TARGET IIT-JEE

HINT & SOLUTIONS

ANSWER KEY

PAPER-I CLASS XII (DATE 24-05-09)

MATHEMATICS

1.	C	**2.**	D	**3.**	D	**4.**	B	**5.**	C	**6.**	C	**7.**	D
8.	D	**9.**	A,B,C,D	**10.**	A,B,C	**11.**	A,B,C						
12.	A,D	**13.**	C	**14.**	A	**15.**	B	**16.**	B	**17.**	C	**18.**	C

19. (A) → (P,S,T) ; (B) → (Q,R); (C) → (Q,R,T) ; (D) → (P,S)

20. (A) → (T) ; (B) → (Q); (C) → (T) ; (D) → (R)

PHYSICS

21.	B	**22.**	A	**23.**	D	**24.**	A	**25.**	B	**26.**	A	**27.**	A
28.	B	**29.**	A,D	**30.**	B,C	**31.**	A,C,D	**32.**	B,D	**33.**	A	**34.**	B
35.	C	**36.**	D	**37.**	C	**38.**	B						

39. (A) → (P), ; (B) → (R), ; (C) → (T) ; (D) → (R)

40. (A) → (Q) ; (B) → (S), ; (C) → (P)

CHEMISTRY

41.	C	**42.**	A	**43.**	C	**44.**	D	**45.**	B	**46.**	A	**47.**	D
48.	C	**49.**	A,C	**50.**	A,B	**51.**	B,D	**52.**	A,C,D	**53**	A	**54.**	A
55.	B	**53.**	A	**54.**	A	**55.**	B	**56**	D	**57.**	A	**58.**	B

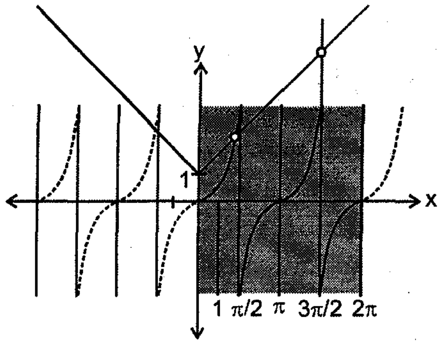
59. (A → Q), (B → S), (C → P),(D → R)

60. (A → Q,R), (B → P,T), (C → S), (D → S,U)

SOLUTIONS

MATHEMATICS

Sol.1



Clearly graph of y = tan x & y = max {1 + x, 1 – x} intersect at two points in [0, 2π]

Sol.2 We must have ,
We have two cases

(i) $x \ge 1$ and $x > 2\{x\} \Rightarrow x \ge 1$ and $x \ge 2$.
common part is $[2, \infty)$.

(ii) $x \le 1$ and $x < 2\{x\} \Rightarrow x < 1$ and $x \ne 0$.
Common part is $x \in (-\infty, 0) \cup (0, 1)$
Finally, x = 1 is also a point of the domain.

Sol.3 Consider $g(x) = f(x) - x$

$\because\ 2 \le \frac{f(x)}{x^2} \le 3$

$2 \le f(1) \le 3,\ \ \frac{1}{8} \le f\left(\frac{1}{4}\right) \le \frac{3}{16}$

Now $g(1) = f(1) - 1 > 0$

$g\left(\frac{1}{4}\right) = f\left(\frac{1}{4}\right) - \frac{1}{4} < 0$

By IVT, there exists atleast one point $c \in \left(\frac{1}{4}, 1\right)$

such that $g(c) = 0 \Rightarrow f(c) = c$

Sol.4 $2f(x)$ and $\frac{f(x)}{2}$ have the same domain as f (x)

and $f(2x)$, $f(x+2)$, $f\left(\frac{x}{2}\right)$ have the range as f (x)

$\Rightarrow\ \ m = 2,\ n = 3$

verify by considering $f(x) = \sin^{-1}x$; D : | x | ≤ 1;

R : $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

Sol.5 Since, $\tan^4 x + \cot^4 x + 1 = 3\sin^2 y$
{given}

$\Rightarrow\ (\tan^2 x - \cot^2 x)^2 + 3 = 3\sin^2 y$

$\Rightarrow\ (\tan^2 x - \cot^2 x)^2 = -3\cos^2 y$

which is possible if $\cos^2 y = 0$, such that

$(\tan^2 x - \cot^2 x)^2 = 0$

$\Rightarrow\ \tan x = \pm 1$ and $\cos y = 0$

i.e. $x = \pm\frac{\pi}{4}, \pm\frac{3\pi}{4}, \ldots\ldots$

i.e. $y = \pm\frac{\pi}{2}, \pm\frac{3\pi}{2}, \ldots\ldots$

Also, $x^2 + y^2 = 4$

$\Rightarrow\ x^2 \le 4$ and $y^2 \le 4$

i.e. $|x| \le 2$, i.e. $|y| \le 2$

$\Rightarrow\ x = \pm\frac{\pi}{4}$ only

$\Rightarrow\ y = \pm\frac{\pi}{2}$ only

Hence, the number of points lying inside the circle and satisfying the given equation are (x, y) :

$\left(\frac{\pi}{4}, \frac{\pi}{2}\right), \left(\frac{\pi}{4}, -\frac{\pi}{2}\right), \left(-\frac{\pi}{4}, \frac{\pi}{2}\right), \left(-\frac{\pi}{4}, -\frac{\pi}{2}\right)$

Sol.6 Using wavy curve method and the fact that x = 0 and 3 are the repeated roots of $x(e^x - 1)(x+2)(x-3)^2 = 0$, we get the sign scheme of the given expression as

$$\begin{array}{ccccccc} - & & + & & + & & + \\ & -2 & & 0 & & 3 & \end{array}$$

Thus complete solution is $x \in (-\infty, -2] \cup \{0, 3\}$

Sol.7 Obviously limit is of the form 1^∞

hence $= e^{\lim_{t\to 0}\frac{1}{t}\left[\frac{b^{t+1}-a^{t+1}}{b-a} - 1\right]}$

$= e^{\lim_{t\to 0}\left(\frac{b^{t+1}-a^{t+1}-b+a}{t(b-a)}\right)} = e^{\lim_{t\to 0}\left(\frac{b(b^t-1)-a(a^t-1)}{t(b-a)}\right)}$

$= e^{\frac{b\ln b - a\ln a}{b-a}} = e^{\frac{\ln b^b - \ln a^a}{b-a}} = e^{\frac{\ln\frac{b^b}{a^a}}{b-a}}$

$= e^{\left(\ln\frac{b^b}{a^a}\right)^{\frac{1}{b-a}}} = \left(\frac{b^b}{a^a}\right)^{\frac{1}{b-a}}$ Ans.]

Sol.8 $l_1 = \lim_{x\to 0} \ln(\cos 3x)^{\frac{1}{2x^2}} = \lim_{x\to 0}\frac{\cos 3x - 1}{2x^2} =$

$-\lim_{x\to 0}\frac{1-\cos 3x}{(3x)^2}\cdot\frac{9x^2}{2x^2} = -\frac{9}{4}$

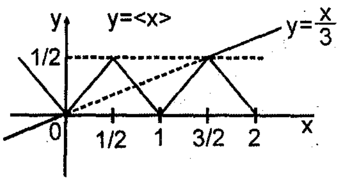
$l_2 = -\lim_{x\to 0}\frac{\sin^2 3x}{(3x)^2}\cdot\frac{9x^2}{x(e^x-1)} = -9$

$$l_3 = \lim_{x \to 1} \frac{x - x^2}{\ln x} \cdot \frac{1}{\sqrt{x} + x} = \frac{1}{2} \lim_{h \to 0} \frac{(1+h)(-h)}{\ln(1+h)}$$

$$= -\frac{1}{2}$$

Hence $l_2 < l_1 < l_3 \Rightarrow$ (D)

Sol.9



In the nghd of x = 0, $<x> = |x|$

$$\lim_{x\to 0} \frac{\cos <x> - 1}{x^2} = \lim_{x\to 0} \frac{\cos|x| - 1}{x^2}$$

$$= \lim_{x\to 0} \frac{\cos x - 1}{x^2} = -\frac{1}{2}$$

Since $0 \le <x> \le \frac{1}{2}$, tan(<x>) is continuous. < cos x > is continuous as composition of two continuous function is continuous. Sum of two continuous function is continuous.

Sol.10 $f(0^-) = 0$; $f(0^+) = 1$; $f(0) = 1$

$\Rightarrow$ discontinuous at x = 0

$f(1^-) = 1$; $f(1) = 1$; $f(1^+) = 0$

$\Rightarrow$ discontinuous at x = 1]

Sol.11 (A) f (x) is non negative $\forall x \in R$

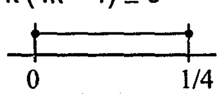
$\Rightarrow f(x) \ge 0 \;\; \forall x \in R$

$\Rightarrow D \le 0$

$\therefore 64k^2 - 16k \le 0$

$4k^2 - k \le 0$

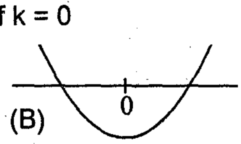
$k(4k - 1) \le 0$



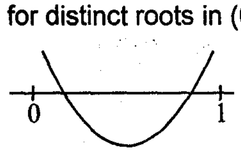
$\therefore$ integral value of k = 0

(B) $f(0) < 0$

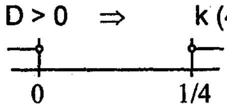
$k < 0 \Rightarrow$ (B)



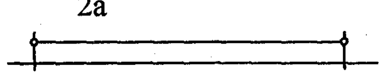
(C) for distinct roots in (0, 1)



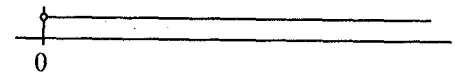
$D > 0 \Rightarrow k(4k - 1) > 0$ ....(1)



$0 < -\frac{b}{2a} < 1 \Rightarrow 0 < k < 1$ ....(2)

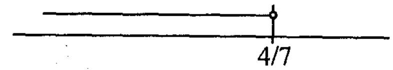


$f(0) > 0 \Rightarrow k > 0$ ....(3)



$f(1) > 0 \Rightarrow 4 - 7k > 0$

$\Rightarrow k < 4/7$ ....(4)



$(1) \cap (2) \cap (3) \cap (4) \Rightarrow k \in (1/4, 4/7)$]

Sol.12 $g'(0) = \lim_{x\to 0} \frac{g(x) - g(0)}{x - 0} = \lim_{x\to 0} \frac{g(x)}{x} =$

$\lim_{x\to 0} f(x) = f(0)$ (since f is continuous)

$$f'(0) = \lim_{x\to 0} \frac{f(x) - f(0)}{x} = \lim_{x\to 0} \frac{g(x)}{x^2} = \lim_{x\to 0} \frac{g'(x)}{2x}$$

$$= \frac{g''(0)}{2} = 3$$

Sol.13 (C) $\lim_{x\to 0^-} \frac{1}{2 - 2^{1/x}} = \frac{1}{2}$

$\lim_{x\to 0^+} \frac{1}{2 - 2^{1/x}} = 0 \qquad \left[\left|\frac{1}{2} - 0\right|\right] \le 1.$ True

$\therefore \text{Approx}_{x\to a} f(x) = \lim_{x\to a^+} f(x) = 0$

Sol.14 (A) L.H.L. = 0 R.H.L. = –1

$\text{Approx}_{x\to 0} f(x) = -1$

Sol.15(B) R.H.L. = $\lim_{x\to 0^+} [x^x] + a = 0 + a = a$

L.H.L. = $\lim_{x\to 0^-} (0) = 0$

$[\,|a - 0|\,] \le 1 \Rightarrow |a| < 2 \Rightarrow a \in (-2, 2)$

Sol.16 $f(x + y) = f(x + 2 + 2) = \frac{1}{f(x+2)} = \frac{1}{1/f(x)} = f(x)$

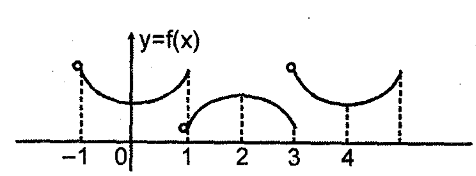
$\therefore$ period is 4.

Sol.17 For $x \in (1, 3]$, $f(x) = f(x - 2 + 2) = \frac{1}{f(x-2)}$

$$= \frac{1}{(x-2)^2 + 1}$$

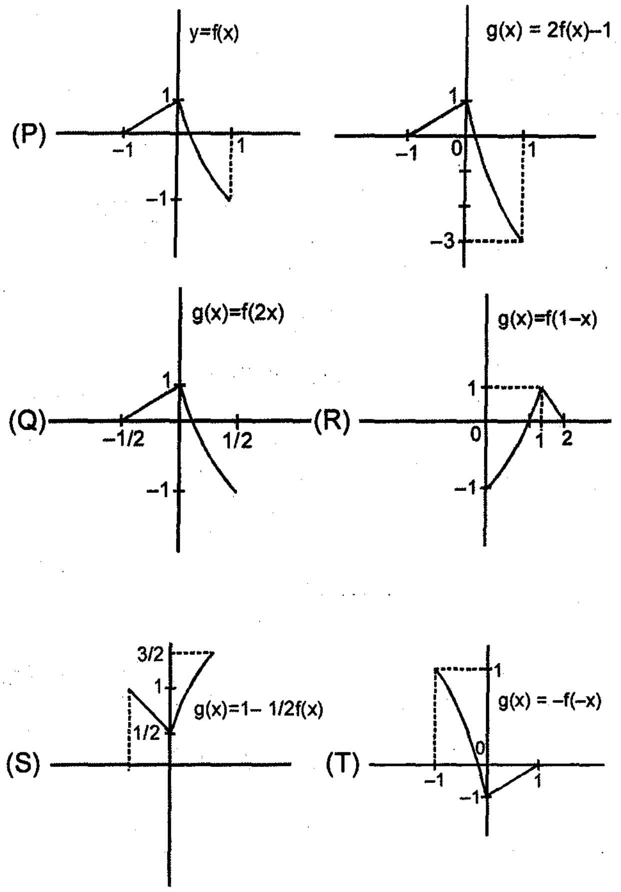
Now $\lim_{x\to 1^+} = \frac{1}{(x-2)^2 + 1} = \frac{1}{2}$

Sol.18



f is discontinuous at x = 1, 3

Sol.19 (A) P, S, T (B) Q, R
(C) Q, R, T (D) P, S



Sol.20 (A) – (T), (B) – (Q), (C) – (T), (D) – (R)

(A) If we take a neighbourhood of y, say N, there is no neighbourhood of x i.e. (–δ, δ) such that f(x) is in N for every x in (–δ, δ).

(B)

$$\lim_{x\to 0}\frac{\sin(\pi - \pi\cos^2(\sin(\pi\cos^2 x))\pi\sin^2(\sin(\pi\cos^2 x)))\sin^2(\pi - \pi\cos^2 x)}{\pi\sin^2(\sin(\pi\cos^2 x))\,.\,\sin^2(\pi\cos^2 x)\sin^2(\pi\sin^2 x)}\times$$

$$\frac{\pi^2\sin^4 x\,.\,x^4(1-\tan^2 x)}{x^4\,2x\tan x\,.\,\tan^3 x} = \frac{\pi^3}{2}$$

(C)

$$\text{R.H.L.} = \lim_{t\to 0}\sqrt{\frac{1-\sqrt{\cos 2t}}{t^2}} = \lim_{t\to 0}\sqrt{\frac{1-\sqrt{\cos 2t}}{t^2\sqrt{1+\sqrt{\cos 2t}}}}$$

$$= \lim_{t\to 0}\sqrt{\frac{2\sin^2 t}{t^2.2}} = 1$$

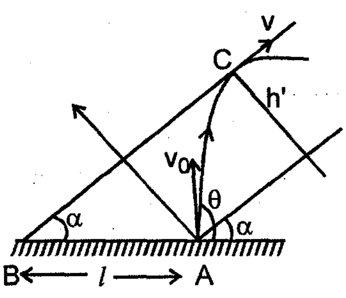
LHL = – RHL = –1 Limit does not exist

(D) Put $x = \frac{1}{t}$, $\lim_{t\to 0}\frac{e^{t^2}-1}{\pi - 2\tan^{-1}\frac{1}{t^2}}$

$$= \lim_{t\to 0}\frac{e^{t^2}-1}{\pi - 2\left(\frac{\pi}{2}-\tan^{-1}t^2\right)} = \lim_{t\to 0}\frac{e^{t^2}-1}{2\tan^{-1}t^2} = \frac{1}{2}$$

PHYSICS

21. **[B]**



$v_{0x} = v_0\cos(\theta-\alpha)$; $v_{0y} = v_0\sin(\theta-\alpha)$

$$h' = l\sin\alpha = \frac{v_0^2\sin^2(\theta-\alpha)}{g\cos\alpha}$$

$$\theta = \alpha + \sin^{-1}\frac{\sqrt{gl\sin 2\alpha}}{v_0}$$

$$R = \frac{v_0^2}{g}\sin 2\left(\alpha + \sin^{-1}\frac{\sqrt{gl\sin 2\alpha}}{v_0}\right)$$

22. **[A]** **23.** **[D]** **24.** **[A]**
25. **[B]** **26.** **[A]**

27. **[A]**
$x = x - v(t - t_0)$

28. **[B]**
The phase difference is introduced in the plate having smaller path length

29. **[A,D]**

30. **[B,C]**

31. **[A,C,D]**
TIR takes place when ray of light travels from denser to rarer medium.

Further $\sin\theta_{12} = \frac{\mu_2}{\mu_1}$ and $\sin\theta_{13} = \frac{\mu_3}{\mu_1}$

Since, $\frac{\mu_2}{\mu_1} > \frac{\mu_3}{\mu_1}$

$\theta_{12} > \theta_{13}$

Smaller the value of critical angle, more are the chances of TIR.

32. [B,D]

$$\frac{I_{max}}{I_{min}} = \frac{(\sqrt{I_1}+\sqrt{I_2})^2}{(\sqrt{I_1}-\sqrt{I_2})^2} = \left(\frac{\sqrt{I_1/I_2}+1}{\sqrt{I_1/I}-1}\right)^2 = 9 \quad \text{(Given)}$$

Solving this, we have $\frac{I_1}{I_2} = 4$

but $I \propto A^2$

$$\frac{A_1}{A_2} = 2$$

$\therefore$ Correct options are (B) and (D)

33. [A] by u – v method

34. [B] 35. [C] 36. [D]

37. [C] 38. [B]

39. (A) → (P), ; (B) → (R), ; (C) → (T) ; (D) → (R)

Introduction of a slab in to the path of a ray just increases path length of this ray. Fringe width remains unchange

40. (A) → (Q) ; (B) → (S), ; (C) → (P)

CHEMISTRY

41. [C] $E_1 = \frac{1}{2}\frac{Ze^2}{r} - \frac{Ze^2}{r} = -\frac{1}{2}\frac{Ze^2}{r}$

$E_T = -kE = \frac{PE}{2}$

$2 \times \frac{13.6}{n^2} = \frac{1}{32} \cdot \frac{13.6 \times 4}{1}$

n = 4

$\frac{1}{\lambda} = Rz^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

for $\lambda_{max} \cdot \frac{1}{\lambda_{max}} = RZ^2\left[\frac{1}{n_1^2} - \frac{1}{4^2}\right]$

for λ_{max} $n_1 = 3$

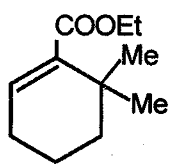
4 → 3

42. [A] $PO_2Cl \Rightarrow$ O = P = O → SP^3d^0 (with C bonded below P)

x = 1, y = 3, z = 0, n = 7

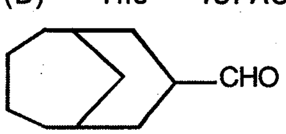
Total lone pair/molecul = 2 + 2 + 3 = 7

43. [C]

(A) The I.U.P.A.C name of  is ethyl–6, 6–dimethyl cyclohex – 1 – en – 1 – carboxylate

(B) If β - H of iso butyramide is replaced by $-CH_2COOH$. The IUPAC name of the compound formed is 4-carbamoyl pentanoic acid

(C) The IUPAC name of the secondary iso pentyl group is 1,2-dimetyl propyl

(D) The IUPAC name of the  is bicylo [4,3,1] decane-8-carbaldehyde

44. [D]

Volume contraction = volume of reactant – volume of product

70 = 10 + 20 + volume of O_2 –(Volume of CO_2 + unreacted O_2)

70 = 30 – 60 + reacted O_2

100 = reacted O_2

$C_xH_y + C_{y/2}H_3x + O_2 \rightarrow CO_2 + H_2O$

10 20 100 60

Applying POAC on C

10x + 10y = 60 ⇒ x + y = 6 ...(i)

Applying POAC on H

10y + 60x = 2 × moles of H_2O

5y + 30x = moles of H_2O ...(ii)

Applying POAC on O

100 × 2 = 60 × 2 + 5y + 30x

200 – 120 = 5y + 30x

80/5 = y + 6x

6x + y = 16 (iii)

from I & III

5x = 10 ⇒ x = 2

y = 4

Ans. 2 & 4

45. [B]

Let the mmoles are K_2CO_3 & $KHCO_3$ = n

K_2CO_3 & $KHCO_3$ are equimolar when methyl orange is used as indicator

meq. of H_2SO_4 = meq. of K_2CO_3 + meq. of $KHCO_3$

60 × N = n × 2 + n × 1

3n = 60 N

n = 20 N = 20 × 0.6 × 2

When 2w gm mixture is treated with H_2SO_4 in th presence Phenolphthalein as indicator then

$\frac{1}{2}$meq of K_2CO_3 = meq. of H_2SO_4

$\frac{1}{2} \times 2n \times 2 = 0.6x \times x \times 2 \times 1000$

n = 0.6x × x × 1000

$20 \times 0.6 \times 2 = 0.6\, x^2 \times 1000$

$\frac{40}{1000} = x^2 \Rightarrow x = \frac{2}{10} = 0.2$ Ans.

46. **[A]**

$C_{2a}H_{3a}N_a + O_2 \rightarrow CO_2 + H_2O + NO_2$
40 ml 250 ml

$3O_2 \xrightarrow{u.v} 2O_3$

Let remaining O_2 = V ml

$3O_2 \rightarrow 2O_3$
V – 3x   2x

Now V – 3x = 2x
v = 5x

moles of NO_2 = 2x = 2v/5
reacted O_2 = (250 – v)
Applying POAC on N

$$40\,a = \frac{2v}{5} \Rightarrow 100a = V$$

Apply POAC on H
120 a = 2 0+ moles of H_2O
60 a = moles of H_2O
Apply POAC on C
40 × 2a = moles of CO_2
80 a = moles of CO_2
Applying POAC on O

$$(250–v) \times 2 = 2 \times 80\,a + 60\,a + 2 \times \frac{2v}{5}$$

$$500 – 2v = 160\,a + 60a + \frac{4v}{5}$$

$$500 = 220\,a + 14\frac{v}{5}$$

$$500 = 220\,a + 14 \times \frac{100}{5}a$$

$$= 220\,a + 280\,a$$

500 = 500 a
a = 1
Hence $C_2H_3N = CH_3CN$

47. **[D]**

Mass of the system remains conserved.

48. **[C]**

A → 2B + C
$A_0 – x$ 2x   x

Let P & Q are the rotation of B & C /mole respectively
at t = 10 min
60 = 2xp + qx ...(i)
at the end of the reaction
$2A_0 \times P + A_0q = 180$
$A_0 (2p + q) = 180$ ...(ii)
from (i) & (ii)
$(A_0 – x) (2P + q) = 120$

$$\frac{A_0}{A_0 - x} = \frac{180}{120} = \frac{3}{2}$$

$$\frac{A_0 - x}{A_0} = \frac{2}{3}$$

% Amount of A left at t = 10 min

$$\frac{A_0 - x}{A_0} \times 100 = \frac{2}{3} \times 100 = 66.67\%$$

49. **[A,C]**

$$\text{Angular momentum} = \frac{nh}{2\pi} = \frac{7h}{11}$$

n = 4

$r_n = xa_0$

$$r_n = a_0 \times \frac{n^2}{z} = 16a_0 = xa_0,\ z = 1$$

x = 16

$$(A)\ \frac{9x}{4}a_0 \Rightarrow \frac{9}{4} \times 16a_0 = n^2a_0$$

⇒ n = 6, possible

$$(c)\ xa_0/4 = \frac{16a_0}{4} = n^2a_0$$

⇒ n = 2, possible

50. **[A,B]**

	$FeSO_4$	$Fe_2(SO_4)_3$
Let	(x mole)	(y mole)

no. of iron atom = $(x + 2y)N_A$
S atom = $(x + 3y)\,N_A$

$$(x + 3y)\,N_A – (x + 2y)N_A = \frac{1}{13}(4x + 12y)N_A$$

$$y = \frac{1}{13}(x + 12y)$$

13y = 4x + 12y
y = 4x

(A) gm atom of oxygen in $FeSO_4$ = 4x = y
(B) difference of gram atom of Fe and gm atom of sulphur = (x + 3y) – (x + 2y) = y

51. **[B,D]**

52. **[A,C,D]**

$$\frac{r_{vapours}}{r_{O_2}} = \sqrt{\frac{M_{O_2}}{M_{vapours}}}$$

$$\frac{4}{3} = \sqrt{\frac{32}{M}}$$

M = 18

$$\text{Density} = \frac{\text{mass of 1 mole}}{\text{volume of 1 mole}} = \frac{18}{22.4} = 0.8035\ g/\ell$$

Because vapours are triatomic; atomic weight = $\frac{18}{3}$ = 6

(Note that this is atomic weight, not atomic number)

$$V.D. = \frac{MW}{2} = \frac{18}{2} = 9$$

$$PV = Z\,nRT$$

$$PV = z.\frac{w}{M}RT$$

$$PM = z\frac{w}{V}RT$$

$$\Rightarrow PM = zdRT = \frac{PM}{dRT} = \frac{18P}{dRT} = Z$$

53,54,55 [A,A,B]

rate = $k\,[CH_3COCH_3]^x\,[Br_2]^y\,[Ba(OH)_2]^z$

$= k(0.1)^x\,(0.2)^y\,(0.3)^z$

$$\frac{dCHBr_3}{dt} = 1.2 \times 10^{-3}$$

$$\text{rate} = \frac{1}{2}\frac{dCHBr_3}{dt} = \frac{1.2\times10^{3}}{2}$$

$0.6 \times 10^{-3} = k\,(0.1)^x(0.2)^y\,(0.3)^z$ ...(1)

IInd experiment

$$= k\,(0.2)^x\,(0.2)^y\left(\frac{x_1}{1710}\right)^z$$

$(OH^-) = 0.6$ M

$Ba(OH)_2 = 0.3$ M

$$\frac{x_1}{1710} = 0.3 \qquad \Rightarrow x_1 = 513 \text{ gm}$$

$$\frac{d}{dt}[(CH_3COO)_2Ba] = 1.2\times10^{-3}$$

$1.2 \times 10^{-3} = k(0.2)^x\,(0.2)^y\,(0.3)^z$ ..(ii)

In (iii[rd] experiment)

$$-\frac{dBr_2}{dt} = 216 \times 10^{-3} \text{ mole/lit min}$$

$$= \frac{216}{60} \times 10^{-3} \text{ moles/lit sec}$$

$$-\frac{1}{6}\frac{dBr_2}{dt} = \frac{36}{6}\times10^{-4}$$

$\Rightarrow 0.60 \times 10^{-3}$ moles/lit sec

$0.6 \times 10^{-3} = k(0.1)^x\,(0.4)^y\,(0.3)^z$ ...(iii)

from (i) & (ii)

x = 1

from (ii) & (iii)

y = 0

A → Product

$$k = \frac{2.303}{30}\log\frac{120\sqrt{2}}{231A}$$

$$\frac{0.693}{60} = \frac{2.303}{30}\log\frac{20\sqrt{2}}{231A}$$

$$\Rightarrow \quad \frac{2.303}{2}\log 2 = 2.303\,\log\frac{120\sqrt{2}}{231A}$$

$$\sqrt{2} = \frac{120\sqrt{2}}{231A} \quad\Rightarrow\quad A = \frac{120}{231}$$

$$\text{rate} = k.A = \frac{0.693}{60}\,\frac{120}{231}$$

$$= \frac{1}{1000}\times\frac{2\times693}{231} = \frac{6}{1000} \text{ moles/lit/min}$$

rate constant of Haloform reaction

$$= 200 \times \text{rate} = \frac{200\times6}{1000\times60} \text{ moles/lit/sec.}$$

$$= \frac{12}{600}\,\frac{\text{mole / lit}}{\text{sec}}$$

$k = 2 \times 10^{-2}$

Hence

rate = $k\,(0.1)^x\,(0.2)^y\,(0.3)^z = 0.6 \times 10^{-3}$

z = 1

53. **[A]** $\frac{1}{3}\frac{dBaBr_2}{dt} = k(0.01)^1\,(0.04)^0\,(0.1)^1$

$= 2 \times 10^{-2} \times 10^{-3}$

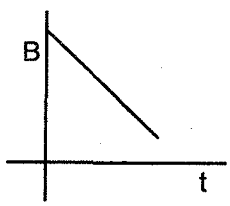
$= 2 \times 10^{-5}$

$$\frac{dBaBr_2}{dt} = 6\times10^{-5} \text{ moles/lit sec}$$

54. **[A]** B → Product

order = order w.r.t Br_2 = 0

(A)



55. **[B]** 513 gm

56,57,58 [D, A, B]

$$A \underset{k_b}{\overset{k_f}{\rightleftharpoons}} B$$

2 – x	x
2 – xe	xe

$$\frac{B_{eq}}{A_{eq}} = 4 \quad\Rightarrow\quad \frac{x_e}{2-x_e} = 4$$

$x_e = 8–4\,xe \Rightarrow x_e = 8/5$

$$\frac{dB}{dt} = k_f(2-x) - k_b x$$

and at equilibrium

$k_f(2 - x_e) - k_b\,xe = 0$

$$k_b = k_f \frac{(2-xe)}{xe} \quad ...(1)$$

$$\frac{-dA}{dt} = \frac{dB}{dt} = k_f(2-x) - k_f\left(\frac{2-xe}{xe}\right)x$$

$$= \frac{k_f}{xe}[2xe - xx_e - 2x + xxe]$$

$$= \frac{k_f.2}{xe}[xe - x]$$

$$k_f \times \frac{2}{xe} = \frac{2.303}{t}\log\left(\frac{xe}{xe-x}\right)$$

$$k_f \times \frac{2}{xe} = \frac{2.303}{t}\log\left(\frac{xe}{xe - xe/2}\right)$$

$$= \frac{2.303}{t}\log 2$$

$$= \frac{2\times 6.93\times 10^{-2}}{8/5} = \frac{0.693}{t}$$

$$\Rightarrow t = \frac{0.693\times 8\times 10}{5\times 2\times 0.693}$$

$\Rightarrow$ t = 8 min

t = 480 sec

57. $k = \frac{2.303}{t}\log\left(\frac{xe}{xe-x}\right)$

$$2 \times k_f/xe = \frac{2.303}{t}\log\left(\frac{xe}{xe-x}\right)$$

$$2 \times \frac{0.693\times 10^{-1}}{xe} = \frac{2.303}{t}\log\left(\frac{xe}{xe-x}\right)$$

$$2 \times \frac{0.693\times 10^{-1}}{8} \times 5 = \frac{2.303}{16}\log\left(\frac{xe}{xe-x}\right)$$

$$\frac{1}{4}2.303\log 2 = \frac{2.303}{8}\log\left(\frac{xe}{xe-x}\right)$$

$$4 = \frac{xe}{xe-x}$$

4xe – 4x = xe

3xe = 4x

$$x = 3/4\ xe \Rightarrow \frac{3}{4} \times \frac{8}{5} = \frac{6}{5} = 1.2$$

58. $A \underset{k_b.x}{\overset{k_f}{\rightleftharpoons}} B$

$2 - x_e$	x_e
0.4	1.6

If 0.5 mole of B is added at equilibrium

$A \underset{k_b.x}{\overset{k_f}{\rightleftharpoons}} B$

0.4	1.6 + 0.5
0.4 + x	1.6 + 0.5 – x

$$-\frac{dB}{dt}p = k_b(2.1 - x) - k_f(x + 0.4)$$

at new equilibrium

$$k_f(x_e' + 0.4) = k_b(2.1 - x_e')$$

$$\frac{k_f}{k_b} = 4$$

Hence $x_e' = 0.1$

Given concentration of B at new equ.

$$= \frac{41}{8} \text{ of A at initial equilibrim}$$

$$2.1 - x = \frac{41}{8} \times 0.4$$

x = 1/20 = 0.05

$$-\frac{dB}{dt} = k_b(2.1 - x) - k_f(0.4 + x)$$

$$= k_b(2.1 - x) - 4k_b(0.4 + x)$$

$$= 5k_b[0.1 - x]$$

$$5k_b = \frac{2.303}{t}\log\left(\frac{0.1}{0.1-x}\right)$$

$$5k_b = \frac{2.303}{t}\log\left(\frac{0.1}{0.1-0.005}\right)$$

t = 8 minutes

59. **($A \to Q$)** at high temp gas behaves as an ideal gas

($B \to S$) at high P, $\frac{a}{v^2}$ is negligible

($C \to P$) at low press a/v^2 connot be negligible

($D \to R$) for hydrogen gas a/v^2 is negligible

50. **($A \to Q,R$), ($B \to P,T$), ($C \to S$), ($D \to S,U$)**

$t_{1/2} \propto \left(\frac{1}{A_0}\right) \Rightarrow \log t_{1/2} = \log k + (n-1)\log\log 1/A_0$

$\log t_{1/2} = \log k - (n-1)\log A_0$

slope = – (n – 1)

In A – (n – 1) = 0

n = 1 , first order

Hence Q & R are correct.

B. Slope = 1 = – (n – 1)

n = 0

zero order

Hence P & T are correct

C. Slope = – 1 = – (n – 1)

n = 2

Hence S is correct

D. n = 3, Hence S & U are correct