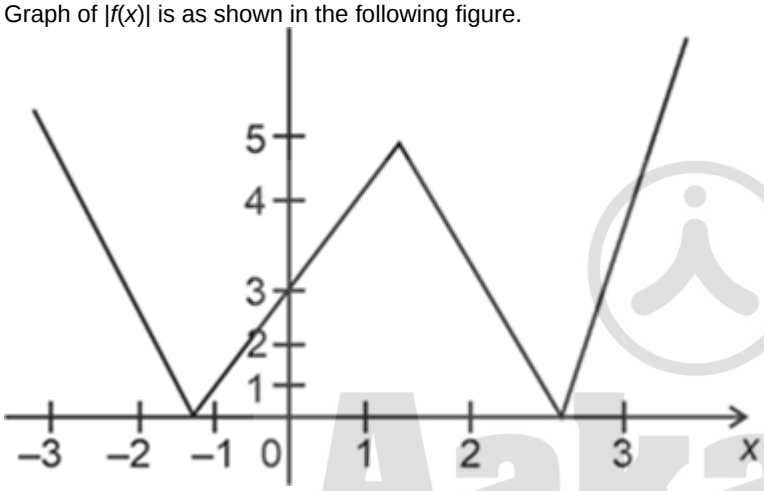
Graph of $y = f(x)$ is as shown in the following figure



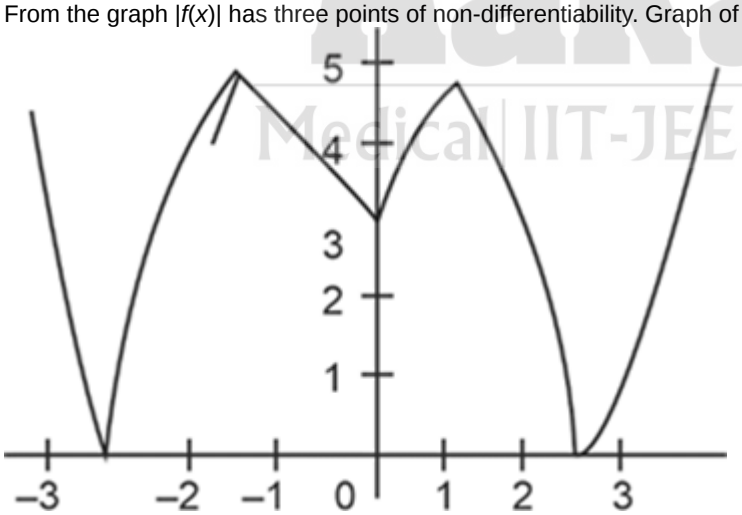
From the graph $f(x)$ has one-point of non-differentiability Graph of $f(|x|)$ is as shown in the following figure.



From the graph $f(|x|)$ has three points of non-differentiability
Graph of $|f(x)|$ is as shown in the following figure.

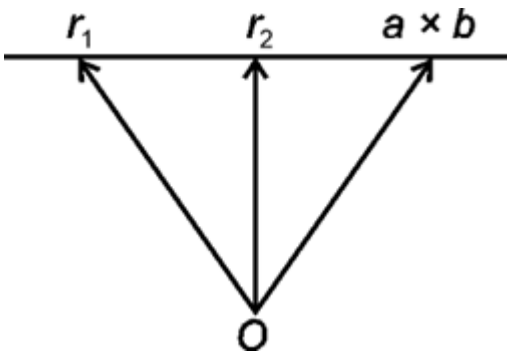


From the graph $|f(x)|$ has three points of non-differentiability. Graph of $|f(|x|)|$ is as shown in the following figure.



From the graph $|f(|x|)|$ has 5 points. of non-differentiability

(32) **Answer :** (B)
Hint:
3-Dimentional geometry
Solution:
(P) Line of shortest distance in perpendicular to both the lines. Hence, the vector is along the line of shortest distance $a \times b$.
(Q) The vector $r_1 - r_2$ is along the plane in which both the straight lines are lying and $a \times b$, is the vector perpendicular to the plane of line.
$\therefore\ (r_1 - r_2) \cdot (a \times b) = 0 \Rightarrow c = r_1 - r_2$
(R) If lines are intersecting, then
$(r_1 - r_2) \cdot (a \times b) = 0$
(S) Since, $(r_1 - r_2)$ and $(a \times b)$ are coplanar.



$\therefore \ (r_1 \times r_2) \cdot (a \times b) = 0$

$\therefore$ Option (B) is correct

PHYSICS

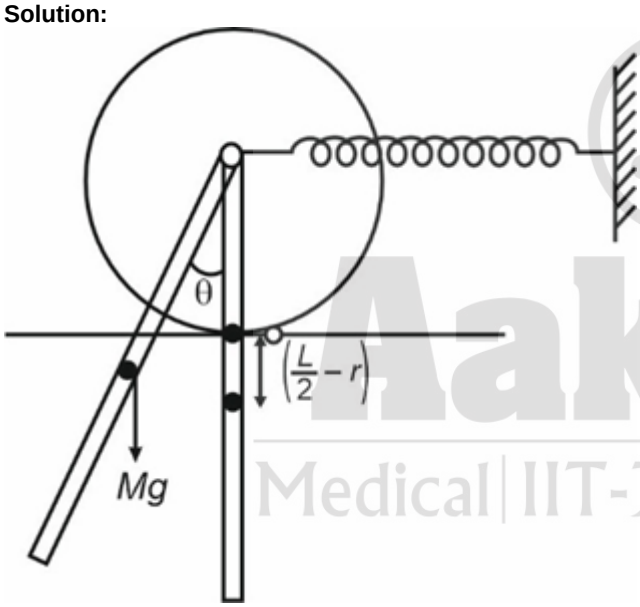
Section-I

(33) Answer : (B)

Hint:

Calculate net torque about point of contact.

Solution:



System will oscillate about 0

$(I_{system})_0 = \frac{3}{2}Mr^2 + \frac{ML^2}{12} + M\left(\frac{L}{2}-r\right)^2$

$\tau_0 = \left(Mg\frac{L}{2}(\sin\theta) + K(r\theta)r\right) = (I_{system})_0\,\alpha$

$\Rightarrow \ \omega^2 = \left(\frac{g\left(\frac{L}{2}+r\right)}{(I)_{system_0}}\right) \left\{Kr = Mg\right\}$

$\omega = \left[\frac{g\left(\frac{L}{2}+r\right)}{\frac{3}{2}r^2+\frac{L^2}{12}+\left(\frac{L}{2}-r\right)^2}\right]^{1/2}$

(34) Answer : (D)

Hint:

$T = 2\pi\sqrt{\frac{I}{Mgd}}$

Solution:

$T = 2\pi\sqrt{\frac{I}{Mgd}}$

I – moment of inertia about hinge point.

d – distance of C.O.M.

$100\% \times \frac{\Delta T}{T} = \frac{1}{2}\frac{\Delta I}{I}$

$I_1 = 12MR^2$

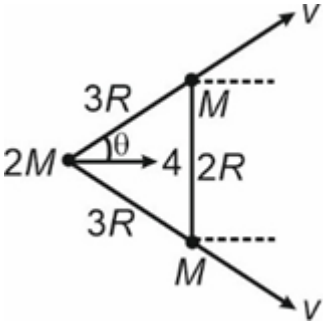
$I_2 = \frac{23}{2}MR^2$

(35) Answer : (D)

Hint:

Conserve linear momentum along line of motion.

Solution:



$Mu = 2Mv\cos\theta$ …(i)

$e = \frac{v}{u\cos\theta}$ …(ii)

$\Rightarrow \quad e = \frac{1}{2\cos^2\theta} = \frac{9}{16}$

(36) Answer : (D)

Hint:

L.C. = 1 M.S.D – 1 V.S.D

Solution:

L.C. = 1 M.S.D – 1 V.S.D

1 V.S.D. = $\frac{9}{10}$ M.S.D.

= $\frac{1}{10}$ M.S.D = $\frac{0.1}{10}$ cm = 0.01 cm = 0.1 mm

Reading 3.2 + 0.01 × 4 = 3.24 cm

Section-II

(37) Answer : (B,D)

Hint:

Energy ∝ (Amplitude)^2

Solution:

$y_i = A\cos(ax + bt) = (0.2 + 0.8)A\cos(ax + bt)$

$y_r = -0.8A\cos(ax - bt)$

$y_i + y_r = A\cos ax\cos bt - A\sin ax\,.\sin bt - 0.8\,A\cos ax\cos bt - 0.8\,A\sin ax\sin bt$

$= -1.8\,A\sin ax\,.\sin bt + 0.2\,A\cos ax\cos bt$

$I' = 0.64I \quad \frac{I'}{I} = 0.64 = \frac{A'^2}{A^2}$

$\Rightarrow A' = 0.8A$

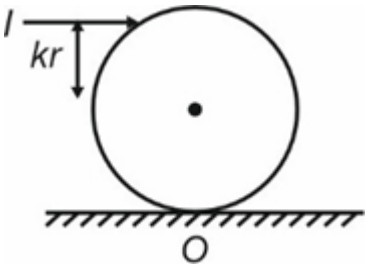
$C = 0.2$

(38) Answer : (B,C)

Hint:

Calculate angular impulse

Solution:



$L_0 = I(1+k)r = I_0\omega = \frac{7}{5}mr^2\omega$

$= \frac{7}{5}mr(v)$

$v = \frac{5}{7}(1+k)\frac{I}{m}$

$\Rightarrow \quad v_0 = \frac{I}{m}\ \omega_0 = \frac{Ikr}{2/5\ mr^2} = \frac{v_0}{r}$

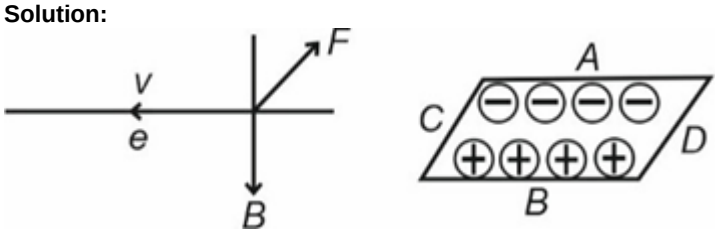
$K = \frac{2}{5}$

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

Hint:

Electrons will experience force due to flow.

Solution:



$\vec{E} = \left(\vec{v}_{\propto} \times \vec{B}\right)$

Section-III

(40) **Answer :** 00.00

Hint:

Ampere circuital law.

Solution:

Conceptual

(41) **Answer :** 02.00

Hint:

They will revolve due to their natural gravitation.

Solution:

$\frac{2Mv^2}{l} = \frac{GM^2}{l^2}$

$v = \sqrt{\frac{GM}{2l}}$

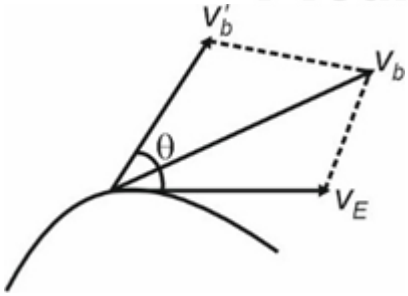
$T = \frac{\sqrt{2}\pi r^{3/2}}{\sqrt{GM}}$

(42) **Answer :** 12.00

Hint:

$v_{\text{eq}} = v_0\sqrt{2}$

Solution:



$v_0 = \sqrt{\frac{GM}{R_0}} = 30$ km/s

$v_{\text{eq}} = \sqrt{2}v_0$

So, $\Delta v = v_0\left(\sqrt{2}-1\right)$

$\Delta v = 30\,(0.4) = 12$ km/s

(43) **Answer :** 12.00

Hint:

$\frac{\Delta v}{v} \times 100 = 3.\frac{\Delta r}{r} \times 100$

Solution:

$v = \frac{4}{3}\pi r^3$

$\frac{\Delta v}{v} \times 100 = 3.\frac{\Delta r}{r} \times 100$

$= 3\left(\frac{0.2}{5.0}\right) \times 100 = 12\%$

(44) Answer : 04.00
Hint:
Apply Faraday's law.
Solution:

ϕ (flux) $= \frac{N\mu_0 i R^2}{2\left(R^2+l^2\right)^{3/2}} \times \pi r^2$

$\varepsilon = \frac{d\phi}{dt} = \frac{N\mu_0 b\pi R^2 r^2}{4\sqrt{t}\left(r^2+l^2\right)^{3/2}}$

(45) Answer : 05.00
Hint:
Mechanical energy will remain conserved.
Solution:

$E_{(r)} = \frac{KQ'}{r^2} = \frac{KQr}{R^3}$

$\frac{1}{2}mv_{\min}^2 = \Delta v = q\int_0^R E \cdot dr$

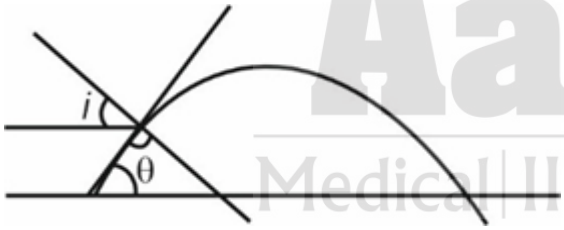
$\frac{1}{2}mv_{\min}^2 = \frac{KqQ}{2R}$

$\Rightarrow \quad v_{\min} = \sqrt{\frac{kqQ}{4\pi\varepsilon_0 mR}}$

α = 5

Section-IV

(46) Answer : (D)
Hint:
$\delta = \pi - 2i$
(deviation)
Solution:
δ = π – 2*i*



(P) *i* = 45°
tanθ = tan(90 – *i*) = cot*i*

$\Rightarrow \quad \frac{dy}{dx} = 2\cos\left(\frac{\pi x}{L}\right) = \cot i$

$h = y = \frac{2L}{\pi}\sin\left(\frac{\pi x}{L}\right) = \frac{L\sqrt{3}}{\pi}$

(Q) *i* = 60 $2\cos\left(\frac{\pi x}{L}\right) = \cot 60^\circ$

$h = \frac{L}{\pi}\sqrt{\frac{\pi}{3}}$

(R) *i* = 30° $h = \frac{L}{\pi}$

(S) $i = 53^\circ$ $h = \frac{L}{\pi}\sqrt{\frac{55}{16}}$

(47) Answer : (C)
Hint:

$ev_0 = \frac{hc}{\lambda} - \phi$

Solution:

(P) $n_e = \frac{P\pi r^2 \times 10^{-6}}{4\pi(100r)^2 \times E}$ *P* = 3.2 mW

= 10^5 *E* = 5 eV

(Q) $\lambda_d = \sqrt{\frac{150}{(5-3)}}\text{Å} = 8.68\ \text{Å}$ *KE* = *E* – φ

(R) $\frac{Kq}{r} = 2 \Rightarrow q = \frac{2r}{9\times10^9}$ = 1.78 × 10^{-12} C

(S) $q = n_e + tx_e$

$\Rightarrow t = \frac{q}{n_e \times e} = \frac{16}{9} \times \frac{10^{-12}}{10^5 \times 1.6 \times 10^{-19}} = \frac{10^3}{9}$ sec

(48) Answer : (A)

Hint:

Faraday's law and Lenz's law

Solution:

(P) $v \parallel dt$, φ = const $\varepsilon = 0$

(Q) $\varepsilon = 0$, φ = const. $dE = \vec{v} \times \vec{B} \cdot dt \neq 0$

(R) $\varepsilon = \frac{AdB}{dt} = E \cdot 2\pi R \quad \vec{E} \neq 0$

(S) $\varepsilon \neq 0 \quad dE = \left(\vec{v} \times \vec{B}\right) \cdot dt \neq 0$