



**CLASS XII**

**DATE : 23-05-2010**

**PAPER - II**

**ANSWER KEY WITH SOLUTION**

**MATHEMATICS**

**SECTION - A**

1. B,D    2. C,D    3. B,D    4. B,C    5. C,D    6. A,B,D

**SECTION - B**

1. (A) – (P) ; (B) – (Q) ; (C) – (T) ; (D) – (R)  
2. (A) – (R) ; (B) – (P),(Q) ; (C) – (S) ; (D) – (P)

**SECTION - C**

1. 0.0005    2. 0.0002    3. 0.0015    4. 0.0002    5. 0.0003    6. 0.0004  
7. 0.0002    8. 0.0012

**PHYSICS**

**SECTION - A**

1. A,D    2. A    3. B,C    4. A,B,C,D    5. B,C,D    6. D

**SECTION - B**

1. (A) → (Q) ; (B) → (P), ; (C) → (S) ; (D) → (R)  
2. (A) → P,Q,R, (B) → S, (C) → S, (D) → P,Q,R

**SECTION - C**

1. 4    2. 180    3. 35    4. 60    5. 90    6. 40  
7. 5cm    8. 1

**CHEMISTRY**

**SECTION - A**

1. A,D    2. A,B,D    3. C,D    4. A,B    5. A, B, C    6. BD

**SECTION - B**

1. A -S; B-R; C-Q; D-P  
2. (A) → P,Q,R,S (B) → Q,R, (C) → P,Q,R,S, (D) → P,Q

**SECTION - C**

1. 2    2. 47    3. 9    4. 990 J    5. 11    6. –19 Kcal  
7. 250 kcal    8. 45%



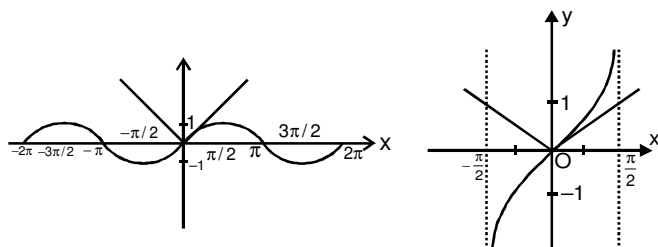
# SOLUTIONS

## MATHEMATICS

### SECTION – A

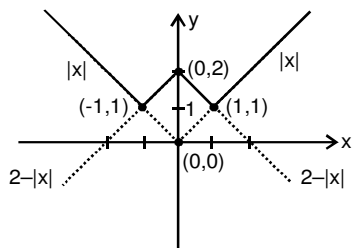
### SECTION – B

1. (B),(D)



2. (C),(D)

3. (B),(D)



f is an even function & range is  $[1, \infty)$

4. (B),(C)

for  $\sec^{-1} \sqrt{2x^2 - x^4}$  or  $\operatorname{cosec}^{-1} \sqrt{2x^2 - x^4}$  to exist

$$2x^2 - x^4 \geq 1$$

$$(x^2 - 1)^2 \leq 0 \Rightarrow x^2 = 1 \Rightarrow x = \pm 1$$

$$\text{if } x = 1 \Rightarrow a(3) + \frac{\pi}{2} = 0 \Rightarrow a = -\frac{\pi}{6}$$

$$\text{if } x = -1 \Rightarrow a + \frac{\pi}{2} = 0 \Rightarrow a = -\frac{\pi}{2}$$

5. (C),(D)

$$x^2 + x + 1 = \lambda x + 1$$

$$x^2 + (1 - \lambda)x = 0$$

$$\Rightarrow x = 0 \quad \text{or} \quad x = \lambda - 1$$

also for  $\sin^{-1}(x^2 + x + 1)$  to exist,  $-1 \leq x^2 + x + 1 \leq 1$

$$x^2 + x + 1 > 0 \quad \forall x \in \mathbb{R}$$

$$\therefore x^2 + x + 1 \leq 1$$

$$x(x + 1) \leq 0$$

$$x \in [-1, 0]$$

for exactly 2 solutions  $-1 \leq \lambda - 1 < 0$

$$0 \leq \lambda < 1$$

$$\therefore a = 0, b = 1$$

6. (A),(B),(D)

$$\text{as } 0 \leq \{-x\} < 1$$

$$\therefore -1 < -\{-x\} \leq 0$$

$$\therefore R_f = \left[ \frac{\pi}{2}, \pi \right)$$

f is neither even nor odd.

but  $f(x + 1) = f(x) \Rightarrow$  period of f is '1'.

1. (A) – (P) ; (B) – (Q) ; (C) – (T) ; (D) – (R)

$$(A) \lim_{x \rightarrow 0} \left( x^{-3} \sin 3x - 3ax^{-2} + \frac{9}{2} \right) = 0$$

$$\lim_{x \rightarrow 0} \left\{ \frac{\left( 3x - \frac{(3x)^3}{3!} + \dots \right)}{x^3} - \frac{3a}{x^2} + \frac{9}{2} \right\} = 0$$

$$\lim_{x \rightarrow 0} \left\{ \left( \frac{3}{x^2} - \frac{9}{2} + \dots \right) - \frac{3a}{x^2} + \frac{9}{2} \right\} = 0$$

it is possible only a = 1

$$(B) \lim_{x \rightarrow -\infty} ((x^5 + 7x^4 + 2)^a - x)$$

$$\text{Replace } x \rightarrow \frac{1}{h}$$

$$\lim_{h \rightarrow 0^-} \left\{ \left( \frac{1 + 7h + 2h^5}{h^5} \right)^a - \frac{1}{h} \right\} = \lim_{h \rightarrow 0^-} \left\{ \frac{h^{1-5a}(1 + 7h + 2h^5)^a - 1}{h} \right\}$$

Case-I If  $5a < 1$

$$\lim_{h \rightarrow 0^-} \left\{ \frac{h^{1-5a}(1 + 7h + 2h^5)^a - 1}{h} \right\} = \text{not defined}$$

Case-II If  $5a \geq 1$

$$\lim_{h \rightarrow 0^-} \left\{ \frac{(1 + 7h + 2h^5)^a - h^{5a-1}}{h^{5a}} \right\}$$

$$\text{If } a = \frac{1}{5} \text{ then } \lim_{h \rightarrow 0^-} \left\{ \frac{(1 + (7h + 2h^5))^{1/5} - 1}{h} \right\} = \frac{7}{5}$$

$$\therefore a = \frac{1}{5} \text{ and } b = \frac{7}{5}$$

Hence  $3a + b = 2$

$$(C) \text{ R.H.L.} = \lim_{x \rightarrow \frac{\pi}{4}} \frac{4\sqrt{1 - \sqrt{\sin 2x}}}{\pi - 4x}$$

$$\text{replace } x \rightarrow \frac{\pi}{4} + t$$

$$= - \lim_{t \rightarrow 0} \sqrt{\frac{1 - \sqrt{\cos 2t}}{t^2}} = - \lim_{t \rightarrow 0} \sqrt{\frac{1 - \cos 2t}{t^2(1 + \sqrt{\cos 2t})}}$$

$$= - \lim_{t \rightarrow 0} \sqrt{\frac{2 \sin^2 t}{t^2 \cdot 2}} = -1 \text{ Limit does not exist}$$

$$\text{L.H.L.} = \lim_{x \rightarrow \frac{\pi}{4}} \frac{4\sqrt{1-\sqrt{\sin 2x}}}{\pi - 4x}$$

replace  $x \rightarrow \frac{\pi}{4} - t$

$$\lim_{t \rightarrow 0} \sqrt{\frac{1-\sqrt{\cos 2t}}{t^2}} = 1$$

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

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

2. (A) - (R); (B) - (P), (Q); (C) - (S); (D) - (P)

(A)  $\log_3(\cos^{-1} x) \geq 0 \Rightarrow \cos^{-1}(x) \geq 1$

Maximum value of  $\cos^{-1} x = \pi$

$$\therefore 1 \leq \cos^{-1} x \leq \pi$$

$$\cos \pi \leq x \leq \cos 1$$

$$-1 \leq x \leq \cos 1$$

Integral values of  $x = -1$  and  $0$

(B)  $f(x) = \frac{1}{1-x}$ ,  $x \neq 1$

$$f(f(x)) = \frac{1}{1 - \frac{1}{1-x}} = \frac{x-1}{x} \therefore x \neq 0$$

$$f(f(f(x))) = \frac{1}{1 - \frac{1-x}{1-x}} = x$$

(C)  $S = \lim_{x \rightarrow 0} \operatorname{sgn} \left( \frac{\tan x}{x} \right) = 1 \left( \because \lim_{x \rightarrow 0} \frac{\tan x}{x} > 1 \right)$

$$\Rightarrow [5 \tan^{-1}(\cos(\tan^{-1}\{1\}))] = [5 \tan^{-1}(\cos 0)]$$

$$= [5 \tan^{-1} 1] = \left[ \frac{5\pi}{4} \right] = 3.$$

### SECTION - C

1. 0005

Since  $\alpha, \beta$  are the roots of  $x^2 + px + q = 0$

$$\therefore \alpha + \beta = -p, \alpha\beta = q \quad \dots(1)$$

Also  $\alpha, \beta$  are roots of  $x^{2n} + p^n x^n + q^n = 0$

$$\therefore \alpha^n + \beta^n = -p^n \text{ and } \alpha^n \beta^n = q^n \quad \dots(2)$$

Now,  $\alpha/\beta$  is root of  $x^n + 1 + (x+1)^n = 0$

$$\Rightarrow \frac{\alpha^n}{\beta^n} + 1 + \left( \frac{\alpha}{\beta} + 1 \right)^n = 0$$

$$\Rightarrow \frac{\alpha^n + \beta^n}{\beta^n} + \frac{(\alpha + \beta)^n}{\beta^n} = 0$$

$$\Rightarrow (\alpha^n + \beta^n) + (\alpha + \beta)^n = 0$$

$$\Rightarrow -p^n + (-p)^n = 0 \text{ \{from (1) and (2)\}}$$

This is true only if  $n$  is an even integer.

2. 0002

$$\lim_{x \rightarrow 0} f(x) = \lim_{x \rightarrow 0} \frac{1 - \frac{x^6}{2!} \dots - 1 + x^6 + \dots}{x^2 \left( 1 + x^2 + \frac{x^4}{2!} \dots - 1 - x^2 \right)} = 1$$

$$\lim_{x \rightarrow 1} g(x) = \lim_{x \rightarrow 1} \frac{e(e^{x^2-1})(x^2-1)}{e(x^2-1)(x-1)} = 2$$

$$\lim_{x \rightarrow 0} g(f(x)) = 2$$

3. 0015

$$f_2(x) = f_1(f_1(x)) = f_1(x/3 + 10) = x/3^2 + 10/3 + 10$$

$$f_3(x) = f_1(f_2(x)) = \frac{x}{3^3} + \frac{10}{3^2} + \frac{10}{3} + 10$$

similarly

$$f_n(x) = \frac{x}{3^n} + \frac{10}{3^{n-1}} + \frac{10}{3^{n-2}} + \dots + \frac{10}{3} + 10$$

$$f_n(x) = \frac{x}{3^n} + 10 \left\{ 1 + \frac{1}{3} + \frac{1}{3^2} + \dots + \frac{1}{3^{n-1}} \right\}$$

$$f_n(x) = \frac{x}{3^n} + 10 \left\{ \frac{1-1/3^n}{1-1/3} \right\}$$

$$f_n(x) = \left( \frac{x-15}{3^n} \right) + 15$$

4. 0002

Let two linear functions be  $f(x) = ax + b$

and  $g(x) = cx + d$

They map  $[-1, 1] \rightarrow [0, 2]$  and mapping is onto

$$\Rightarrow f(-1) = 0 \text{ and } f(1) = 2 \text{ and } g(-1) = 2$$

$$\text{and } g(1) = 0$$

$$\Rightarrow -a + b = 0 \text{ and } a + b = 2 \quad \dots(1)$$

$$\text{and } -c + d = 2 \text{ and } c + d = 0$$

$$\Rightarrow a = b = 1 \text{ and } c = -1, d = 1$$

$$\Rightarrow f(x) = x + 1 \text{ and } g(x) = -x + 1$$

$$\text{or } f(x) = -x + 1 \text{ and } g(x) = x + 1$$

**Case-1** If  $h(x) = \frac{x+1}{-x+1}$

$$\text{then } h(h(x)) = -\frac{1}{x} \text{ \& } h(h(1/x)) = -x$$

$$\Rightarrow h(h(x)) + h(h(1/x)) = -\left( \frac{1}{x} + x \right) = -2$$

**Case-2** If  $h(x) = \frac{-x+1}{x+1}$

$$\text{then } h(h(x)) = x \text{ \& } h(h(1/x)) = 1/x$$

$$\Rightarrow h(h(x)) + h(h(1/x)) = \left( x + \frac{1}{x} \right) = 2$$

$$\therefore |h(h(x)) + h(h(1/x))| > 2$$

5. 0003

Let  $x^{\log_{10} 3} = t = 3^{\log_{10} x}$

$\therefore t^2 - t - 2 = 0 \Rightarrow t = 2, -1$  (not possible)

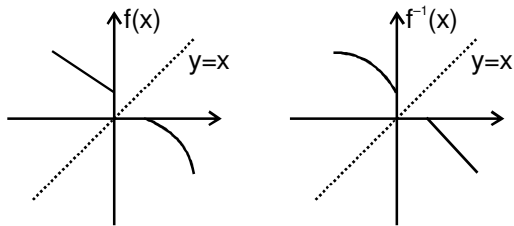
$x^{\log_{10} 3} = 2 \Rightarrow x = 2^{\log_3 10}$   
 $b = 3.$

$$f(p) = \lim_{h \rightarrow 0} \frac{(1+h)^p - p(1+h) + p - 1}{h^2}$$

$$= \lim_{h \rightarrow 0} \frac{1 + ph + \frac{p(p-1)}{2}h^2 \dots - p - ph + p - 1}{h^2}$$

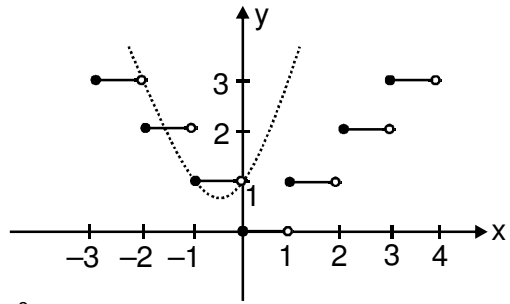
$$= \frac{p(p-1)}{2} \quad \therefore f(3) = 3.$$

6. 0004



$f^{-1}(x) = \begin{cases} -x+1 & x \geq 1 \\ 1+\sqrt{-x} & x \leq 0 \end{cases}$  solution  $-1, 1, 0, 2$

7. 0002



$x^2 + x + 1 = |[x]|$  only two solution  
 $x = -1$  & another between  $(-2, -1)$ .

8. 0012

Replace  $x \rightarrow x + 1$  then  $x \rightarrow x - 1$  in given equation

$f(x) + f(x + 2) = \sqrt{3} f(x + 1)$  .....(1)

$f(x - 2) + f(x) = \sqrt{3} f(x - 1)$  .....(2)

adding (1) & (2), we get  
 $f(x - 2) + f(x + 2) = f(x)$  .....(3)

Replace  $x \rightarrow x + 2$   
 $f(x) + f(x + 4) = f(x + 2)$  .....(4)

Subtract (3) from (4) we get  
 $f(x + 4) = -f(x - 2)$

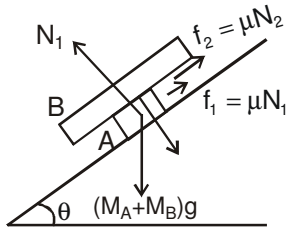
Replace  $x \rightarrow x + 2$   
 $f(x + 6) = -f(x)$  .....(5)

Replace  $x \rightarrow x + 6$   
 $f(x + 12) = -f(x + 6)$  .....(6)

by (5) & (6)  $f(x) = f(x + 12)$   
 hence the period of function is 12.

SECTION - A

1. A,D  
2. A



As block B is held stationary by the cord, the equation of motion of block A is

$$M_A g \sin \theta - f_1 - f_2 = M_A a$$

As velocity of block is constant  $a = 0$

$$M_A g \sin \theta - \mu (M_A + M_B) g \cos \theta - \mu M_B g \cos \theta = 0$$

$$\therefore \mu = \frac{(M_A)g \sin \theta}{(M_A + 2M_B)g \cos \theta} = \frac{(M_A)}{(M_A + 2M_B)} \tan \theta$$

Given

$$M_A = M_B = m, \theta = 37^\circ$$

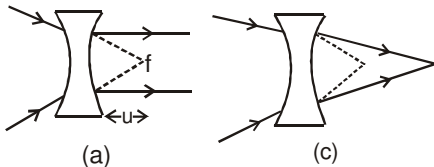
$$\therefore \mu = \frac{m}{3m} \tan 37^\circ = \frac{1}{3} \left( \frac{3}{4} \right) = 0.25 = \frac{1}{4}$$

3. B,C  
4. A,B,C,D  
5. B,C,D  
6. D

SECTION - B

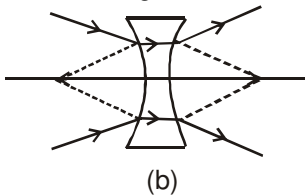
1. (A) → (Q) ; (B) → (P), ; (C) → (S) ; (D) → (R)  
2. (A) → P,Q,R, (B) → S, (C) → S, (D) → P,Q,R

$$(A) \frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$



$u = \text{positive}, f = \text{negative},$   
If  $|u| = |f|, v = \infty$

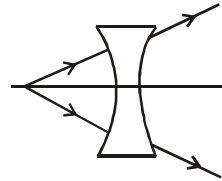
(a) If  $u = f$ , the emergent beam is a parallel beam.



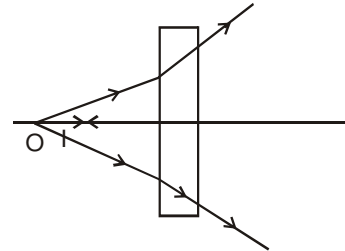
(b) If  $|u| > |f|, v = \text{negative}$ , the emergent beam is a divergent beam.

(c) If  $|u| < |f|, v = \text{positive}$ , the emergent beam is a convergent beam.

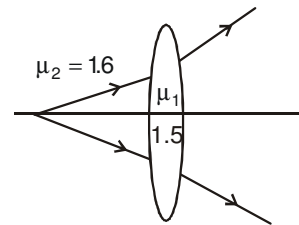
(B) If the divergent beam of light passes through a diverging lens, the emergent beam must be a divergent beam.



(C) When the divergent beam of light passes through a glass slab, the emergent beam must be a divergent beam.



$$(D) \frac{1}{f'} = \left( \frac{\mu_1}{\mu_2} - 1 \right) \left( \frac{1}{R_2} - \frac{1}{R_1} \right)$$



(a)

(a) If  $\mu_1 < \mu_2, f' = \text{negative}$

The converging lens acts as a diverging lens the emergent beam is a divergent beam.

The diverging lens acts as a converging lens, the emergent beam is a convergent beam.

SECTION - C

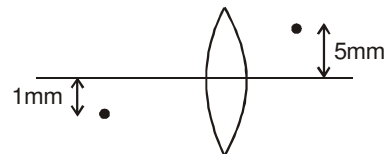
1. 4

$$\text{from } \frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} + \frac{1}{12} = \frac{1}{10} \Rightarrow v = 60 \text{ cm}$$

If lens is displaced along optical axis then

$$dv = \frac{v^2}{u^2} du = \left( \frac{60}{12} \right)^2 \cdot 1 = 25 \text{ mm}$$

Now lens is displaced above optical axis then



$$h_1 = \frac{v}{u} h_0 = 5 \text{ mm}$$

Displacement of image = 6mm

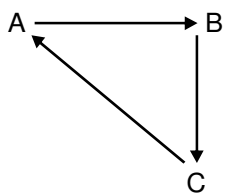
$$\Rightarrow \frac{x_1}{x_2} = \frac{25}{6} = 4.1$$



**SECTION - A**

1. [A,D]

The over all process can be depicted as



Thus it is a cyclic process.

Hence,  $\Delta E = 0$ ,  $\Delta H = 0$ ,

and  $\Delta E = q + W$  (1st law)

$\therefore 0 = 1 + W$

or  $q = -W$

Total work done = Area under curve(PV graph)

2. [A, B, D]

For such a process

$$W = -nRT \ln \frac{P_1}{P_2}$$

3. [C, D]

Volume of A

$$V_A = \frac{1 \times R \times 200}{1} = 200R$$

[ $\because PV = nRT$ ]

$$= 200 \times 0.082 = 16.4 \text{ L}$$

gives work in isothermal and reversible expansion of an ideal gas

$$V_B = \frac{0.082 \times 800}{2} = 32.8 \text{ L}$$

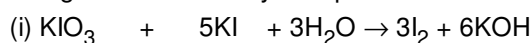
$$V_C = \frac{6.082 \times 400}{1} = 32.8 \text{ L}$$

Since  $V_B > V_A$ , expansion of gas occurs along A and B and work is done by the gas.

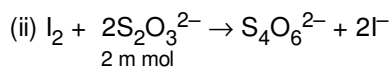
4. [A, B,]

5. [A, B, C]

The given reaction may be represented as



Given :  $x \text{ m mol}$                        $y \text{ m mol}$



From (ii), we find that

1 m mole of  $\text{I}_2$  needs for neutralisation  $z$  m moles of  $\text{S}_2\text{O}_3^{2-}$

$\therefore \text{I}_2$  produced in reaction (i) =  $\frac{1}{2} \times z$  or  $\frac{z}{2}$  m moles

From (i), we have

3 millimoles of  $\text{I}_2$  is produced from  $\text{KIO}_3 = 1$  millimole

$\therefore \frac{z}{2}$  millimole of  $\text{I}_2$  is produced from  $\text{KIO}_3$

$$= \frac{1}{3} \times \frac{z}{2} \text{ millimoles}$$

$$= \frac{z}{6} \text{ millimoles}$$

Hence,  $x \text{ m mol}$  of  $\text{KIO}_3 = \frac{z}{6}$  millimoles of  $\text{KIO}_3$

or  $x = \frac{z}{6}$ , or  $z = 6x$  i.e. (a) is correct

Similarly 5 millimole of  $\text{KI} = 3 \text{ mol}$  of  $\text{I}_2$  [from (i)]

$$\text{Millimoles of I} \frac{3y}{5} = \frac{z}{2}$$

or  $6y = 5z$  i.e. (b) is correct

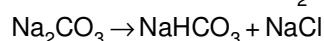
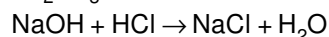
From (i),  $x$  moles of  $\text{KIO}_3$  will oxidize  $5x$  moles of  $\text{KI}$ . Hence  $5x = y$  i.e. (c) is correct.

6. [BD]

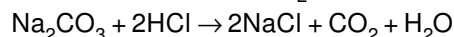
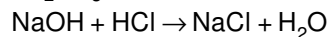
**SECTION - B**

1. **A-S; B-R; C-P; D-Q**

**Mixture I** : End point with phenolphthalein (disappearance of pink colour) corresponds to neutralization of  $\text{NaOH}$  and half neutralization of  $\text{Na}_2\text{CO}_3$



End point with methyl orange (appearance of red colour) corresponds to neutralization of  $\text{NaOH}$  and  $\text{Na}_2\text{CO}_3$ .



Volume of  $\text{HCl}$  required for neutralization of  $\text{Na}_2\text{CO}_3$

$$= 2(x - w)$$

$$\text{Normality of Na}_2\text{CO}_3 = \frac{2(x - w)}{1 \times 100} = 2(x - w) \times 10^{-2}$$

$$\text{Molarity of Na}_2\text{CO}_3 = (x - w) \times 10^{-2} \text{ M}$$

Volume of  $\text{HCl}$  required for neutralization of  $\text{NaOH}$

$$= w - (x - w) = 2w - x \text{ ml}$$

$$\text{Hence molarity of NaOH} = \frac{(2x - w)}{1 \times 100} = (2w - x) \times$$

$$10^{-2} \text{ M}$$

**Mixture II** : end point with phenolphthalein corresponds to half neutralization of  $\text{Na}_2\text{CO}_3$  as:  
 $\text{Na}_2\text{CO}_3 + \text{HCl} \rightarrow \text{NaHCO}_3 + \text{NaCl} \equiv y \text{ ml of HCl}$   
 Volume of HCl needed for complete neutralization of  
 $\text{Na}_2\text{CO}_3 = 2y$

$$\text{Hence, Molarity of NaCO}_3 = \frac{1}{2} \times \frac{2y}{1 \times 100} = y \times 10^{-2}$$

End point with methyl orange corresponds to neutralization of  $\text{NaHCO}_3$  already present and that formed from  $\text{Na}_2\text{CO}_3$ .

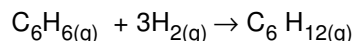
Hence, volume required for neutralization for neutralization of  $\text{NaHCO}_3$  present initially =  $z - 2y$

$$\text{Hence molarity of NaHCO}_3 = \frac{z - 2y}{1 \times 100} = (z - 2y) \times 10^{-2}$$

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

### SECTION - C

1. 2



Let  $x$  and  $y$  be the partial pressures (initial) of gaseous benzene and hydrogen in the vessel.

$$\text{then, } x + y = 60 \quad \dots\dots\dots(i)$$

After the reaction, whole of benzene is converted to cyclohexane.

Partial pressure of cyclohexane =  $x$  mm

Partial pressure of hydrogen left unreacted =  $y - 3x$

Total pressure of the system after the reaction,

$$x + y - 3x = y - 2x = 3 \quad \dots\dots\dots(ii)$$

Solving (i) and (ii),  $x = 10$  mm

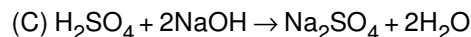
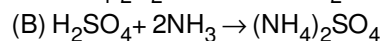
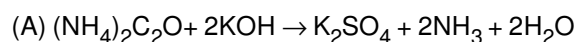
Number of moles  $\propto$  pressure; Volume  $\propto$  number of moles

Hence, fraction of benzene by volume in the original

$$\text{mixture} = \frac{10}{60} = \frac{1}{6} = 0.167$$

2. 47

The reactions involved are :



$$\begin{aligned} \text{Equivalent mass of } (\text{NH}_4)_2\text{C}_2\text{O}_4 &= \frac{\text{mol. mass}}{2} \\ &= \frac{124}{2} = 62. \end{aligned}$$

Equivalent mass of  $\text{NH}_3 = \text{mol. mass} = 17$

Equivalent mass of  $\text{HSO}_4 = \text{mol. mass}/2$

Equivalent of  $(\text{NH}_4)_2\text{C}_2\text{O}_4 = \text{Equivalents of } \text{NH}_3 = \text{Equivalents of } \text{H}_2\text{SO}_4 \text{ used.}$

$$\begin{aligned} \text{Milli equiv. of } \text{H}_2\text{SO}_4 \text{ taken} &= 2 \times 0.0500 \times 50.00 \\ &= 5.000 \end{aligned}$$

$$\text{Milli equiv. of NaOH used} = 0.1214 \times 11.3 = 1.3718$$

$$\text{Milli equiv. of excess } \text{H}_2\text{SO}_4 = 1.3718$$

$$\begin{aligned} \text{Milli equiv. of } \text{HSO}_4 \text{ used by } \text{NH}_3 \\ &= 5.000 - 1.3718 = 3.6282 \end{aligned}$$

$$\text{Milli equiv. of } (\text{NH}_4)_2\text{C}_2\text{O}_4 = 3.6282$$

$$\begin{aligned} \text{Mass of } (\text{NH}_4)_2\text{C}_2\text{O}_4 \text{ in the sample} \\ &= 3.6282 \times 10^{-3} \times 62 = 0.2249 \text{ g} \end{aligned}$$

$$\begin{aligned} \text{Percent by mass of } (\text{NH}_4)_2\text{C}_2\text{O}_4 &= \frac{0.2249 \times 100}{0.4775} \\ &= 47.10 \end{aligned}$$

3. 9

$$4. \quad \Delta U = \Delta Q + \Delta W$$

for adiabatic process  $\Delta Q = 0$

$$\therefore \Delta U = \Delta W = -P\Delta V = -100 \times 10^5 (-10^{-6}) = 10 \text{ J}$$

$$\Delta H = \Delta U + \Delta(PV)$$

$$\begin{aligned} \therefore \Delta H &= \Delta U + P_2V_2 - P_1V_1 \\ &= 10 + 100 \times 10^5 \times 99 \times 10^{-6} - 1 \times 10^5 \times 100 \times 10^{-6} \\ &= 10 + 990 - 10 = 990 \text{ J} \end{aligned}$$

5. 11

6. -19 Kcal

7. 250 kcal

8. 45%