Intermediate 1

Int 1 Chemistry

Section 2

Chemical Reactions

2LO Section 2: Learning Outcomes

Intermediate 1 Chemistry Unit 1: Chemistry In Action

Section 2: Chemical Reactions

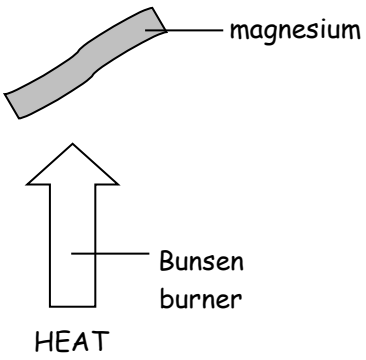
LO	Lesson	Text Book	Learning Outcome	Int1 Only
1	2.1	p19	All chemical reactions involve the formation of one or more new substances.	
2	2.2 2.3 2.4	p19 p20 p20	Chemical reactions can be identified by changes in appearance of substance, including: a) colour change, b) gas evolved, c) precipitate formed.	
3	2.5	p21	**Chemical reactions can be identified by energy changes.**	**Int1**
4	2.6	p21	A wide variety of chemical reactions occurs in the world around us.	
5	2.7 2.8 2.9	p22 p23 p27	Speed of reactions, both in the laboratory and in our everyday life are affected by changes in: a) particle size, b) temperature c) concentration	
6	2.11	p24	**Catalysts are substances which speed up some reactions and are not used up by the reactions.**	**Int1**
7	2.12	p25	**Enzymes are catalysts which affect living things.**	**Int1**
8	2.12	p25 p26	**There are many everyday examples of uses of catalysts and enzymes.**	**Int1**
9	2.13	p28	A chemical reaction can be described by a word equation.	

2.1 What is a Chemical Reaction?

a) **Read** the following passage.

What is a chemical reaction? Dynamite exploding is a fast chemical reaction while the Titanic rusting is certainly a slow chemical reaction. However, a puddle of water evaporating on a hot day is not a chemical reaction. How can we tell the difference between a chemical reaction and a physical change.

b) **Carry out** the following experiment.



1. Collect a pair of tongs and a piece of magnesium
2. Collect a Bunsen burner and a heat mat. Light the Bunsen burner. (Remember to keep flame colour yellow when the Bunsen is not in use by keeping the airhole closed)
3. Burn the magnesium metal in the blue flame.
   NB: do not look directly at the flame
4. Tap the tongs on the mat to transfer remains from the tongs. Examine the new substance on the mat.

c) **Copy** and **complete** the following passage into your jotter using the wordbank.

wordbank				
new	grey	one	colourless	white

i) Magnesium is a …… metallic solid.

ii) Oxygen, in air, is a …… gas.

iii) When magnesium reacts with oxygen a …… solid is formed.

iv) The white solid formed is a …… substance. This white solid was not present at the beginning of the chemical reaction.

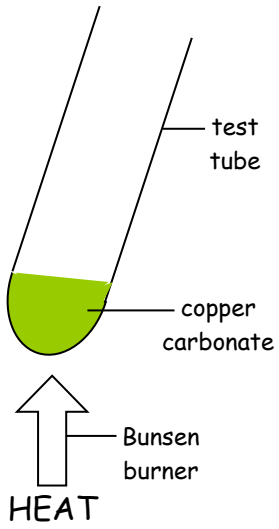
v) All chemical reactions involve the making of at least …… new substance with the atoms combining to make new bonds.

2.2 Chemical Reactions I: Colour Changes

a) **Copy** the following passage into your jotter.

Chemical reactions involve making a new substance. The new substance may loook different from the original substances

b) **Copy** the following diagram into your jotter.



c) **Carry out** the following experiment.

1. Collect a pyrex test tube and transfer a spatula of green copper carbonate powder into the test tube
2. Collect a Bunsen burner and a heat mat. Light the Bunsen burner
3. Place your test tube into a test tube holder and carefully heat the test tube in a blue flame of the Bunsen burner. (Make sure you point the mouth of the test tube away from other members of the class.)
4. Observe the chemical reaction in the test.

d) **Copy** and **complete** the following conclusion into your jotter.

Chemical reactions can be detected by ……

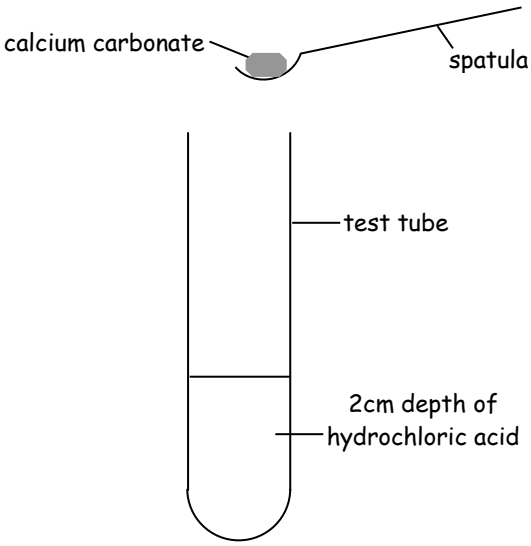
……

2.3 Chemical Reactions II: Gas Given Off

a) **Copy** the following passage into your jotter.

Chemical reactions can be indicated if the new substances is in a different state from the original substances.

b) **Copy** the following diagram into your jotter.



c) **Carry out** the following experiment.

1. Use a dropper bottle to transfer hydrochloric acid solution into the test tube to a depth of 2cm.
2. Collect a test tube and use a spatula to transfer a small amount of calcium carbonate (chalk) powder into the test tube.
3. Observe the chemical reaction.

d) **Copy** and **complete** the following conclusion into your jotter.

Chemical reactions can be detected by ……

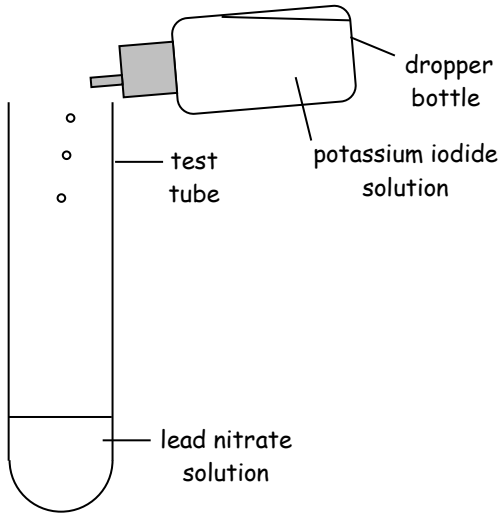
……

2.4 Chemical Reactions III: Solid Being Formed

a) **Copy** the following passage into your jotter.

A chemical reaction is indicated if a new solid is formed, if that solid wasn't there at the start of the reaction.

b) **Copy** the following diagram into your jotter.



c) **Carry out** the following experiment.

1. Use a dropper bottle to fill a test tube to a depth of 2 cm with lead nitrate solution.
2. Use a dropper bottle to add a further 2cm depth of potassium iodide solution to the same test tube
3. Observe the chemical reaction.

d) **Copy** and **complete** the following conclusion into your jotter.

Chemical reactions can be detected by ……

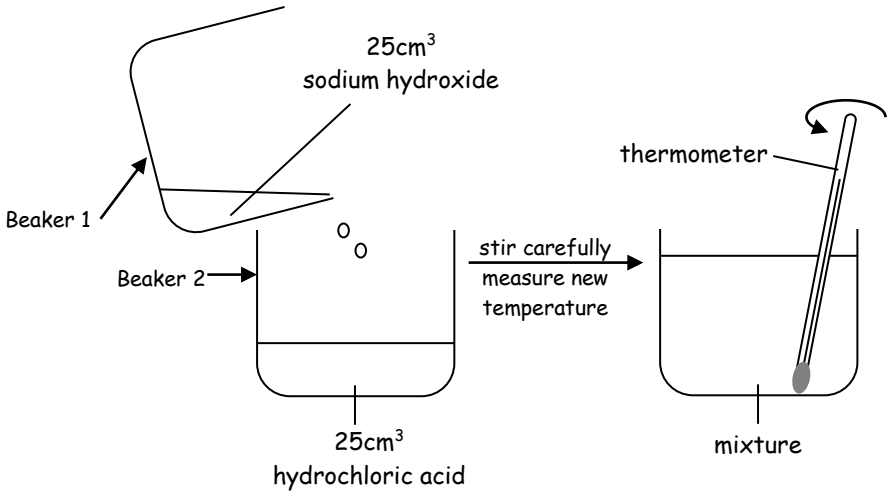
……

2.5 Chemical Reactions IV: Energy Changes

a) **Copy** the following passage into your jotter.

Colour changes, gases given off and solids being formed are all visible signs of a chemcial reaction. Are there any signs that are not visible to your eyes?

b) **Copy** the following diagram into your jotter.



c) **Carry out** the following experiment.

1. Collect 2 beakers and a measuring cylinder.
2. Use a measuring cylinder to measure 25cm^3 of sodium hydroxide solution into beaker 1.
3. Rise out your measuring cylinder with water.
4. Measure 25cm^3 of hydrochloric acid and transfer the acid to beaker 2.
5. Use a thermometer to measure the temperature of the solutions. Record your starting temperature in the results section below.
   (If the temperature of the two solutions are different, enter the average temperature in your results)
6. Pour beaker 1 into beaker 2 and carefully stir the mixture with the thermometer. Observe the highest temperature reached on the thermometer as you stir. Enter this highest temperature in your results below and then complete the experiment report below.

d) **Copy** and **complete** the following conclusion into your jotter.

Chemical reactions can be detected by ……

……

2.6 Chemical Reactions Around Us

a) **Copy** and **complete** the following table into your jotter using the word bank.

Chemical Reactions	Physical Changes

wordbank

new substance(s) formed
melting
solid being formed
evaporation/boiling
gas given off
dissolving
condensation
freezing
colour change
energy/temperature change

b) **Copy** and **complete** the following table into your jotter.

Change	Chemical reaction (yes or no)
frying an egg	
a car rusting	
melting ice	
milk turning sour	
petrol burning	
breaking glass	
coal burning	
plants growing	
condensation forming	

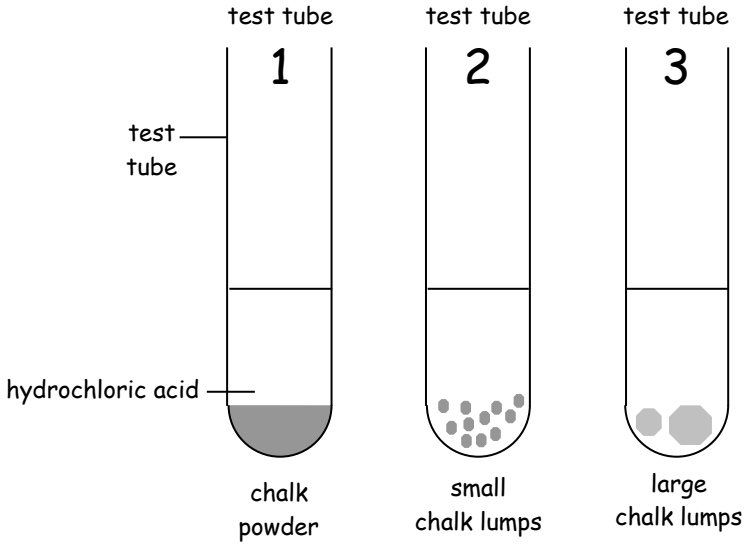
Change	Chemical reaction (yes or no)
water evaporating/boiling	
paint drying	
hair growing	
puddles freezing	
toasting bread	
a leaf rotting away	
sugar dissolving in tea	
gas burning	
firework exploding	

2.7 Reaction Rates and Changing Particle Size

a) **Copy** the following passage into your jotter.

Does changing the size of the reacting particle in a chemical reaction change the rate of a chemical reaction?

b) **Copy** the following diagram into your jotter.



c) **Carry out** the following experiment.

1. Collect three test tubes and a test tube rack.
2. Use a dropper to fill each test tube with hydrochloric acid to a depth of 2cm. Place your test tubes into your test tube rack.
3. Collect a large lump of chalk and put into test tube 3
4. Collect some smaller lumps of chalk. Estimate how many small lumps of chalk will weigh the same as your large lump of chalk. Add these small lumps of chalk to test tube 2.
5. Use as spatula to transfer powder chalk into test tube 1. You must estimate the weight of powdered chalk to add to be approximately the same weight as the original large lump of chalk you added to test tube 3.
6. Observe the rate of chemical reaction in the three test tubes.

d) **Copy** and **complete** the following conclusion into your jotter.

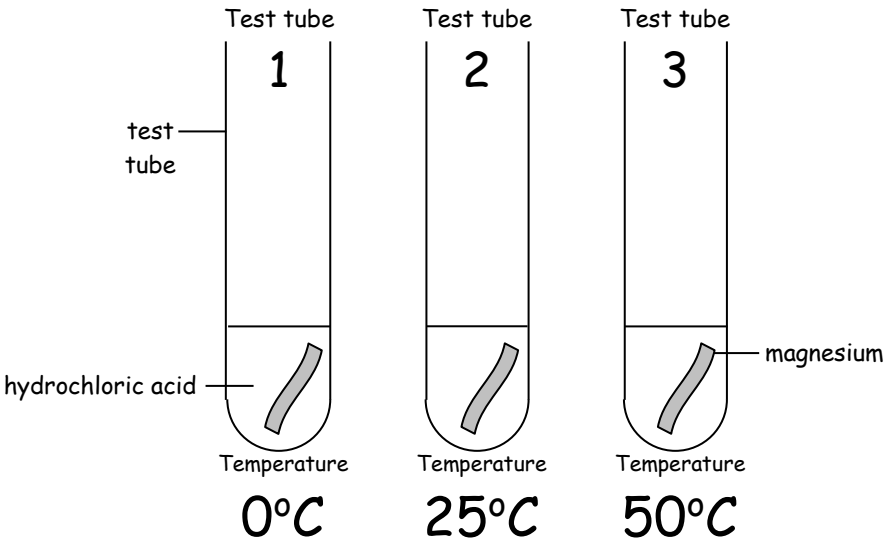
Decreasing the particle size …… the speed of a chemical reaction.

2.8 Reaction Rates and Changing Temperature

a) **Copy** the following passage into your jotter.

Does changing the temperature of a chemical reaction change the rate of a chemical reaction?

b) **Copy** the following diagram into your jotter.



c) **Carry out** the following experiment.

1. Collect a three test tubes and a test tube rack.
2. Using a dropper, fill each test tube with hydrochloric acid to a depth of 2cm.
3. Place one test tube (test tube 1) in the ice bath.
4. Place another test tube (test tube 3) in the water bath at 50°C.
5. While the test tubes are changing temperature, collect three equal-sized pieces of magnesium ribbon.
6. Collect your test tubes, place them in your test tube rack in the correct order and quickly add one piece of magnesium ribbon to each test tube. It is important that you do this step quickly as the test tube temperatures will change quickly if you are too slow.
7. Observe the rate of the chemical reaction in the three test tubes.

d) **Copy** and **complete** the following conclusion into your jotter.

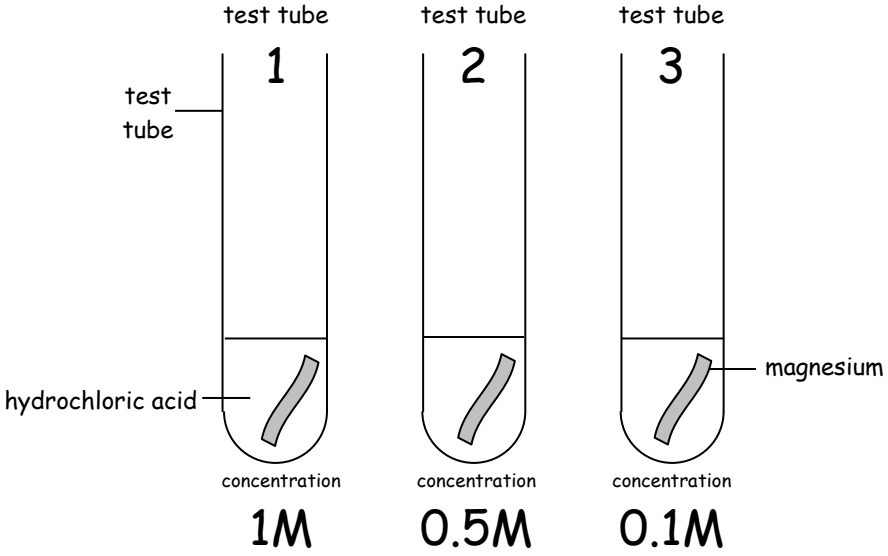
Increasing the temperature …… the speed of a chemical reaction

2.9 Reaction Rates and Changing Concentration

a) **Copy** the following passage into your jotter.

Does changing the concentration of the chemicals in a chemical reaction change the rate of a chemical reaction?

b) **Copy** the following diagram into your jotter.



c) **Carry out** the following experiment.

1. Collect three test tubes and a test tube rack.
2. Using each of three acid concentrations available, use a dropper to fill each of your test tubes with acid to a depth of 2cm.
3. Place your test tubes in your test tube rack in the appropriate order. You must know which test tube has the most concentrated acid (1M) and which test tube has the least concentrated acid (0.1M)
4. Collect 2 equal-sized pieces of magnesium ribbon. Put one piece of magnesium into each test tube at the same time.
5. Observe the rates of reactions in the three test tubes.

d) **Copy** and **complete** the following conclusion into your jotter.

Increasing the concentration …… the speed of a chemical reaction

2.10 Everyday Reaction Rate Examples

a) **Answer** the following questions in your jotter.

(Make sure you know what the original question was from your answer. Look at the way the 1st example has been done for you)

1. If you had stomach ache which would act faster, indigestion powder or indigestion tablets?

ANSWER: Indigestion powder acts faster than tablets because the particle size is smaller.

2. Which would cook slower, small pieces of carrot or large pieces of carrot?

3. Which would cook faster, potatoes in water at 75°C or in water at 100°C?

4. Which burn slower, small sticks or logs?

5. Which grow more quickly, plants in a greenhouse or plants outside in the open air?

6. Which would start more slowly, a car engine first thing in the morning or a car engine late in the afternoon?

7. Which kills germs more slowly, bleach straight from the bottle or bleach diluted with water?

8. In a coal-burning power station, which burns faster – lumps of coal or powdered coal?

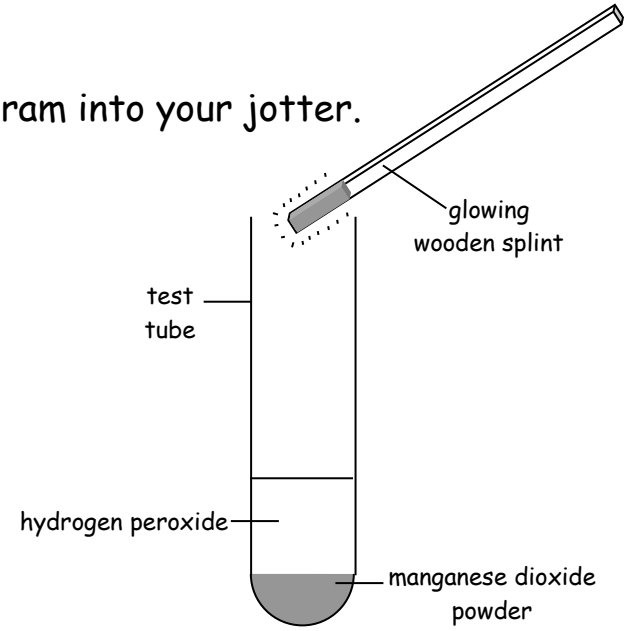
9. Which would burn more brightly, a coal fire with air blown on it or a coal fire with no extra air blown on it?

2.11 Reaction Rates & Catalysts

a) **Copy** the following passage into your jotter.

Catalysts speed up chemical reactions, but what makes catalysts different from other chemical reactants?

b) **Copy** the following diagram into your jotter.



c) **Carry out** the following experiment.

1. Collect one test tube and a test tube rack.
2. Collect a Bunsen burner, a heat mat and a wooden splint. Light the Bunsen burner and turn it to the yellow safety flame.
3. Use a dropper to fill your test tube with hydrogen peroxide to a depth of 2cm. It is important that you do not overfill the test tube.
4. Use a spatula to transfer a *small* quantity of black manganese oxide powder to your test tube of hydrogen peroxide.
5. Test the gas given off with a glowing splint.
6. Observe the test tube when the bubbling stops. Look at the quantity of black manganese oxide powder at the bottom of the test tube. You will need this for you experiment report.

d) **Copy** and **complete** the following conclusion into your jotter.

A catalyst …… …… a chemical reaction.

A catalyst is not …… …… in a chemical reaction.

The mass of the catalyst left at the end of a chemical reaction is the …… .

2.12 Enzymes and Catalysts

a) **Copy** the following passage into your jotter.

Catalysts are chemicals which speed up chemical reactions but are not used up in the reaction.

In living organisms, biological catalysts called *enzymes* carry out chemical reactions in the body at 37°C.

b) **Copy** the following table into your jotter.

Enzyme	Use

c) Use the following information to **complete** the table.

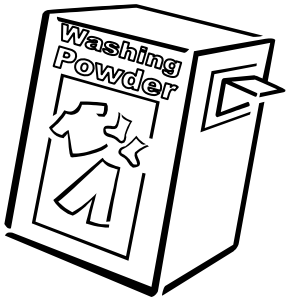
Many enzymes are used in industry.

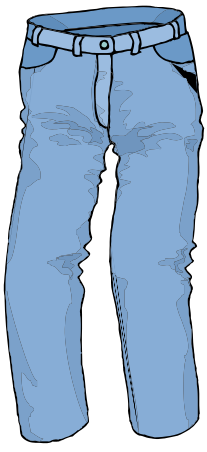
Cellulose *is used to make jeans look more faded.*

Yeast contains ***zymase*** *which catalyses the fermentation of sugars to alcohol.*

Protease *is added to detergent powders to assist the removal of stains from clothes.*

To make meat more tender ***papain*** *is added.*





2.13 Reactants, Products and Equations

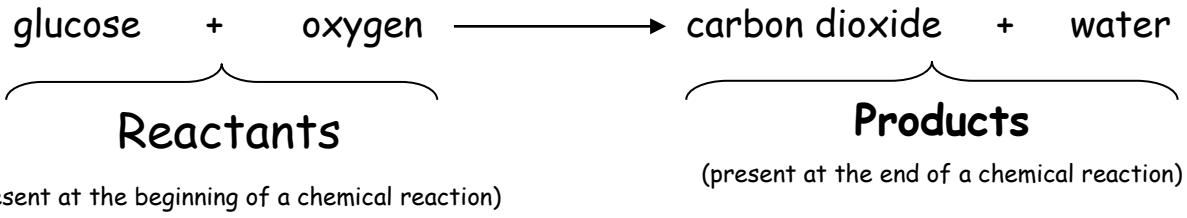
a) **Read** the following passage.

All chemical reactions produce *at least* one new substance

- The chemicals present at the beginning of any chemical reaction are called **reactants**.
- Reactants in a chemical reaction appear on the left hand side of a chemical equation
- The chemicals formed during a chemical reaction which were not present at the beginning but are present at the end of a chemical reaction are called **products**.
- Products of a chemical reaction appear on the right hand side of a chemical reaction.
- The reactants and products in a chemical equation are separated by an **arrow**.

b) **Copy** the following example into your jotter.

Glucose in our food is broken down in the body to release energy to keep us alive. *Carbon dioxide* and *water* are produced in this process, called respiration. The body also uses up *oxygen* in this process.



2.14 Word Equations

a) **Copy** and **complete** the following word equations into your jotter.

(You will need to write the questions into your jotter)

1. Consider what happens when **natural gas** is burned. It reacts with the **oxygen** in the air to form **water** and **carbon dioxide**.

- The **reactants** are **natural gas** and **oxygen**.
- The **products** are **water** and **carbon dioxide**.

…… + …… ⟶ …… + ……

2. Magnesium burns in oxygen to form magnesium oxide.

⟶

3. Sodium carbonate reacts with hydrochloric acid to produce carbon dioxide, water and sodium chloride.

⟶

4. Carbon dioxide is formed when carbon burns in oxygen.

⟶

5. Nitrogen and hydrogen react together to form ammonia.

⟶

6. On heating, copper carbonate breaks down into carbon dioxide and copper oxide.

⟶

7. When potassium is added to water, hydrogen and potassium hydroxide are formed.

⟶

8. When plants photosynthesise, they make glucose and oxygen from water and carbon dioxide.

⟶

Revision
2.15

Access 3 Level Revision Questions

1. Which of these is a chemical reaction?

   melting ice or **burning wood**

2. Which dissolves faster in acid?

   lumps of metal or **metal powder**

3. Which of these <u>always</u> happens in a chemical reaction?

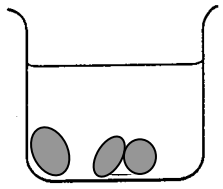
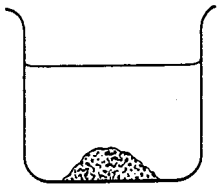
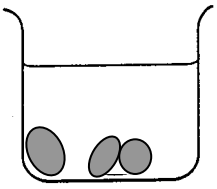
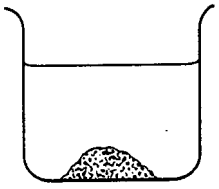
   a gas is given off or **a new substance is produced**

4. Carbon dioxide is formed when carbon is burned in oxygen.
   The carbon dioxide is **a reactant** or **a product**

5. When a piece of sodium is dropped into water, hydrogen gas is given off and sodium hydroxide is formed.

   Write a word equation for this reaction.

6. Zinc is reacted with hydrochloric acid. Hydrogen gas is given off.

A	B	C	D
			
zinc lumps 20°C	zinc powder 20°C	zinc lumps 30°C	zinc powder 30°C

a) Which experiment is the fastest?

b) Which experiment is the slowest?

c) What are you investigating if you compare experiments A + C?

d) Which experiments would you compare if you were investigating the effect of changing particles size on reaction rate?

Revision
2.16

Intermediate 1 Level Revision Questions

1. Magnesium is **a metallic / non-metallic** solid.

2. In a chemical reaction, a new substance is **sometimes / always** formed.

3. A catalyst **speeds up / slows down** a chemical reaction.

4. Increasing the concentration of a solution **speeds up / slows down** a chemical reaction.

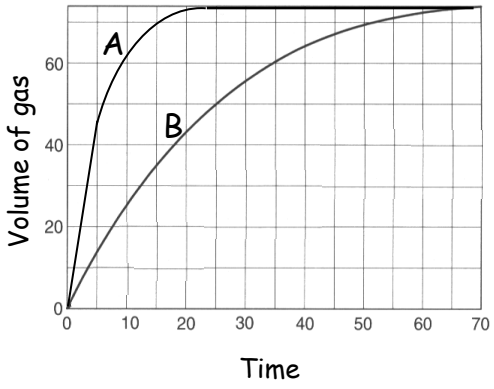
5. Using large lumps instead of powder **speeds up / slows down** a chemical reaction.

6. Which of these is a chemical reaction?
   A. Water boiling.
   B. Tar melting on a road.
   C. A candle burning.
   D. Sugar dissolving in a cup of tea.

7. When burning *magnesium* is put into a jar of *carbon dioxide*, a crackling noise can be heard and black lumps of *carbon* appear on the side of the jar. A white solid called *magnesium oxide* is also formed.

   Write a word equation for this reaction.

8. Look at the graph for the reaction of magnesium metal with hydrochloric acid.



a) Which reaction (A or B) was faster?
b) One reaction was done using magnesium pieces and the other used magnesium powder. Which reaction (A or B) used the magnesium pieces?
c) If reaction B was repeated using more concentrated acid, what change would you see in the shape of the graph?