Answer all the questions below then check your answers

1. What is a displacement reaction?

b. Put the following metals in order of reactivity, most reactive first.

Potassium, Copper, Iron, Zinc

c. Fill in the gaps to complete the sentence below:

In a displacement reaction, the more reactive metal _____ the less reactive metal from its _____.

d. What is the general formula for a displacement reaction between a metal and a metal salt solution?

2. Name a more reactive metal that can displace copper from copper sulfate solution.

3. What colour is a copper sulfate solution?

a. Write a word and symbolic equation for the displacement reaction that occurs when a strip of zinc metal is added to a copper (II) sulfate solution.

b. In the reaction between zinc and copper(II) sulfate, which metal gets oxidized and which metal is reduced?

c. What is the colour change observed when iron displaces copper from copper sulfate solution?

4. Write the word equation for the reaction between magnesium and copper(II) sulfate.

b. Fill in the gaps to complete the sentence below:

When magnesium metal is placed in a copper sulfate solution, the magnesium metal _____ the copper while the copper ions are _____ to form metal atoms.

c. Identify and explain the oxidation and reduction processes in the reaction between magnesium and copper(II) sulfate.

5. Write the balanced chemical equation for the reaction between aluminium and iron(III) oxide.

6. Explain why copper cannot displace zinc from zinc sulfate solution.

7. Describe an experiment to demonstrate the displacement reaction between iron and copper(II) sulfate solution. Include any observations you would expect to see.

8. Given the reactivity series of metals, predict and explain the outcome of placing a piece of calcium in a solution of zinc sulfate. Include both word and symbol equations.

9. Explain why a piece of silver placed in copper(II) nitrate solution does not result in a displacement reaction.

Answers

1. What is a displacement reaction.

   Answer: A displacement reaction is a chemical reaction in which a more reactive metal displaces a less reactive metal from its compound.

b. Put the following metals in order of reactivity, most reactive first.

   Potassium, Copper, Iron, Zinc

Answer: Potassium > Zinc > Iron > Copper

c. Fill in the gaps to complete the sentence below:

   In a displacement reaction, the more reactive metal _____ the less reactive metal from its _____.

   Answer: displaces, compound

d. What is the general formula for a displacement reaction between a metal and a metal salt solution?

   Answer: Metal A + Metal B salt solution → Metal A salt solution + Metal B

2. Name a more reactive metal that can displace copper from copper sulfate solution.

   Answer: Zinc for example or any metal above copper in the reactivity series

3. What colour is a copper sulfate solution?

   Answer: Blue

a. Write a word and symbolic equation for the displacement reaction that occurs when a strip of zinc metal is added to a copper (II) sulfate solution.

Answer

Zinc + copper sulfate → zinc sulfate + copper

$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

b. In the reaction between zinc and copper(II) sulfate, which metal gets oxidized and which metal is reduced?

Answer: Zinc is oxidised, copper ions (Cu^{2+}) are reduced to form copper metal

c. What is the colour change observed when iron displaces copper from copper sulfate solution?

Answer: The solution changes from blue to colourless, and reddish-brown copper

4. Write the word equation for the reaction between magnesium and copper(II) sulfate.

Answer: Magnesium + Copper(II) sulfate → Magnesium sulfate + Copper

b. Fill in the gaps to complete the sentence below:

When magnesium metal is placed in a copper sulfate solution, the magnesium metal _____ the copper while the copper ions are _____ to form metal atoms.

Answer: displaces, reduced

c. Identify and explain the oxidation and reduction processes in the reaction between magnesium and copper(II) sulfate.

Answer: In the equation for the displacement reaction between magnesium and copper sulfate is shown below:

$$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$$

Magnesium is oxidised as it loses electrons: $Mg \rightarrow Mg^{2+} + 2e$

Copper(II) ions are reduced as they gain electrons:

$$Cu^{2+} + 2e \rightarrow Cu$$

5. Write the balanced chemical equation for the reaction between aluminium and iron(III) oxide.

Answer:

$$2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3$$

6. Explain why copper cannot displace zinc from zinc sulfate solution.

Answer: Copper cannot displace zinc from zinc sulfate solution because copper is less reactive than zinc. Only a more reactive metal can displace a less reactive metal from its compound.

7. Describe an experiment to demonstrate the displacement reaction between iron and copper(II) sulfate solution. Include any observations you would expect to see.

Answer:

Method: Place a clean iron nail into a beaker containing copper(II) sulfate solution.

Observations: After some time, the blue colour of the copper(II) sulfate solution will fade as a colourless solution of iron sulfate forms, and a reddish-brown layer of copper metal will form on the surface of the iron nail.

Explanation: Iron displaces copper from the copper sulfate solution because iron is more reactive than copper.

8. Given the reactivity series of metals, predict and explain the outcome of placing a piece of calcium in a solution of zinc sulfate. Include both word and symbol equations.

Answer:

Prediction: Calcium will displace zinc from zinc sulfate solution because calcium is more reactive than zinc.

Word Equation: Calcium + Zinc sulfate → Calcium sulfate + Zinc

Symbol Equation: $Ca + ZnSO_4 \rightarrow CaSO_4 + Zn$

Explanation: Calcium, being higher in the reactivity series, will lose electrons to form calcium ions, while zinc ions will gain electrons to form zinc metal. This is an example of a displacement reaction where a more reactive metal displaces a less reactive metal from its compound.

9. Explain why a piece of silver placed in copper(II) nitrate solution does not result in a displacement reaction.

Answer: Silver does not displace copper from copper(II) nitrate solution because silver is less reactive than copper. For a displacement reaction to occur, the metal being placed in the solution must be more reactive than the metal in the compound.