Completing word equations (1)

Word equations are used to describe chemical reactions. Look at the word equations below. In each case complete the word equation by adding the name of the missing substance. (Explain your answers.)

1. nitric acid + potassium hydroxide → _____ + water

I think this is the answer because

_____

_____

_____

_____

2. zinc + _____ → zinc nitrate + copper

I think this is the answer because

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_____

_____

3. _____+ zinc carbonate → zinc sulfate + water + carbon dioxide

I think this is the answer because

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_____

_____

_____

4. Calcium + chlorine → _____

I think this is the answer because

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_____

_____

_____

5. magnesium + hydrochloric acid → _____ + hydrogen

I think this is the answer because

_____

_____

_____

_____

Word equations – information sheet

Word equations are a shorthand used to describe chemical reactions.

Although there are many millions of possible chemical reactions you are not expected to know about them all.

It is useful to remember that many reactions are of similar types.

1. Metal + acid

One type of reaction is that between a metal and an acid. When a metal reacts with an acid the reaction produces a salt, and hydrogen gas is released. The salt produced depends upon the metal and the acid. If magnesium reacts with hydrochloric acid, then the salt produced is magnesium chloride.

metal + acid → salt + hydrogen

2. Metal carbonate + acid

Metal carbonates also react with acid, to give a salt. When a carbonate reacts with acid the gas carbon dioxide is given off. The salt produced depends upon which acid, and which metal carbonate react. If zinc carbonate reacts with sulfuric acid, then the salt produced is zinc sulfate.

metal carbonate + acid → salt + carbon dioxide + water

3. Acid + alkali

When an alkali and an acid react the product is a salt solution. The particular salt produced depends upon which acid and which alkali reacted. When nitric acid reacts with potassium hydroxide the salt produced is potassium nitrate.

acid + alkali → salt + water

4. Metal + salt solution

When a reactive metal is placed in the solution of a salt of a less reactive metal, a 'displacement' reaction occurs. The more reactive metal is said to displace the less reactive metal from solution. For example zinc is added to copper nitrate solution the copper is displaced and the solution will contain zinc nitrate.

5. Element + element

When two elements react together to form a compound the compound is given a name to show which elements reacted. So if calcium reacts with chlorine the compound is called calcium chloride.

These examples show you the patterns that are found in five important types of reaction. If you look for patterns you should find it easier to work out how to complete word equations.

In this worksheet you will find some examples to help you practice thinking about word equations.

Word equations – the reaction between acids and alkalis

When an acid reacts with an alkali, a salt and water is produced:

acid + alkali → salt + water

for example

hydrochloric acid + sodium hydroxide → sodium chloride + water

The salt that is produced depends upon which acid and which alkali react. The following table provides a summary of the name of the salt produced by different reactions between acids and alkalis.

1. Complete the table (Hint – look for the patterns)

	Name of alkali	
Name of acid	**Sodium hydroxide**	**Potassium hydroxide**
Hydrochloric acid	Sodium chloride	
Nitric acid		Potassium nitrate
Sulfuric acid	Sodium sulfate	Potassium sulfate

Salts produced when acids react with alkalis

2. Complete the following word equation

(acid + alkali → salt + water)

nitric acid + _____ → potassium nitrate + water

Word equations – the reaction between acids and metals

When an acid reacts with metal, a salt and hydrogen are produced:

acid + metal→ salt + hydrogen

for example

nitric acid + calcium → calcium nitrate + hydrogen

The salt that is produced depends upon which acid and which metal react. The following table provides a summary of the name of the salt produced by different reactions between acids and metals.

1. Complete the table (Hint – look for the patterns)

Name of metal	**Name of acid**		
	Hydrochloric acid	**Nitric acid**	**Sulfuric acid**
Iron	Iron chloride		Iron sulfate
Zinc	Zinc chloride	Zinc nitrate	
Magnesium			Magnesium sulfate

2. Complete the following word equation

(acid + metal → salt + hydrogen)

hydrochloric acid + _____ → calcium chloride + hydrogen

Word equations – the reaction between acids and metal carbonates

When an acid reacts with a metal carbonate, a salt, water and carbon dioxide are produced:

Acid + metal carbonate → salt + water + carbon dioxide

for example

sulfuric acid + zinc carbonate → zinc sulfate + water + carbon dioxide

The salt that is produced depends upon which acid and which metal react. The following table provides a summary of the name of the salt produced by different reactions between acids and metal carbonates.

1. Complete the table (Hint – look for the patterns)

Name of metal carbonate	**Name of acid**		
	Hydrochloric acid	**Nitric acid**	**Sulfuric acid**
Copper carbonate		Copper nitrate	
Zinc carbonate			Zinc sulfate
Iron carbonate	Iron chloride		

2. Complete the following word equation

(acid + metal carbonate → salt + water + carbon dioxide)

hydrochloric acid + magnesium carbonate → _____ + water + carbon dioxide

Word equations – displacement reactions

When a reactive metal is added to a solution containing the salt of a less reactive metal, a reaction occurs.

See if you can complete the following word equations (Hint – look for the patterns).

eg magnesium + iron chloride → magnesium chloride + iron

1. magnesium + iron nitrate → magnesium nitrate + _____

2. magnesium + _____ → magnesium sulfate + zinc

3. _____ + copper sulfate → magnesium sulfate + _____

4. zinc + _____ → zinc sulfate + copper

5. zinc + iron chloride → _____ + _____

6. zinc + _____ → zinc sulfate + iron

7. _____ + _____ → zinc nitrate + copper

8. iron + copper sulfate → iron sulfate + _____

9. iron + copper nitrate → _____ + _____

Word equations – synthesis reactions

When a metallic element reacts with a non-metallic element a compound is produced.

The name of the compound contains the name of the metal and the altered name of the non-metal.

1. Complete this summary:

When oxygen reacts with a metal, the compound is called an oxide.

When chlorine reacts with a metal, the compounds is called a chloride.

When _____ reacts with a metal, the compound is called a sulfide.

When fluorine reacts with a metal, the compound is called a _____.

2. Complete the table below: (Hint – look for the patterns)

Name of metal	**Name of non-metal**			
	Oxygen	**Sulfur**	**Fluorine**	**Chlorine**
Magnesium	Magnesium oxide		Magnesium fluoride	
Iron	Iron oxide	Iron sulfide		
Zinc				Zinc chloride
Copper			Copper fluoride	

3. Complete the following word equations:

sodium + iodine → _____

nickel + sulfur → _____

_____ + bromine → calcium bromide

Completing word equations (2)

Word equations are used to describe chemical reactions. Look at the word equations below. In each case complete the word equation by adding the name of the missing substance. (Explain your answers.)

1. sulfuric acid + sodium hydroxide → _____ + water

I think this is the answer because

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2. iron + _____ → iron chloride + copper

I think this is the answer because

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_____

3. _____ acid + magnesium carbonate → magnesium chloride + water + carbon dioxide

I think this is the answer because

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_____

_____

_____

4. zinc + oxygen → _____

I think this is the answer because

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_____

_____

_____

5. calcium + nitric acid → _____ + hydrogen

I think this is the answer because

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_____