GRADE 7S

Please Note this is a working booklet for Term 2.

Notes and Activities included.

ALL WORK SHOULD NOT BE DONE IN ONE DAY.

Instructions:

- Page 2 and 3 you will the previous work knowledge to answer the multiple choice questions.
- Page 4 – 10 will be done this week (Week ending 03/06/2020)
- Page 11 -14 (week ending 10/06/2020)
- Page 14 -18 (week ending 17/06/2020)
- Page 19 – 21 (Week ending 24/06/2020)
- 20 July – 24 July 2020 (STUDY term 1 and 2 work)
- Test to Follow

education
Department: Education
GAUTENG PROVINCE

NATURAL SCIENCES

TERM 2

MATTER AND MATERIAL

GRADE 7

CATCHUP BOOKLET

2020

ACTIVITY 1.3

MULTIPLE CHOICE QUESTIONS.

1. Density is? .....

   (a) Matter/liquid

   (b) volume/matter

   (c) mass/volume

   (d) gas/mass

2. When substances change from gas to liquid, it is called...

   (a) Melting

   (b)Freezing

   (c) Boiling

   (d) Condensation

3. When a liquid changes into a gas, it is called..

   (a) Boiling

   (b) Melting

   (c) Freezing

   (d) Condensation

4. The amount of space occupied by matter is....

   (a) Area

   (b) Volume

   (c) Pressure

   (d) Tension

5. Which of the following is associated with mass?

   (a) Never changes

   (b) Changes with gravity

   (c) Changes with available space

(d) Changes with amount of force applied

6. Which of the following is not a physical property?

(a) Strength

(b) Colour

(c) Pressure

(d) Flammability

7. The amount of matter an object has is the..

(a) Weight

(b) Density

(c) Pressure

(d) Mass

8. Clouds or fog are in which state?

(a) Solid

(b) Liquid

(c) Gas

(d) Plasma

SEPERATING MIXTURES

Mixtures

Key words

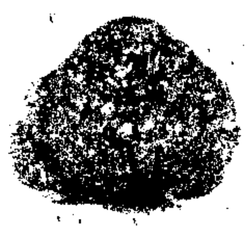
- **pure substance** – substance that is of made up of one type of particle
- **mixture** – two or more substances with different physical properties that are mixed together
- **physical properties** – special characteristics used to describe the particles of a substance – the tiny parts that make up substances

All materials or substances are made up of matter. Matter is made of tiny particles. Air, water, gold and trees are matter, and so are made of tiny particles. The particles are so small that we cannot see them. We can use pictures of the particles to help us understand substances.

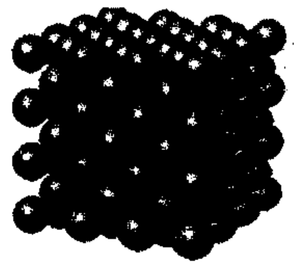
We classify matter as either a **pure substance** or a **mixture** of different substances.

Pure substances

A pure substance is made up of only one type of particle. A pure substance has the same properties all the way through. The following diagrams show some examples of pure substances.



(a)

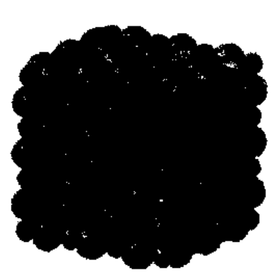


(b)

Figure 2 (a) Gold nugget and (b) gold particles

All the gold particles that make up the gold nugget are identical.

(a)

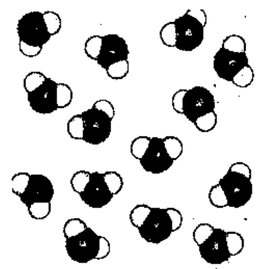


(b)

Figure 4 (a) Table salt and (b) table salt particles

The same particles are arranged in the same way in a spoon of table salt.

(a)



(b)

Figure 3 (a) Water and (b) water particles

All the particles in a glass of water are identical.

(a)

(b)

Figure 5 (a) Carbon dioxide blown into a balloon and (b) carbon dioxide particles

All the carbon dioxide particles are identical.

Mixtures

A mixture is not a pure substance. A mixture is made up of two or more substances or materials that have different **physical properties**. Physical properties are the special characteristics of a substance that we use to describe it. You learnt about physical properties, such as flexibility, melting point, boiling point and conductivity, in Topic 5.

When we mix two substances, the particles of one substance move in between the particles of the other substance. The different parts of the mixture do not join together. The different parts of a mixture can be combined in any amounts.

(a)

(b)

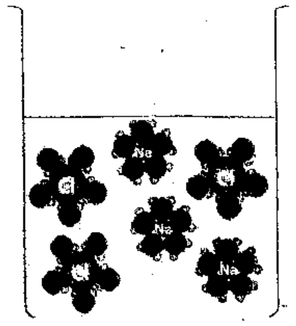
Figure 6 Examples of mixtures: (a) beans and rice, and (b) fruit salad

The parts of a mixture have different physical properties

In some mixtures, the substances that are mixed together keep all of their own physical properties. Figure 6(a) shows a mixture of beans and rice. The properties of the beans and the properties of the rice remain the same. They are just mixed together.

Sometimes we cannot see the different parts of a mixture. Salt water is a mixture of salt and water. In this case, the properties of the mixture are a combination of the properties of the substances that were mixed. Salt water looks like water, but it tastes like salt.

(a)



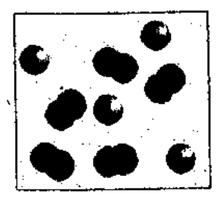
(b)

Figure 7 (a) A glass containing salt water and (b) the particles in salt water

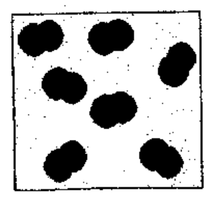
We can separate a mixture using physical methods. This means that we do not need a chemical reaction to separate a mixture. Because the different substances in a mixture are not joined together, we can use their different physical properties to separate them. For example, in a mixture of sand and rice, the sand and rice have different physical properties. The sand particles and the rice particles differ in size, colour and shape. The mixture can be separated by placing it in a sieve – the small sand particles pass through the sieve, but the rice grains do not.

Activity 2 Identify mixtures in diagrams

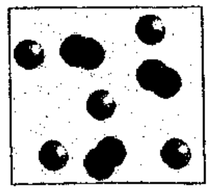
1. Identify which of the diagrams below show mixtures and which do not. Provide reasons for your answers.



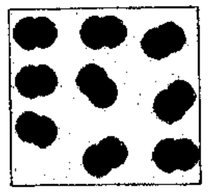
(a)



(b)



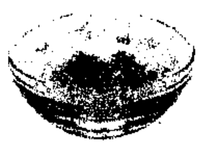
(c)



(d)

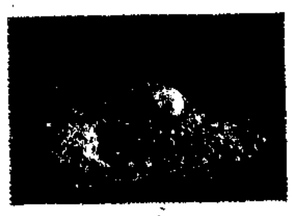
2. Identify which of the photographs below show mixtures and which do not.

(a)



(b)

(c)



(d)

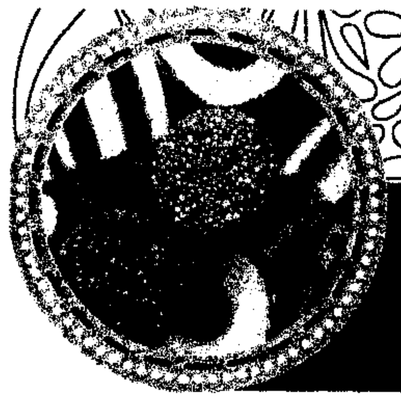
Key concepts

- A mixture is made up of different substances that have different physical properties.
- We can use physical methods to separate a mixture.

TERM 2: MATTER AND MATERIALS

Matter and materials

- Unit 1: Properties of materials
- Unit 2: Separation of mixtures
- Unit 3: Acids, bases and neutral substances
- Unit 4: Periodic Table



Unit 2

SEPARATION OF MIXTURES

Unit 2: Separation of mixtures

- 2.1 Mixtures
- 2.2 Methods of physical separation
  - 2.2.1 Hand sorting
  - 2.2.2 Sifting
  - 2.2.3 Filtration
  - 2.2.4 Magnet
  - 2.2.5 Evaporation
  - 2.2.6 Distillation
  - 2.2.7 Chromatography
- 2.3 Sorting and recycling

2.1 Mixtures

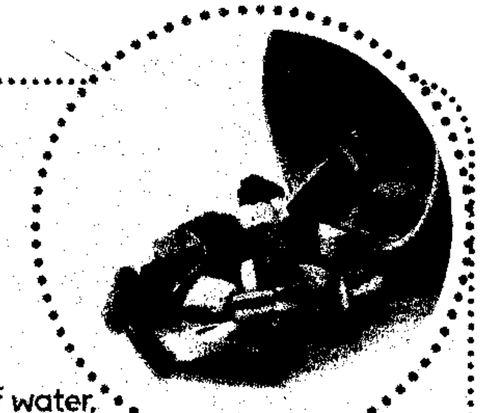
What is a mixture?

- Any two or more substances mixed together.
- It can be in any state. It can therefore by solids, liquids or gases. It can also be a combination of states.
- The substances do not react with each other chemically.
- The substances can be mixed in any ratio.

Examples

Everyday examples of mixtures are:

- Air: a mixture of oxygen, nitrogen, carbon dioxide and other gases
- Orange juice: a mixture of water, sugar, cellulose and other substances
- Mud: a mixture of sand and water
- Different sweets, e.g. *Liquorice Allsorts*



Mixtures: when two or more substances, with different physical properties, are mixed together (in any ratio), without reacting chemically, a mixture is formed.

2.2 Methods of physical separation

The physical properties of mixed substances differ. We can use these physical properties to separate them from each other. The specific physical properties will determine which separation method will be used.

Physical separation methods include the following:

2.2.1 Hand sorting

Hand sorting can be used when the different particles are big enough to be handled easily. The particles can be picked up one by one and separated from each other.

Examples

- The separation of thorns from sheep wool
- The sorting of export apples.
- Sorting of diamonds by hand.

2.2.2 Sifting

Sifting can be used when the particles of one substance are much bigger than the particles of the other substance. A sieve with holes of a specific size is used. The mixture is put into the sieve and it is then vibrated or shaken to allow the particles that are small enough to fall through.

Examples

- Using a sieve to separate pebbles and sand.
- Vegetables and fruit are separated into sizes small, medium and large with the aid of a sieve.
- Small change (money) can be sorted, using a sieve with different size holes.

2.2.3 Filtration

Filtration as a separation method is used when one substance is a liquid and the other a solid. The liquid mixture is poured into the filter to allow the liquid to run through while the solid stays behind, because the holes in the filter are too small for it to pass through.

Examples

- Separation of sand and water
- A swimming pool filter separates leaves from the water.
- A petrol filter in the engine of a car separates dust particles from the petrol.
- A coffee percolator separates the coffee and the coffee grounds.

QUICK FACTS

The liquid that passed through the filter is called the filtrate.
The particles that remain on the filter paper are called the residue.

2.2.4 Magnet

To be able to use this method of separation it is necessary that one substance is magnetic and the other is not. A magnet is used to attract the magnetic substance and remove it from the other substance.

Examples

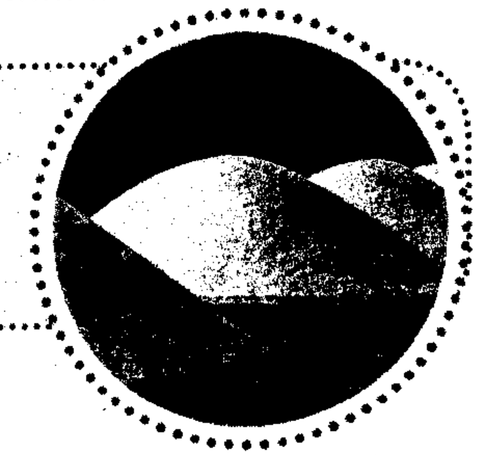
- The separation of iron filings from sand
- The removal of staples from recycled paper
- Separation of magnetic metals from non-magnetic metals

2.2.5 Evaporation

Evaporation is used to separate a substance that is dissolved in another. The liquid will evaporate because the bonds between the particles of the liquid are weaker than the bonds between the particles of the solid. After evaporation the solid will remain behind as crystals.

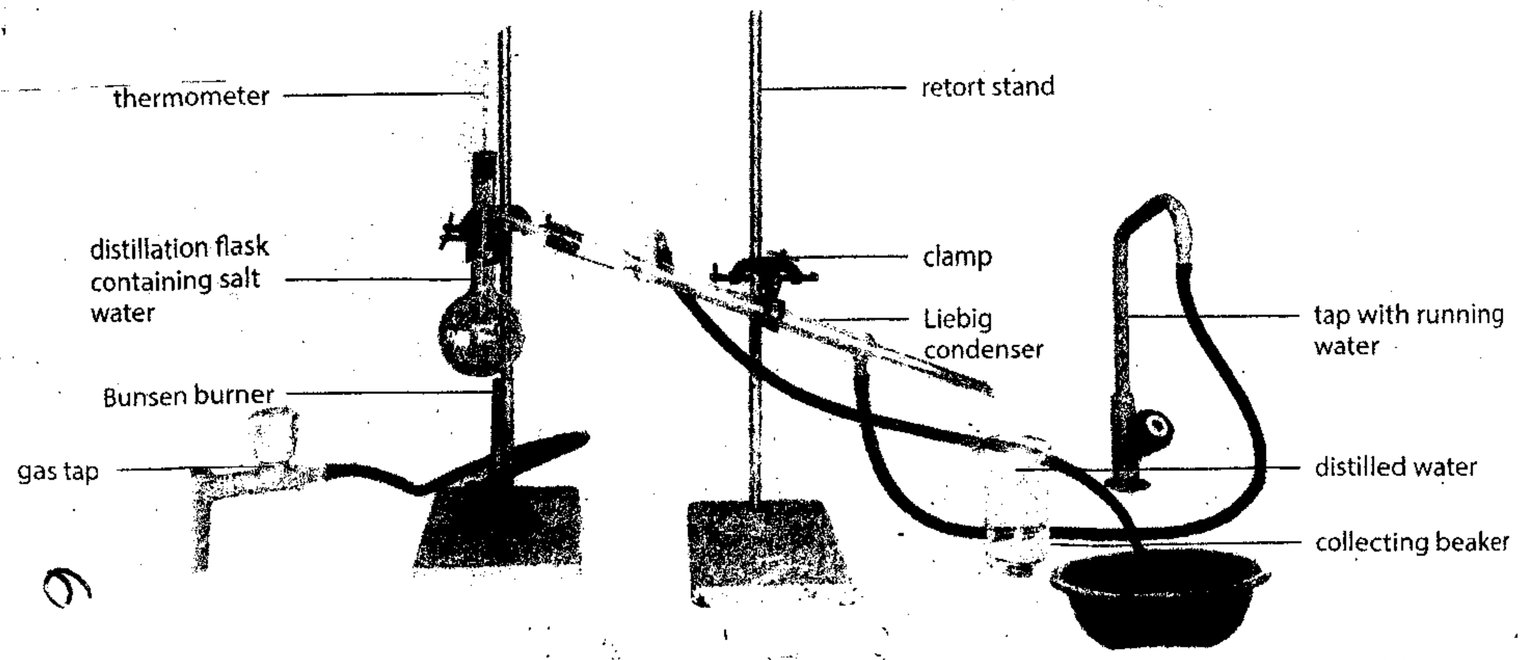
Examples

- Recovery of salt from sea water.
- Production of sugar from sugar cane juice



2.2.6 Distillation

Distillation is used to separate two liquids with different boiling points. There are two processes that are part of the distillation process, namely boiling and condensation. Distillation differs from evaporation in that the evaporated liquid is collected. In the first unit we learned that every liquid has its own unique melting and boiling points. We can use the different boiling points of liquids to separate a mixture of liquids. The same is true for gases. The substance with the lowest boiling point (with the weakest forces between the particles) will evaporate first, and can therefore be separated from the mixture first. The process is called fractional distillation.



Unit 2: Separation of mixtures

Manual sorting
To systematically separate different substances into different groups

Examples
Thorns from sheep wool
Sorting apples by size
Diamonds

Sifting
Used if one substance is much coarser or larger than the other.

Examples
Pebbles and sand
Vegetables and fruits
Small change (coins)

Filtration
Used where one of the substances is a is liquid and the other substance is a solid.

Examples
Sand and water
Pool filter separates leaves from water
Coffee percolator to separate coffee and grounds

A mixture
When two or more substances with different physical properties are blended in any ratio, but which do not chemically interact with each other.

SEPARATION OF MIXTURES

Magnet
One substance must be magnetic and the other not.

Examples
Separation of magnetic and non-magnetic metals
Separation of iron fillings from sand

Evaporation
Used when one substance is dissolved in another.

Examples
Recycling salt from seawater and salt pans
Production of sugar from sugar cane juice

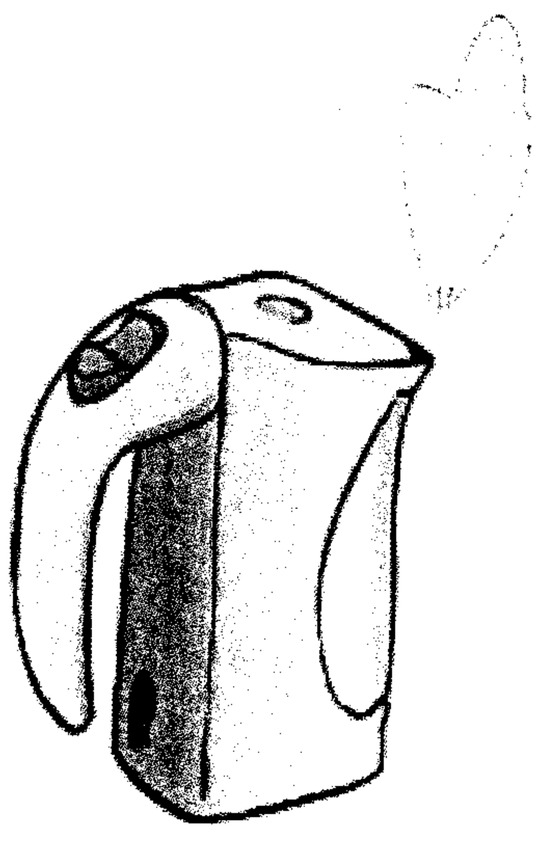
Fractional distillation
A process used to separate a mixture of liquids with different boiling points.

Examples
Recovery of pure water from seawater
Alcohol and water can be separated
Crude oil is broken up.

Chromatography
A technique used to separate two or more soluble solids by passing it through an absorbent medium.

Examples
Different colors of ink

2.2.5. A mixture of a gas and a gas (mixture of gases)



Can you see the water vapour in the picture of a boiling kettle? Point to it with your finger. Discuss this with your teacher and classmates and when you have agreed on an answer, draw an arrow onto the picture to indicate the water vapour.

Can we see most gases? Why do you think so?

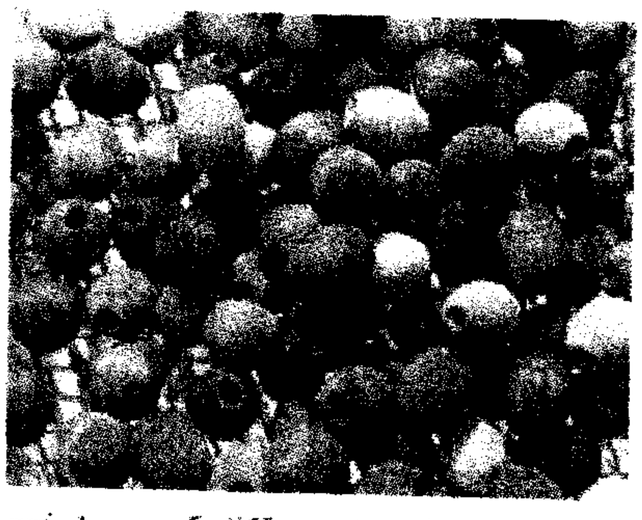
_____

_____

_____

2.3. DIFFERENT METHODS OF SEPARATING MIXTURE

2.3.1. Hand sorting



A mixture of different coloured beads

How would you separate the mixture of beads in the adjacent picture into the different colours?

_____

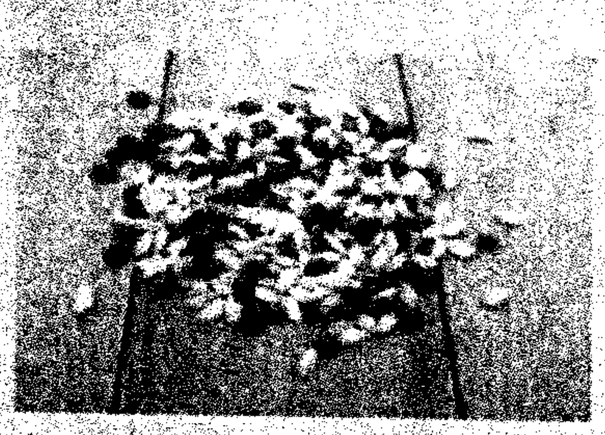
_____

_____

Use this video to understand the process on Hand sorting:
https://www.youtube.com/watch?v=n5TFJ-y8aVk

ACTIVITY 2.1

1. Would hand sorting also be a practical way to sort out the mixture of rice and lentil beans in the picture below?



A mixture of rice and lentils

2. Would hand sorting be a practical way to sort the pebbles out of a large pile of sand?

3. Besides what we discussed in the chapter, think of at least three other examples of mixtures that could be hand sorted.

4. When is hand sorting a good method for separating the components in a mixture?

2.3.2. Sieving

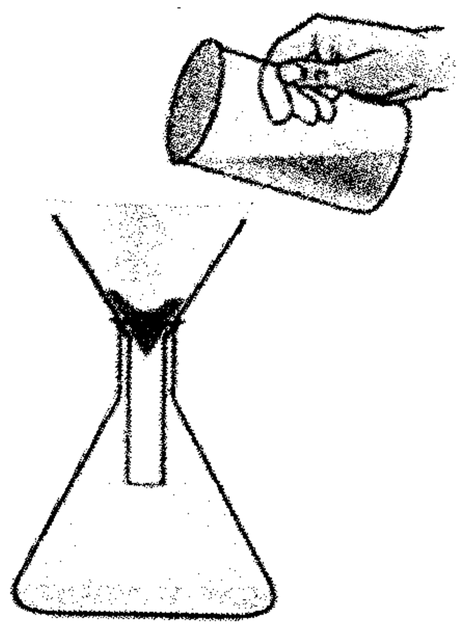
How would you separate the pebbles from the sand in this pile?

When we have large quantities of materials to sort and the different particles have different sizes, we can **sieve** the mixture. The smaller particles will fall through the openings in the sieve, while the larger particles stay behind.

Use this video to understand the process on Sieving;

https://www.youtube.com/watch?v=zC3J7Mdt8W4

2.3.3. Filtration



Muddy water is poured through a funnel lined with filter paper to remove the small sand and clay particles.

When the particles in a mixture are too small to be caught by a sieve and when the components of the mixture are in different states, we can separate them by **filtration** using a filter.

What type of mixture is the muddy water in the glass an example of?

A firefighter wears a mask to filter out the smoke.

Have you ever noticed how, when people have to work in dusty or smoky environments, they wear dust masks or smoke masks? Why do you think that is necessary?

Use this video to understand the process on filtration:
https://www.youtube.com/watch?v=0DU0VP5ICPA

ACTIVITY 2.2

1. Besides what we discussed in the chapter, think of at least three other mixtures that could be sieved, and write them in the space below.

2. When is sieving a good method for separating the components in a mixture?

3. Nowadays most people use tea bags to make tea, but there was a time when people brewed tea from leaves and then poured the tea through a sieve into the cup. Why do you think they did this?

4. Sometimes the particles that we want to remove from a mixture are so small that they will pass easily through a sieve (think of the example of the muddy water from before). Can you think of a way to overcome this?

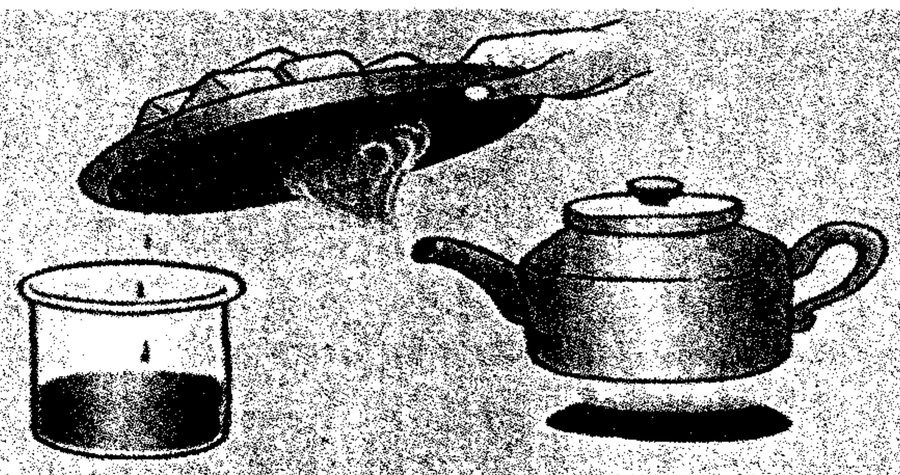
5. Besides what we discussed in the chapter, think of at least three other mixtures that could be filtered, and list them below.

6. When is filtering a good method for separating the components in a mixture?

ACTIVITY 2.3

1. Do you think separation by evaporation would be a good method to separate a salt-water-solution if you wanted to keep both the salt and the water? Why do you say so?

2. Can you think of a way to modify the method so that the water that evaporates is not lost? Perhaps the following diagram will help you to formulate a plan. Write an explanation.



3. What is happening in the kettle?

4. Can you say what change in state is happening inside the kettle? What is the process called?

5. What change of state is occurring on the cold surface of the metal plate? What is the process called? (Hint: the change of state from gas to liquid was covered in the previous chapter, under *Physical properties of materials*.)

6. Does the salt evaporate with the water? How would you find out?

7. What can you tell about the purity of the water after it has evaporated and condensed?

Substance	Boiling point (°C)
Acetone	56
Methanol	65
Ethanol	78
Isopropanol	83
Water	100

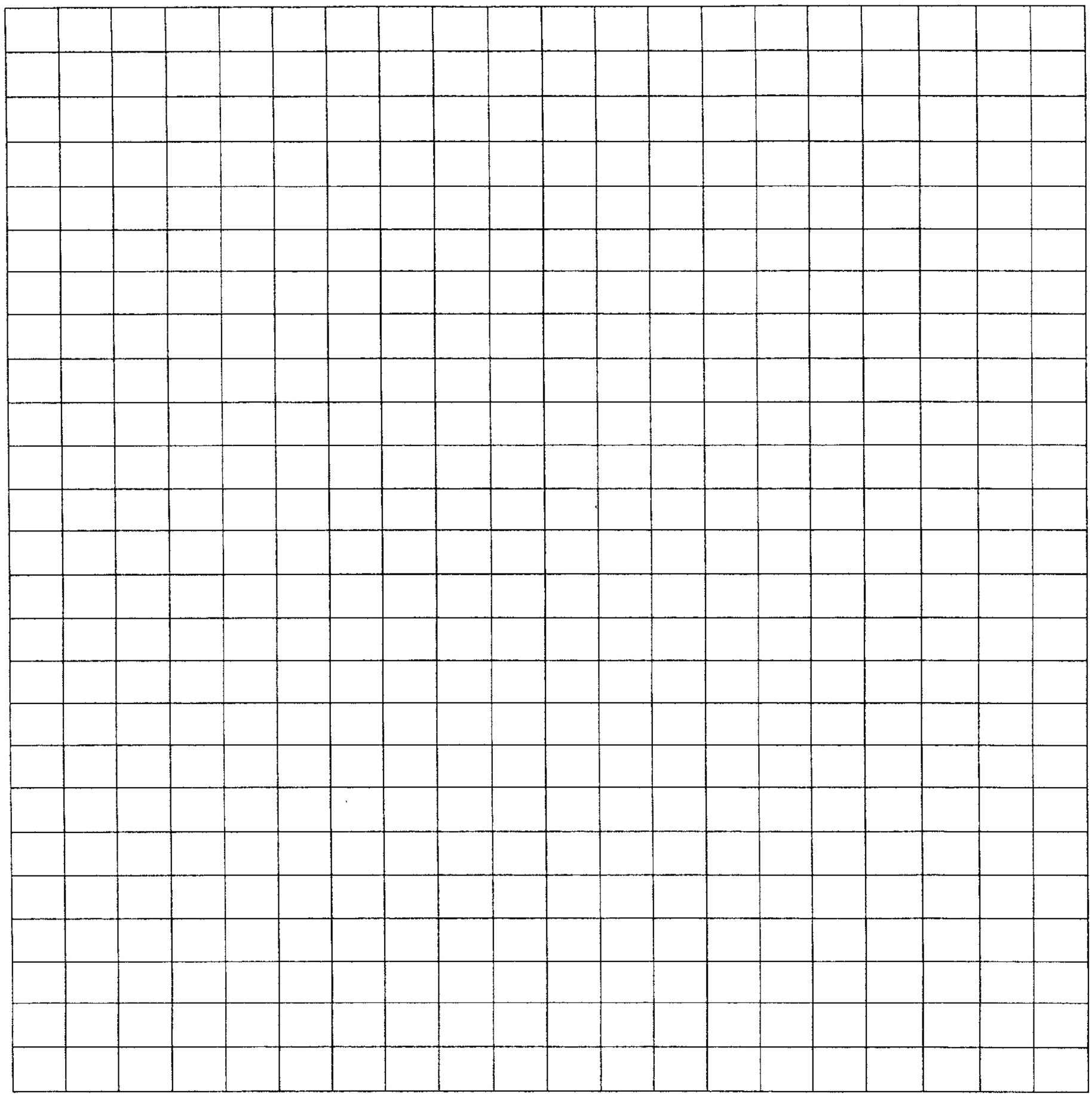
We can use the same distillation method that we used for separating seawater, to separate the two liquids. The principle is exactly the same, except that we will distill the mixture more than once. Here is how it works:

The mixture of the two liquids is placed in the distillation flask and heated to the lowest boiling point. In the case of an ethanol/water mixture, that temperature would be the boiling point of ethanol, namely 78°C. All of the liquid with that boiling point will evaporate, condense in the Liebig condenser, and pass into the receiving flask. The liquid with the higher boiling point will remain in the distillation flask. Suppose it contains a third substance that we want to separate. How would you do this?

ACTIVITY 2.4

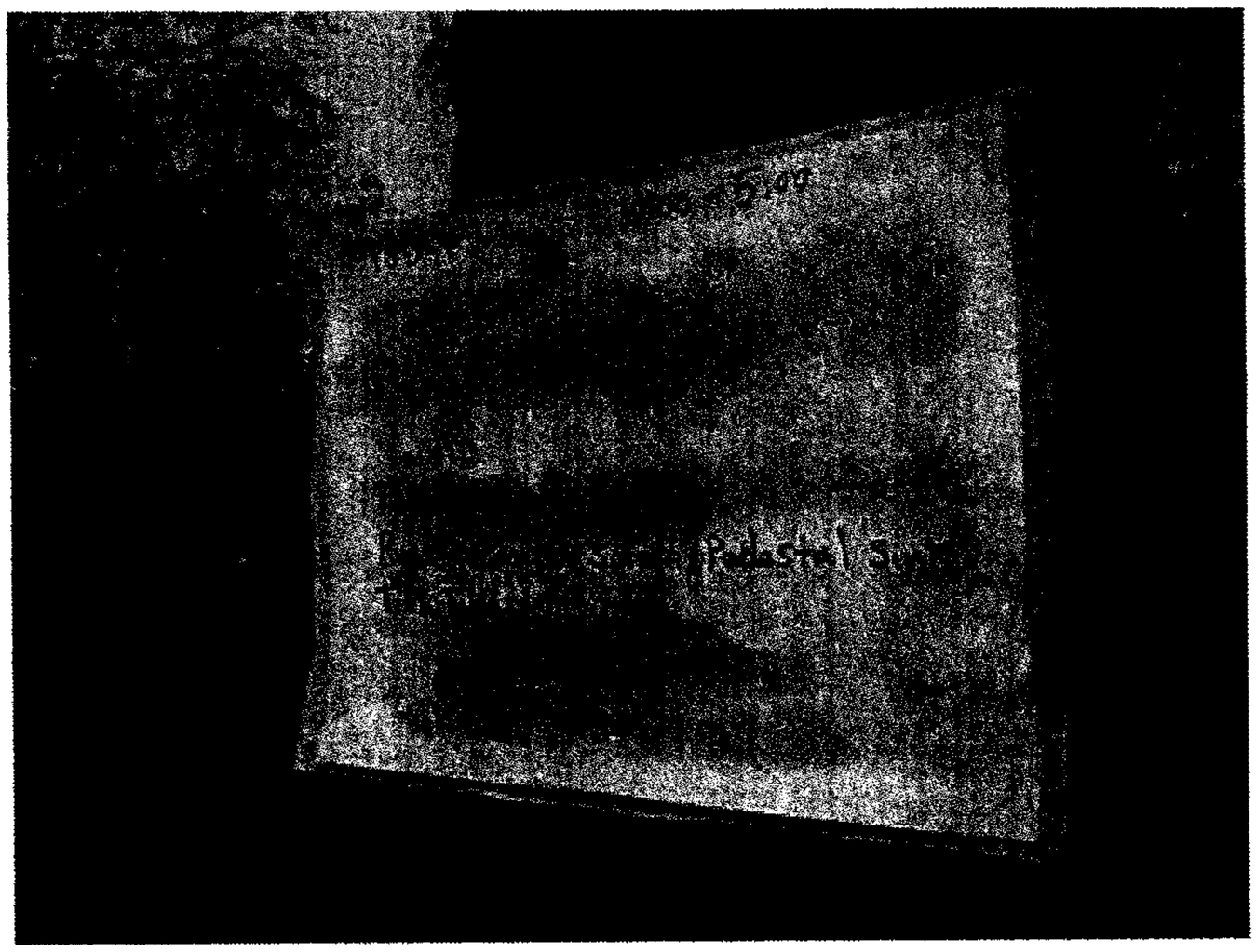
1. If you have a mixture of Methanol and Ethanol, and you are required to boil the mixture using Fractional Distillation method. Which of the two liquids will boil first and at which temperature?_____
2. What will be your maximum boiling temperature to separate the two liquids above and why?_____
3. What is the boiling and freezing point of water?_____
4. How would you separate a mixture of water and Isopropanol_____
5. Rearrange the list of liquids above in an ascending order of their boiling points and use your list to draw a bar graph below.

BAR GRAPH



2.3.8. PAPER CHROMATOGRAPHY (Separating colours)

There is one more separation technique for us to explore. Have you noticed how ink on paper will sometimes 'run' when it gets wet?



Can you see how the ink on this sign has run after being wet, probably by the rain?

Most inks are a mixture of different pigments, blended to give them just the right colour. A **pigment** is a chemical that gives colour to materials. When a mixture contains colourful compounds, it is often possible to separate the different components using a separating method called chromatography. Let's have a look at this next.

PRACTICAL INVESTIGATION: To Investigate if black ink is really black

AIM: To separate the pigment components in ink using different liquids

HYPOTHESIS:_____

_____

INVESTIGATIVE QUESTION:_____

_____

Use this video to understand the process on Paper chromatography:

https://www.youtube.com/watch?v=uOhefwQBAbI&t=197s

TERM 2: MATTER AND MATERIALS

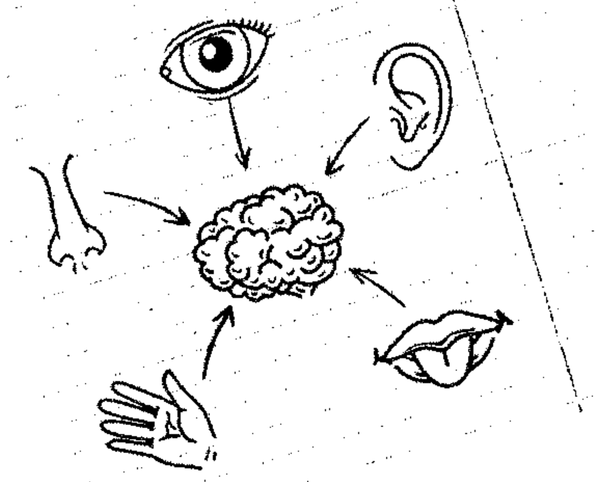
Matter and materials

- Unit 1: Properties of materials
- Unit 2: Separation of mixtures
- Unit 3: Acids, bases and neutral substances
- Unit 4: Periodic Table

Unit 3

ACIDS, BASES AND NEUTRAL SUBSTANCES

Unit 3: Acids, bases and neutral substances

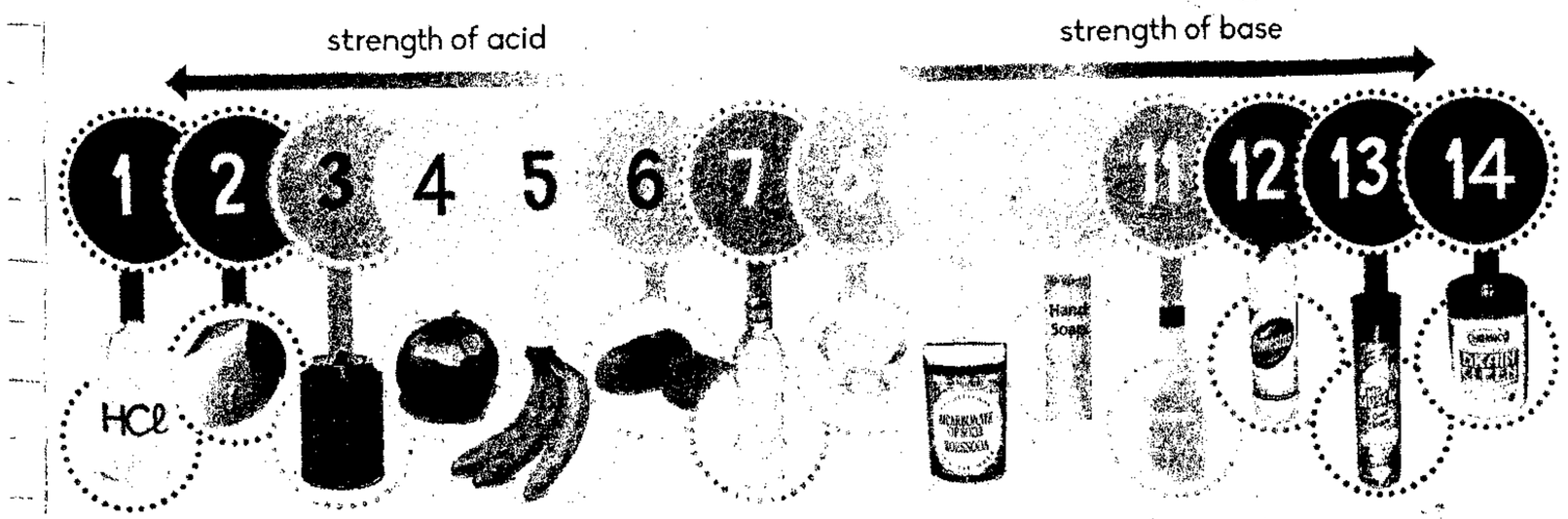


3.1 Introduction

Most substances can be classified as acids, bases or neutral substances (salts). We can use the pH scale to distinguish between different substances. Acids have a pH lower than 7, neutral substances have a pH close to 7 and bases/alkali's have a pH above 7.

QUICK FACTS

pH scale: the pH scale measures how acidic or basic a substance is.



3.2 Senses

Humans have five senses that enable them to survive. Our senses enable us to classify different materials, situations, colours, etc. These senses are sight, hearing, taste, smell and touch. Our sense of taste can distinguish between the four basic tastes (sweet, sour, salty and bitter).

A fifth, less common taste is umami, which means "nice" in Japanese. It can be described as a savoury taste.

The round buds on the tongue are called papillae. Most of them contain taste buds. The taste buds are situated on the surface and sides of the tongue, the roof of the mouth and the entrance to the pharynx. There are more than 10 000 taste buds in our mouth.

QUICK FACTS

Scent is a combination of different tastes and smells.

Practical task 3

Date: .....

Divide into groups of four.
Each group is supplied with:

1. four small glass beakers containing:
   - Lemon juice
   - Sugar water
   - Salt water
   - Coffee powder dissolved in boiling water and allowed to cool down.
2. four plastic straws cut into quarters (total of sixteen pieces).

Method:

1. Group members use the straws to put a small amount of each of the substances in the beakers on the following places on their tongue; front, sides and back.
2. Do not use a straw twice. It can contaminate the contents of the beakers.
3. Write labels on the diagram to show where on your tongue you tasted sweet, sour, salt and bitter.

Interesting facts

Insects have taste organs on their feet, antennae and mouth parts.

3.3 Acids

There are acids that are extremely dangerous. These acids are classified as corrosives. These acids are mainly used in laboratories and in industry. This year, we will investigate only household acids.

Acids have the following properties:

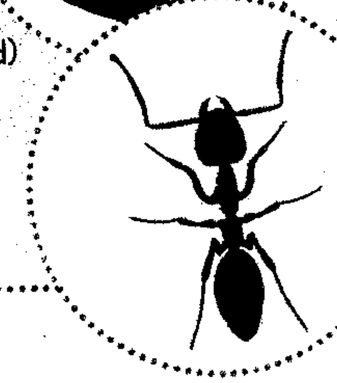
- Acids taste sour (e.g. lemon juice).
- Some are corrosive (it can dissolve/"eat away" certain substances).
  - It can "burn" holes into material.
  - Some acids can cause damage to the skin and eyes.
  - Some might be very dangerous to taste.
- Acids can neutralise bases to form a salt.
- It changes the colour of indicators.
- Acid rain can very slowly dissolve/"eat away" cement and stone buildings.

The containers in which caustic agents are kept, has a warning sign. It must be handled very carefully.

Examples

Examples of common acids:

- Swimming pool acid (hydrochloric acid)
- Vinegar in food
- Sour apples
- Tomatoes
- The poison in the bite of red ants



Interesting facts

Acid rain forms when gases like carbon dioxide dissolve in rain water.

3.4 Bases

Bases are the opposite of acids.

A base has the following properties:

- It has a bitter taste.
- It can be caustic.
  - It can "burn" a hole into material.
  - It can cause damage to your skin and eyes.
  - It can be very dangerous to taste.
- It feels smooth and slippery when you rub it between your fingers.
- Bases neutralise an acid to form a salt.
- It changes the colour of indicators.

It can dissolve fats and oils or react with it.

There are also bases that are dangerous and should be handled very carefully. They have the warning sign for caustic substances. An example of such a base is caustic soda.

Examples

Examples of common bases/ alkalis:

- Caustic soda that can be used as a drain cleaner.
- Dishwashing liquids
- Rennies or other indigestion tablets
- Bath soap
- Bicarbonate of soda, used for baking.

Interesting facts

A bee sting is acidic and you can soothe it with a base, e.g. bicarbonate of soda.

3.5 Neutral substances

A neutral substance has a pH value of 7. It is neither an acid nor a base. It can taste salty or it might have taste at all. When an acid reacts with a base it will produce a salt and water. Salts are examples of neutr substances. Other examples are oil, water and sugar solutions.

How can it be determined whether a substance is an acid, base or a neutral substance? One method is t use indicators.

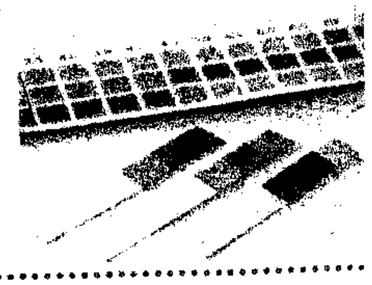
3.6 Indicators

Indicators are natural substances that will change colour when exposed to an acid or base. It can be used to determine whether a substance is an acid, a base or a neutral substance.

Indicators are mostly organic (natural) compounds:

Examples

- Red litmus paper will turn blue when in contact with an alkali.
- Blue litmus paper will turn red when in contact with an acid.
- Universal indicator can turn into different colours and shades in both acids and alkali's.



The following table gives a summary of the colours of the different indicators in different types of substances.

Indicator	Base	Acid
Red litmus paper	Blue	Red
Blue litmus paper	Blue	Red
Universal indicator	Blue to purple	Yellow to red

Household liquidsubstance	Red litmus paper	Blue litmus paper
Milk		
Soap		
Fizzy soft drink		
Vinegar		
Yoghurt		
Soda water		
Table salt		
Sugar		

Conclusions:

1. What colour litmus paper will indicate an acid?

.....

2. Describe the colour change that litmus paper will undergo in an acid.

.....

3. Describe the colour change litmus paper will undergo in an alkali.

.....

4. Are household soaps and detergents mainly acids or alkalis?

.....

5. Fruit juice is a/an .....

6. What do we call a substance that is neither an acid nor a base?

.....

7. Distilled water is a/an ..... substance.

Unit 3: Acids, bases and neutral substances

Acids

pH < 7

Properties
Taste sour.
Can be caustic.
Change the colour of indicators.
Can neutralise bases to form salt.

Examples
Vinegar, sour apples, tomatoes, lemons

Bases

pH > 7

Properties
Bitter taste
Can be caustic.
Feel smooth and soapy
Can neutralise an acid to form a salt.
Change the colour of indicators.

Examples
Caustic soda, dishwasher soap, *Handy Andy*, soap, tea

pH scale
Measure of how acidic or basic a substance.

0 1 2 3 4 5 6 | 7 | 8 9 10 11 12 13 14

acid | neutral | base

ACIDS AND BASES

Neutral substances
- A Neutral substance has a pH value of 7.
- It is neither an acid nor a base.
- It can have a salty taste or no taste at all.

Examples
Salts, oil, water, sugar solution

Indicators
Change colour in an acid or a base.
Used to identify an acid, base or neutral substance.

Examples
Blue and red litmus paper, universal indicator

Science language activity

Complete the following paragraph using the words in bold.

blue **bitter** **rough** **sour** **indicator**
red **slippery** **corrosive** **alkali** **neutrals**

Acids taste _____ and feel _____ on the skin. Strong acids can burn your skin. We say these acids are _____. Bases taste _____ and feel _____. A base that can dissolve in water is called an _____. _____ are neither acids nor bases. An _____ is a dye that changes colour in chemicals. Acids will turn blue litmus _____ and bases will turn red litmus _____.

Test yourself

1. Give two examples of everyday materials that contain:
a) acid (1)
b) alkali (1)

2. a) Name two citrus fruits. (2)
b) Describe the taste of citrus fruits. (1)
c) Are citrus fruits acidic or basic? (1)
d) Give the name of the acid or base that you find in citrus fruits. (1)

3. Red litmus indicator was used to test toothpaste. It turned blue. Explain what this tells you about toothpaste. (1)

4. What colour would blue litmus paper be in these substances?
a) Fizzy drink
b) Water
c) Sugar solution
d) Soap
e) Orange juice
f) Bicarbonate of soda
g) Salt solution (7)

5. Use the photograph in Figure 18 to answer these questions.
a) Write down the name of the acid in the bottle. (1)
b) Give the more common name for this acid. (1)
c) What hazard symbol do you see on the bottle? (1)
d) Explain what the hazard symbol means. (1)
e) Would red litmus paper change colour in this acid? (1)

Total: 20

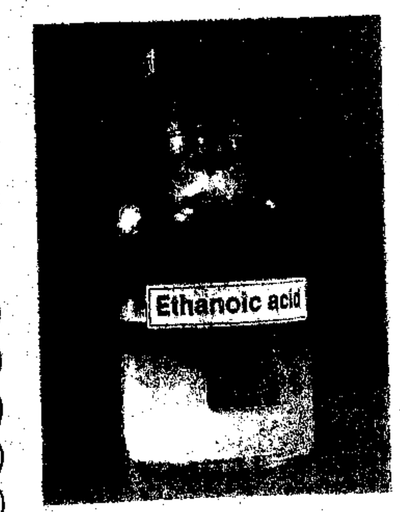


Figure 18 A common household acid

Unit 1

Arrangement of elements in the Periodic Table

Key words

- **elements** – pure substances that cannot be broken down any more
- **matter** – everything around us
- **periods** – the horizontal rows in the Periodic Table
- **groups** – the vertical columns in the Periodic Table

The photo in Figure 1 on the previous page shows many different material that all look different from each other. Even though the materials are different, they are all made from **elements**. Everything around us that we c see and touch is called **matter**. Matter is made from many different materi and elements that make up all the matter and materials in the world. An element is a pure substance that cannot be broken down any more.

All the elements that exist are in the Periodic Table. The Periodic Table is a classification system for elements, which means that it is a way of organising the elements into groups. No two elements are the same and each one has it own properties. For example, sodium conducts heat and electricity. It is very reactive and has a melting point of 98 °C. No other element has this specific s of properties. There are, however, other elements that have similar properties

Figure 2 Dmitri Mendeleev

For many years, scientists tried to find a way to grou the elements in a pattern. It was the Russian chemist Dmitri Mendeleev (1834–1907), who was the first to arrange the elements in a pattern that we know toda as the Periodic Table of elements. He arranged the elements according to their properties. He realised that in this arrangement there were patterns of repeating properties. Scientists did not discover all the elements at the same time. Some elements were discovered quite recently. However, even though some elements had not yet been discovered in the 1860s, Mendeleev still knew to leave blank spaces for these in the table.

Arrangement of the elements

Look at Figure 5 on page 112. The Periodic Table is arranged in a grid with horizontal rows and vertical columns. The rows are called **periods** and the columns are called **groups**. The periods and groups are numbered to make it easier to find an element.

Each element has its own name and chemical symbol. Each element has its own block in the Periodic Table. Inside the block is the element's chemical symbol. The symbol always starts with a capital letter, and if there is a second letter, it is a lower case letter.

There are also two numbers inside the block of each element: the atomic number and mass number. Figure 3 shows what this looks like for the element nitrogen. Each element has its own atomic number and mass number. The atomic number also helps us find an element, because the atomic numbers increase from left to right in each row across the Periodic Table.

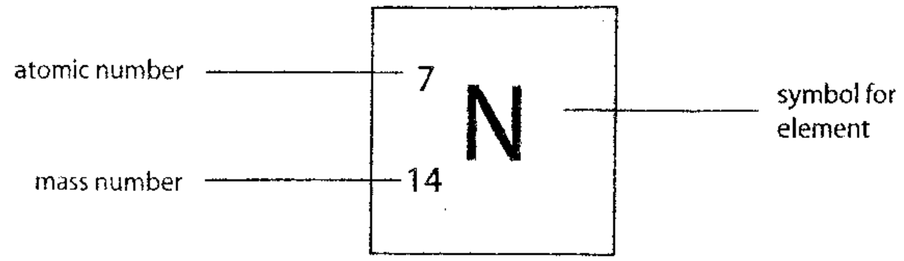


Figure 3 The block for the element nitrogen from the Periodic Table

Activity 2 Investigate the Periodic Table

1. Look at the symbol in Figure 4 and use the Periodic Table to answer the following questions.
   a) What is the name of this element?
   b) What is its atomic number?
   c) Write down the name of an element in the same group as this element.
   d) Write down the name of an element in the same period as this element.

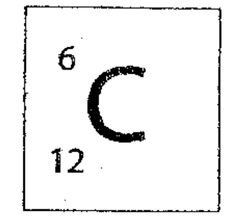


Figure 4 A single block from the Periodic Table

2. Draw a table, like the one below, of the names and symbols for the first 20 elements. The first three have been done for you as an example.

Element name	Symbol
Hydrogen	H
Helium	He
Lithium	Li

The three main categories of elements

The elements in the Periodic Table are arranged into three categories: metals, semimetals and non-metals.

- Metals are arranged in the middle and on the left-hand side of the Periodic Table. Most of the elements are metals.
- Non-metals are found on the far right-hand side of the Periodic Table, except for hydrogen, which is on the left.
- Semimetals are found in the region between metals and non-metals.

The zigzag line separates the metals from the non-metals on the Periodic Table, with the semimetals on either side of the zigzag line.

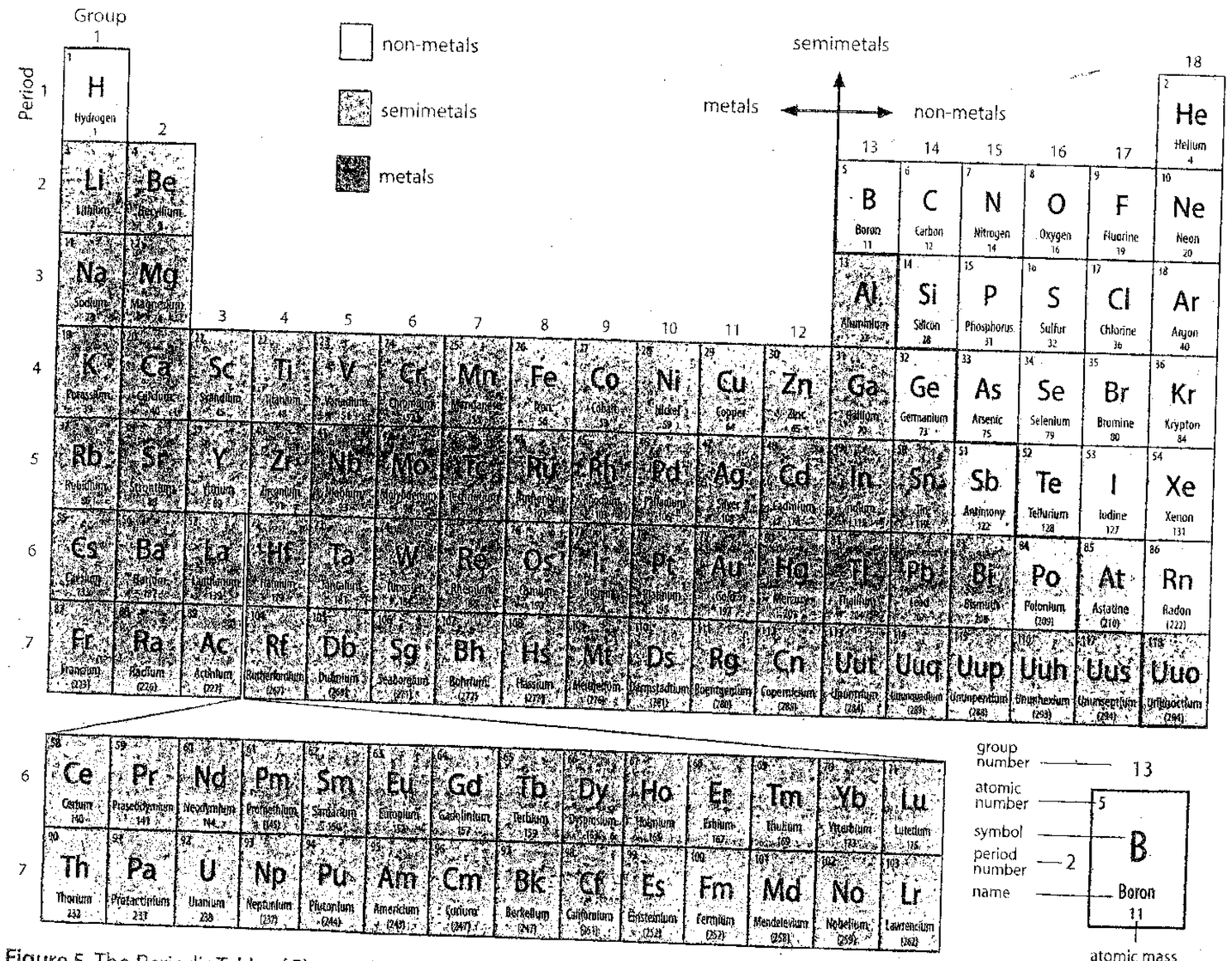


Figure 5 The Periodic Table of Elements. You will find a larger copy at the back of this book.

Unit 2

Properties of metals, semimetals and non-metals

Key words

- **ductile** – can be stretched into thin wires
- **malleable** – can be bent and flattened into thin sheets without breaking

From the Periodic Table, you can see that most of the elements in the Periodic table are metals, a few are non-metals and even fewer are semimetals. It is important to know the properties of metals, semimetals and non-metals so that we know what to use them for and whether we can make new materials from them. For example, we use the two metals aluminium and titanium to make aeroplanes, because these metals are solids and strong, but are also light. If an aeroplane was made of iron, it would be much too heavy to fly.

Figure 7 Aeroplanes are made from the metals aluminium and titanium.

Metals and non-metals

Activity 5 **Investigate the properties of three different metals**

You will need: iron nail • aluminium foil • copper rod • a magnet • three test tubes • Bunsen or spirit burner • test tube tongs • safety glasses • wires • crocodile clips • a cell • light bulb

Test	Iron	Aluminium	Copper
Appearance (Look)			
State of matter (solid, liquid, gas)			
Magnet (which are attracted?)			
Heat (Melt easily or not)			
Electricity (connect each and see)			
Bend (bend / break)			
Stretch (stretch / not)			

Semimetals

Semimetals are in the region between metals and non-metals in the Periodic Table. The semimetals are boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb) and tellurium (Te). The semimetals have some properties of metals and some properties of non-metals. They look like metals and are solids, but are brittle like non-metals.

Silicon is the most common semimetal. It is shiny, which gives it a property of a metal, but it is not ductile and malleable; it is brittle, which gives it a property of a non-metal. Germanium and boron are also shiny substances like metals, but they are hard and brittle like non-metals. Semimetals can conduct electricity, but not as well as metals. They are called semiconductors. There is a very high demand for semiconductors as they are used in most electronic devices, such as computers, phones and radios.


(a)


(b)


(c)

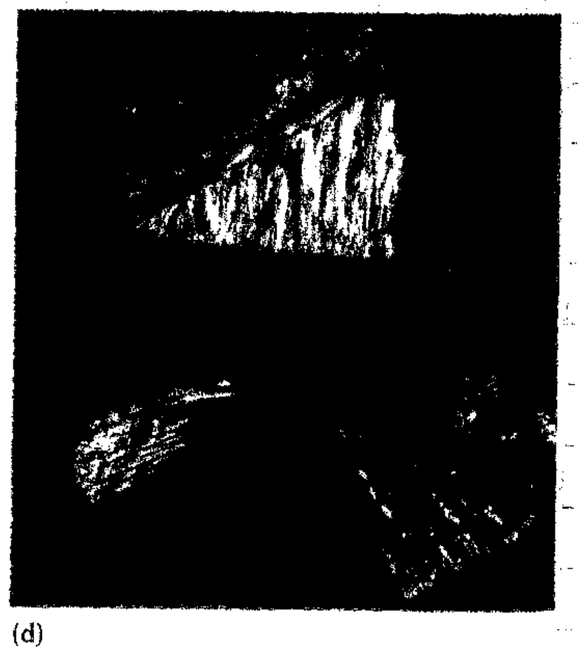

(d)

Figure 10 Four semimetals: (a) silicon, (b) germanium, (c) boron and (d) tellurium

Science language activity

Write down one word that fits the following descriptions.

1. The vertical columns in the Periodic Table
2. The horizontal rows in the Periodic Table
3. The elements in the region between metals and non-metals in the Periodic Table
4. The property of metals that means that they can be bent without breaking
5. Elements that are mostly solids at room temperature
6. Elements that are usually dull
7. Elements that have properties of metals and non-metals
8. The elements on the far right of the Periodic Table

Test yourself

1. Copy and complete the following table in your book.

Property	Metals	Non-metals	Semi-metals
Appearance			
State of matter			
Conduction of electricity			
Malleable and ductile?			
Boiling point			

(15)

2. Use Figure 23 and your Periodic Table to answer the following questions.
   a) Give the name of the element in Figure 23. (1)
   b) Is this element a metal, a semimetal or a non-metal? (1)
   c) Write down the name of a metal in the same group as this element. (1)
   d) Write down the name of a non-metal in the same period as this element. (1)
   e) Write down the name of a semimetal in the same period as this element. (1)

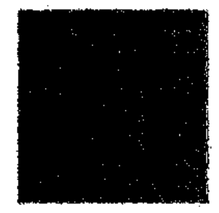


Figure 23 A single block from the Periodic Table

Total: 20