THE LESTER VAUGHAN SCHOOL

SECOND FORM

INTEGRATED SCIENCE

WORK BOOK

States of Matter
Changes of State
Water
Mixtures
Metals and Non-metals
Physical and Chemical Changes
Acids and Bases
Air

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For success, attitude is as important as ability. The secret to success - try!

HOW TO EXCEL AT INTEGRATED SCIENCE

1. Pay close attention in class. If you are talking or listening to someone who is talking, you are not listening to your teacher. Take part in class discussions, let your teacher know that you are paying attention.
2. Science has its own vocabulary, so you need to learn all the new words, how to spell them and how define them and how to use them in a sentence.
3. While your teacher is going through a topic, you may have to highlight key words or phrases so get a ***highlighter of a ruler and pen and underline important points***.
4. You're smart but ***everyone needs to study for tests***! Most students fail tests because they do not prepare properly for them.
5. Learn your diagrams. Trace diagrams and label them with numbers. Practise labeling the diagram until you ***always*** get it right.
6. ***Test yourself*** by writing questions based on your notes. Example: Your teacher makes you label a diagram of an eye and then gives you the functions of the parts of an eye. Your questions become: 1) Label the parts of the eye. 2) State the function of the following: retina, lens, cornea etc.
7. ***Get help***. If you do not understand something in class, ask your teacher to explain. You can form a study group sometimes you friends are really good at explaining things.
8. Do not get distracted during practicals. You need to write up you lab quickly and make accurate observations so that you can analyse them. If you are not focused you will get poor marks in your practicals.
9. Read over your notes on a regular basis.
10. Complete all of your assignments well.
11. Take your Food and Nutrition classes seriously. It is part of Integrated Science, almost every aspect of food and cooking involves Science.
12. Always aim for 100 %. *Stop thinking of 50 % as a pass – think of your new pass mark as 70 %.*

WHAT WILL YOU NEED

Pens, HB pencil, coloured markers or highlighter, ruler, eraser, sharpener, glue stick

SYLLABUS

TOPIC	DETAILS
States of Matter	Definition of matter, characteristics of solids, liquids and gases,
Changes of State	How changes of state are brought about, boiling, freezing, solidification, condensation, evaporation, sublimation.
Water	Properties of water, water cycle, water conservation, role of water in food preparation, uses of water
Mixtures	Definitions of solute, solvent, solution, suspension, filtrate and residue; separation of solutions and suspensions
Metals and Non-metals	Characteristics of metals, differences between metals and non metals, reactivity of metals, allows, rusting
Physical and Chemical Changes	Characteristics of physical and chemical changes, cake making, stain removal
Acids and Bases	Characteristics of acids and bases, indicators, neutralization
Air	Composition of air, uses and properties of gases, tests for oxygen and carbon dioxide, respiration, preservation of food

PRACTICAL REMINDERS

Format: Aim, Materials and Apparatus, Method, Observations, Discussion, Conclusion

Aim: Tells you the purpose of the experiment
Materials and Apparatus: Everything you will need to do your experiment.
Method: This is what you did and is written in past tense and third person.
Observations: This includes what you measured or observed. Your observations can be presented in tables, diagrams, drawings or graphs. Each of these requires a title.
Discussion: Here you give some back ground information, discuss your observations and relate them back to the aim.
Conclusion: A simple statement on what your experiment tells you.

SCHOOL BASED ASSESSMENTS
These are assignments which will contribute to your final grade in Science. They will also be used for the CCSLC examination you will take at the end of Third Form.

CONTINUOUS ASSESSMENT: Practicals, Projects, Standardized Tests 40 % + Promotion Exam 60 %

STATES OF MATTER

- Matter is made up of particles
- These particles are in constant random motion.
- There are spaces between particles.
- There are forces of attraction and repulsion between particles.
- The state of material depends on the arrangement of its particles, the forces between them and the amount of energy the particles have.

SOLIDS
These have ordered structures, their particles are closely packed, they have definite shape and volume and incompressible.

Why?
The particles are linked together with bonds – forces of attraction between the particles. The particles which make up a solid can vibrate in their fixed position but they can move away.

LIQUIDS
These have a definite volume. They take the shape of the container in which they are in. The particles in a liquid are further apart than solids. Particles can move past each other but cannot escape from the liquid. Liquids are not easily compressed.

Why?
The bonds between the particles are weaker.

GASES
These have no structure. Particles are free to move and spread to fill the space they are in. The particles in a gas are easily compressed. They have no definite volume or shape.

KINETIC ENERGY

1. Kinetic energy is moving energy.
2. An increase in temperature causes an increase in kinetic energy of the particles in a substance.
3. The greater the kinetic energy of a particle the faster it moves

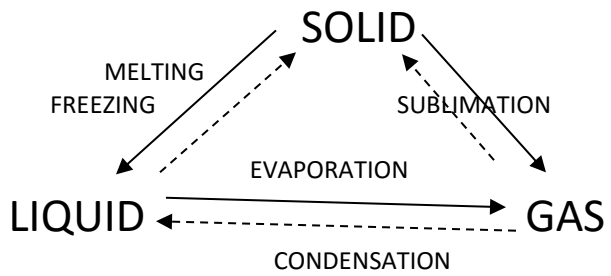
ACTIVITY

The circles below represent a solid, liquid and gas.
Copy them and label them with the correct state.

CHANGES OF STATE

In order for a substance to change from one state to another, there must be a change in energy. Heat energy must be added or removed.

Add heat ⟶ Remove heat ⇢



MELTING

The particles gain kinetic energy.

1. They vibrate more vigorously.
2. They overcome their forces of attraction.
3. The move more freely and further apart.

EVAPORATION

The particles gain kinetic energy when heated.

1. The particles move faster.
2. Forces of attraction are overcome.
3. Particles escape the liquid.

BOILING

This takes place throughout the liquid. The temperature of a boiling liquid remains constant until all the liquid particles have turned to gas.

CONDENSATION

Particles lose kinetic energy when the temperature is lowered.

1. Particles move more slowly.
2. Forces of attraction increase.
3. Particles move closer together forming a liquid.

FREEZING

Kinetic energy is lost as the temperature is lowered.

1. The particles begin to move more slowly.
2. The forces of attraction increase.
3. Particles move close together forming a solid.

SUBLIMATION

This is reversible – it occurs if a solid is heated and changes directly into a gas or if a gas is cooled and changes directly into a solid.

Substances which sublime include iodine, ammonium chloride and carbon dioxide.

QUESTIONS

1. State the four main ideas of the particle theory of matter.
2. What are the three states of matter?
3. What is the relationship between the temperature of a particle and movement of the particle?
4. Copy and complete this table.

Change of State	Name given to change of state	Energy added or removed to change state
Solid to liquid		
Liquid to gas		
Gas to liquid		
Liquid to solid		
Solid to gas		

WATER THE UBIQUITOUS STATE OF MATTER

USES OF WATER

Water has many uses in the home: washing food items, utensils and cleaning work areas, to cook items using the wet method – boiling, broiling or steaming, it is an ingredient in dishes e.g. gravy and sauce.

PROPERTIES OF WATER

- It is a liquid at room temperature.
- Water freezes at 0 ° C
- Water expands when it freezes
- Water boils at 100 ° C
- It takes a lot of heat to raise the temperature of water i.e. it has a high heat capacity.
- It is colourless, odourless and tasteless.
- Water is a solvent of many solutes including gases like water and carbon dioxide.

The numerous physical and chemical properties of water makes it suitable for recreation such as swimming, surfing and scuba diving. It's property as a solvent makes it useful for cleaning and cooking. The fact that water can have oxygen dissolved in it makes it an ideal habitat. When water freezes over a large body of water the ice floats on top, this means that aquatic organisms are safe underneath it.

Question

Where does drinking water come from in Barbados? What can Barbadians do to conserve water?

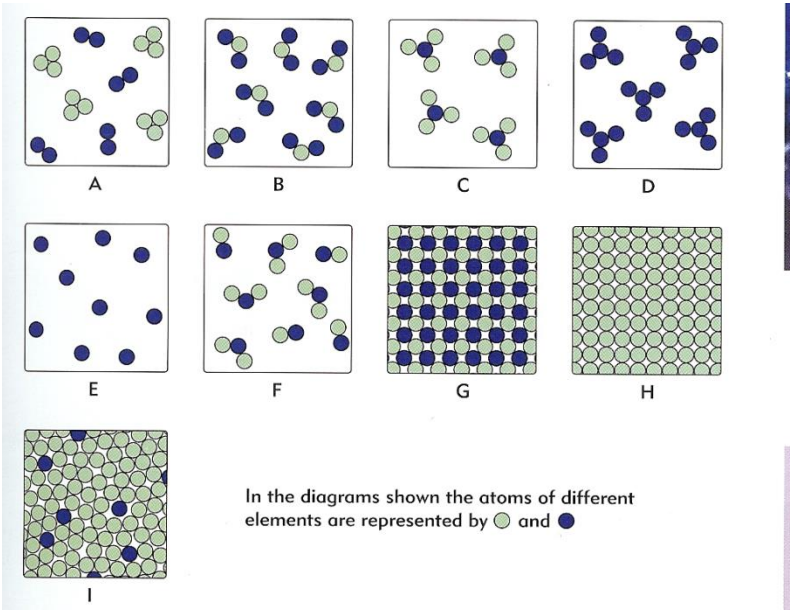
MIXTURES

MIXTURES

Mixtures are made up of components which are not chemically combined and can be separated by physical means.

- The component parts in a mixture are not in a fixed ratio.
- They retain their physical properties.

ACTIVITY



Which of the above are atoms, molecules, mixtures and compounds?

Homogeneous mixture - A mixture which is has uniform properties and composition throughout its structure.

Heterogeneous mixture – A mixture which is non uniform throughout its structure.

SOLUTIONS, SUSPENSIONS AND COLLOIDS

SOLUTIONS

These are homogeneous mixtures consisting of two of more components. Solutions are made up of solutes and solvents. The solute dissolves in the solvent. The solute may be a solid, liquid or gas.

Features of solutions

- All parts of the solution have the same chemical composition, chemical properties and physical properties.
- The solute and solvent do not separate when allowed to stand.
- The particles of the solute are not visible.
- The solution may be coloured but is usually transparent if the solvent is a liquid.
- The solute may often be separated from the solvent by purely physical means.

Types of Solutions

Solute	**Solvent**	**Examples**	**Components**
Solid	Liquid	Sea water, Kool Aid	Salt in water. Kool Aid crystals in water
Gas	Liquid	7-Up	CO_2 in flavoured water
Solid	Solid	Brass	Zinc in copper
Liquid	Liquid	Rum	Ethanol in water
gas	Gas	air	Oxygen, carbon dioxide, nitrogen, noble gases

SUSPENSIONS

These are heterogeneous mixtures. The solute particles can be seen to the unaided eye. Suspended particles settle out if the suspension is allowed to stand. Suspensions do not transmit light, they are opaque.

Examples

Muddy water, flour in water, some medicines e.g. Pepto Bismol.

COLLOIDS

These are heterogeneous mixtures. The colloidal particles are smaller than in a suspension but larger than in a solution. They can pass through filter paper but can scatter a beam of light. They are usually opaque. They do not settle on standing. Examples include foams, aerosols and emulsions. An emulsion is a special type of colloid made up of two immiscible liquids – fine droplets of one liquid in another e.g. creamy salad dressings.

Test Your Understanding

Complete the following table comparing solutions, colloids and suspensions

Table comparing solutions, colloids and suspensions

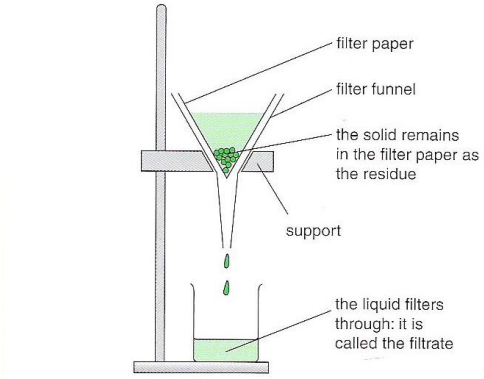
Property	Solution	Colloid	Suspension
Particle Size			
Type of Mixture (homogeneous or heterogeneous)			
Appearance (transparent or opaque)			
Can the components be separated by filtration?			
Do the components separate out on standing?			

SEPARATION OF MIXTURES

Separation Method	Physical properties of component parts
Filtration	To separate an insoluble solid from a liquid
Evaporation	To separate a solid dissolved in a liquid
Sublimation	To separate two solids, one which sublimes from one which does not
Simple Distillation	To separate a liquid from a solution
Fractional Distillation	To separate miscible liquids (mix completely) with different boiling points
Separating funnel	To separate two immiscible (do not mix) liquids
Chromatography	To separate two dissolved substances with differences in solubility of the solute in the solvent

Diagrams from Chemistry for CSEC and Chemistry for CXC

FILTRATION



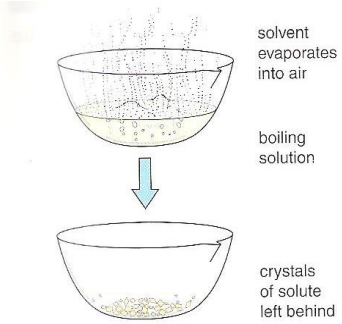
▲ Figure 2.4.1 Filtration apparatus

How does it work?

1. A piece of filter paper is folded into a cone shape.
2. It is placed in a funnel.
3. The funnel is held over a container with clamp and stand.
4. The liquid is poured into the funnel.

The particles are too big to pass through the filter paper so they remain on top. This is known as the *residue*. The liquid can pass through the filter paper, this is known as the *filtrate*.

EVAPORATION

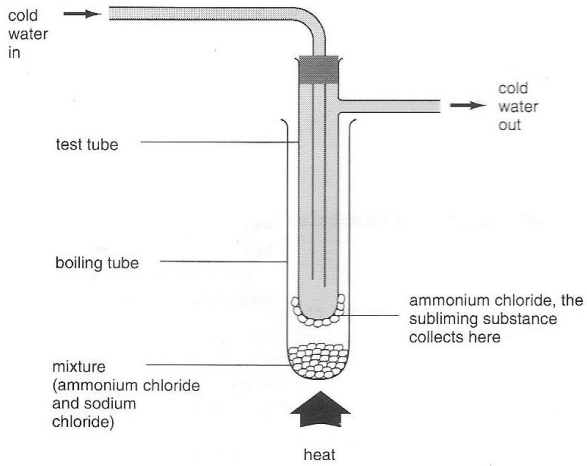


▲ Figure 2.4.2 Evaporation

How does it work?

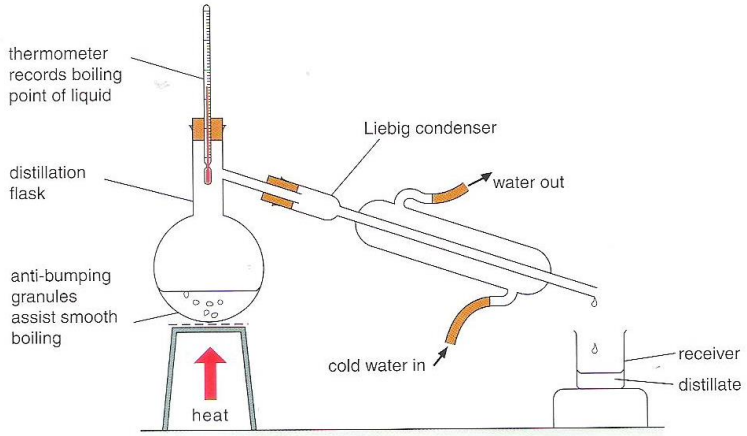
The solvent is evaporated off leaving the solute behind.

SUBLIMATION



How does it work?

The mixture is heated and one of solid sublimes into a gas, the cold water causes it to change back into a solid.



▲ Figure 2.4.3 Apparatus for simple distillation

SIMPLE DISTILLATION

How does it work?

The impure liquid is heated, the solvent evaporates into pure vapour. The vapour is cooled in the condenser and it condenses back into a pure liquid.

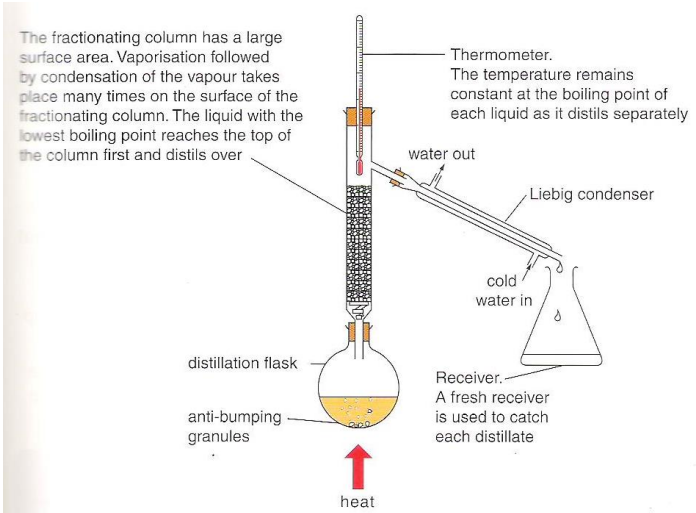
Note the direction of the water going through the condenser.

n.b. The thermometer can be used to determine that the vapour is pure. Anti-bumping granules are added to the flask to achieve steady boiling.

FRACTIONAL DISTILLATION

In fractional distillation there are two of more immiscible liquids. Each liquid has a different boiling point. Vapour condenses and vaporizes as it moves up the fractionating column. The liquid with the lowest boiling point reaches the top first and is collected, then the next and so on.

Industrial distillation would have openings at several levels along the fractionating column to take off the various fractions.



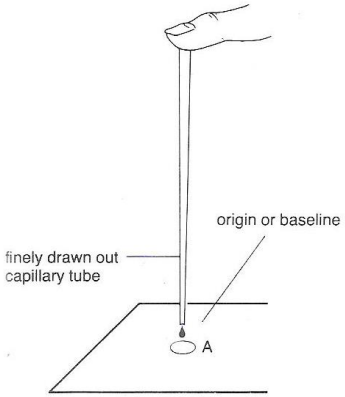
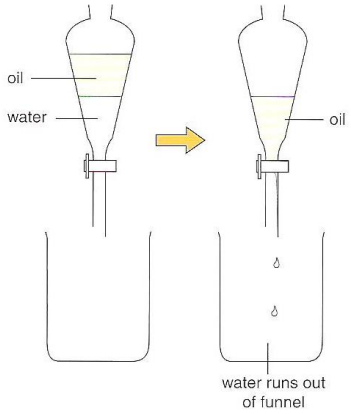


Figure 3.15 Preparing for a chromatographic separation.

SEPARATING FUNNEL

How Does it Work?
The less dense liquid is on the top of the more dense liquid. The separating funnel can be used to remove the layer.



▲ Figure 2.4.5 Separation using a separating funnel

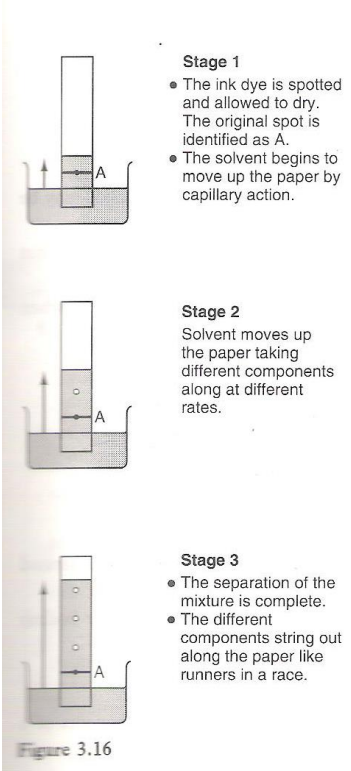


Figure 3.16

CHROMATOGRAPHY

How does it work?
The R_f value (retention factor) is the ratio of the distance travelled by the separated spot to the distance travelled by the solvent. R_f values are constant for a type of chromatography paper and solvent system and can be used to identify substances.

QUESTIONS

1. Briefly explain the meaning of the following terms: filtration and sublimation.
2. What is the main difference between using distillation and evaporation as a separation method.
3. For each of the following mixtures, explain how you would separate them into their component parts.
   (a) A mixture of salt, pepper and water.
   (b) A mixture of oil, sugar and water.
4. What is: a filtrate? A residue?
5. Sugar cannot be separated from a sugar solution by filtering. Explain why?
6. What happens when a solution is evaporated?
7. How would you crystallize potassium nitrate from its aqueous solution?
8. How would you obtain pure water from ink? Draw the apparatus you would use, and explain how the method works.
9. Why are condensers so called? What is the reason for running cold water through them?
10. Water and turpentine are immiscible. How would you separated a mixture of the two?
11. Explain how fractional distillation works.

METALS AND NON METALS

Table showing the properties of metals and non-metals

Most metals	**Most non-metals**
Solids have a high melting points, giving high boiling point liquids	Gases or low melting point solids giving low boiling point liquids
Shiny, reflecting light	Dull, reflecting light poorly or absorbing strongly
High density	Low density
Usually hard	Usually soft
Malleable, ductile, strong	Often brittle, weak
Good conductors of heat and electricity	Insulators

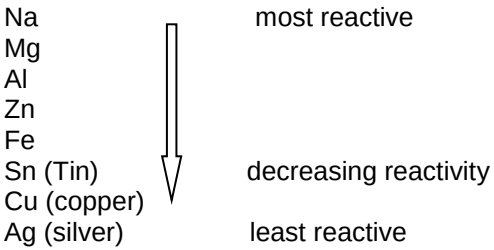
Malleable – easily hammered into shape

Ductile – can be drawn into wires.

Material	**Use**	**Reason**
Metal	Electrical appliances Cooking implements Gardening and other tools, Furniture, nails, doors and gates	They conduct electricity The conduct heat They are strong and malleable.
Wood	Furniture Handles	They are insulators, less dense than metal (density does vary with type of wood)
Plastic	Food containers, pipes, tooth Brushes, hangers, outside of electrical fittings and wires.	Plastics are light, insulators, easy to mould into a variety of shapes

REACTIVITY OF METALS

The following shows the reactivity of selected metals



REACTIVITY OF METALS WITH ACID AND WATER

Metal	Reacts with:	
	Water/steam	Acid
sodium	Violent with cold water forms hydrogen and sodium hydroxide solution	
Magnesium	Very slow with cold water but vigorous with steam	Vigorous, forms hydrogen and magnesium chlorine solution.
Aluminium	No reaction, protected by oxide layer	Effervescence , forming hydrogen and a salt.
Zinc	Reacts with steam, giving hydrogen	Effervescence, forming hydrogen and a salt.
Iron	Rust with water, forms hydrogen with steam	Effervescence, forming hydrogen and a salt.
Tin	No reaction	Slow reaction forming hydrogen and a salt
Copper	No reaction	No reaction
Silver	No reaction	No reaction

RUSTING

Rusting is the formation of hydrated iron oxide in the presence of oxygen and moisture.

Iron + oxygen (in the presence of moisture) → rust

Salt in sea water can make iron rust more quickly as well as the acid in acid rain.

Rusting can be prevented by preventing moisture from coming into contact with the metal. This can be done with: painting, galvanizing (coating object with zinc), tin-plating, oiling, electroplating (covering iron with another metal), plastic coating and sacrificial protection (e.g. magnesium is attached to the side of a steel ship, it corrodes instead of the steel. When it is nearly eaten away it can be replaced – the magnesium is sacrificed to protect the steel.

Removing Rust Stains

Rust stains can be removed with acids such as lemon juice.

Implications of Rusting in the Caribbean

Since the islands of the Caribbean are surrounded by sea water and experience sea breezes daily, rusting is a real and expensive problem. It affects vehicles and equipment. Money is spent preventing rusting and replacing rusted items.

QUESTIONS

1. Suggest reasons why:
   (a) Silver is used for jewellery;
   (b) Mercury is used in thermometers
   (c) Aluminium is used for beer cans.
2. Compare how aluminium and iron each react with oxygen.
3. Which is more reactive, zinc or tin?
4. Explain why tin is used to coat food tins.
5. What gas is always produced it a metal reacts with water?
6. What two substances cause rusting?
7. Steel that is tin-plated does not rust. Why?

ALLOYS

Alloys are mixtures of a metal and another metal or non metal which have enhanced properties in comparison to the individual components.

The following table shows some common alloys.

ALLOY	COMPONENT METALS	USES	PROPERTIES
BRASS	Copper and zinc	plumbing	Hard shiny and resist corrosion
BRONZE	Copper and tin	Ornaments and statues	Hard shiny and resists corrosion.
STAINLESS STEEL	Iron and chromium	Sink tops and washing machines	Does not corrode

(a) What are alloys? How are they made?
(b) Which metals are used to make stainless steel?

PHYSICAL AND CHEMICAL CHANGES

A chemical change or reaction usually involves the following:

1. One or more new chemicals substances are formed.
2. Energy is taken in or given out during the reaction.
3. The change is usually difficult if not impossible to reverse.

Examples heating iron filings and sulphur powder to form iron sulphide. Frying an egg, once you have cooked eggs, you can't change them back again.

A physical change:

1. Forms no new substance.
2. It is reversible. E.g. ice melting or sugar dissolving in water.

QUESTIONS

1. physical chemical
   Copy these sentences. Fill in the blanks, choosing word from those above. (You can use the same word more than once)
   a In a _____ change, one or more new substances are made.
   b A _____ change is usually difficult to reverse.
   c In a _____ change, you end up with the same substance that you started with.
2. Copy the table on the right. Fill in the blanks, by writing 'physical' or 'chemical' in each space.

	Change: physical or chemical
Cooking an egg	
Ice melting	
Salt dissolving in water	
Baking a cake	
Iron going rusty	
Hot fat going solid when cooled	
Wood burning	

THE USE OF COMMON HOUSEHOLD CHEMICALS

Table showing a list of common household chemicals

TYPE OF CHEMICAL	PURPOSE	EXAMPLES
Solvent	To remove stains or dirt; to prepare food; to clean brushes and other implements	Water, kerosene oil, nail polish remover, methylated spirits
Cleanser	To clean household items	Soap detergents, bleach, ammonia, dish wash liquid
Foodstuffs	To feed the family	Tinned and dried goods, fresh produce, frozen products (all foods are made up of chemicals)
Medicines	To treat illness	Cold and sinus medicines, diarrhoea medicines, antacids
Preservatives	To stop food from going bad	Vinegar, sugar, salt, MSG

STAIN REMOVAL

Stains can be used by the following methods:

1. Using a solvent to dissolve the stain.
2. Using an acid to react with and remove the stain.
3. Bleach the stain (remove the colour).
4. Enzymes which break down the stain.

Method 1 is a physical method.
Methods 2, 3 and 4 are chemical methods of stain removal.
The following table shows some common stains and how to remove them.

ACIDS AND BASES

ACIDS

Acids are substances which produce free hydrogen ions in aqueous solutions. Acids have a pH less than 7.

Table showing some common acids

SUBSTANCE	DESCRIPTION	pH
Carbonated Drinks	Contains carbonic acid Solution of sugar and flavouring, popular choice of beverage	4.3
Vinegar	A dilute solution of ethanoic acid; used as a preservative or to flavour food	3
Lemon Juice	Contains citric acid; used to provide a tart taste in foods	2
Gastric fluid	Contains hydrochloric acid, provides the acidic conditions required by enzymes in the stomach.	1.3 – 1.5

Characteristics of Acids

1. Acids have a sour taste but most acids are dangerous to ingest.
2. Acids are corrosive (they can burn flesh)
3. Acids turn litmus paper from blue to red.
4. Acids conduct electricity
5. They react with certain metals to give a salt and hydrogen gas.
   Acid + metal →salt + hydrogen
6. They react with bases to form a salt and water only.
   Acid + base → salt + water
   This reaction is known as a neutralization reaction since the acid is neutralized by the base.
7. Acids react with carbonates to form salt, water and carbon dioxide gas.

USE OF NEUTRALIZATION

- Neutralization occurs when bicarbonate of soda is used to remove fruit stains or borax is used to remove wine and tea stains.
- Insect stings may be acid or alkaline. Bee stings are acid they can be treated with alkalis (onion juice is very effective). Wasp stings are alkaline and can be neutralized with vinegar or lime juice.
- Sometimes your stomach makes too much acid. This can cause you to suffer from indigestion. Indigestion tablets help relieve the pain because they neutralize the stomach acid.

Acids are produced by bacteria consuming food on the teeth. These can cause holes or cavities in the teeth. Ash is basic and can be used to neutralize these acids. This is why the teeth can be cleaned with ash.

BASES

A base is an oxide or hydroxide of a metal that react with acids to form salt and water. Examples of bases are copper oxide, copper hydroxide, magnesium oxide and magnesium hydroxide. Bases have a pH greater than 7. Alkalis are soluble bases.

Characteristics of Alkalis

1. Alkalis have a bitter taste.
2. Alkalis are corrosive
3. Alkalis are soapy to touch.
4. Alkalis turn red litmus blue
5. Alkalis conduct electricity
6. Alkalis often react with salt solutions to form insoluble precipitates.
7. Base neutralize acids
8. Alkalis react with metals to form hydrogen and a solution of a salt.

NEUTRAL SUBSTANCES - These have a pH of 7.

QUESTIONS

1. What element is present in all acids?
2. What is a base? What is a soluble base called?
3. Give the names and uses of 2 alkalis found in the home.
4. What are formed when an acid is neutralized by a base?
5. What is an indicator? Give the colours of litmus?
6. What kind of solution has a pH of 4 or 5?

INDICATORS

The pH scale is a number scale which indicates whether a solution is alkaline, acidic or neutral. An indicator is a substance which varies in colour depending on whether it is in alkaline, acidic or neutral conditions. It can be used to determine the strength or weakness of an acid or alkaline substance. Indicators may liquid solutions or a paper.

Table showing colour changes of some common indicators

Indicator	**Litmus**	**Methyl Orange**	**Screened Methyl Orange**	**Phenol-phthalein**
Colour with acid	Red	Red	Light red	Colourless
Colour with base	Blue	yellow	green	Pink

Litmus is the most common indicator. While these indicators show whether something is acidic or alkaline, they do not show how acidic or alkaline a solution is/
Universal Indicator is a mixture of indicators. It has different colours in solutions of different pH.

pH 1 2 3 4 5 6 7 8 9 10 11 12 13 14
A C I D I C NEUTRAL A L K A L I N E

Becoming more acidic Becoming more alkaline

QUESTIONS

1. The following table shows the pH of a number of aqueous solutions.

SOLUTION	A	B	C	D	E
pH	10	4	2	7	8

a) (i) Which solution is most acidic?
(ii) Which solution is most alkaline?
(iii) Which solution is neutral?
(iv) Which solution could be salt water?
(v) Which solution could be vinegar?

b) Which of the following could give a neutral solution on mixing?
(i) A + B
(ii) C + D
(iii) B + D
(iv) C + E
(v) A + B + C + D + E

2. Ammonium hydroxide, citric acid, copper, copper carbonate, calcium hydroxide, hydrochloric acid, magnesium, sodium hydroxide.
For each of the following chose one substance from the above list.
a) An alkali
b) A substance that produces carbon dioxide gas when added to dilute sulphuric acid
c) A strong acid
d) A weak acid
e) A substance which produces hydrogen gas when added to dilute sulphuric acid
f) A substance that reacts with acids to form salt and water only
g) A weak alkali
h) A substance found in lemons.

AIR

Air is made up of various gases

- Nitrogen 78 %
- Oxygen 21 %
- Carbon Dioxide 0.035 %
- Noble Gases 0.955 %
- Water Vapour (variable)

ACTIVITY
Draw a pie chart representing the composition of gases in air.

THE NOBLE GASES

These are so called because they do not react much. They are used in electric light bulbs (argon), in strip lights (neon) and filling airships and balloons (helium).

NITROGEN

Nitrogen is not very reactive. For that reason, it is pumped into oil storage tanks when they are empty, to prevent the possibility of fire. It combines with hydrogen to make ammonia this compound is used to make nitric acid. Liquid nitrogen is very cold and is used to quick freeze and transport food.

ASSIGNMENT

Making carbon dioxide

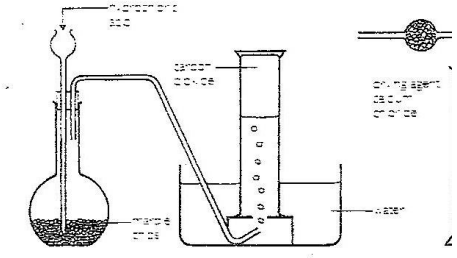
In the laboratory You can make carbon dioxide by adding moderately dilute hydrochloric acid to chips of marble (a form of calcium carbonate) using the apparatus shown.

calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

$CaCO_3 + 2HC \rightarrow CaCl_2 + H_2O + CO_2$

To obtain dry gas it is passed through a tube containing lumps of calcium chloride. It then pushes the air out of a gas jar.

All carbonates will give off carbon dioxide when treated with acid. Most naturally occurring carbonate rocks will also give off the gas when strongly heated, as explained in section 3.6.



Research other ways in which food can be preserved: drying, canning and salting. Write a letter to a housewife advising her how to preserve foods. The letter should be no more than one page.

Air can be driven from an object by replacing it with water, warming it or vacuum packing. Even through air cannot be seen it does take up space i.e. it has volume.

QUESTIONS

1. List the gases in dry air and give their percentages.
2. What other gas is always present? Why is no percentage given for it?
3. Give the name of the noble gases and some of their uses.
4. Describe the test for carbon dioxide.

RESPIRATION

DEFINITION: *Respiration is the process by which food is broken down to make energy.*

Respiration is a chemical process which occurs in all living organisms. It can be summarized by the word equation below:

Oxygen + glucose → carbon dioxide + water + energy

Nb oxygen and glucose are inputs of respiration; carbon dioxide and water are outputs.

In order for respiration to occur, we must bring oxygen into our bodies. This is done by breathing. The lungs are air tight structures with tubes lined with small hair like structures called cilia. The tubes get smaller and end in air sacs called alveoli. This is where oxygen is absorbed into the blood. The blood then takes the oxygen to where it is needed in the body.

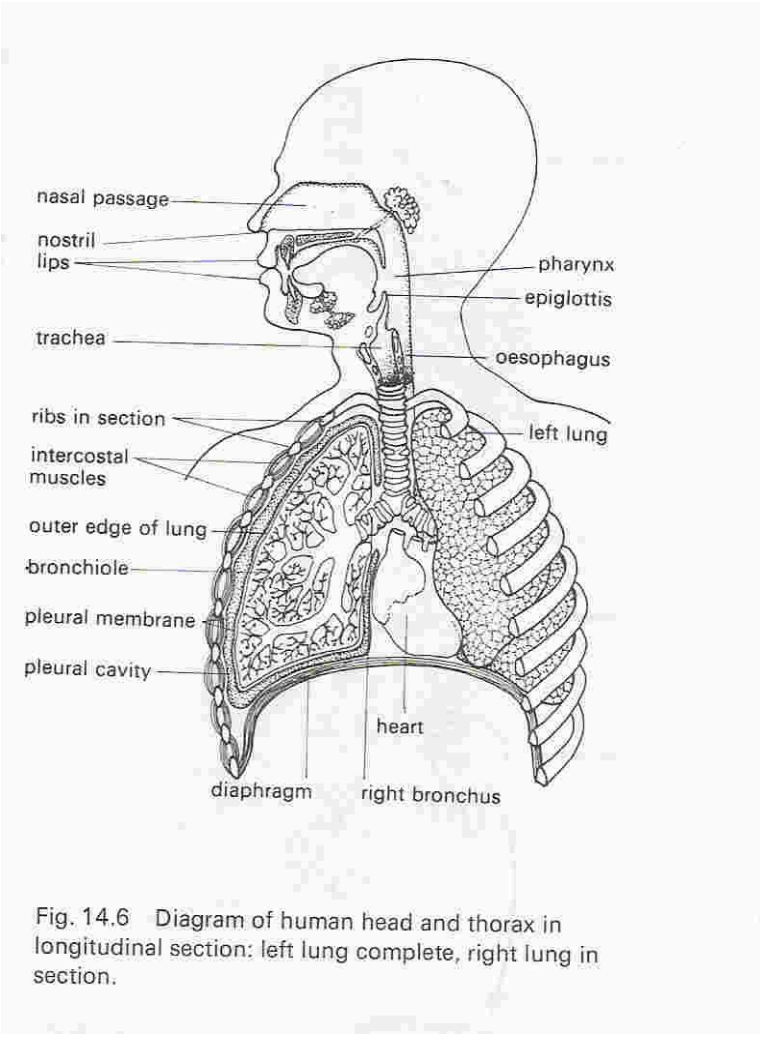


Fig. 14.6 Diagram of human head and thorax in longitudinal section: left lung complete, right lung in section.