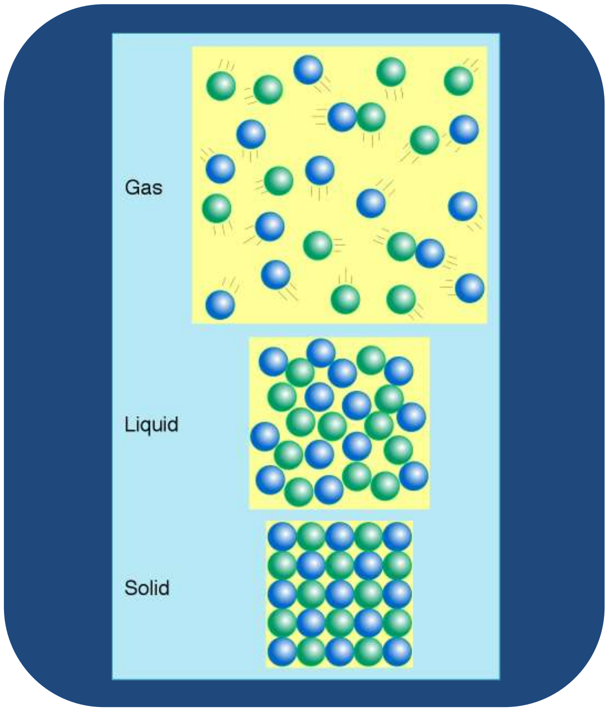

CHAPTER 3

MATTER & MATERIALS:

Classification of Matter

MATTER & MATERIALS

We will look at:

* the classification of matter according to their macroscopic properties
- mixtures and pure substances
- metals & non-metals
- conductor; insulators & semi-conductors

* the composition of matter according to their microscopic properties
- properties of atoms
- breaking down atoms into their sub-atomic particles

* atomic combinations
- 3 types of bonds (intramolecular forces) holding atoms together:
- ionic; covalent and metallic bonding
- crystal lattices, molecules & products of bonding => macroscopic properties

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CLASSIFICATION OF MATTER

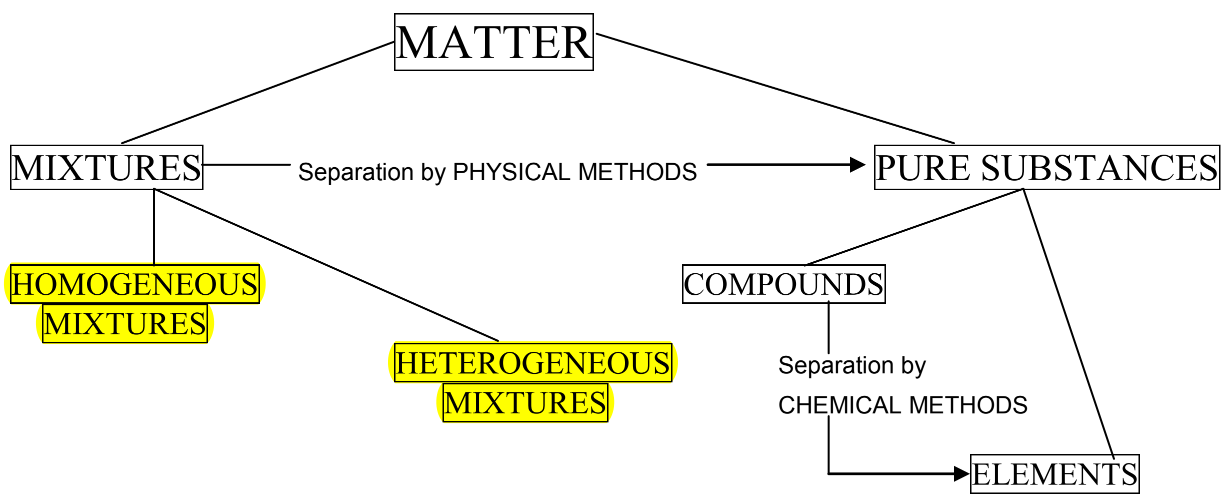
Matter is anything that occupies space and possesses mass.

Everything around us consists of matter.

A substance is a form of matter that has a constant composition and distinct properties;
Eg: water, sugar, table salt (NaCℓ), silver (Ag), oxygen (O_2)

Substances are identified by their smell, taste and appearance etc… These are their *macroscopic properties*.

Substances can be classified into three different types:
- elements
- compounds; and
- mixtures

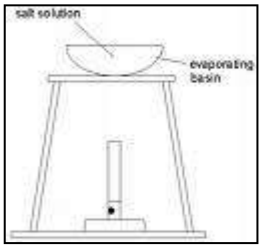


MIXTURES

A mixture is a combination of two or more substances in which the substances retain their own properties.

A mixture's composition does not remain constant. Eg: Air samples in CT; Dbn and Jhb differ in composition due to differences in altitude, pollution etc...

Mixtures are not pure and can be separated by **physical methods** into their pure components, **without changing the properties of the substances**.



Eg: Salt can be recovered from a water solution by heating the solution and allowing the water to evaporate.
A magnet can be used to separate the mixture of iron and sand, because sand is not attracted to the magnet.

HOMOGENEOUS MIXTURES

A homogeneous mixture is a mixture in which the composition is the same throughout.

All the substances in a homogeneous mixture appear to exist in **one phase**.

A homogeneous mixture is also called a **solution**. The solution is **always clear**, although it may be coloured.

In solution we distinguish between the SOLUTE and SOLVENT.

Solute: the component that dissolves in the solvent. (*The little bit of stuff!)*
Solvent: the component that represents the largest amount. (*The very BIG amount of stuff!)*

Substances that dissolve in water are **soluble** in water.

Any substances that mix completely to form a homogeneous mixture are said to be **miscible** and can only be separated by **fractional distillation** (boiling the substances off at their different boiling points).

Overpage are two diagrams:

Diagram 1: Shows distillation of a homogeneous mixture (eg: alcohol & water) in a school laboratory using a Liebig Condenser. Alcohol would be the first distillate as it has a lower boiling point than water.

Diagram 2: Shows fractional distillation of crude oil in industry

Diagram 1:

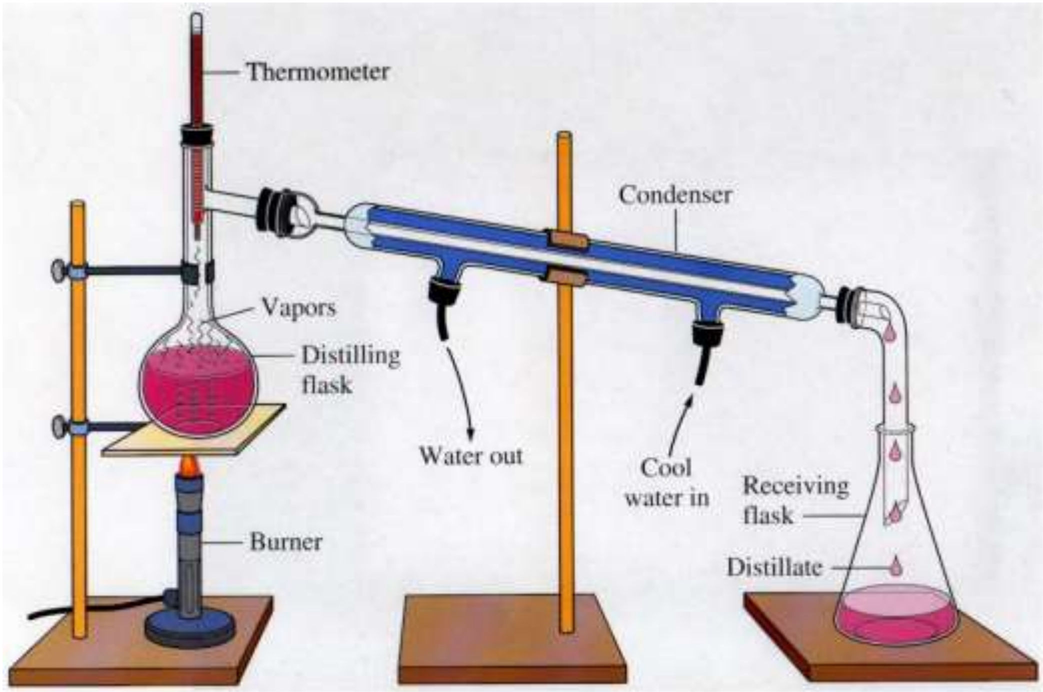
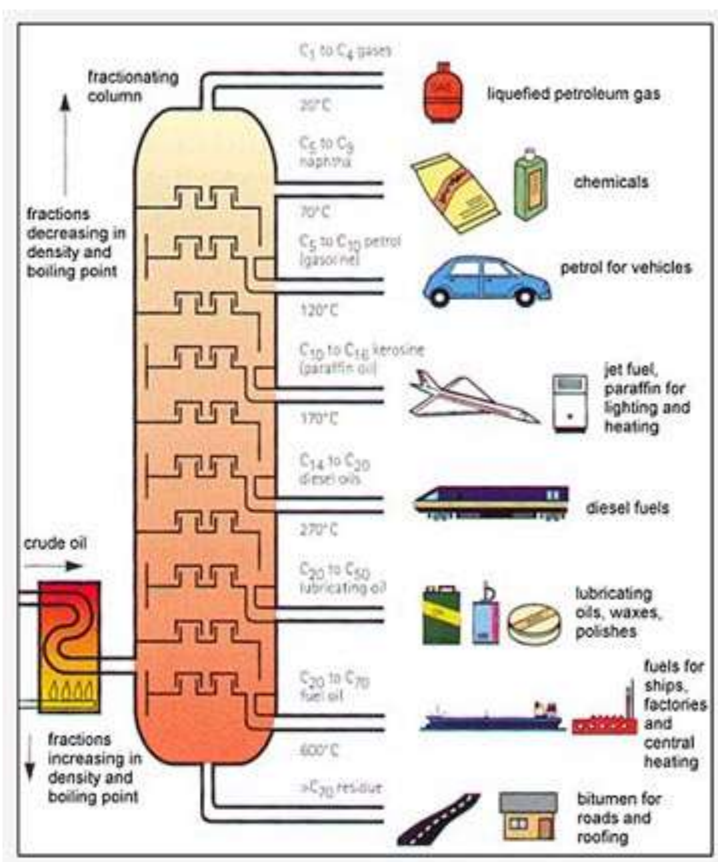
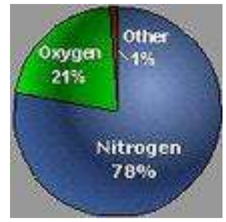


Diagram 2:



Examples of homogeneous mixtures / solutions are:



Gaseous solutions	=>	air, natural gas
Liquid solutions	=>	alcoholic drinks; all fizzy drinks; brine; sugar water
Solid solutions	=>	metal alloys such as brass (Cu and Zn); steel (Fe and C)

HETEROGENEOUS MIXTURES

A heterogeneous mixture is a mixture in which the composition is not constant / uniform.

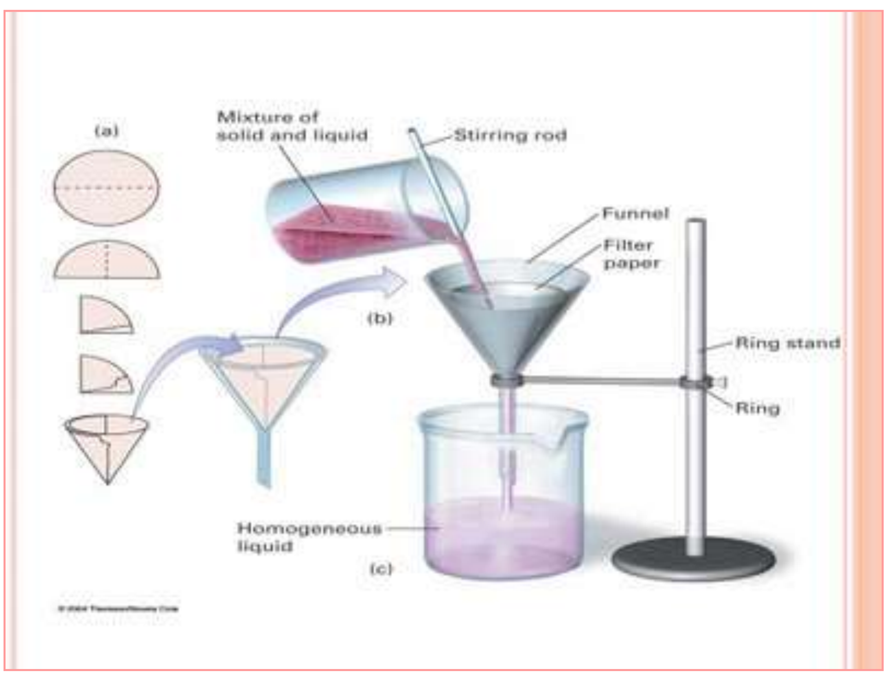
The substances in a heterogeneous mixture generally exist in **different phases**.

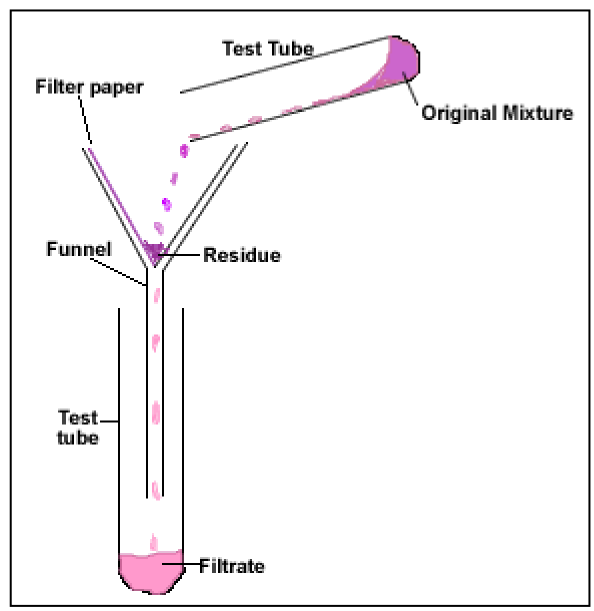
Any combination of substances that do not dissolve in each other can form a heterogeneous mixture.

Any two liquids that will not mix are **immiscible** and they may be separated using a **separating funnel**.

Suspensions as heterogenous mixtures:

- Sand is insoluble in water and if mixed with water it will form a slurry or **suspension**. The solid particles are dispersed in the liquid and will eventually settle out if left to stand.

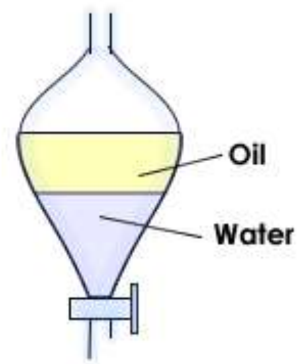




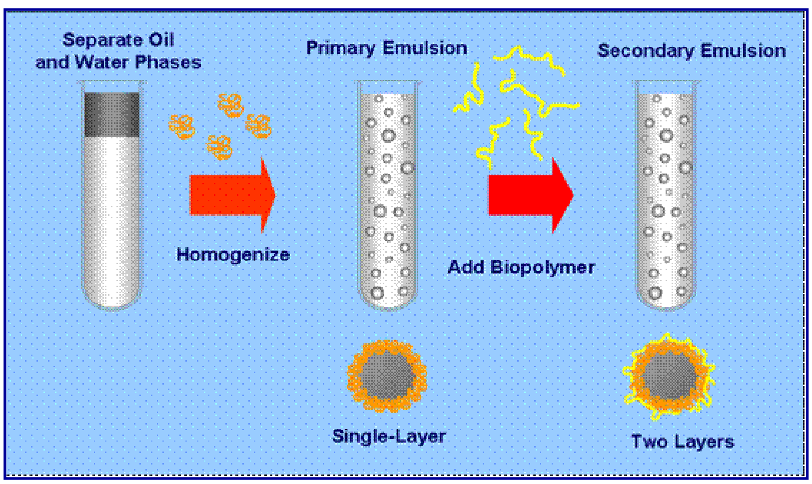
- A suspension can be separated into its components by **filtering**.
- The substance (eg: water) that passes through the filter paper is called the **filtrate**; and the substance (eg: sand) that remains on the filter paper is called the **residue**.

Emulsions as heterogeneous mixtures:

- Cooking oil and water are immiscible due to their different intermolecular forces. Oil and water may be separated using a separating funnel. The more dense liquid will pass through the funnel first.



- When oil and water are vigorously mixed together they form a cloudy mixture that appears to be in one phase. This is called an **emulsion**.



- Examples of emulsions are: salad dressing; mayonnaise; milk; paint and skin care products.

- An **emulsifier** is added to stop an emulsion from separating into layers.

- Milk is **homogenised** to prevent the cream from forming a layer on top of the milk.

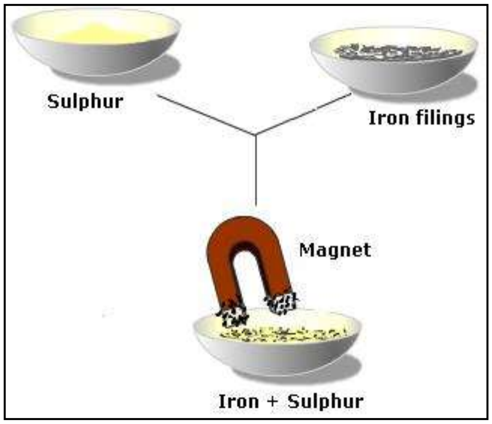
Other types of heterogeneous mixtures:

• Gel	liquid trapped in solid	Eg: Fruit jelly
• Aerosol	liquid in gas	Eg: Spray paint
	solid in gas	Eg: Smoke
• Foam	gas trapped in liquid	Eg: Shaving foam
• Solid foam	gas trapped in solid	Eg: Polystyrene

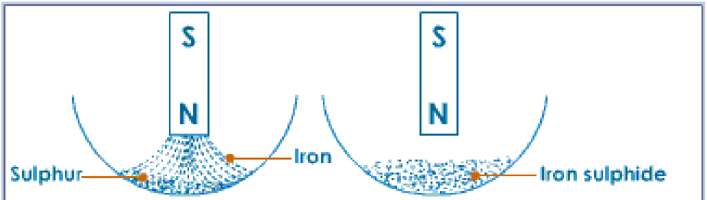
PURE SUBSTANCES

A mixture of iron filings and sulphur powder can be separated (by physical means) in two ways:

- By using a magnet - the iron filings are attracted to the magnet but the sulphur is not
- By dissolving the mixture in carbon disulphide (CS_2) – the sulphur powder will dissolve in the CS_2 but the iron will not. Then filter the solution. The iron filings will remain as residue in the filter paper.



However, if the iron filings and sulphur powder are heated in a test tube over a bunsen burner, a chemical reaction takes place. A new substance, iron sulphide (FeS) forms, that has **different properties than the original components**. $Fe + S \rightarrow FeS$



(A)
Iron gets attracted by a magnet from a mixture of iron and sulphur.
Iron sulphide particles do not get attracted by a magnet.

Mixtures are comprised of pure substances in varying combinations, eg: the amount of sulphur powder and iron filings may vary in the mixture,
BUT

The **composition of pure substances is constant / in a fixed ratio**, eg:

Fe	+	S	→	FeS
56g	+	32g	→	88g
5,6g	+	3,2g	→	8,8g
28g	+	16g	→	44g

FeS **cannot be separated by physical means**, but it can be broken down by reacting it with hydrochloric acid.

$FeS + 2HC\ell \rightarrow FeC\ell_2 + H_2S$

Pure substances consist of one type of substance only and can be either elements or compounds.

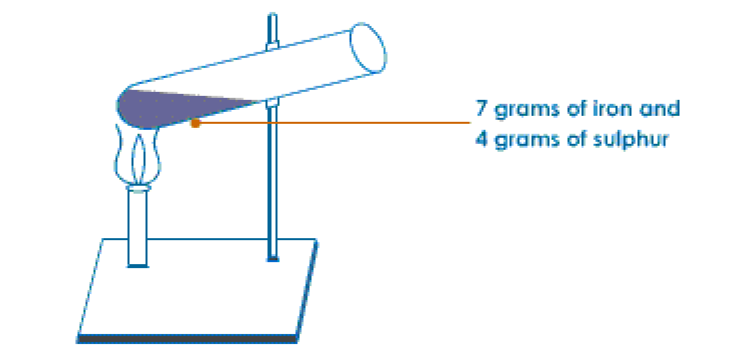


Fig. 4.2 Preparation of iron sulphide by heating a mixture of 7 g of iron and 4 g of sulphur.

ELEMENTS

- ***are pure substances that cannot be broken down into simpler substances by chemical methods.***

- can be subdivided into metals, non-metals and metalloids / semi-metals.

- are the most basic substances from which all material things are constructed

An atom is the smallest particle that retains the property of an element.
Atoms of a particular element cannot be broken down into simpler atoms.
Atoms of elements are represented by **symbols**

The periodic table is a table of over 100 elements, each represented by their symbols. In 1869 a Russian chemist, Dimitri Mendeleev, drew up the first version of the Periodic Table. A periodic table is given on page 6. Only the names of the elements which you are required to know, are given. The names of the other elements may be learnt as general knowledge.

I	II											III	IV	V	VI	VII	VIII
1 H hydrogen																	2 He helium
3 Li lithium	4 Be beryllium											5 B boron	6 C carbon	7 N nitrogen	8 O oxygen	9 F fluorine	10 Ne neon
11 Na sodium	12 Mg magnesium											13 Aℓ aluminium	14 Si silicon	15 P phosphorus	16 S sulphur	17 Cℓ chlorine	18 Ar argon
19 K potassium	20 Ca calcium	21 Sc	22 Ti titanium	23 V vanadium	24 Cr chromium	25 Mn manganese	26 Fe iron	27 Co cobalt	28 Ni nickel	29 Cu copper	30 Zn zinc	31 Ga gallium	32 Ge germanium	33 As arsenic	34 Se selenium	35 Br bromine	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd palladium	47 Ag silver	48 Cd	49 In	50 Sn tin	51 Sb	52 Te tellurium	53 I iodine	54 Xe
55 Cs caesium	56 Ba barium	57 La	72 Hf	73 Ta	74 W tungsten	75 Re	76 Os	77 Ir	78 Pt platinum	79 Au gold	80 Hg mercury	81 Tℓ	82 Pb lead	83 Bi	84 Po polonium	85 At astatine	86 Rn
87 Fr francium	88 Ra radium	89 Ac															
			58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	
			90 Th thorium	91 Pa	92 U uranium	93 Np	94 Pu plutonium	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

Metals are to the left of the “step-ladder”.
Non-metals are to the right of the “step-ladder” (and include Hydrogen).
Metalloids are given in blue.

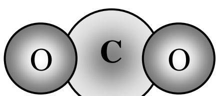
solids   liquids   gases

COMPOUNDS

- ***are pure substances that are made up of two or more elements that have chemically combined in fixed ratios / proportions.***
- can only be broken down into simpler substances (and not always into their pure components) by chemical means.

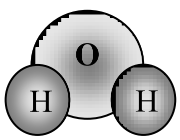
Each compound has its own **formula**. The formula of a compound tells us two things:

- the type of elements in the compound
- the number of atoms of each element in the compound



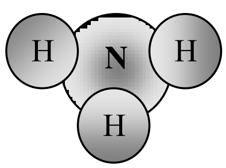
carbon dioxide

formula is CO_2 → 1 carbon atom & 2 oxygen atoms



water

formula is H_2O → 2 hydrogen atoms & 1 oxygen atom



ammonia

formula is NH_3 → 1 nitrogen atom & 3 hydrogen atoms

Calcium oxide has the formula **CaO**

1 calcium atom & 1 oxygen atom

Copper sulphate has the formula **$CuSO_4$**

1 copper atom; 1 sulphur atom & 4 oxygen atoms

Magnesium hydroxide has the formula **$Mg(OH)_2$**

1 magnesium atom; 2 oxygen atoms & 2 hydrogen atoms

Ammonium nitrate has the formula **NH_4NO_3**

4 hydrogen atoms; 2 nitrogen atoms & 3 oxygen atoms

Matter & Materials Worksheet 1

1. Classify the following as **mixtures** or **pure** substances:

Concrete	Dairy milk chocolate	Titanium
Cake	Copper sulphate	Petrol
Clover orange juice	Plastic	Oxygen
Ethanol (alcohol)	Iron ore	Sodium chloride

2. Copy and complete the following table to differentiate between an element; a compound and a mixture:

	Element	**Compound**	**Mixture**
Composition			
Properties			
Method of separation			

3. Identify each of these pure substances from the description given, and classify it as an element or a compound. *You may need to research these answers!*

	Description of substance	**Name of substance**	**Element / Compound?**
3.1	This gas sublimes at about -80^0C to form a solid called "dry ice".		
3.2	This inert gas gives its name to fluorescent lights.		
3.3	This golden metal is used as an electrical conductor.		
3.4	This poisonous gas is represented by the chemical formula NH_3. It is used in household cleaners and it has a characteristic smell.		
3.5	This solid is the main constituent of steel. It has magnetic properties.		
3.6	This substance has the chemical symbol U. It is used as fuel in nuclear reactors.		
3.7	This silver metal which is more precious than gold, is mined near Rustenburg.		
3.8	This substance is the main component of chalk and marble.		
3.9	This white crystalline substance is commonly known as table salt.		
3.10	This metal is extracted by the electrolysis of bauxite. It is processed into metal foil, which is used in cooking and packaging.		

4. Why is a mixture of iron and sulphur different from iron sulphide?

CRYSTAL PURE SPRING WATER

Natural spring water containing no additives or preservatives

5. Sometimes bottled spring water is advertised as “pure spring water”. What is the manufacturer claiming? Is the bottled water “pure”? Or is it “pure spring water”? And what is the difference between these two claims?

6. Will 2% low fat milk from different dairies differ in its chemical composition? Explain briefly.

7. Diamond and graphite are pure forms of the same element: carbon. They have very different physical properties, but similar chemical properties. Compare diamond with graphite by redrawing and completing the following table of their physical properties. *You may need to research this answer!*

CARBON	Diamond	Graphite
Hardness		
Colour		
Ability to conduct electricity		

8. Explain why you would obtain an impure substance if you mixed pure baking soda (bicarbonate of soda) with pure table salt.

9. State in each case, whether a mixture or a compound is formed and give a reason for your answer.
   9.1) Vinegar (acetic acid) is poured over baking soda (sodium bicarbonate).
   9.2) Copper(II) chloride is dissolved in water.

10. When sulphur dissolves in carbon disulphide (CS_2), what is this kind of mixture called? Which substance is the solute and which is the solvent?

11. When a mixture of sand and water is filtered, what do we call the sand which remains behind on the filter paper? What do we call the water which passes through the filter paper?

12. Complete the following sentences:
    To separate two liquids which do not mix, called ____12.1____ liquids, a ____12.2_____ funnel is used. The liquid which is the ___12.3____ dense will pass though the funnel first. To separate liquids which do mix, a process called ____12.4_____ distillation is used. For this process, a _____12.5______ flask and a _____12.6_____ condenser are needed.

13. Three liquids are separated by fractional distillation. The boiling point of A is 155^0C, B is 75^0C and C is 100^0C. Which would form the first distillate and which would form the last?

14. Which method would you use to:
 14.1) separate salt and sand from water?
 14.2) get pure water from sea water?
 14.3) collect salt from sea water?
 14.4) separate filings of copper and iron?
 14.5) separate mercuric oxide (a red powder) into mercury and oxygen?
 14.6) separate a mixture of zinc powder and flowers of sulphur?
 14.7) separate water in hydrogen and oxygen gas?

15. What is the difference between a distillate and a filtrate?

16.

Apparatus	
A separating funnel	A thermometer
A beaker	A Bunsen burner
An evaporating dish	A distillation flask
A Liebig Condenser	

Choose from the table of apparatus given above, that which you would need to:
 16.1) separate water from a mixture of water and magnesium chloride.
 16.2) separate water from a mixture of water and methylated spirits.
 16.3) separate oil from a mixture of water and oil.

17. Is river water clean and drinkable after it has been filtered? Give reasons for your answer.

18. Redraw and complete the following table:
You may need to research the formula of some of the following compounds!

	Name of compound	Chemical formula	Type of elements in the compound	No. of atoms of each element in the compound
18.1	Sulphur dioxide			
18.2	Methane			
18.3	Sulphuric acid			
18.4	Ammonium sulphate			
18.5	Lead acetate			

19. **ACTIVITY**
Choose and element off the periodic table (one whose name you DO need to know).
Make an A4 poster giving all the physical and chemical properties of your element.
Include a picture of your element.

20. **TEST**
Learn all the names and corresponding symbols of the elements that you are required to know. An oral test will be conducted in class next lesson!

Grade 10

Practical Work: MIXTURES; ELEMENTS & COMPOUNDS

Practical 1: GROUP 1

Chemicals & Apparatus:

Iron Filings	Filter paper
Flowers of Sulphur	Glass rod (for stirring)
Distilled Water	Metal spoon / spatula
Carbon Disulphide	Test tube
White A4 Paper	Test tube holder
Magnet	Bunsen burner
3 x 80 ml beaker	Matches
Funnel	Hydrochloric acid
Dropper	Latex Glove

Method & Questions

* *Take two spoonfuls of sulphur and 1 spoonful of iron filings and mix them together on your piece of white A4 paper using the glass rod*

Q1: What type of mixture have you made?

Q2: Give the symbol for the elements *iron* and *sulphur*.

Q3: Should one use physical or chemical methods to separate this mixture?

* *Hold the magnet over the mixture.*

Q4: What do you observe? Give a reason for your answer.

Q5: What name is given to this method of separation?

* *Clean your magnet so that you have the original mixture of the white paper. Fold the paper and gently transfer* ***a third*** *the mixture into 40 ml of distilled water. Stir and leave to settle.*

Q6: What do you observe?

Q7: Is this a good method of separating the mixture of iron and sulphur?

Q8: What could be done to separate the three substances, namely iron; sulphur and water?

* *Transfer another **third** of the iron and sulphur mixture from your A4 paper into 40 ml of carbon disulphide. Stir and leave to settle.*

Q9: What do you observe?

Q10: Is this a good method of separating the mixture of iron and sulphur?

* *Fold a piece of filter paper to make a cone and place it in the funnel. Hold the funnel over a beaker and pour all the mixture of iron, sulphur and carbon disulphide slowly into the funnel.*

Q11: What do we call this method of separation?

Q12: Is this a physical or chemical method of separation?

Q13: What substance is left on the filter paper?

And what do we call the substance that is left on the filter paper?

Q14: What substance passes through the filter paper?

And what do we call the substance that passes through the filter paper?

Is this a homogeneous or heterogeneous substance?

* *Transfer the remaining **third** of the iron and sulphur mixture into a test tube. Hold the test tube with the test tube holder. Connect the Bunsen burner to the gas tap. Light a match and then turn on the gas. Hold the match over the outlet at the top of the Bunsen burner until a flame appears. Adjust the air intake on the shaft of the Bunsen burner so that a blue flame is observed. Move the test tube over the flame but ensure that you do not breath in any fumes by facing the opening of the test tube away from your face. Keep heating the mixture inside the test tube until it appears to have "blended" together thoroughly.*

Allow the test tube to cool down completely. Hold a magnet over the substance that has formed in the text tube.

Q15: Is this new substance a mixture or a pure substance?

Q16: Does it have the same physical and chemical properties as its original components?
Give a reason for your answer.

* *Put the latex glove on and use the dropper to put 5 drops of acid over his new substance.*

Q17: What do you observe?

Q18: Have you managed to break down this substance into its original components?

Grade 10

Practical Work: MIXTURES; ELEMENTS & COMPOUNDS

Practical 2: GROUP 2

Chemicals & Apparatus:

Ethanol (alcohol)	2 lengths of Rubber tubing	Hydrogen peroxide
Distilled Water	Retort stand with boss head & clamp	Potassium iodide
3 x 200 ml beaker	Bunsen burner & Matches	1000 ml measuring cylinder
2 x porcelain dish	Thermometer	Sunlight soap
Flat bottom flask	Tripod stand & Guaze	Food colouring
Round bottomed side armed flask with built in stopper (stopper with hole)	Liebig Condenser	Metal spoon
	Glass rod	Glass trough
	Wooden splint	Latex gloves

Method & Questions

* *Pour 100 ml of distilled water into a beaker. Pour 100 ml of ethanol into a beaker. Connect the Bunsen burner to the gas tap. Light a match and then turn on the gas. Hold the match over the outlet at the top of the Bunsen burner until a flame appears. Adjust the air intake on the shaft of the Bunsen burner so that a blue flame is observed. Light a splint of wood using the Bunsen burner and bring the flame near the surface of the ethanol.*

Q1: Are water and ethanol pure substances? Give a reason for your answer.

Q2: What do you observe when the flame is brought near the surface of the ethanol?

* *Pour the ethanol into the beaker of distilled water. Stir with the glass rod. Pour a small quantity of this mixture into a porcelain dish. Light the splint of wood again and bring the flame near the surface of the mixture.*

Q3: What do you observe when the flame is brought near the surface of the mixture?

Q4: Is this mixture homogeneous or heterogeneous? Give a reason for your answer.

Q5: Will separating this mixture into the original components require a physical or chemical method?

Q6: What method of separation would be most suitable?

Q7: What is the boiling point of water? and of ethanol?

Q8: Which substance will evaporate first; water or ethanol?

* *Place the guaze on the tripod stand over the burner. Place the neck of the round bottomed flask securely into the clamp connected to the retort stand and adjust the height of the boss head so that the bottom of the flask just touches the centre of the guaze.*

* *Pour the water and alcohol mixture, from your beaker, into the flask and place the stopper in the neck of the flask. Insert the thermometer into the hole of the stopper so that the mercury end of the stopper is immersed in the mixture in the flask.*

* *Connect the Liebig condenser to the side arm of the flask. Place one end of rubber tubing over the top inlet of the Liebig condenser and connect the other end of the tubing over the tap. Place one end of another piece of rubber tubing over the outlet of the Liebig condenser and allow the other end of the tubing to dangle in the basin.*

* *Place a clean, dry flat bottomed flask under the loose end of the Liebig condenser, ensuring that the loose end of the Liebig condenser is lower than the end attached to the round bottomed flask.*

* *Light the Bunsen burner and gently turn on the tap so that the water flows through the condenser. Keep your eye on the thermometer. When it reaches the boiling point of ethanol, move the Bunsen burner in and out from under the tripod stand and try to maintain a constant temperature (ie: that of the boiling point of ethanol)*

* *Turn off the tap and the Bunsen burner once you have collected at least 30 ml of substance in the flat bottomed flask. Pour this substance into a clean porcelain dish and bring a lit wooden splint near the surface of the substance.*

Q9: Why must you ensure that the Liebig condenser is angled when it is set-up?

Q10: Why must you try to maintain a constant temperature (ie: that of the boiling point of ethanol)? Give a reason for your answer.

Q11: What did you observe when you brought a lit splint near the surface of the substance that was collected in the flat bottomed flask and then poured into the porcelain dish?

Q12: What conclusion can be drawn from your observation?

Q13: Is this method of separation effective?

Q14: What method of separation would be used for a mixture containing many different substances all with different boiling points?

* *Do this OUTSIDE! Put on the latex gloves. Place the 1000 ml cylinder into the glass trough. Pour 100 ml of hydrogen peroxide into the cylinder. Pour in some sunlight and food colouring. Put one heaped spoonful of potassium iodide into the cylinder and QUICKLY stand back.*
Note: The potassium iodide is a catalyst in this reaction and the sunlight soap and food colouring are added just for effect!

Q15: Is hydrogen peroxide and mixture, element or compound?

Q16: What is the formula for hydrogen peroxide?

Q17: What two gases are released?

Q18: Is hydrogen peroxide a pure substance?
Give a reason for your answer.

Grade 10

Practical Work: MIXTURES; ELEMENTS & COMPOUNDS

Practical 3: GROUP 3

Chemicals & Apparatus:

Distilled water	2 x Porcelain dish
Cooking oil	Separating funnel
Cobalt chloride	Retort stand with boss head & clamp
Zinc metal pieces	Latex gloves
Copper metal pieces	Filter paper
Sugar	Filter funnel
Sulphuric acid	Metal spoon
4 x 80 ml beaker	Gauze
3 x 200 ml beaker	Tripod stand
200 ml Measuring cylinder	Bunsen burner & Matches

Method & Questions

* *Pour 80 ml of distilled water into an 80 ml beaker. Pour 80 ml of oil into another 80 ml beaker. Pour the oil and the water together into a 200 ml beaker and allow the mixture to settle.*

* *Place the neck of the separating funnel securely into the clamp connected to the retort stand and adjust the height of the boss head so that the bottom of the separating funnel is lowered slightly into a clean and dry 200 ml beaker. Ensure that the tap of the separating funnel is closed and then pour the oil and water mixture into the separating funnel.*

* *Open the tap of the separating funnel and allow the more dense substance of the water and oil mixture to pass through into the beaker. Close the tap.*

* *Pour this more dense substance into the measuring cylinder and check to see if you have accurately collected 80 ml of pure substance.*

Q1: What do you observe when the oil and water are poured together into a beaker and left to settle?

Q2: What conclusions can be made from your observation?

Q3: Is this mixture homogeneous or heterogeneous? Give a reason for your answer.

Q4: Which substance is more dense; oil or water?

Q5: Did you manage to collect exactly 80 ml of this more dense substance?

Q6: Is this an effective method of separating a mixture? Give a reason for your answer.

* *Pour 40 ml of distilled water into an 80 ml beaker.*

* *Add spoonful of cobalt chloride to the water and stir with the glass rod until it is completely dissolved. Repeat this procedure until no more cobalt chloride appears to be dissolving.*

Q7: Is this mixture homogeneous or heterogeneous? Give a reason for your answer.

Q8: What method of separation would be most suitable for this mixture?

* *Fold a piece of filter paper to make a cone and place it in the funnel. Hold the funnel over a porcelain dish and pour all the mixture slowly into the funnel.*

* *Place the guaze on top of the tripod stand and place the stand over a Bunsen burner. Place the porcelain dish on top of the gauze. Connect the Bunsen burner to the gas tap. Light a match and then turn on the gas. Hold the match over the outlet at the top of the Bunsen burner until a flame appears. Adjust the air intake on the shaft of the Bunsen burner so that a blue flame is observed. Allow the water to evaporate.*

Q9: What do you observe about the cobalt chloride left in the porcelain dish compared to the cobalt chloride crystals that you started with?

Q10: A substance that has had all the water removed from it is said to be ……..

Q11: Is cobalt chloride a pure substance? What is its formula?

* *Mix some zinc and copper metal pieces together in a porcelain dish.*

Q12: Is this mixture homogeneous or heterogeneous?

Q13: What method is separation is most suitable for this mixture?

Q14: Are zinc and copper elements or compounds? Give their symbols.

* *DO THIS OUTSIDE! Put on the latex gloves. Pour some sulphuric acid into your last clean and dry 80 ml beaker. Half fill your last clean and dry 200 ml beaker with sugar. Pour the acid over the sugar. Stand back, wait a few moments and observe what happens. (if nothing happens, add a little more acid to the sugar)*

Q15: What is the formula for sugar?

Q16: Name the elements making up sugar and state their ratio.

Q17: You have managed to separate sugar into two substances.

What substance is left in the beaker?

and what substance was given off?

Q18: Is sugar a pure substance?

Is the substance left in the beaker pure? Give a reason for your answer.

* *Take your gloves off and lightly touch the side of the beaker. Do Not attempt to pick up the beaker.*

Q19: How does the beaker feel?

What does this suggest about this reaction?

Q20: Is this method of separation a physical or chemical method?

Grade 10

Practical Work: MIXTURES; ELEMENTS & COMPOUNDS

Practical 4: GROUP 4

Chemicals & Apparatus:

Copper(II) sulphate	1 x 80 ml beaker	Gauze
Distilled water	3 x Metal spoon	Tripod stand
Barium chloride	Glass rod	Bunsen burner and matches
Aluminium Powder	Funnel & filter paper	String
Iodine crystals	Porcelain dish	Mortar & Pestle
3 x 200 ml beaker	Spatula	2 x Dropper

Method & Questions

* *Pour 150 ml of distilled water into the 200 ml beaker.*

* *Add a spoonful of copper(II) sulphate to the water and stir with the glass rod until it is completely dissolved. Repeat this procedure until no more copper(II) sulphate appears to be dissolving. It should be a* ***deep blue*** *solution.*

Q1: Is this mixture homogeneous or heterogeneous? Give a reason for your answer.

Q2: Name the solute; solvent and solution.

Q3: What do we call a solution in which no more substance can be dissolved?

Q4: What method of separation would be most suitable for this mixture?

* *Fold a piece of filter paper to make a cone and place it in the funnel. Hold the funnel over a clean and dry 200 ml beaker and pour all the mixture slowly into the funnel.*

* *Place the guaze on top of the tripod stand and place the stand over a Bunsen burner. Place the beaker on top of the gauze. Connect the Bunsen burner to the gas tap. Light a match and then turn on the gas. Hold the match over the outlet at the top of the Bunsen burner until a flame appears. Adjust the air intake on the shaft of the Bunsen burner so that a blue flame is observed. Heat the mixture to just below boiling point.*

* *Switch off the gas. Remove the beaker from the guaze and allow the mixture to cool. You will notice copper(II) sulphate crystals forming at the bottom of the beaker.*

* *Use a spatula to remove one of the crystals. Tie a piece of string around the crystal.*

* *Clean and dry your spatula and tie the string around the centre of the spatula and suspend the crystal from the spatula ensuring that it is immersed in the solution. Leave this for a while (perhaps overnight) and observe what has formed on the string.*

Q5: Is copper(II) sulphate a mixture or pure substance?

Q6: What is the formula for copper(II) sulphate?

Q7: Name the elements making up copper(II) sulphate and state their ratio.

Q8: Were you able to separate the copper(II) sulphate into its constituent elements?
Give a reason for your answer.

* *Make another 80 ml solution of copper(II) sulphate in an 80 ml beaker (follow the same procedure that you followed at the start of this prac.)*

* *Add, drop by drop, barium chloride to the solution. Wait a few moments between each added drop.*

Q9: What do you observe?

Q10: Do you think you have separated the water and copper(II) sulphate mixture or has your copper(II) sulphate reacted with the barium chloride to produce new substances?

Give a reason for your answer.

Q11: What is this type of reaction called?

* *Do this OUTSIDE! Crush and mix 1 spoonful of aluminium powder and 3 spoonfuls of iodine crystals using a mortar and pestle. Transfer this mixture into a clean and dry porcelain dish and place the dish on the floor (choose an inconspicuous area!). Using a dropper, slowly drop some water onto the mixture. Stand back as soon as it ignites and do not breathe in the fumes!*
(Note: The water is used as a catalyst)

Q12: Do you think that this mixture has been separated or has a new substance been formed?

Q13: What physical changes did you observe?

Q14: Show the chemical change that occurred by writing a balanced chemical equation for this reaction.

Q15: Identify your reactant/s and product/s as being either an element or a compound.