

Name: _____ () Date: _____

Class: 4Q

Marks:

3. REDOX REACTIONS IN TERMS OF CHANGES IN OXIDATION STATE

3.1 a. Introduction

The oxidation state is _____
_____.

In the compound magnesium oxide, MgO , magnesium exists as the ion Mg^{2+} .

Thus, the oxidation state of magnesium in MgO is _____.

The oxygen exists as the oxide ion O^{2-} . Oxygen, thus, has the oxidation state _____.

b. Oxidation states

As a rule of thumb:

1. Oxidation state of hydrogen is always _____, *except*

- in _____ where it is _____
e.g. in LiH (lithium hydride)

2. Oxidation state of oxygen is always _____ *except*

- in _____, where it is _____

e.g. in hydrogen peroxide, H_2O_2

- when _____ are present, the oxidation state of _____ must remain the same, while oxidation state of oxygen is adjusted e.g. in OF_2 , oxidation state of oxygen is +2

c. Basic rules in write oxidation states

1. A free, uncombined element has 0 oxidation state

E.g.

2. The sum of the oxidation numbers of the atoms in a molecule or ions in an ionic compound is equal to 0

E.g.

3. The charge on a simple ion is its oxidation state

E.g.

4. The sum of the oxidation state of atoms in a polyatomic ion is equal to the charge on the ion

E.g.

5. Covalent and/or complicated compounds are allocated oxidation states by assuming that they are ionic.

E.g.1 NO_2 ,

\Rightarrow assuming it is ionic, it is made up of "nitrogen ion" and "oxide ion",

\Rightarrow sum of the oxidation states of "nitrogen ion" and "oxide ion" is 0.

(Rule No. 2)

\Rightarrow let oxidation state of "nitrogen" be x

E.g. 2 KMnO_4

⇒ a compound that has a mixture of _____ and _____.

⇒ assuming it is ionic, it is made up of "potassium ion", "manganese ion" and "oxide ion"

⇒ sum of the oxidation states of "potassium ion", "manganese ion" and "oxide ion" is 0 (Rule No. 2)

⇒ let oxidation state of "manganese" be x

E.g. 3 H_2SO_4

⇒ it is made up "hydrogen ion", "sulfur ion" and "oxide ion"

⇒ sum of the oxidation states of "hydrogen ion", "sulfur ion" and "oxide ion" is 0 (Rule No. 2)

⇒ let oxidation state of "sulfur" be x

d. Recall

Name of compounds

- some compounds include a Roman numeral (I, II, III) ⇒ oxidation state of that element
- some elements, e.g. the transition elements have more than one o.s.

E.g. 1 Copper

Copper (I) oxide ⇒ Cu^+ , oxidation state: _____

Copper (II) oxide $\Rightarrow \text{Cu}^{2+}$, oxidation state: _____

E.g. 2 Iron

iron (II) sulphate $\Rightarrow \text{Fe}^{2+}$, oxidation state: _____

iron (III) sulphate $\Rightarrow \text{Fe}^{3+}$, oxidation state: _____

3.2 Redox reactions in terms of changes in oxidation states

a. Oxidation

Oxidation occurs when there is _____ of oxidation states.

A substance is oxidised if its oxidation state _____.

b. Reduction

Reduction occurs when there is _____ of oxidation states.

A substance is reduced if its oxidation state _____.

E.g.1 : $\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$

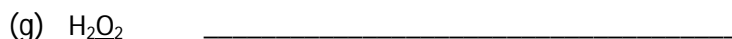
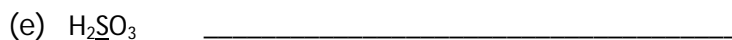
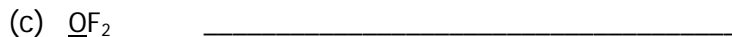
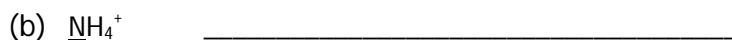
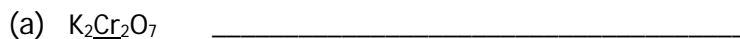
- _____ is oxidised because oxidation state of _____ increases from _____ to _____
- _____ is reduced because oxidation state of _____ decreases from _____ to _____
- _____ is the oxidising agent
- _____ is the reducing agent

E.g.2 : $\text{Mg} + \text{CuO} \rightarrow \text{MgO} + \text{Cu}$

- _____ is oxidised because oxidation state of _____ increases from _____ to _____
- _____ is reduced because oxidation state of _____ decreases from _____ to _____
- _____ is the oxidising agent
- _____ is the reducing agent

c. Exercises

1. Write the oxidation state of the element underlined in each of the compound given below:



2. For each of the equation given below, state whether the underlined substance is oxidized, reduced or no change in oxidation state. Explain your answer in terms of oxidation states.

