



JABchem



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Intermediate 1 Int 1 Chemistry



Section 1

Substances

Int 1 Chemistry Section 1: Substances

LO	Lesson	Text Book	Learning Outcome	Int1 Only
1	1.7	p2	Everything in the world is made from about 100 elements.	
2	1.7	p2	Each element has a name, a symbol and an atomic number. They are listed on page 1 of data booklet.	
3	1.7	p2	Chemists have arranged elements in the Periodic Table.	
4	1.11	p3	Most elements are solid at room temperature	
5	1.11	p3	Mercury and bromine are liquid at room temperature.	
6	1.11	p3	Some elements are gases at room temperature.	
7	1.10	p4/5	Elements can be classified as metals or non- metals. A heavy black line is sometimes used to divide the metals from the non-metals in the Periodic Table. Metals lie to the left of the line.	
8	1.10	p4	There are more metals than non- metals.	
9	1.9	p5	Some elements, including gold, silver and copper, have been known for a long time.	
10	1.9	p5	The most recently discovered elements have been made by scientists.	
11	1.13	p6	Many elements have everyday uses. Some uses are listed on page 5 of the data booklet.	
12	1.14	p7	Elements in a column of the Periodic Table show similar chemical properties.	Int1
13	1.14	p9	Compounds are formed when elements react together.	
14	1.16	p10	Most compounds with a name ending in '- ide' contain the two elements indicated	Int1
15	1.16	p10	The ending '- ite' or '- ate' indicates the additional element oxygen.	Int1
16	1.15	p11	Mixtures occur when two or more substances come together without reacting.	
17	1.5	p11	Air is a mixture of gases.	
18	1.5	p11	Air is approximately 80% nitrogen and 20% oxygen.	Int1
19	1.5	p11	The test for oxygen is that it relights a glowing splint.	
20	1.5	p11	There is not enough oxygen in the air for the test to be positive.	
21	1.18	p12	A solution is formed when a substance dissolves in a liquid.	
22	1.18	p12	A substance which dissolves in a liquid is soluble; a substance which does not dissolve is insoluble.	
23	1.19	p14	A saturated solution is one in which no more substance can be dissolved.	Int1
24	1.18	p13	A dilute solution has a lower concentration of dissolved substance than a concentrated solution.	Int1
25	1.18	p13	A solution is diluted by adding more liquid.	Int1
26	1.6	p15	Carbon dioxide gas is dissolved in some drinks to make them fizzy.	
27	1.6	p15	The test for carbon dioxide is that it turns lime water milky.	
28	1.20	p15	Chlorine is dissolved in drinking water to kill bacteria.	
29	1.20	p15	Sodium fluoride is dissolved in drinking water to help to prevent tooth decay.	
30	1.20	p15	Lead compounds in drinking water can be harmful to health.	
31	1.4	p17	Regulations on the use of chemicals exist for the safety of everyone who uses chemicals at work.	
32	1.3	p17	Each hazard of toxic, corrosive, flammable, harmful/ irritant is given a simple symbol which can be easily recognised.	
33	1.4	p17	Hazard warning labels are attached to all appropriate chemicals.	
34	1.4	p17	Hazard symbols are on road tankers to indicate dangers in the event of spillage.	

Safety in Chemistry

a) **Copy** the following table into your jotter. Use a whole page in your jotter

Unsafe Thing	Why is it unsafe?	Safety Rule
Eating in lab	You can be poisoned	No eating or drinking in lab

b) **Look** at the diagram below.

- There are many unsafe things going on in the diagram below.
- **Write** down in your table your ideas.











- a) **Read** the following Science Safety Rules. Add any of them which you did not include in your table in the previous activity.

Science Safety Rules	
1	Always listen to instructions and follow them carefully. If you are unsure ASK! <i>This will help to prevent accidents.</i>
2	Always act sensibly in the science lab - no running, pushing or shoving. <i>This will prevent tripping, falling and breakages.</i>
3	Always wear safety glasses and tie long hair back when told to. <i>This will prevent damage to your eyes and hair.</i>
4	No eating or drinking in the lab. <i>This will prevent infections and poisoning.</i>
5	Keep chairs and bags under the desk . <i>This will prevent tripping, spilling and accidents.</i>
6	Report all spillages and breakages at once. <i>This will prevent any further damage, especially to the others in class.</i>
7	Always put broken glass into the glass bin . <i>This will prevent cuts when the bin is emptied.</i>
8	Allow hot equipment and glassware to cool before it is moved or washed. <i>This will prevent burns and glassware breaking.</i>
9	Use the gas, electricity and water for experiments only when instructed by your teacher. <i>This will prevent damage to yourself and the equipment.</i>
10	At the end of your experiment wash all glassware and put all the equipment away . <i>This will allow the next class to find and use the equipment again.</i>

a) **Collect** a copy of the hazard symbols table and **stick** it into your jotter.

b) Use the word bank to **complete** your table.

wordbank corrosive	oxidising	explosive	highly flammable
radioactive	toxic	harmful/irritant	dangerous for the environment

Symbol Diagram	Symbol Name	Meaning
		Substance which releases harmful radiation.
		Substance may explode if it is <ul style="list-style-type: none"> • burned • heated • left to dry out
		Causes a small health risk if it is <ul style="list-style-type: none"> • breathed in • eaten • soaked through the skin
		Substance which will cause damage to animal and plant life in the environment. Be careful when disposing of the chemical.
		May burn when lighted (even when colder than room temperature) <ul style="list-style-type: none"> • use in a flame-proof area
		May burn skin or wear away solids
		Substance will react with other substances and may cause them to burn or explode.
		Causes a serious health risk if it is <ul style="list-style-type: none"> • breathed in • eaten • soaked through the skin

a) **Copy** and **complete** the following passage in your jotter.

In school and in jobs, there are safety which must be followed if the pupils and workers are to be safe from accidents with chemicals.

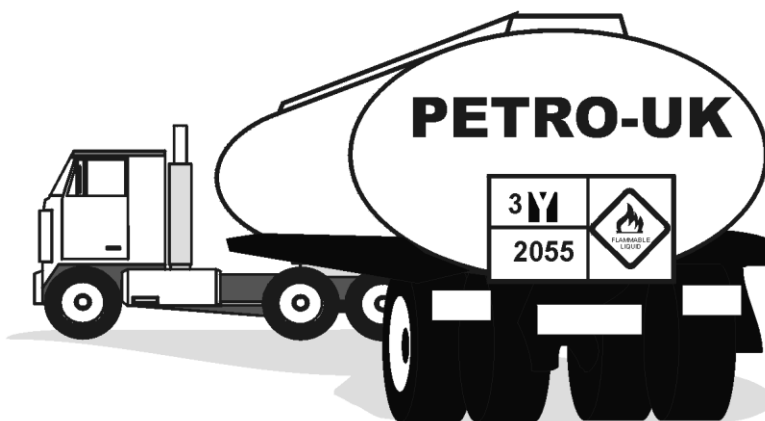
All chemicals have hazard warning labels on them to clearly indicate any potential dangers to pupils and workers.



b) **Look** at the diagram of an oil tanker.

Question:

What are the potential dangers associated with this job and the transportation of the oil in the tanker?



c) **Draw** the following table into your jotter.

Substance	Hazard Symbol

d) **Look** at the collection of containers with hazard symbols and **complete** your table.

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

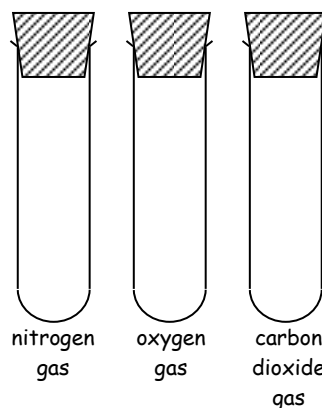
Air is a mixture of gases.

Air contains approximately 80% nitrogen gas and 20% oxygen gas.

But how can we tell the colourless gases nitrogen and oxygen apart?

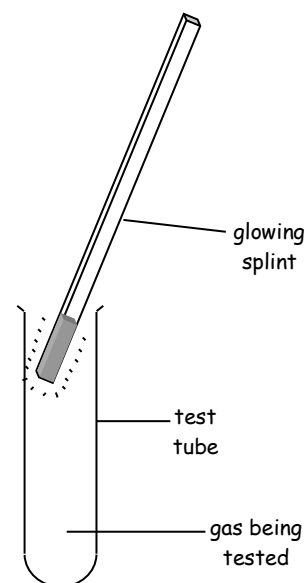
b) **Draw** the following table into your jotter.

Gas	Glowing Splint Test
Nitrogen	
Oxygen	
Carbon Dioxide	



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

1. Light a Bunsen burner, on a heat mat, set to yellow flame.
2. Collect a test tube of one of the three gases.
3. Light a wooden splint, let it burn for a short time. Blow out the wooden splint
4. Quickly remove the stopper from the test tube and move the glowing splint into the test tube.
5. Observe any change in the glowing splint and record your results in the table in your jotter.
6. Repeat the experiment for the other two gases.



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

- i) Oxygen gas is the only gas which will a glowing splint.
- ii) Nitrogen and carbon dioxide gases do not a glowing splint.
- iii) Air will not relight a glowing splint because

.....

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

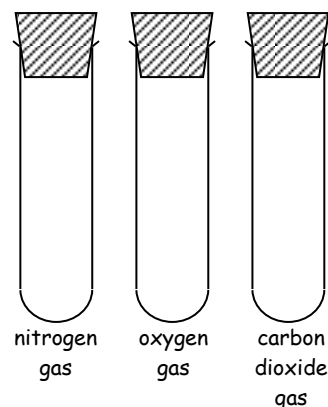
Air is mainly nitrogen and oxygen but contains small quantities of other gases.

Carbon dioxide is one of the gases which makes up less than 1% of air.

But how can we test for carbon dioxide?

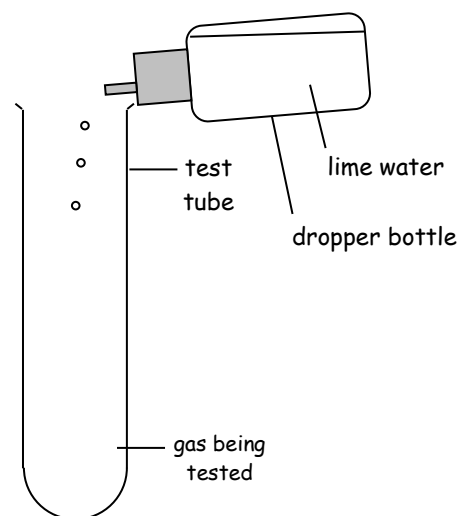
b) **Copy** the following table into your jotter.

Gas	Lime Water Test
Nitrogen	
Oxygen	
Carbon Dioxide	



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

1. Collect a dropper bottle with lime water and a test tube of one of the gases
2. Remove the stopper, add a small quantity of lime water (no more than 1 cm depth of lime water) to the test tube.
3. Put the stopper back in and shake the test tube.
4. Observe any change and record your results in the table in your jotter.
5. Repeat the experiment for the other two gases.



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

The test for carbon dioxide is it turns lime water

Carbon dioxide is dissolved in drinks to make them fizzy. Three examples of fizzy drinks are and

Elements

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

Atoms are the simplest building blocks of every substance in the universe. There are over 100 different types of atoms.

Each atom type is called an element. There are just over 100 elements.

Chemists list all the elements on the *Periodic Table* where each element has

- a name e.g. Magnesium
- a symbol e.g. Mg
- an atomic number e.g. 12

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

Letter	Element on Periodic Table
a	magnesium
b	

c) Use the Periodic Table on page 8 of your data booklet to **identify** the following elements and **write** them in your table

[illegible]

a) **Copy and complete** the following table in your jotter. (Use page 8 of data booklet)

Element Symbol	Element Name	Atomic Number
1. Li		
2. Cl		
3.	Silicon	
4.	Sodium	
5. U		
6. Sr		
7.	Gold	
8.	Lead	
9.		29
10.		19
11. Pm		
12. Al		
13. Sc		
14.		103
15. Sb		
16. Es		
17.	Mercury	
18.	Tin	

b) **Copy and complete** the following table in your jotter. (Use page 8 of data booklet)

Description	Name of element
Named after Alfred Nobel who discovered dynamite	
Named after Madame Curie who discovered radium	
Named after Dmitri Mendeleev	
Named after a country in Europe	
Named after a planet in the solar system	
Named after a continent	
Named after a state in the USA	

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

Some elements were discovered a long time ago and have been known a long, long time.

- Silver, gold and copper were discovered in pre-historic times

Some elements have been discovered in recent times and are made by scientists.

- Mendelevium (Md, atomic number 101) was discovered in 1957.
- Mendelevium is named after Dmitri Mendeleev who devised the Periodic Table of Elements



Dmitri Mendeleev
Russia 1834 - 1907

b) **Find** the dates of discovery for the following elements

- Use page 2 of your data booklet

1. aluminium
2. carbon
3. sodium
4. iodine
5. neon
6. lead
7. iron
8. gold
9. chlorine
10. calcium
11. iron
12. americium

c) **Make a list** of all the elements on page 2 of the data booklet which were discovered before history records the actual date (called pre-historic)

d) **Make a list** of the 6 most recently discovered elements on page 2 of the data booklet. Then look at page 8 of the data booklet. Where are these elements found on the Periodic Table.

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

One way to look at elements is to separate elements into metals and non-metals. Metals conduct electricity but non-metals do not. (you will investigate this in Unit 2)

There is a heavy black line on the left of the Periodic Table which indicates whether an element is a metal or non-metal.

b) **Collect** a copy of the Periodic Table and **stick** into your jotter.

H	The Periodic Table of Elements																He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra																

metal

key

non-metal

c) **Colour** in the following areas of the Periodic Table with different colours

- The area to the *right* of the steps are non-metals
- Hydrogen H is also a non-metal
- The area to the *left* of the steps are metals
- Complete the key in the appropriate colours

d) **Copy** and **complete** the following statements in your jotter.

There are metals on the Periodic Table.

There are more than on the Periodic Table.

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

Elements can be separated into different groups according to whether they are solids, liquids or gases.

b) **Collect** a Periodic Table and **stick** it into your jotter.

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra																

The Periodic Table of Elements

key

solid	liquid	gas
-------	--------	-----

c) Use coloured pencils to **colour in** the following elements according to whether they are solids, liquids or gases.

Gases		Liquids		Solids
Nitrogen	N	Bromine	Br	All the remaining elements are solid at room temperature
Radon	Rn	Mercury	Hg	
Neon	Ne			
Hydrogen	H			
Oxygen	O			
Argon	Ar			
Helium	He			
Chlorine	Cl			
Krypton	Kr			
Xenon	Xe			
Fluorine	F			

1.12

Melting and Boiling Points of Elements

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

- Solids elements have a melting point above room temperature ($\sim 25^{\circ}\text{C}$)
- Gas elements have boiling points below room temperature ($\sim 25^{\circ}\text{C}$)
- Liquid elements have:
 - a melting point below room temperature
 - a boiling point above room temperature
 - 25°C is between the melting and boiling point

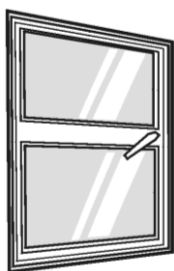
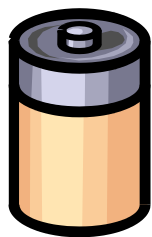
b) **Copy** and **complete** the following table in your jotter.

- Use page 3 of the data booklet

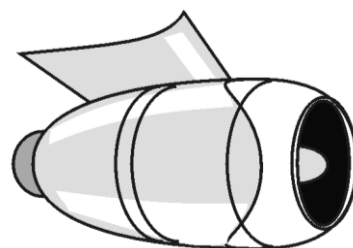
Substance	Melting Point ($^{\circ}\text{C}$)	Boiling Point ($^{\circ}\text{C}$)	State at Room Temperature		
			solid	liquid	gas
aluminium			✓		
chlorine					
bromine					
silicon					
potassium					
oxygen					
helium					
sodium					
mercury					
	232	2602			

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

- Use page 5 of the data booklet



1. Name the metal used to make doors and window frames.
2. Name the metal used to make nails.
3. Name the metal used to make jet engines.
4. Name the metal used in dry batteries.
5. Why is copper used for electrical wiring?
6. Why is mercury used in thermometers?
7. Why is lead used for radiation protection?



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

Non-Metal	Use of Non-metal Element

c) **Read** the following passage and **transfer** the information into a table



Neon gas is used in brightly coloured advertising signs.
 Oxygen gas is found in cylinders which divers use for breathing.
 Light bulbs contain argon gas because it is unreactive.
 In swimming pools, chlorine is used to kill bacteria.
 Liquid nitrogen is used to freeze food.
 At the centre of pencils is carbon which is used for writing.



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

Elements are listed in a particular way on the Periodic Table.

Elements in the same column have very similar chemical properties.

1. The *Alkali Metals* are all reactive metals and must be stored under oil e.g. sodium
2. The *Halogens* are all reactive non-metals e.g. chlorine
3. *Nobel Gases* are all very unreactive non-metals. e.g. helium

b) **Collect** a periodic table and **stick** it into your jotter.

H	The Periodic Table of Elements																He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra																
key																	

key		
alkali metals	halogens	Nobel gas

c) **Colour** in the periodic table in the following way:

- You will need to collect 3 coloured pencils.

Alkali Metals		Halogens		Nobel Gases	
Lithium	Li	Fluorine	F	Helium	He
Sodium	Na	Chlorine	Cl	Neon	Ne
Potassium	K	Bromine	Br	Argon	Ar
Rubidium	Rb	Iodine	I	Krypton	Kr
Caesium	Cs	Astatine	As	Xenon	Xe
Radium	Ra			Radon	Rn
Francium	Fr				

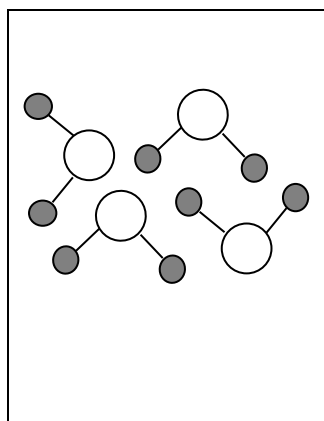
a) **Copy** the following passage into your jotter.

Compounds are formed when two different elements chemically join together to form a new substance called a compound. The new substance often has a different appearance from the original substances.

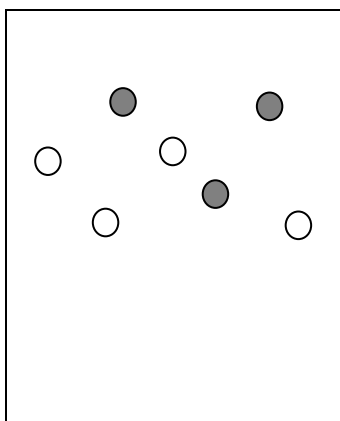


When two substances come together but they do not form react together and form chemical bonds between them, a mixture is formed.

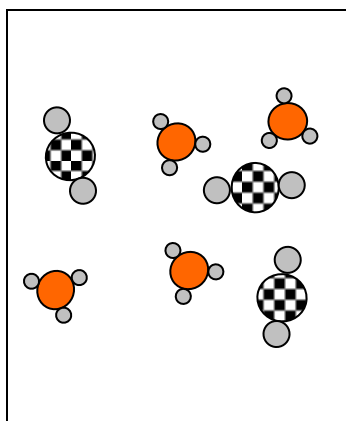
b) **Collect** a copy of the following diagram and **stick** it into your jotter.



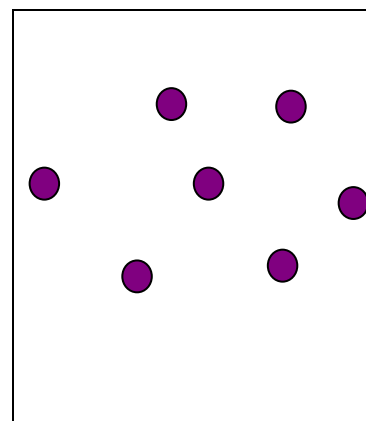
a)



b)



c)



d)

c) Use the following word bank to **complete** the diagram

wordbank	
pure element	pure compound
mixture of elements	mixture of compounds

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

Compounds are formed when two or more different elements chemically join together. The name of the compound comes from the elements within the compound.

Compound Name Ends In	Description of Compound Name	Example
-IDE	The compound contains two elements	copper sulph <u>ide</u> <small>contains</small> copper + sulphur
-ATE	The compound contains oxygen plus the two named elements in the compound name	copper sulphat <u>e</u> <small>contains</small> copper + sulphur + oxygen
-ITE	The compound contains oxygen plus the two named elements in the compound name	copper sulphit <u>e</u> <small>contains</small> copper + sulphur + oxygen

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

Compound Name	Elements in Compound
sodium chloride	
copper sulphate	
copper carbonate	
magnesium oxide	
potassium nitrate	
sodium sulphite	
silicon oxide	
copper phosphate	
sodium nitride	
calcium bromate	
potassium manganate	

a) **Read** the following passage.

Not all substances are soluble in water. Just as well as there would be no beach to lie on in the summer, there would be no earth on the ground to build houses on.

Let's test some substances to see which are soluble or insoluble.



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

Substance	Soluble	Insoluble
sodium chloride (salt)	✓	
copper sulphate		
copper carbonate		
magnesium oxide		
potassium nitrate		
sodium sulphite		
silicon oxide (sand)		

c) **Carry out** the following experiment

1. Use a spatula to transfer a small quantity of the substance into a test tube.
2. Fill the test tube with water to half way.
3. Put a stopper onto the test tube and shake the test tube 30 times.
4. Let the liquid settle and look in the test tube to see if the substance has dissolved.
5. Complete the table in your jotter recording which substances are soluble and which are insoluble.

d) **Copy** the following table into your jotter

- use your data booklet (page 4) to complete the table

Substance	Soluble	Insoluble
calcium carbonate		
potassium carbonate		
calcium nitrate		
copper chloride		
potassium nitrate		

Substance	Soluble	Insoluble
iron phosphate		
sodium sulphate		
magnesium chloride		
calcium sulphate		
copper phosphate		

a) **Read** the following passage.

When you add sugar to tea it gives it a sweet taste. You can't see the sugar anymore but it hasn't been removed as you can still taste it. The sugar has dissolved. When something dissolves the particles mix with the particles in the liquid. Because sugar dissolves in water to make a solution. Sugar is soluble.

In a solution, the substance that dissolves is called the solute. The sugar dissolves in the water. The water is called the solvent and is the liquid which does the dissolving. When the solute dissolves in the solvent, the mixture produced is called a solution.

If a substance is not soluble (it doesn't mix) it is Insoluble. Insoluble substances can be removed from liquids by filtration, using a filter funnel and filter paper.

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

Word	Definition
	A substance which dissolves in a liquid
	Formed by a substance dissolving in a liquid
	A solid which is dissolved
	The liquid which does the dissolving
	A substance which does not dissolve in a substance
	The process where a solid and the liquid form a solution

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

wordbank	
dilute	concentrated

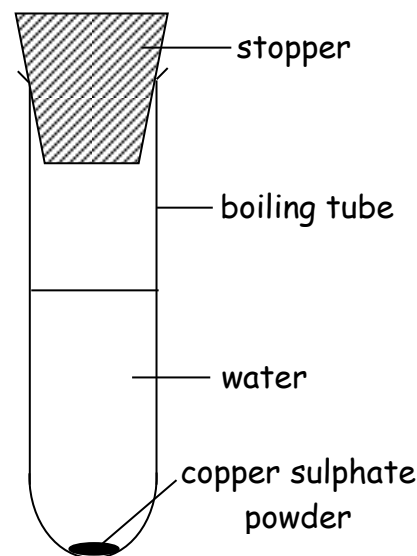
- i) A solution has a lower amount of solid dissolved in a liquid
- ii) A solution has a higher amount of solid dissolved in a liquid.
- iii) When water is added to a solution, the solution becomes more

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

When a substance dissolves in water the substance splits up and goes into the little spaces between the water molecules. But what happens when all the little spaces are taken up?

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

1. Collect a boiling tube, stopper, spatula and a tub of blue copper sulphate powder.
2. Fill the boiling tube up with pure water up to the half-way.
3. Add a spatula of copper sulphate powder to the boiling tube.
4. Stopper the boiling tube and shake the tube until all the copper sulphate has dissolved.
5. Remove the stopper and add another spatula of copper sulphate.
6. Repeat steps 4 & 5 until no more copper sulphate will dissolve. (at this point there will be blue powder on the bottom of the boiling tube and no amount of shaking will dissolve the remaining powder)
7. Note how many spatulas of copper sulphate were added.



c) **Copy and complete** the following statement

Number of spatulas added when no more dissolves =

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

1. Where does the copper sulphate powder go when it dissolves?
2. Why does some copper sulphate powder lie on the bottom of the boiling tube when a saturated solution is created?

e) If you have time:

- i) Filter your solution in your boiling tube into a crystallising dish
- ii) Allow the saturated solution to evaporate
- iii) After 3-4 days, look at what remains in the dish once all the water has evaporated.

a) **Read** the following passage.

The water that comes through the taps is not something that we think about very often. We drink it, wash in it, swim in it, put fires out with it and many other simple everyday tasks.

Some chemicals are added to water are added to benefit our health. However there are chemicals that can get into the water supply which could cause us harm.

b) **Copy** and **complete** the following passage in your jotter.

- Use the word bank to complete the passage

wordbank		
lead	chlorine	fluoride

- i) Sodium is dissolved in drinking water to help prevent tooth decay.
- ii) is dissolved in drinking water to kill bacteria
- iii) compounds in drinking water can be harmful to you health.

Access 3 Level Revision Questions

1. Why is chlorine added to drinking water?

To help prevent tooth decay or to kill bacteria

2. The hazard symbol shown below means



Irritant or flammable

3. Methane is a gas which makes up over 90% of natural gas. It has a formula CH_4 .

Methane is an element or a compound

4. The number of different elements is about 100 or 150

5. Most elements are solids at room temperature.

Name an element which is a liquid at room temperature

6. When the chalk reacts with hydrochloric acid, a gas is given off which burns with a "turns limewater milky". The gas is

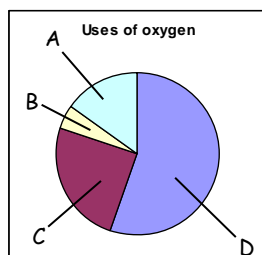
7. Copy and complete the table using page 1 in the Data Book.

Metal element	Date of discovery
Aluminium	1827
	1808
iron	

8. The Romans Empire used several metals for weapons and jewellery. Which of the above metals in the table could they used?

9. Oxygen is used for several things.

uses of oxygen	percentage used
steelmaking	55
chemicals	25
explosives	5
other uses	15



Which segment represents steelmaking?

Intermediate 1 Level Revision Questions

1. Sulphur is a **metal** / **non-metal**.
2. If water is added to a solution it becomes more **dilute** / **concentrated**.
3. When elements react together a **compound** / **mixture** is formed.
4. The element iodine is a **solid** / **liquid** at room temperature.
5. Which of the following substances is an element?
 - A. water
 - B. copper
 - C. air
 - D. salt
6. Which of these is true for oxygen?
 - A. It turns limewater milky
 - B. It makes up around 80% of the air
 - C. It burns with a "pop"
 - D. It relights a glowing splint
7. Copy and complete the table.

Elements present	Name of compound
magnesium + oxygen	magnesium oxide
a)	sodium bromide
calcium + sulphur	b)