

# REDOX REACTIONS

- (A)  $\text{HOCl} + \text{H}_2\text{O}_2 \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- + \text{O}_2$   
 (B)  $\text{I}_2 + \text{H}_2\text{O}_2 + 2\text{OH}^- \rightarrow 2\text{I}^- + 2\text{H}_2\text{O} + \text{O}_2$   
 Choose the correct option.  
 (1)  $\text{H}_2\text{O}_2$  acts as reducing and oxidising agent respectively in equation (A) and (B)  
 (2)  $\text{H}_2\text{O}_2$  acts as oxidising agent in equation (A) and (B)  
 (3)  $\text{H}_2\text{O}_2$  acts as reducing agent in equation (A) and (B)  
 (4)  $\text{H}_2\text{O}_2$  act as oxidizing and reducing agent respectively in equation (A) and (B)  
 (A)  $\text{HOCl} + \text{H}_2\text{O}_2 \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- + \text{O}_2$   
 (B)  $\text{I}_2 + \text{H}_2\text{O}_2 + 2\text{OH}^- \rightarrow 2\text{I}^- + 2\text{H}_2\text{O} + \text{O}_2$
- The reaction of sulphur in alkaline medium is the below:  

$$\text{S}_{8(s)} + a \text{OH}^-_{(aq)} \rightarrow b \text{S}^{2-}_{(aq)} + c \text{S}_2\text{O}_3^{2-}_{(aq)} + d \text{H}_2\text{O}_{(l)}$$
  
 The values of 'a' is \_\_\_\_\_. (Integer answer)
- Which of the following equation depicts the oxidizing nature of  $\text{H}_2\text{O}_2$ ?  
 (1)  $\text{KIO}_4 + \text{H}_2\text{O}_2 \rightarrow \text{KIO}_3 + \text{H}_2\text{O} + \text{O}_2$   
 (2)  $2\text{I}^- + \text{H}_2\text{O}_2 + 2\text{H}^+ \rightarrow \text{I}_2 + 2\text{H}_2\text{O}$   
 (3)  $\text{I}_2 + \text{H}_2\text{O}_2 + 2\text{OH}^- \rightarrow 2\text{I}^- + 2\text{H}_2\text{O} + \text{O}_2$   
 (4)  $\text{Cl}_2 + \text{H}_2\text{O}_2 \rightarrow 2\text{HCl} + \text{O}_2$
- In basic medium  $\text{CrO}_4^{2-}$  oxidises  $\text{S}_2\text{O}_3^{2-}$  to form  $\text{SO}_4^{2-}$  and itself changes into  $\text{Cr}(\text{OH})_4^-$ . The volume of 0.154 M  $\text{CrO}_4^{2-}$  required to react with 40 mL of 0.25 M  $\text{S}_2\text{O}_3^{2-}$  is \_\_\_\_\_ mL. (Rounded-off to the nearest integer)
- In mildly alkaline medium, thiosulphate ion is oxidized by  $\text{MnO}_4^-$  to "A". The oxidation state of sulphur in "A" is \_\_\_\_\_.
- $2 \text{MnO}_4^- + b \text{C}_2\text{O}_4^{2-} + c \text{H}^+ \rightarrow x \text{Mn}^{2+} + y \text{CO}_2 + z \text{H}_2\text{O}$   
 If the above equation is balanced with integer coefficients, the value of c is \_\_\_\_\_. (Round off to the Nearest Integer).  

$$2 \text{MnO}_4^- + b \text{C}_2\text{O}_4^{2-} + c \text{H}^+ \rightarrow x \text{Mn}^{2+} + y \text{CO}_2 + z \text{H}_2\text{O}$$

- The exact volumes of 1 M NaOH solution required to neutralise 50 mL of 1 M  $\text{H}_3\text{PO}_3$  solution and 100 mL of 2 M  $\text{H}_3\text{PO}_2$  solution, respectively, are :  
 (1) 100 mL and 100 mL  
 (2) 100 mL and 50 mL  
 (3) 100 mL and 200 mL  
 (4) 50 mL and 50 mL
- 15 mL of aqueous solution of  $\text{Fe}^{2+}$  in acidic medium completely reacted with 20 mL of 0.03 M aqueous  $\text{Cr}_2\text{O}_7^{2-}$ . The molarity of the  $\text{Fe}^{2+}$  solution is \_\_\_\_\_  $\times 10^{-2}$  M (Round off to the Nearest Integer).
- The oxidation states of nitrogen in NO,  $\text{NO}_2$ ,  $\text{N}_2\text{O}$  and  $\text{NO}_3^-$  are in the order of :  
 (1)  $\text{NO}_3^- > \text{NO}_2 > \text{NO} > \text{N}_2\text{O}$   
 (2)  $\text{NO}_2 > \text{NO}_3^- > \text{NO} > \text{N}_2\text{O}$   
 (3)  $\text{N}_2\text{O} > \text{NO}_2 > \text{NO} > \text{NO}_3^-$   
 (4)  $\text{NO} > \text{NO}_2 > \text{N}_2\text{O} > \text{NO}_3^-$
- When 10 mL of an aqueous solution of  $\text{Fe}^{2+}$  ions was titrated in the presence of dil  $\text{H}_2\text{SO}_4$  using diphenylamine indicator, 15 mL of 0.02 M solution of  $\text{K}_2\text{Cr}_2\text{O}_7$  was required to get the end point. The molarity of the solution containing  $\text{Fe}^{2+}$  ions is  $x \times 10^{-2}$  M. The value of x is \_\_\_\_\_. (Nearest integer)
- Identify the process in which change in the oxidation state is five :  
 (1)  $\text{Cr}_2\text{O}_7^{2-} \rightarrow 2\text{Cr}^{3+}$   
 (2)  $\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$   
 (3)  $\text{CrO}_4^{2-} \rightarrow \text{Cr}^{3+}$   
 (4)  $\text{C}_2\text{O}_4^{2-} \rightarrow 2\text{CO}_2$
- 10.0 mL of 0.05 M  $\text{KMnO}_4$  solution was consumed in a titration with 10.0 mL of given oxalic acid dihydrate solution. The strength of given oxalic acid solution is .....  $\times 10^{-2}$  g/L. (Round off to the nearest integer)
- The species given below that does NOT show disproportionation reaction is :  
 (1)  $\text{BrO}_4^-$  (2)  $\text{BrO}^-$  (3)  $\text{BrO}_2^-$  (4)  $\text{BrO}_3^-$

14. When 10 mL of an aqueous solution of  $\text{KMnO}_4$  was titrated in acidic medium, equal volume of 0.1 M of an aqueous solution of ferrous sulphate was required for complete discharge of colour. The strength of  $\text{KMnO}_4$  in grams per litre is  $\text{_____} \times 10^{-2}$ . (Nearest integer)  
[Atomic mass of K = 39, Mn = 55, O = 16]

15. Match List - I with List - II.

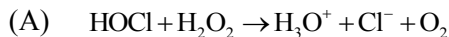
List -I (Colloid Preparation Method)		List -II (Chemical Reaction)	
(a)	Hydrolysis	(i)	$2\text{AuCl}_3 + 3\text{HCHO} + 3\text{H}_2\text{O} \rightarrow 2\text{Au(sol)} + 3\text{HCOOH} + 6\text{HCl}$
(b)	Reduction	(ii)	$\text{As}_2\text{O}_3 + 3\text{H}_2\text{S} \rightarrow \text{As}_2\text{S}_3(\text{sol}) + 3\text{H}_2\text{O}$
(c)	Oxidation	(iii)	$\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 3\text{S(sol)} + 2\text{H}_2\text{O}$
(d)	Double Decomposition	(iv)	$\text{FeCl}_3 + 3\text{H}_2\text{O} \rightarrow \text{Fe(OH)}_3(\text{sol}) + 3\text{HCl}$

Choose the most appropriate answer from the options given below.

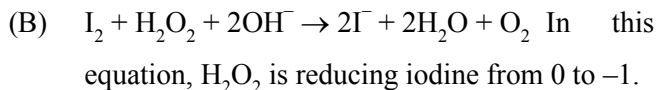
- (1) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)  
 (2) (a)-(iv), (b)-(i), (c)-(iii), (d)-(ii)  
 (3) (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)  
 (4) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)

**SOLUTION**

**1. Official Ans. by NTA (3)**



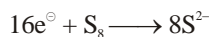
In this equation,  $\text{H}_2\text{O}_2$  is reducing chlorine from +1 to -1.



**Sol.** In (A) reduction of  $\text{HOCl}$  occurs so it will be an oxidising agent hence  $\text{H}_2\text{O}_2$  will be a reducing agent.

In (B) reduction of  $\text{I}_2$  occurs so it will be an oxidising agent and  $\text{H}_2\text{O}_2$  will be a reducing agent.

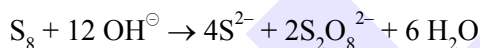
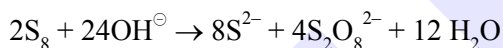
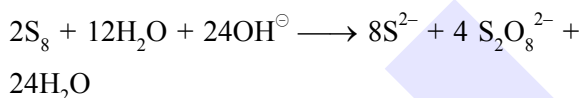
**2. Official Ans. by NTA (12)**



**Sol.**



for balancing in basic medium add equal number of  $\text{OH}^-$  that of  $\text{H}^+$



$$a = 12$$

**3. Official Ans. by NTA (70)**

**Sol.**  $P \propto T$

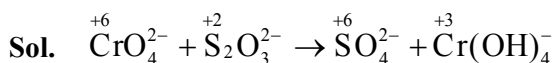
$$\frac{P_2}{P_1} = \frac{T_2}{T_1} \Rightarrow \frac{40}{35} = \frac{T_2}{300}$$

$$T_2 = 342.854 \text{ K}$$

$$= 69.70^\circ\text{C} \approx 70^\circ\text{C}$$

Hence answer is (70)

**4. Official Ans. by NTA (173)**



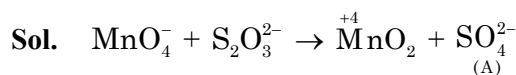
$$\text{gm equiv. of } \text{CrO}_4^{2-} = \text{S}_2\text{O}_3^{2-}$$

$$0.154 \times 3 \times v = 0.25 \times 40 \times 8$$

$$v = 173.16 = 173 \text{ ml}$$

Hence answer is (173)

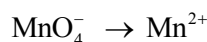
**5. Official Ans by NTA (6)**



Oxidation state of 'S' in  $\text{SO}_4^{2-}$   
= +6

**6. Official Ans. by NTA (16)**

**Sol.** Writing the half reaction  
oxidation half reaction



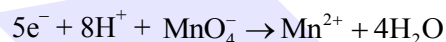
balancing oxygen



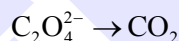
balancing Hydrogen



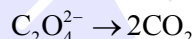
balancing charge



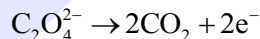
Reduction half



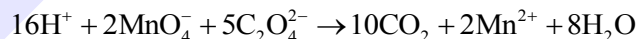
Balancing carbon



Balancing charge



Net equation



$$\text{So } c = 16$$

**7. Official Ans. by NTA (3)**

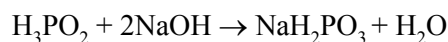


$$50 \text{ ml } 1\text{M}$$

$$1\text{M } V = ?$$

$$\Rightarrow \frac{n_{\text{NaOH}}}{n_{\text{H}_3\text{PO}_3}} = \frac{2}{1}$$

$$\Rightarrow \frac{1 \times V}{50 \times 1} = \frac{2}{1} \Rightarrow \boxed{V_{\text{NaOH}} = 100 \text{ ml}}$$



$$100 \text{ ml } 1\text{M}$$

$$2\text{M } V = ?$$

$$\Rightarrow \frac{n_{\text{NaOH}}}{n_{\text{H}_3\text{PO}_3}} = \frac{1}{1}$$

$$\Rightarrow \frac{1 \times V}{2 \times 100} = \frac{1}{1} \Rightarrow \boxed{V_{\text{NaOH}} = 200 \text{ ml}}$$

**8. Official Ans. by NTA (24)**

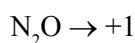
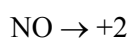
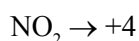
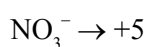
**Sol.**  $n_{\text{eq}} \text{Fe}^{2+} = n_{\text{eq}} \text{Cr}_2\text{O}_7^{2-}$

$$\text{or, } \left( \frac{15 \times M_{\text{Fe}^{2+}}}{1000} \right) \times 1 = \left( \frac{20 \times 0.03}{1000} \right) \times 6$$

$$\therefore M_{\text{Fe}^{2+}} = 0.24 \text{ M} = 24 \times 10^{-2} \text{ M}$$

**9. Official Ans. by NTA (1)**

**Sol.** The oxidation states of Nitrogen in following molecules are as follows

**10. Official Ans. by NTA (18)**

**Sol.** milli-equivalents of  $\text{Fe}^{2+}$  = milli-equivalents of  $\text{K}_2\text{Cr}_2\text{O}_7$

$$M \times 10 \times 1 = 0.02 \times 15 \times 6$$

$$M = 0.18 = 18 \times 10^{-2} \text{ M}$$

**11. Official Ans. by NTA (2)**

**Sol.**  $\text{MnO}_4^- + 5\text{e}^- \rightarrow \text{Mn}^{+2}$

**12. Official Ans. by NTA (1575)**

**Sol.**  $n_{\text{eq}} \text{KMnO}_4 = n_{\text{eq}} \text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$

$$\text{or, } \frac{10 \times 0.05}{1000} \times 5 = \frac{10 \times M}{1000} \times 2$$

$$\therefore \text{Conc. of oxalic acid solution} = 0.125 \text{ M}$$

$$= 0.125 \times 126 \text{ g/L} = 15.75 \text{ g/L}$$

$$= 1575 \times 10^{-2} \text{ g/L}$$

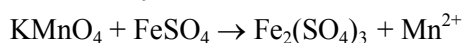
**13. Official Ans. by NTA (1)**

**Sol.** In  $\text{BrO}_4^-$ , Br is in highest oxidation state (+7),

So it cannot oxidise further hence it cannot show disproportionation reaction.

**14. Official Ans. by NTA (316)**

**Sol.** Let molarity of  $\text{KMnO}_4 = x$



$$n = 5 \quad n = 1$$

(Equivalents of  $\text{KMnO}_4$  reacted)

= (Equivalents of  $\text{FeSO}_4$  reacted)

$$\Rightarrow (5 \times x \times 10 \text{ ml}) = 1 \times 0.1 \times 10 \text{ ml}$$

$$\Rightarrow x = 0.02 \text{ M}$$

Molar mass of  $\text{KMnO}_4 = 158 \text{ gm/mol}$

$$\Rightarrow \text{Strength} = (x \times 158) = 3.16 \text{ g/l}$$

**15. Official Ans. by NTA (2)**

**Sol.** According to type of reactions for preparation, colloids have been classified