Your teacher may watch to see if you can…

- follow instructions carefully
- handle acids carefully and safely.

Aim

To identify the gases evolved when metals and metal carbonates react with dilute acids.

Apparatus

- eye protection
- Bunsen burner and heat-resistant mat
- dropper pipettes
- spatula
- test tubes
- test-tube rack
- bung to fit test tube with delivery tube attached
- wooden splints
- limewater
- copper foil, iron filings, magnesium ribbon, granulated zinc
- copper carbonate, magnesium carbonate
- dilute hydrochloric acid, dilute sulfuric acid

⚠ Safety

Eye protection must be worn.
Sulfuric acid is an irritant.
Wash off any spills immediately with plenty of water.

Method

A Place 2–3 cm^3 of dilute hydrochloric acid in a test tube.

B Add a small piece of magnesium ribbon. Notice whether there is any effervescence and, if there is, test the gas with a lighted wooden splint. Record your results.

C Repeat steps **A** and **B** using the other three metals.

D Repeat steps **A**, **B** and **C** using sulfuric acid instead of hydrochloric acid.

E Place 2–3 cm^3 of dilute hydrochloric acid in a test tube.

F Place 2–3 cm^3 of limewater in a different tube.

G Add a small spatula of copper carbonate to the hydrochloric acid. Quickly bubble the gas through limewater. Record your results.

H Repeat steps **E**, **F** and **G** using magnesium carbonate instead of copper carbonate.

I Repeat steps **E** to **H** using sulfuric acid instead of hydrochloric acid.

Results

1 Record your results in suitable tables.

Conclusions

2 Summarise the reactions between dilute acids and metals.

3 Summarise the reactions between dilute acids and metal carbonates.

4 Write balanced equations for all the reactions that took place.

Name _____ **Class** _____ **Date** _____

Results

1 Record your results for the reactions between acids and metals in the table below.

Metal	Acid	Was there effervescence?	Did the lighted splint pop?

2 Record your results for the reactions between acids and metal carbonates in the table below.

Metal carbonate	Acid	Was there effervescence?	Did the limewater turn milky?

Conclusions

3 Identify the gas produced when metals react with a dilute acid. _____

4 Complete the general equation for the reaction between an acid and a metal.

metal + acid → _____ + _____

5 Give the names of any metals that did not react with a dilute acid. _____

6 Give the name of a metal that would give a violent reaction with a dilute acid. _____

7 Identify the gas produced when metal carbonates react with a dilute acid. _____

8 Complete the general equation for the reaction between an acid and a metal carbonate.

carbonate + acid → _____ + _____ + _____

Name _____ **Class** _____ **Date** _____

1 There are four different ways of preparing soluble salts from dilute acids.

Complete the following general equations.

a metal + acid → _____ + _____

b base + acid → _____ + _____

c alkali + acid → _____ + _____

d carbonate + acid → _____ + _____ + _____

2 Complete the following sentences about the types of salts formed from different acids.

a The salts formed from hydrochloric acids are called _____ .

b The salts formed from nitric acid are called _____ .

c The salts formed from sulfuric acid are called _____ .

d The salts formed from ethanoic acid are called _____ .

3 State a similarity and a difference between a base and an alkali.

_____

4 State whether each of the following substances is an alkali, a base or neither.

a copper oxide _____

b sodium sulfate _____

c magnesium carbonate _____

d ammonium hydroxide _____

5 Give the formula of each of the following substances:

a nitric acid _____

b ammonium carbonate _____

c potassium sulfate _____

d magnesium nitrate _____

6 Write the balanced equation for the reaction between copper oxide and hydrochloric acid.

_____

7 Describe the test to identify:

a hydrogen _____

b carbon dioxide _____

8 When a soluble salt is prepared from an insoluble reactant (base, carbonate and some metals), a similar method can be used for each of them:

A Pour some of the dilute acid into a beaker (warm the acid if you are adding a base).

B Add the insoluble reactant until all the acid has reacted and some solid remains in the beaker.

C Filter the mixture and collect the filtrate in an evaporating basin.

D Heat the filtrate in the evaporating basin on a boiling water bath until about half the water has evaporated.

E Allow the basin to cool and crystals will form. Dry the crystals on paper towels.

a Why is the mixture filtered in step **C**? _____

b Why is the evaporating basin heated on a boiling water bath in step **D**, instead of being heated directly with a Bunsen burner?

_____

c Why is only half the water evaporated in step **D**, instead of evaporating all of the water?

_____

9 Name the method used to produce a solution of a soluble salt from a dilute acid and an alkali. _____

Name _____ **Class** _____ **Date** _____

EASIER

1 Answer the questions by selecting the appropriate metals from the box.

copper	iron	magnesium	potassium	silver	sodium

a Select a metal that reacts steadily with dilute acids. _____

b Select a metal that does not react with dilute acids. _____

c Select a metal that reacts violently with dilute acids. _____

2 The general equation for the reaction between a metal and an acid is

metal + acid → salt + hydrogen

Zinc reacts with dilute sulfuric acid, H_2SO_4.

a Write the word equation for this reaction.

_____

b Complete the balanced equation for this reaction.

$Zn + H_2SO_4 \rightarrow$ _____ + _____

c Describe what is *seen* during this reaction.

_____

d Describe how to show that the gas formed is hydrogen.

_____

3 The general equation for the reaction between a metal carbonate and an acid is

metal carbonate + acid → salt + water + carbon dioxide

Zinc carbonate, $ZnCO_3$, reacts with dilute sulfuric acid.

a Write the word equation for this reaction.

_____

b Write the balanced equation for this reaction.

_____

c Describe what is *seen* during this reaction.

_____

d Describe how to show that the gas formed is carbon dioxide.

_____

HARDER

4 Write word equations for the following reactions:

a magnesium reacting with hydrochloric acid

_____

b magnesium carbonate reacting with nitric acid.

_____

S1 Describe a reaction to make (a) hydrogen; (b) carbon dioxide.
Include an equation for each reaction and a description of how to test for each gas.

Name _____ **Class** _____ **Date** _____

1 Name a metal that does not react with dilute acids. _____

2 Name a metal that reacts violently with dilute acids. _____

3 The general equation for the reaction between a metal and an acid is

metal + acid → salt + hydrogen

Give the names and formulae of the salts formed in the following reactions:

a zinc reacts with sulfuric acid

name of salt _____ formula of salt _____

b zinc reacts with hydrochloric acid.

name of salt _____ formula of salt _____

4 Magnesium reacts steadily with hydrochloric acid, HCl.

a Write the word equation for this reaction.

_____

b Write the balanced equation for this reaction.

_____

c Describe what is *seen* during this reaction.

_____

d Describe how to show that the gas formed is hydrogen.

_____

5 The general equation for the reaction between a metal carbonate and an acid is

metal carbonate + acid → salt + water + carbon dioxide

Give the names and formulae of the salts formed in the following reactions:

a copper carbonate reacts with sulfuric acid

name of salt _____ formula of salt _____

b calcium carbonate reacts with nitric acid. (*Hint:* the symbol for a calcium ion is Ca^{2+}, the symbol for a nitrate ion is NO_3^-)

name of salt _____ formula of salt _____

6 Magnesium carbonate, $MgCO_3$, reacts with dilute hydrochloric acid.

a Write the word equation for this reaction.

_____

b Write the balanced equation for this reaction.

_____

c Describe what is *seen* during this reaction.

_____

d Describe how to show that the gas formed is carbon dioxide.

_____

1 Hydrogen is produced when some metals are added to dilute acids.

a Explain why hydrogen is not produced when copper is added to dilute sulfuric acid.

b Explain why adding sodium to a dilute sulfuric acid is not a suitable method to make hydrogen.

2 Give the name and formula of the salt formed when:

a zinc is added to dilute sulfuric acid

b iron is added to dilute hydrochloric acid.

3 Write the balanced equation for the reaction between magnesium and hydrochloric acid. Include state symbols.

4 Describe the test to identify hydrogen.

5 Describe the test to identify carbon dioxide.

6 Give the name of the salt formed when:

a copper carbonate is added to ethanoic acid

b barium carbonate is added to hydrochloric acid.

7 Write the balanced equation for the reaction between calcium carbonate and nitric acid. Include state symbols.

8 Describe how you could prepare a pure, dry sample of zinc sulfate crystals starting with zinc carbonate and dilute sulfuric acid.

Extra challenge

9 Magnesium reacts with sulfuric acid.

a Describe what you would see during this reaction.

b Write the balanced ionic equation for the reaction. Include state symbols.

c Write the two half equations for the reaction.

d Explain:

i what is oxidised in this reaction and give a reason why

ii what is reduced in this reaction and give a reason why.

10 Magnesium carbonate reacts with sulfuric acid.

a Describe what you would see during this reaction.

b Write the balanced ionic equation for the reaction.

c Explain this reaction in terms of the changes to the particles involved.

Name _____ **Class** _____ **Date** _____

Progression questions

Answer these questions.

1 What happens when an acid reacts with a metal?

_____

_____

2 What happens when an acid reacts with a metal carbonate?

_____

_____

3 What are the tests for hydrogen and carbon dioxide?

_____

_____

Now circle the faces in the 'Start' row in the table showing how confident you are of your answers.

Question	**1**	**2**	**3**
Start			

Assessment

Using a different colour, correct or add to your answers above. You may need to use the back of this sheet or another piece of paper. Then circle the faces in the 'Check' row in the table.

Question	**1**	**2**	**3**
Check			

Feedback

What will you do next? Tick one box.

☐ strengthen my learning ☐ strengthen then extend ☐ extend

Note down any specific areas you need to improve.

_____

Action

You may now be given another activity. After this, note down any remaining areas you need to improve and how you will try to improve in these areas.

_____

_____