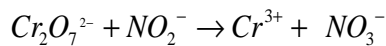


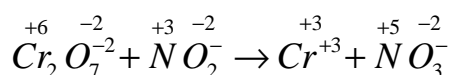
# STOICHIOMETRY

## Short Answer Questions:

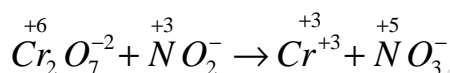
1. Balance the following redox reaction by ion- electron method taking place in acidic medium



**Solution:** Writing oxidation numbers

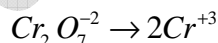
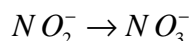


Locating atoms undergoing change in oxidation numbers

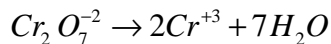
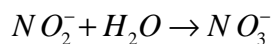


**Dividing the reaction into two halves and balancing in acidic medium, separately**

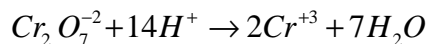
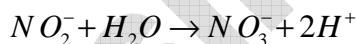
Oxidation half-reaction: Reduction half-reaction



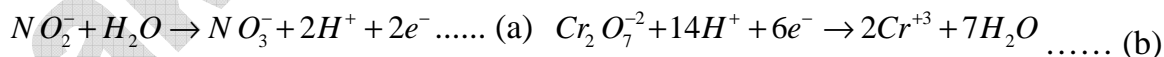
**Step1: Balance oxygen atoms**



**Step2: Balance hydrogen atoms in acidic medium**

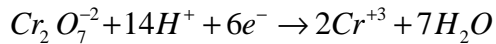
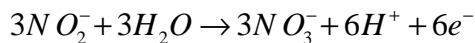


**Step3: Balance the charge**



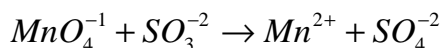
Equalising the electrons and adding the two halves.

eq (a) × 3 + eq (b) × 1, we get

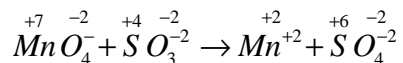


$Cr_2 O_7^{2-} + 3N O_2^- + 8H^+ \rightarrow 2Cr^{+3} + 3N O_3^- + 4H_2O$ . This is the balanced equation.

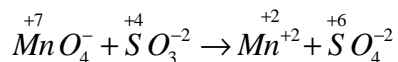
**2. Balance the following redox reaction by ion electron method taking place in acidic medium**



**Solution: Writing oxidation numbers**

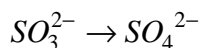


**Locating atoms undergoing change in oxidation numbers**

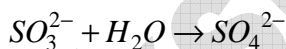


**Dividing the reaction into two halves and balancing in acidic medium, separately**

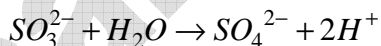
Oxidation half-reaction:



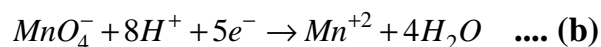
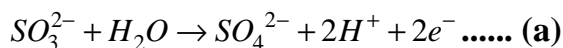
**Step1: Balance oxygen atoms**



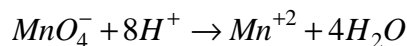
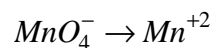
**Step2: Balance hydrogen atoms in acidic medium**



**Step3: Balance the charge**

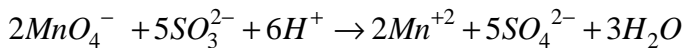
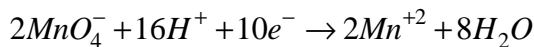


Reduction half-reaction:



Equalising the electrons and adding the two halves.

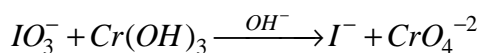
eq (a) × 5 + eq (b) × 2, we get



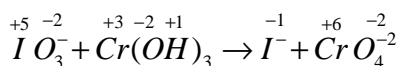
This is the balanced equation.

### 3. Iodate oxidises chromic hydroxide and gives iodide and chromate in basic medium.

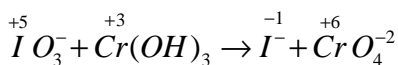
**Solution:** The ionic skeleton equation is written as



**Writing oxidation numbers**

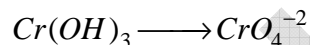


**Locating atoms undergoing change in oxidation numbers**

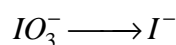


**Dividing the reaction into two halves and balancing in basic medium, separately**

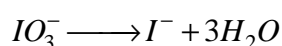
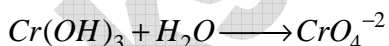
Oxidation half-reaction:



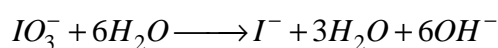
Reduction half-reaction:



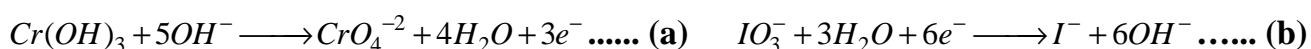
**Step1: Balance oxygen atoms**



**Step2: Balance hydrogen atoms**

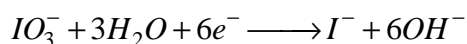
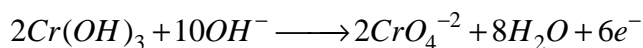


**Step3: Balance charge**



**Equalising the elements and adding the two halves**

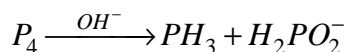
eq (a) × 2 + eq (b) × 1, we get



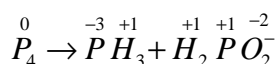
$IO_3^- + 2Cr(OH)_3 + 4OH^- \rightarrow I^- + 2CrO_4^{2-} + 5H_2O$  This is the balanced equation.

**4. White phosphorous reacts with aqueous caustic soda to give hypophosphite and phosphine.**

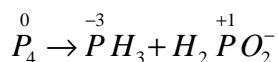
**Solution:** The ionic skeleton equation is



Writing oxidation numbers

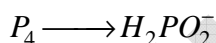


Locating atoms undergoing change in oxidation numbers

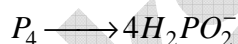


d) Dividing the reaction into two halves and balancing in acidic medium, separately

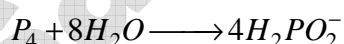
**Oxidation half-reaction:**



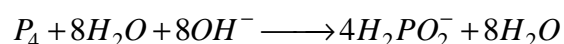
Step1: Balance phosphorous atoms



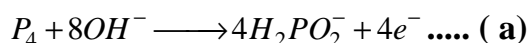
**Step2: Balance oxygen atoms**



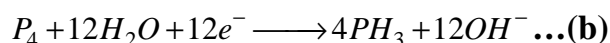
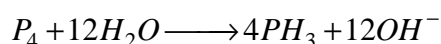
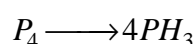
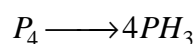
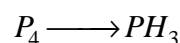
**Step3: Balance hydrogen atoms**



**Step4: Balance charge**

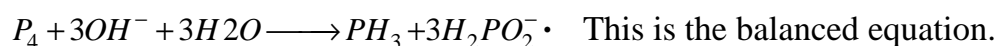
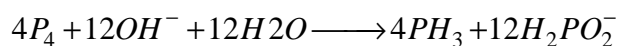
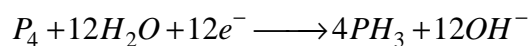
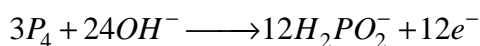


**Reduction half-reaction:**



**Equalising the electrons and adding the two halves**

eq (a)  $\times$  3 + eq (b)  $\times$  1, we get



**5. A carbon compound contains 12.8% carbon, 2.1% hydrogen, 85.1% bromine. The molecular weight of the compound is 187.9. Calculate the molecular formula.**

**Solution:**

**Step1:** Percentage composition of the elements present in the compound.

C	H	Br
12.8	2.1	85.1

**Step2:** Dividing with the respective atomic weights of the elements.

$$12.8/12 = 1.067 \quad 2.1/1 = 2.1 \quad 85.1/80 = 1.067$$

**Step3:** Dividing by the smallest number to get simple atomic ratio.

$$1.067/1.067 = 1 \quad 2.1/1.067 = 2 \quad 1.067/1.067 = 1$$

The empirical formula is  $CH_2Br$ . Empirical formula weight  $12 + (2 \times 1) + 80 = 94$

The molecular weight = 187.9 (given)

$$n = \frac{187.9}{94} = 2$$

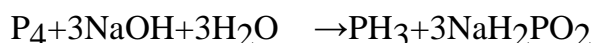
The molecular formula = (empirical formula) $_2 = (CH_2Br)_2 = C_2H_4Br_2$

6. What are disproportionation and Comproportionation reaction? Give one example to each.

**Ans).** The reactions in which the same element undergoing both oxidation and reduction simultaneously are called Disproportionation.

**Examples;**

a) Reaction of white phosphorous in aqueous caustic soda solution.

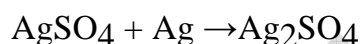


b) Reaction of hot concentrated potash with bromine.



**Comproportionation:** The reverse of disproportionation is comproportionation. In a comproportionation reaction, two species with the same element in two different oxidation states form single product. The element in the product is in an intermediate oxidation state, between that in reactants.

**Ex;** Divalent silver oxidises metallic silver and it self is reduced to monovalent silver.



7. Calculate the molarity of NaOH in a solution prepared by dissolving 4gm in enough water to form 250ml of the solution.

**Solution:**  $Molarity = \frac{\text{weight of solute} \times 1000}{GMW \times \text{volume of solution in ml}} = \frac{4 \times 1000}{40 \times 250} = 0.4M$

### Very Short Answer Questions

**1. How many moles of glucose are present in 540 gm of glucose?**

**Ans.** Molar mass of glucose is 180gm

$$\text{Number of moles} = \frac{\text{weight}}{\text{GMW}} = \frac{540}{180} = 3 \text{ moles.}$$

**2. Calculate the weight of 0.1 mole of  $\text{Na}_2\text{CO}_3$ ?**

**Ans.** Weight of 0.1 mole of  $\text{Na}_2\text{CO}_3 = \text{moles} \times \text{GMW} = 0.1 \times 106 = 10.6 \text{ gm}$

**3. How many glucose molecules are present in 5.23 gm of glucose (Molecular weight of glucose is 180U)?**

**Ans.** GMW i.e. 180 gm of Glucose =  $6.023 \times 10^{23}$  molecules.

$$5.23 \text{ gm of glucose} = ?$$

$$\therefore \text{No. of glucose molecules} = \frac{5.23}{180} \times 6.023 \times 10^{23} = 1.75 \times 10^{22} \text{ molecules}$$

**4. Calculate the number of molecules present in  $1.12 \times 10^{-7}$  c.c. of a gas at STP?**

**Solution:** At STP, 22400 cc =  $6.022 \times 10^{23}$  molecules

$$\text{At STP, } 1.12 \times 10^{-7} \text{ c.c} = ?$$

Number of molecules present in  $1.12 \times 10^{-7}$  c.c at STP

$$= \frac{1.12 \times 10^{-7}}{22400} \times 6.023 \times 10^{23} = 3.01 \times 10^{12}$$

**5. Empirical formula of a compound is  $\text{CH}_2\text{O}$  molecular weight is 90, find molecular formula of that compound?**

**Solution:** Empirical formula of the compound =  $\text{CH}_2\text{O}$

$$\text{Empirical formula weight} = (12) + (2 \times 1) + 1(1 \times 16) = 30$$

$$\text{Molecular weight given} = 90$$

$$\therefore n = \frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{90}{30} = 3$$

$$\text{Molecular formula} = (\text{Empirical formula}) \times n = (\text{CH}_2\text{O}) \times 3 = \text{C}_3\text{H}_6\text{O}_3$$

6. Calculate the oxidation number of chromium in (i)  $\text{Cr}_2\text{O}_7^{-2}$  (ii)  $\text{CrO}_4^{-2}$

Ans. Oxidation number of chromium in (i)  $\text{Cr}_2\text{O}_7^{-2} = 2x + 7(-2) = -2 \Rightarrow x = +6$

(ii)  $\text{CrO}_4^{-2} = x + 4(-2) = -2 \Rightarrow x = +6$

7. Calculate the volume occupied by 2.5 Moles of a gas at STP?

Ans. volume of 1mole of a gas at STP = 22.4 lit

$\therefore$  Volume of 2.5 moles of a gas at STP =  $2.5 \times 22.4$  lit = 56 lit.

8. What volume of  $\text{CO}_2$  is obtained at STP by heating 10gms of  $\text{CaCO}_3$ ?

Ans.  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

1 mole of  $\text{CaCO}_3$  gives 1 mole of  $\text{CO}_2$  i.e. 22.4 lit at STP

i.e. 100 gms of  $\text{CaCO}_3$  gives 22.4 lit  $\text{CO}_2$  at STP

$\therefore$  Volume of  $\text{CO}_2$  at STP given by 10 gms  $\text{CaCO}_3 = \frac{10}{100} \times 22.4 = 2.24$  lit

9. State (i) Law of definite proportions (ii) Law of multiple proportions

Ans. (i) Law of definite proportions states that "A given chemical substance always contains the same elements combined in a fixed proportion by weight."

(ii) Law of multiple proportions states that "If two elements chemically combine to give two or more compounds, then the weight of one element which combine with fixed weight of the other element in those compounds bear a simple multiple ratio to one another".

10. What is a red-ox reaction? Give an example?

Ans. The reaction in which both oxidation and reduction takes place simultaneously is called a Red-Ox reaction.

Ex;  $\text{Zn} + \text{CuSO}_4 \longrightarrow \text{Cu} + \text{ZnSO}_4$

In the above reaction zinc under goes Oxidation and copper ion under goes reduction.