

Answer all the questions below then check your answers

- 1. Define an oxidising agent.
- 2. Define a reducing agent.
- 3. What is a redox reaction?

4. State the trend in reducing ability of halide ions down Group 7.

5. What is the oxidation number of sulfur sulfuric acid (H2SO4)?

6. Explain why iodide is a stronger reducing agent than chloride.



7. Write the oxidation numbers of all elements in sulfur dioxide  $(SO_2)$ .

8. Describe how the oxidation number of hydrogen varies in hydrogen halides (HF, HCl, HBr, HI).

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10. Write balanced chemical equations for the reaction of sodium chloride (NaCl) and sodium fluoride (NaF) with concentrated sulfuric acid (H2SO4), and state the type of reaction.

12. Write balanced equations for the reactions between sodium iodide (NaI) and concentrated sulfuric acid ( $H_2SO_4$ ). Discuss the role of NaI in these reactions.

Role of NaI: Sodium iodide (NaI) acts as a reducing agent in these reactions, reducing sulfuric acid to various products (SO<sub>2</sub>, S,  $H_2S$ ) while itself being oxidised to iodine (I<sub>2</sub>).

13. What is the oxidation number of sulfur in hydrogen sulfide  $(H_2S)$ ?

a) +2 b) +4 c) -2 d) O

Question: Which of the following halides reacts with concentrated sulfuric acid to produce hydrogen halide but no further reduction products?

- a) Sodium fluoride (NaF) b) Sodium chloride (NaCl)
- c) Sodium bromide (NaBr) d) Sodium iodide (NaI)

# <u>Answers</u>

### 1. Define an oxidising agent.

Answer: An oxidising agent is a substance that gains electrons and is reduced in a chemical reaction.

### 2. Define a reducing agent.

Answer: A reducing agent is a substance that loses electrons and is oxidised in a chemical reaction.

#### 3. What is a redox reaction?

Answer: A redox reaction is a chemical reaction in which both oxidation and reduction occur.

4. State the trend in reducing ability of halide ions down Group 7.

Answer: The reducing ability of halide ions increases down Group 7 from fluoride to iodide.

5. What is the oxidation number of sulfur in sulfuric acid  $(H_2SO_4)$ ?

Answer: The oxidation number of sulfur in sulfuric acid  $(H_2SO_4)$  is +6.

6. Explain why iodide is a stronger reducing agent than chloride.

Answer: The iodide ion  $(I^{-})$  is a stronger reducing agent than the chloride ion  $(CI^{-})$  because iodide has a larger ionic radius, this means that the electrons in iodide are held less tightly by the nucleus due to increased shielding by the inner shell electrons, making them easier to donate or lose. As a result, iodide can more readily lose an electron and act as a

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reducing agent. In contrast, the chloride ion, being smaller holds its electrons more tightly and is less likely to lose them.

7. Write the oxidation numbers of all elements in sulfur dioxide  $(SO_2)$ .

Answer: In sulfur dioxide  $(SO_2)$ , the oxidation number of sulfur (S) is +4, and the oxidation number of oxygen (O) is -2.

8. Describe how the oxidation number of hydrogen varies in hydrogen halides (HF, HCl, HBr, HI).

Answer: In all hydrogen halides (HF, HCl, HBr, HI), the oxidation number of hydrogen is +1. The oxidation number of the halides (F, Cl, Br, I) is -1.

Answer: In the reaction between sodium iodide and concentrated sulfuric acid, sodium iodide acts as a reducing agent, and sulfuric acid acts as an oxidising agent.

10. Write balanced chemical equations for the reaction of sodium chloride (NaCl) and sodium fluoride (NaF) with concentrated sulfuric acid (H2SO4), and state the type of reaction.

Answer: For sodium chloride:

 $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$ 

The equation is the same for NaF except HF is formed instead of HCl. Both reactions are acid-base reactions (not redox reactions).

12. Write balanced equations for the reactions between sodium iodide (NaI) and concentrated sulfuric acid ( $H_2SO_4$ ). Discuss the role of NaI in these reactions.

Answer:

**Reactions**:

Initial reaction:

Nal + H₂SO4 → NaHSO4 + HI

The hydrogen iodide produced is then oxidised by the sulfuric acid in a series of reactions as shown below:

 $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$   $6HI + H_2SO_4 \rightarrow 3I_2 + S + 4H_2O$   $8HI + H_2SO_4 \rightarrow 4I_2 + H_2S + 4H_2O$ 

Role of NaI: Sodium iodide (NaI) acts as a reducing agent in these reactions, reducing sulfuric acid to various products (SO2, S, H2S) while itself being oxidised to iodine (I2).

13. What is the oxidation number of sulfur in hydrogen sulfide  $(H_2S)$ ?

a) +2 b) +4 c) -2 d) O

Answer: c) -2

Question: Which of the following halides reacts with concentrated sulfuric acid to produce hydrogen halide but no further reduction products?

- a) Sodium fluoride (NaF) b) Sodium chloride (NaCl)
- c) Sodium bromide (NaBr) d) Sodium iodide (NaI)

Answer: a) Sodium fluoride (NaF) and b) Sodium chloride (NaCl)

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