Redox

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Redox Overview

Watch Boseman Science, stop at 8.23 min
and answer the following questions

Redox reactions involve losing and gaining _____.

Oxidation occurs when _____ are _____.

Reduction occurs when _____ are _____.

OIL RIG stands for_____

Oxidation numbers can be used to determine where the electrons are being transferred.

Oxidation number rules

1. Free elements (eg O_2, N_2 or C) have an oxidation number of _____.

2. For ions (eg. Na+) the oxidation number is equal to their _____.

3. Oxygen has an oxidation number of _____,

   hydrogen (with non metals) has an oxidation number of _____.

4. In compounds, the oxidation numbers of each atom is equal to the overall charge.

When a substance has been oxidised the oxidation number_____.

When a substance has been reduced the oxidation number _____.

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Introduction

Although oxidation and reduction occurs simultaneously, the oxidation and reduction processes are often shown separately as half equations.

Eg. Oxidation half equation: $Na(s) \rightarrow Na^{+} + e^{-}$

Reduction half equation: $O_2 + 4e^{-} \rightarrow 2O^{2-}$

Redox Half Equations

Now watch Copper and Zinc reaction (1.29 min) , complete the table and answer the following questions.

Material	Initial Appearance	Final Appearance
Copper sulphate		
Zinc metal		

1. Copper metal formed on the outside of the zinc metal. Where did this Cu originate?

2. Beneath the coating of Cu metal, the Zn metal has become pitted; where did the Zn metal go?

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Redox Half Equations

3. What did Cu^{+2} (in solution) need to form Cu metal? Where did Cu^{+2} obtain what it needed?

4. Which of the reactions represents the reduction "half" of this redox reaction? How do you know?

5. Write the two half equations for this reaction and the overall redox reaction.

Introduction

Complex redox equations can be balanced by using the KOHES process.

K – Key elements, balance all elements other than O and H
O – Oxygen, balance by adding H_2O
H – Hydrogen, balance by adding H+ ions
E – Electrons, balance by adding e- to more positive side
S – Add states, (electrons do not have states)

Complex Redox Equations

Now watch potassium permanganate and iron II sulphate (20s) and answer the following questions.

Note: When balancing complex redox equations, ionic equations are often used to simplify the process.

Therefore for potassium permanganate ($KMnO_4$), only permanganate ions (MnO_4^-) are included in the equation.

For iron(II) sulphate, only the iron II ions (Fe^{2+}) are included in the equation.

1. Explain why dilute H_2SO_4 was first added to the test tube (not shown in the youtube) and state what step this related to in KOHES?

2. It is known that the purple permanganate ions (MnO_4^-) form manganese II ions (Mn^{2+}). What was the colour of Mn^{2+}, and state whether MnO_4^- is oxidised or reduced in this reaction.

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KOHES process.

K – Key elements, balance all elements other than O and H
O – Oxygen, balance by adding H_2O
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Complex Redox Equations

3. Use KOHES to write the half equation for $MnO_4^- \rightarrow Mn^{2+}$.

4. Fe^{2+} ions form Fe^{3+} ions. Write the half equation for this reaction.

5. Write an overall equation for this reaction.

Introduction

Redox titrations can be used to standardise some chemicals. In the following youtube hydrogen peroxide is standardised using potassium permanganate.

Now watch hydrogen peroxide and potassium permanganate titration (4.38 min) and answer the following questions.

Apply Redox Titrations

1. Draw a flow chart representing this experiment and complete the table below.

	Volume added to conical flask
H_2O_2 (approx 0.88 M)	
water	
Sulphuric acid (H_2SO_4)	

2. Why was sulphuric acid added to the conical flask?

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Apply Redox Titrations

3. Write the half equations and overall redox equation for this reaction.

4. A student completing this titration obtained a titre value of 35.4 mL when they used a 0.05M potassium permanganate solution. Calculate the exact concentration of the H_2O_2 solution.

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