Redox Reaction

1. The correct option for a redox couple is: **(2023)**
   (a) Both are oxidised forms involving same element.
   (b) Both are reduced forms involving same element.
   (c) Both the reduced and oxidised forms involve same element.
   (d) Cathode and anode together.

2. On balancing the given redox reaction, $aCr_2O_7^{2-} + bSO_3^{2-}(aq) + cH^+(aq) \longrightarrow 2aCr^{3+}(aq) + bSO_4^{2-}(aq) + \frac{c}{2}H_2O(l)$, the coefficients a, b and c are found to be, respectively- **(2023)**
   (a) 3, 8, 1
   (b) 1, 8, 3
   (c) 8, 1, 3
   (d) 1, 3, 8

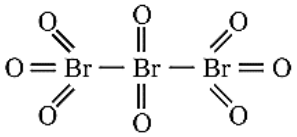
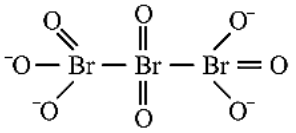
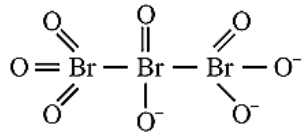
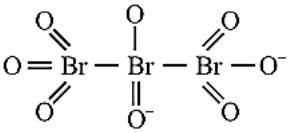
3. Which of the following reactions is a decomposition redox reaction? **(2022)**
   (a) $P_4(s) + + 3OH^-(aq) + 3H_2O(l) \longrightarrow PH_3(g) + 3H_2PO_2^-(aq)$
   (b) $2Pb(NO_3)_2(s) \longrightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$
   (c) $N_2(g) + O_2(g) \longrightarrow 2NO(g)$
   (d) $Cl_2(g) + 2OH^-(aq) \longrightarrow ClO^-(aq) + Cl^-(aq) + 4H_2O(l)$

4. Which of the following reactions is the metal displacement reaction? Choose the right option. **(2021)**
   (a) $Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$
   (b) $Fe + 2HCl \rightarrow FeCl_2 + H_2 \uparrow$
   (c) $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2 \uparrow$
   (d) $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

5. What is the change in oxidation number of carbon in the following reaction? **(2020)**
   $CH_4(g) + 4Cl_2(g) \rightarrow CCl_4(l) + 4HCl(g)$
   (a) 0 to +4
   (b) –4 to +4
   (c) 0 to –4
   (d) +4 to +4

6. The oxidation number of the underlined atom in the following species.
   Identify the incorrect option. **(2020 Covid Re-NEET)**
   (a) $\underline{Cl}O_3^-$ is +5
   (b) $K_2\underline{Cr_2}O_7$ is +6
   (c) $H\underline{Au}Cl_4$ is +3
   (d) $Cu_2\underline{O}$ is –1

7. Which of the following reactions are disproportionation reaction? **(2019)**
   A. $2Cu^+ \rightarrow Cu^{2+} + Cu^0$
   B. $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$
   C. $2KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2$
   D. $2MnO_4^- + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2 + 4H^{\oplus}$
   Select the correct option from the following
   (a) A and B only
   (b) A, B and C
   (c) A, C and D
   (d) A and D only

8. The correct structure of tribromooctaoxide is **(2019)**
   (a) 
   (b) 
   (c) 
   (d) 

9. For the redox reaction
   $MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow Mn^{2+} + CO_2 + H_2O$
   The correct coefficients of the reactants for the balanced equation are **(2018)**

	MnO_4^-	$C_2O_4^{2-}$	H^+
(a)	16	5	2
(b)	2	5	16
(c)	5	16	2
(d)	2	16	5

10. Hot concentrated sulphuric acid is a moderately strong oxidizing agent. Which of the following reactions does not show oxidizing behavior? **(2016-I)**
    (a) $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$
    (b) $CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$
    (c) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$
    (d) $3S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$

11. Assuming complete ionization, same moles of which of the following compounds will require the least amount of acidified $KMnO_4$ for complete oxidation? **(2015 Re)**
    (a) $Fe(NO_2)_2$
    (b) $FeSO_4$
    (c) $FeSO_3$
    (d) FeC_2O_4

12. In acidic medium, H_2O_2 changes $Cr_2O_7^{-2}$ to CrO_5 which has two (–O–O–) bonds. Oxidation state of Cr in CrO_5 is: **(2014)**
    (a) +3
    (b) +6
    (c) –10
    (d) +5

Answer Key

S1. Ans. (c)

S2. Ans. (d)

S3. Ans. (b)

S4. Ans. (a)

S5. Ans. (b)

S6. Ans. (d)

S7. Ans. (a)

S8. Ans. (a)

S9. Ans. (b)

S10. Ans. (b)

S11. Ans. (b)

S12. Ans. (b)

Solutions

S1. Ans.(c)

Redox couples is both the reduced and oxidised form involve same element.

S2. Ans.(d)

Reaction has to be balanced in acidic medium 'O' atoms are balanced by adding H_2O and then H-atom is balanced by adding H^+ ions and charge is balanced by e^-.

Oxidation: $S0_3^{2-} + H_2O \longrightarrow S0_4^{2-} + 2H^+ + 2e^- \times 3$

Reduction: $Cr_20_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$

$Cr_20_7^{2-} + 3S0_3^{2-} + 8H^+ \longrightarrow 2Cr^{3+} + 3S0_4^{2-} + 4H_2O$

a = 1

b = 3

c = 8

S3. Ans.(b)

Decomposition redox reaction leads to breakdown of a compound into two or more compounds at least one of which must be in the elemental state with change in oxidation number.

$2Pb(N0_3^{2-})_2(s) \longrightarrow 2PbO(s) + 4NO_2(g) + 0_2^{\circ}(g)$

S4. Ans.(a)

Aluminium is more electropositive than Cr, so it displaced chromium from Cr_2O_3.

$Cr_2O_3 + Al \xrightarrow{\Delta} Al_2O_3 + Cr$

S5. Ans.(b)

$CH_4(g) + 4Cl_2(g) \rightarrow CCl_4(l) + 4HCl(g)$

In the given reaction

Let Carbon oxidation number assumes to be x

H oxidation state is +1

In CH_4

x + 4 × 1 = 0

x = –4

In CCl_4

Cl oxidation state is –1

x + 4 × (–1) = 0

x = +4

Thus, Change in oxidation state of carbon is from –4 to +4.

S6. Ans.(d)

(a) $\underline{Cl}O_3^-$

x + 3 (–2) = –1

x = +5

(b) $K_2\underline{Cr_2}O_7$

2(+1) + 2x + 7(–2) = 0

X = +6

(c) $H\underline{Au}Cl_4$

(+1) + x + 4(–1) = 0

x = +3

(d) $Cu_2\underline{O}$

2(+1) + x = 0

x = –2

S7. Ans.(a)

A. $\overset{+1}{2Cu^+} \longrightarrow \overset{+2}{Cu^{2(+)}} + \overset{0}{Cu}\}$ Disproportionation

(red: $Cu^+ \rightarrow Cu$; oxd: $Cu^+ \rightarrow Cu^{2(+)}$)

B. $3\overset{+6}{Mn}O_4^{2(-)} + 4H^{(+)} \longrightarrow 2\overset{+7}{Mn}O_4^- + \overset{+4}{Mn}O_2$

oxd $+2H_2O\}$ Disproportionation

(red: $Mn^{+6} \rightarrow Mn^{+4}$)

C. $\overset{+7}{2KMnO_4^{-2}} \longrightarrow K_2\overset{+6}{Mn}O_4 + \overset{+4}{Mn}O_2 + \overset{0}{O_2}\}$

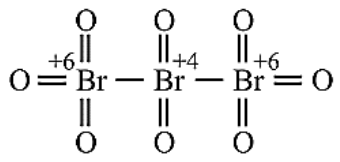
∴ not a disproportionation

D. $2\overset{+7}{Mn}O_4^- + 3\overset{+2}{Mn^{2(+)}} + 2H_2O \longrightarrow 5\overset{+4}{Mn}O_2 + 4H^{\oplus}\}$

S8. Ans.(a)

The correct structure of Br_3O_8.

The oxidation no of bromine is $\frac{16}{3}$ in this structure



Tribromooctaoxide

S9. Ans.(b)

$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow$

$2Mn^{2+} + 10CO_2 + 8H_2O$

S10. Ans.(b)

$CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$

This reaction is not a oxidation reaction as none of the atom in the reaction is showing any change in the oxidation number. H_2SO_4, here in the reaction is not acting as a reducing nor an oxidizing agent.

S11. Ans.(b)

$Fe(NO_2)_2 \rightarrow Fe^{3+} + 2NO_3^-$

$Fe^{2+} \rightarrow Fe^{3+}$ change in oxidation state = 1

$2NO_2^- \rightarrow 2NO_3^-$ change in oxidation state = 4

Total change in oxidation state = 5

So, $Fe(NO_2)_2$ will have maximum number of moles.

$Fe(NO_2)_2$ will need maximum amount of acidic $KMnO_4$

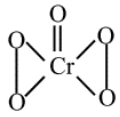
For $FeSO_4$

$Fe^{2+} \rightarrow Fe^{3+}$ change in oxidation state = 1

$FeSO_4$ will need least amount of $KMnO_4$.

S12. Ans.(b)

CrO_5 has a very famous butterfly structure



x + 4 (–1) + 1 (–2) = 0

x = +6