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Photocopy Master Sheets

Years 7-8

Separating Mixtures

Disk filename = “04.Mixtures”

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Topics Available

Year 7-8 General Science

Disk Filename	Topic Name
01.Energy	Energy
02.Forces	Forces
03.Matter	Solids, Liquids & Gases
04.Mixtures	Separating Mixtures
05.Elements	Elements & Compounds
06.Cells	Living Cells
07.Life	Living Things
08.LifeSystems	Plant & Animal Systems
09.Astronomy	Astronomy
10.Earth	The Earth
11.Ecosystems	Ecosystems

Year 9-10 General Science

Disk Filename	Topic Name
12.Waves	Wave Energy (inc. Light)
13.Motion	Forces & Motion
14.Electricity	Electricity
15.Atoms	Atoms & Elements
16.Reactions	Compounds & Reactions
17.DNA	Cell Division & DNA
18.Evolution	Evolution of Life
19.Health	Health & Reproduction
20.Universe	The Universe
21.EarthScience	Earth Science
22.Resources	Resources & Technology

Year 11-12 Science Courses

Biology
Preliminary Core
Local Ecosystem
Patterns in Nature
Life on Earth
Evolution Aust. Biota
HSC Core
Maintain. a Balance
Blueprint of Life
Search for Better Health
Options
Communication
Genetics:Code Broken?

Chemistry
Preliminary Core
Chemical Earth
Metals
Water
Energy
HSC Core
Production of Materials
Acidic Environment
Chem.Monit.&Mngment
Options
Shipwrecks, Corrosion...
Industrial Chemistry

Earth & Envir. Science
Preliminary Core
Planet Earth...
Local Environment
Water Issues
Dynamic Earth
HSC Core
Tectonic Impacts
Environs thru Time
Caring for the Country
Option
Introduced Species

Physics
Preliminary Core
World Communicates
Electrical Energy...
Moving About
Cosmic Engine
HSC Core
Space
Motors & Generators
Ideas to Implementation
Options
Quanta to Quarks
Astrophysics

All Topics Available as PHOTOCOPY MASTERS and/or KCiC

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KCiC = Key Concepts in Colour
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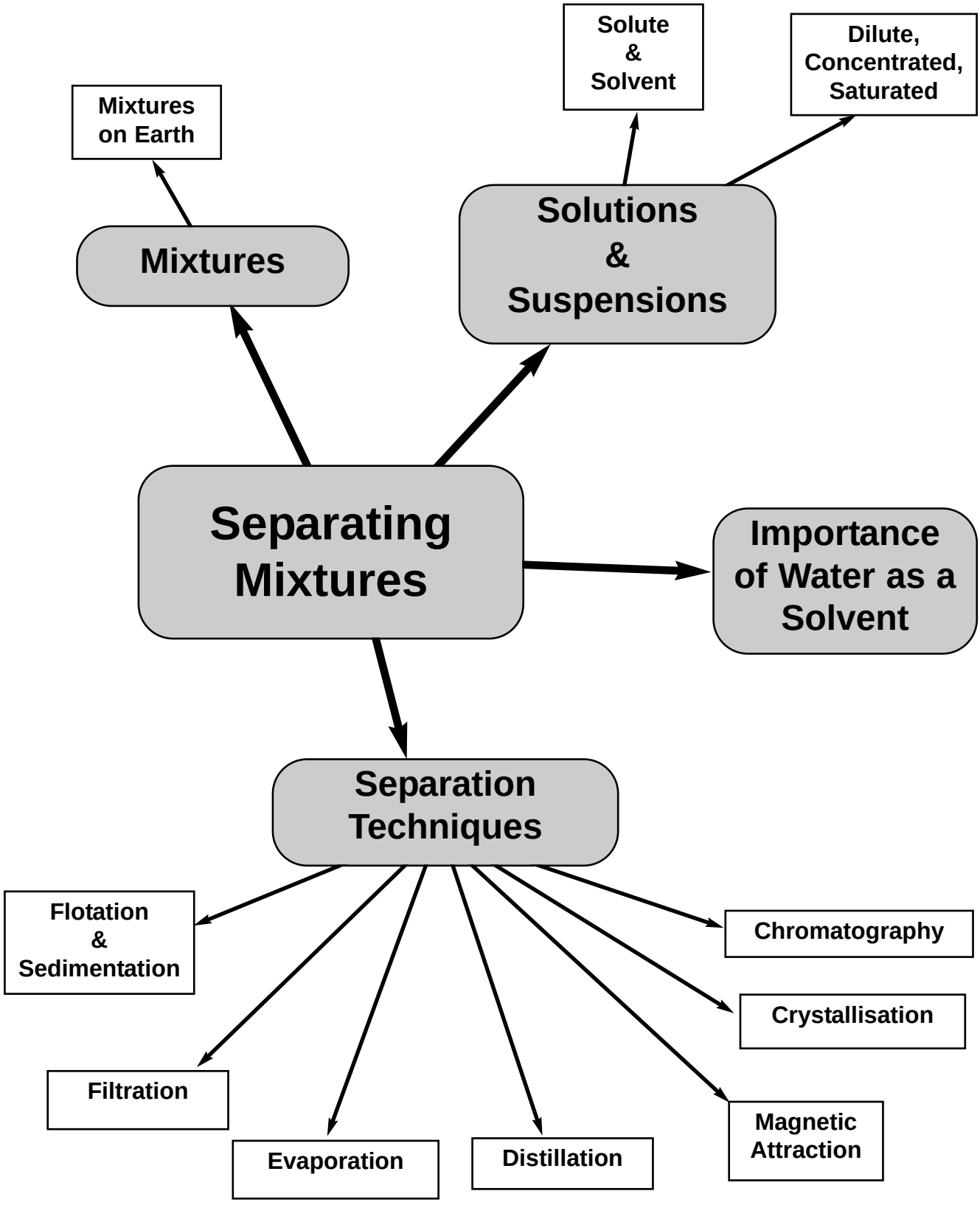
"Mind-Map" Outline of Topic

This topic belongs to the branch of Science called "Chemistry". Chemistry is the study of matter and materials. Chemistry looks at the properties of substances, and how substances can change into new forms.



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Make your own "Mind-Map" TITLE PAGE.
Cut out the boxes. Sort them into an appropriate lay-out on a page of your workbook, then glue them down. Add connecting arrows and colour in.

Separating Mixtures

Mixtures

Mixtures on Earth

Solute & Solvent

Importance of Water as a Solvent

Filtration

Chromatography

Solutions & Suspensions

Dilute, Concentrated, Saturated

Crystallisation

Magnetic Attraction

Distillation

Separation Techniques

Flotation & Sedimentation

Evaporation

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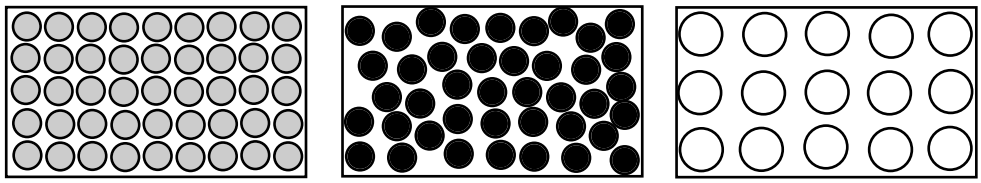
What is a Mixture?

To understand mixtures, you need to know about pure substances.
A substance is "pure" if it is made up entirely of particles that are identical to each other.

Scientists have good reasons to believe that all substances are made up of tiny "particles".

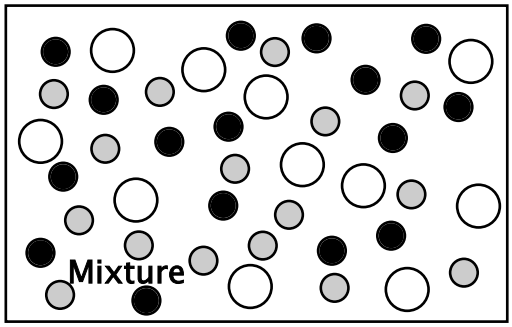


Three different pure substances

There are many different types of particles. The different types of particle are different from each other in their weight and density, in the way they cling together and in the way they combine with other types. You will learn about atoms & molecules in a later topic. For now we will represent particles simply by different shapes and shadings.

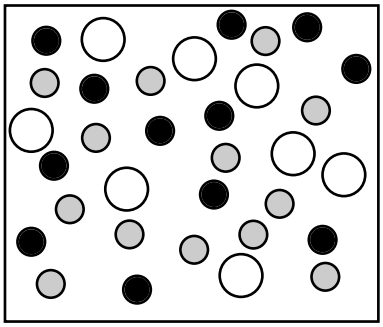
A mixture is NOT PURE.
A mixture is a substance made up of 2 or more different types of particles mixed together, but not chemically combined.

Exactly what "chemically combined" means will be explained in a later topic.



Scientific Models

When we use diagrams like this to describe substances, is this description realistic?



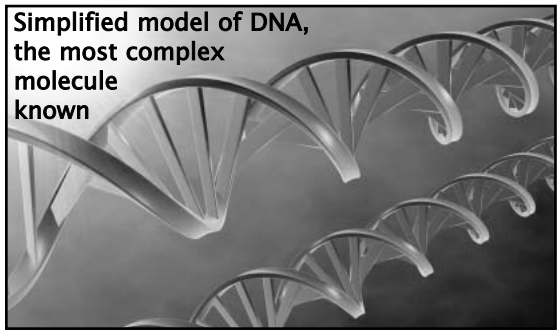
Well, yes, and no.

We have many good reasons to believe that all matter is made up of small particles called atoms. Often they join together in larger lumps called "molecules".

However, we also know that atoms are not solid ball-like particles, but are made up of many smaller pieces.

Overall, the description above is partly true, but is simplified, and not the full story.

Scientists often develop "models" of things that cannot easily be seen. This helps in understanding and explaining the observed facts.



Simplified model of DNA, the most complex molecule known

So long as the model explains things, and always remains totally in agreement with what we can see and measure, then it is useful, even if it is simplified or not quite the full story.

For now, ball-like "particles" will be our model of matter.

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Mixtures Around Us

We are surrounded by mixtures... we breathe mixtures, eat them, drink them and swim in them. We wear them and make art using them.

Nearly everything around us is a mixture.

The Solid Earth

The Earth is mostly made of rock, with a thin layer of soil on top. Rocks are mixtures of various "minerals" combined together.

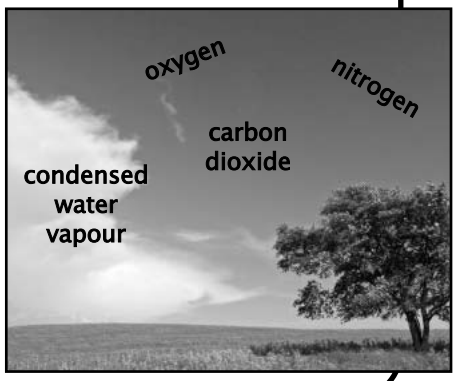
Soil is a complex mixture of minerals, water and the remains of dead plant materials.

The Oceans

The oceans cover 2/3 of the Earth to an average depth of several kilometres. The oceans are mixtures of (mainly) water and salt.

The Atmosphere

The Earth is surrounded by a layer of air... the atmosphere.



Air is a mixture of gases, often with clouds of tiny water droplets drifting about.

We Use the Earth's Resources

Resources

A "Resource" is any substance which we need and use.

Natural Resources

These are things we need and use which occur naturally on Earth.

Many resources come from living things. For example, cotton and wool are fibres which we use to make clothing, carpets and furnishings. Cotton is a plant fibre. Wool, of course, is the hair or fur of a sheep.

Other things are non-living resources.
For example, water is one of our most basic and necessary resources. The water we need for drinking, washing, irrigation and industry is collected from lakes and rivers.

Sand is a simple resource used to make cement, concrete and glass. We simply gather it from the Earth.

Made Resources

These are useful substances which do not occur naturally, but are made artificially.

To make these things, we start with some natural resource, but treat it and modify it so it becomes a totally new substance.

For example, plastics are a range of substances used to make furniture, car parts, toys, pipes, kitchen utensils, etc, etc.
Plastics do not occur naturally. They are made by chemical processing of substances extracted from petroleum.

Dyes and pigments are used to add colour to fabrics, plastics, paint, ink, etc. Although some dyes can be extracted from natural plant and animal sources, most modern pigments are made artificially from chemicals extracted from coal or petroleum.

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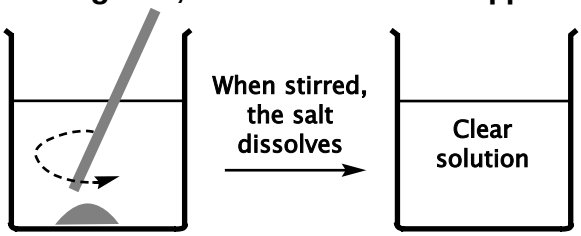
Solutions & Suspensions

If you mix a solid substance with a liquid, one of 2 things is likely to happen... either it "dissolves" in the liquid, or it does not.

Salt Dissolves in Water

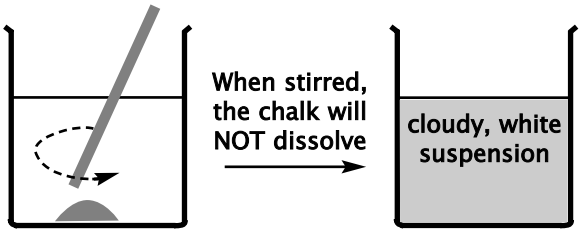
If you add solid salt to water and stir to mix them together, the salt seems to disappear.



This mixture is a "solution".
The salt particles and the water particles are mixed together so intimately that the salt cannot be seen. If you let it stand, the salt will never settle to the bottom.

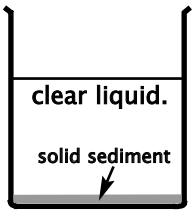
Chalk Dust won't Dissolve

If you mix some chalk dust (or similar solid) with water, no matter how much you stir, it will not dissolve.



This is a "suspension".

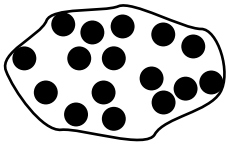
The solid is not dissolved in the liquid. You can see the "cloudiness" of it. If you let it stand, the solid will gradually settle to the bottom.



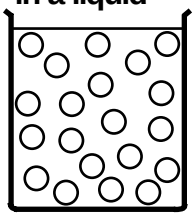
You should learn to recognise solutions and suspensions.
Solutions may be coloured, but are always clear and "see-through".
The solid will never "settle out" from a solution.
Suspensions look "cloudy" and block the light.
Suspended solids will eventually "settle out".

Solutions and the Particle Model

Particles in a solid

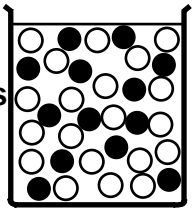


Particles in a liquid



If the solid is "soluble" in this liquid it will dissolve to form a solution.

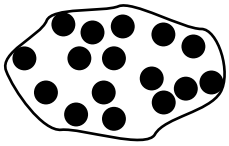
The lump of solid material completely comes apart and its particles are mixed evenly among the particles of liquid.



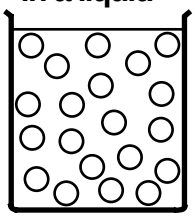
The different particles cling to each other so the particles of solid cannot fall to the bottom, but stay spread throughout the mixture.

Suspensions and the Particle Model

Particles in a solid



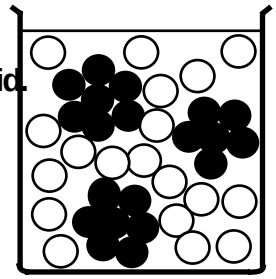
Particles in a liquid



If this solid is "insoluble" in this liquid it will not dissolve, but may mix to form a suspension.

The solid particles are still in "clumps". They may be too small to see, but they are not evenly spread in the liquid.

The "clumps" will eventually settle to the bottom.



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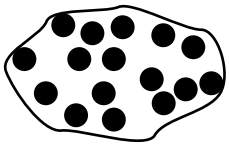
Solute, Solvent, Solution

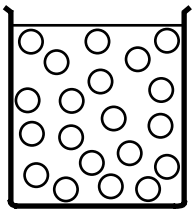
More to learn about solution mixtures:

Particles in a solid



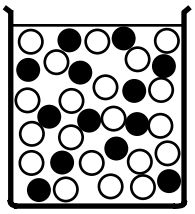
The substance which dissolves is called the "Solute".

Particles in a liquid



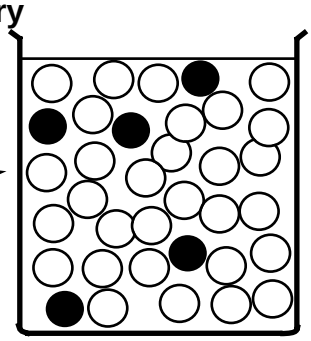
The liquid it dissolves into is called the "Solvent".

This mixture of solute dissolved in solvent, is called a "Solution".



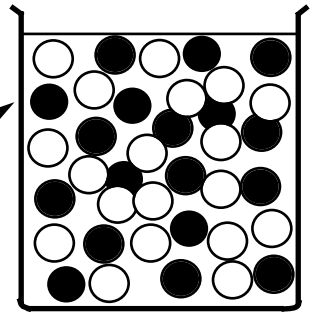
Dilute & Concentrated

If there is only a very small amount of solute dissolved, we say that the solution is "Dilute".



Example: 1 grain of salt dissolved in a glass of water.

If there is a large amount of solute dissolved, we say that the solution is "Concentrated".



Example: 3 spoons of salt dissolved in a glass of water.

Solubility

When a substance (solute) will dissolve in a liquid, we say it is "soluble" in that liquid. If it will not dissolve, we say it is "insoluble".

Each solute may have a different solubility in different solvents.

For example, salt is soluble in water, but is insoluble in petrol.

Oil will not dissolve in water, but is completely soluble in petrol.

Sugar will dissolve in water, and will also dissolve in petrol: it is soluble in both solvents, although not equally in each.

Saturated Solution

There is usually a limit to how much solute will dissolve in a given amount of solvent. When this limit is reached, and no more solute can be dissolved, the solution is said to be "Saturated".

The Effect of Temperature

Generally, the amount of solute that will dissolve increases with temperature.

For example, you can dissolve a lot more sugar in hot water than you can in cold water. This is true for most solutes that are soluble in water.

Strangely enough, the solubility of salt does not change very much from cold to hot water.

Solubility of Gases

Gases such as oxygen from the air can be solutes too, but the amount that will dissolve is often very small.

It is this small amount of dissolved oxygen that fish, and other water-living creatures, rely on for breathing in water.

However, the temperature effect on solubility is the opposite of what happens with most solids... as the temperature goes up, the amount of gas that will dissolve goes down. As water gets warmer, the fish begin to suffocate!

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Worksheet 1

Mixtures
Fill in the blank spaces

Student Name.....

A "pure" substance is something that is entirely made up of a)..... that are b)..... to each other.

Any substance that is not pure, must be a c).....

We are surrounded by mixtures. The air is a mixture of d)..... The oceans are a mixture of (mainly) e)..... and ..... The solid Earth is mostly rock, which is a mixture of different f).....

g)..... resources are substances we need and use, which occur naturally. Some come from living things, (example h).....) others are non-living. (example i).....)

The opposite of a natural resource is a "j)..... resource.

Match the Lists

For each definition, write the letter (A,B,C, etc) of the matching List Item.

Definitions	matches with
1. Substance made of identical particles	.....
2. rocks are mixtures of these.	.....
3. A natural, non-living resource.	.....
4. Substance containing different particles.	.....
5. A mixture of gases surrounding us.	.....

List Items (not all will be used)

A. water	D. plastic
B. atmosphere	E. mixture
C. pure	F. minerals

Worksheet 2

Solutions & Suspensions.
Supply the missing word for each definition.

Student Name.....

1. A mixture where a solid is dissolved in a liquid. .....
2. Name for the solid which is dissolved. .....
3. A solution which has only a small amount of solid. .....
4. A mixture of solid & liquid which will separate if allowed to stand. .....
5. Description of a solid which will not dissolve in a liquid. .....
6. The liquid part of a solution. .....
7. A solution with a large amount of solute. .....
8. Description of a solid which will dissolve. .....
9. A solution with the maximum amount of dissolved solid.....
10. What an increase in temperature usually does to solubility.....

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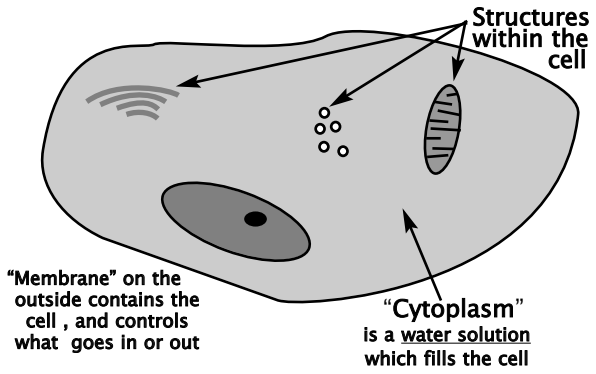
The Importance of Water as a Solvent

Inside Living Things

All living things are mostly made of water. Your body is made of microscopic bags called "cells", which are filled with a water solution.

GENERALISED DIAGRAM OF A LIVING CELL



You will learn more about cells in other topics. For now, just note that water is the "solvent of life". Many of the chemicals which make up living cells are dissolved in water.

Your blood is mostly made of water. It circulates around your body carrying vital chemicals to your brain and other body organs. Many of these chemicals, such as food nutrients, are carried dissolved in your blood.

In the Environment

Water is also important as a solvent in the environment of living things.

Plants need many minerals so they can grow and be healthy. They get these minerals from the soil by absorbing them through their roots. The minerals must be dissolved in the water in the soil, so the plants can absorb them.

Most of the aquatic plants and animals (aquatic = living in water) have to breathe oxygen, just as we do. The difference is that they breathe the oxygen that is dissolved in water.

Water is the vital solvent of life.

Water is the Solvent in the Oceans

Most of the water on Earth is in the oceans and has salt and many other minerals dissolved in it.

All the salt has been dissolved out of the rocks and soil by rainwater seeping through over many millions of years. This has not only created the salty oceans, but is important in the weathering of rocks and soil formation on land.

Human Uses of Solvent Water

Water is important as a solvent in many situations in everyday life, in the workplace, and in industries. Water is the solvent in many medicines, in tea, coffee and milk.

When you wash your hands, or have a shower, or wash the dishes, or do the laundry you are relying on water to dissolve the dirt and wash it away.

To help it clean better, you use soap or detergents which break up insoluble greasy dirt so it is carried away suspended in the water.

In many industrial processes, water is used as a solvent so that important chemicals can be easily pumped through pipes, or mixed with each other.

Whether you drink it, wash with it or swim in it, water is the number one solvent and natural resource for our society and for all living things.

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Separating Mixtures

The rest of this topic is all about how you can separate the parts of a mixture.

As well as learning more about the properties of matter, you will be learning about techniques and methods which are commonly used in scientific laboratories, and in many industrial processes.

The Importance of "Properties"

Every pure substance has a unique set of characteristics, or "properties".

These properties include **colour**, **density**, **solubility**, **particle size**, **melting point**, **boiling point**, and many more.

Differences of Properties Allows Separation

To separate any mixture into its parts, or "fractions", you take advantage of the fact that each part of the mixture has different properties.

As you learn about each method, look out for how a particular difference in properties allows the fractions to be separated.

Separating Solid Mixtures by Sieving

If you had a mixture of dry sand and pebbles, how would you separate the sand from the stones?

You could possibly pick out all the stones one-by-one with your fingers, but a quick and easy way is to use a sieve.

The sand grains fall through the wire mesh, while the stones cannot fit through and are caught on top of the mesh.

Can you see which property of sand and pebbles allows this separation to work?

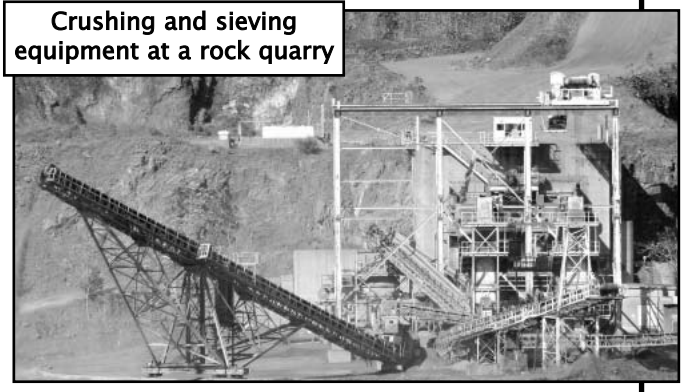
It is simply the different grain size.

Sieves are commonly used in many industries to separate substances with different grain sizes.

In a flour mill, wheat grains are cracked open by heavy rollers to release the powdery flour inside. Then the husk of the wheat seeds needs to be removed. This is done by sieving. Flour falls through a fine mesh sieve, but the seed husks are too big and are trapped on the mesh.

Gravel is used in making concrete, or for road-building. It is important that all the stones are about the same size.

Crushing and sieving equipment at a rock quarry



Gravel and crushed rocks are passed through sieves of different mesh sizes to collect coarse or fine gravels separately.

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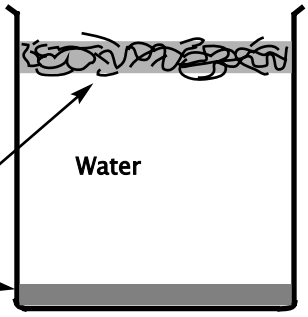
Flotation & Sedimentation

An Idea for a Neat Experiment

Imagine you had a mixture of dry sand and sawdust, and wanted to separate them.

Sieving might work, but a lot of the sawdust grains may be the same size as sand grains, and will sneak through the sieve with the sand.

Try this!
Drop the mixture into a beaker of water, stir it, then let it stand.



The sawdust floats.
The sand sinks.

Scoop the sawdust off the top and dry it. Carefully pour off the water, collect the sand and dry it. Mission accomplished!

Difference in Properties?

Firstly, neither the sand nor the sawdust dissolve in water, so they form a suspension. The separation then occurs because of differences in density.

Sedimentation

Whenever a solid-liquid mixture is a suspension, it will separate if you just leave it alone.

If the solid settles to the bottom to form a "sediment", the process is called "sedimentation", if it floats it is "flotation".

Note that this will NOT work for dissolved solids in a solution. The solid particles in a solution are intimately mixed in with the solvent particles and they cling to each other so that the solid will never separate.

Sedimentation is the process by which mud and sand settle to the bottom of lakes and seas. (More on that in a later topic!)

Sedimentation is important in sewerage treatment. After primary treatment, the solid "sludge" is allowed to settle to the bottom of a "sedimentation pond". The clear water can then be released into the environment, or treated further and re-cycled.

Centrifuging

A Centrifuge is a machine which speeds up sedimentation by spinning a mixture around at high speed.

The spinning action causes sediments to settle faster.

The "spin cycle" of a washing machine has a centrifuge effect. Water is separated from the clothes much faster compared to simply letting it drip out.

Centrifuges are used to separate cream from milk in a dairy factory, and are widely used for separations in scientific laboratories.

Copper Refining

Copper is one of our most important metals. When copper ore is mined, the valuable copper minerals are mixed with large amounts of useless rock.

To separate the copper minerals, the ore is crushed to a powder, then mixed with water in huge vats.

A special oil is added and compressed air is bubbled through the mixture.

The useless rock particles settle to the bottom (sedimentation), but the copper minerals cling to the oil and form a froth on top. This can be skimmed off to collect the copper minerals and re-cycle the oil.

This is called "Froth Flotation"

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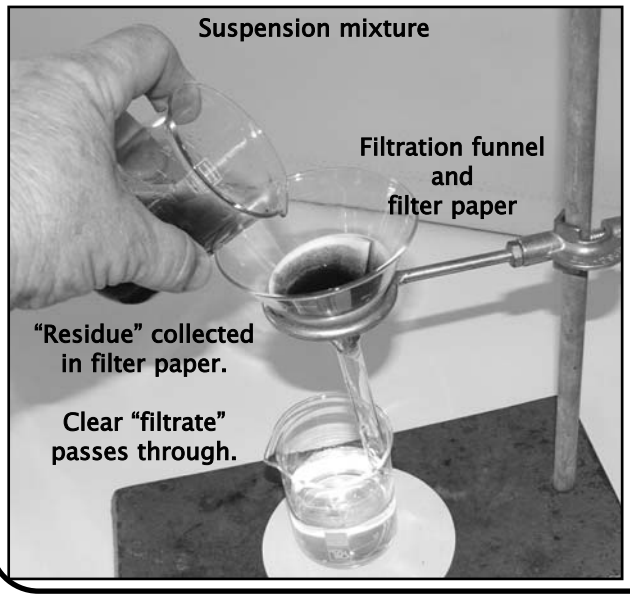
Filtration

Filtration can be used to separate a suspension mixture.
It WILL NOT separate the parts of a solution.

For some suspensions, like sand in water, the solid will rapidly settle to the bottom and form a sediment.

Suspensions containing very fine solids may take days to settle. In this case it may be better to filter the mixture.



What property difference allows separation?

Grain size!

Although the grains of the suspended solid may seem very small, they are very much larger than the particles of the liquid.

The filter paper has microscopic channels and holes between its fibres, and the particles of liquid can easily flow through. The solid grains are much larger, and are caught in the filter paper.

Filtration is really the same as sieving. at a different size scale.

The solid caught in the filter paper is called the "residue".

The liquid which passes through is called the "filtrate".

Evaporation

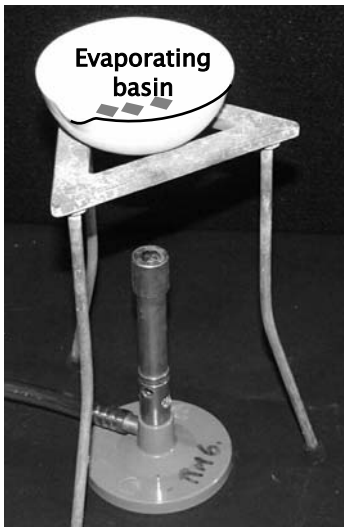
Evaporation can be used to collect the solid from a solution.

If you try to filter a solution, you will quickly find out that you cannot separate its parts that way. Why not?

Simply because in a solution, the particles of dissolved solid are about the same size as the particles of liquid. Since the liquid can flow through the filter paper, so can the dissolved solid.

Crystals of copper sulfate collected from a solution by evaporation

To collect the solid, the best way is to evaporate the liquid solvent. You can just leave it in an open container to slowly evaporate at room temperature, or heat the solution to speed the process up.



The water evaporates away and leaves the solid behind.

Why does it work?

The solute and the solvent have a big difference in their boiling points.

Water slowly evaporates at room temperature, and will boil and vapourise at 100°C.

Most dissolved solids will not evaporate unless heated to much higher temperatures.

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Distillation

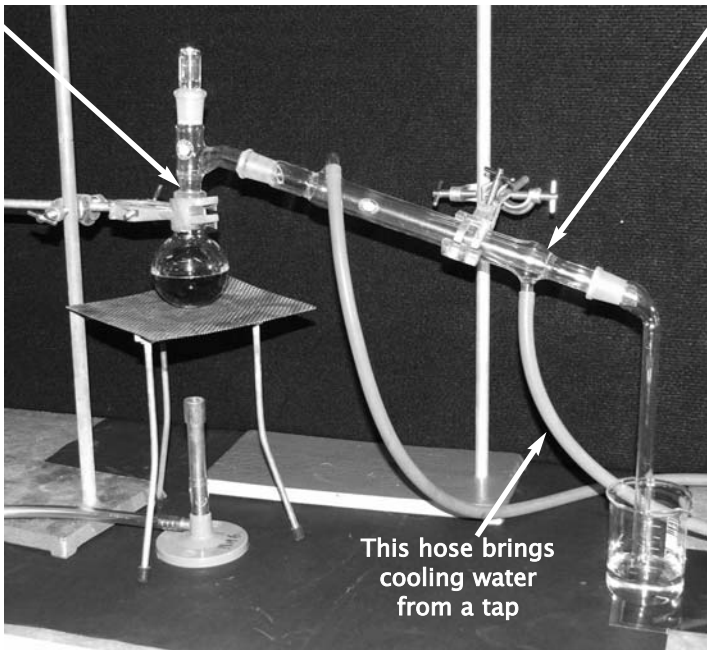
Distillation can be used to collect the liquid from a solution

Flask containing solution to be separated.

The solution boils, and the solvent evaporates.

As the vapour passes through the condenser, it is cooled so that it condenses back to liquid.

The solute remains in the flask.



Condenser

The condenser is a tube within a tube.

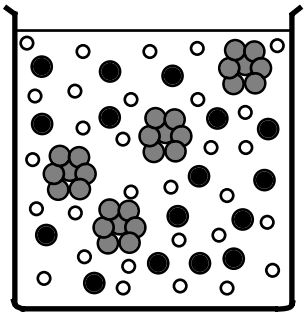
Cold water flows through the outer tube and cools the hot vapour flowing in the central tube.

The vapour condenses, and pure, liquid solvent flows out the end.

What difference in properties allows this to work?
The solvent and the solute have very different **boiling points**.
The solvent boils and evaporates. Then the vapours are condensed back to liquid.
The solute remains behind in the flask.

An Experiment You Might Do

If you stir some **copper sulfate** into water it forms a blue coloured solution. Now stir in some chalk dust, or **calcium carbonate**. This will not dissolve, but forms a suspension.



The mixture could be represented by this diagram.

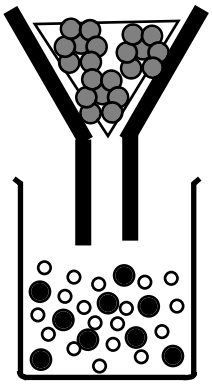
- Water particle (solvent)
- Dissolved copper sulfate particle (solute)
- Particle of suspended solid calcium carbonate

How could you separate this mixture to collect some pure water, pure copper carbonate and pure calcium carbonate?

Filter first, then evaporate & distil

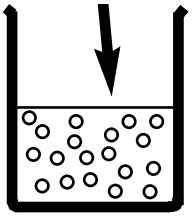
Filtration
The suspended solid (calcium carbonate) is trapped in the filter paper

The filtrate is a solution of copper sulfate in water



divide in 2 parts

Distillation
Pure water collected from the condenser



Evaporation
Crystals of solid copper sulfate

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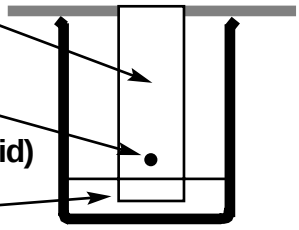
Chromatography

Chromatography can be used to separate mixtures containing very small quantities of quite similar chemicals, such as the dyes in ink. It is used mainly to find out what is in a mixture (analyse it) rather than to separate the parts for collection.

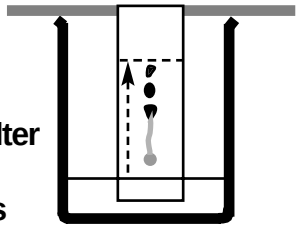
Strip of filter paper taped to a glass rod

Small spot of texta ink (must be above the liquid)

Water, or other solvent



If this is left alone for some time, the solvent soaks up through the filter paper. As it rises above the spot of ink, it carries some of the dyes with it. Soon you can see that what seemed to be one colour of ink actually contains several different dyes.



You might experiment with different colours of texta, or food colourings. Try different solvents, such as water with some methylated spirit mixed into it.

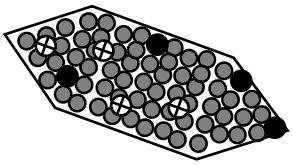
You can hang the filter paper up to dry, and keep your "chromatograms".

How does it work?
Texta ink may contain several different dyes mixed to give the visible colour.

As the solvent climbs up through the paper, it carries the soluble dyes with it. However, different chemical dyes cling to the paper fibres. Some cling tighter than others, so the further the solvent travels, the more the dyes are separated from each other.

Crystallisation

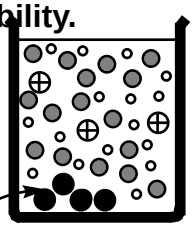
Crystallisation (or "re-crystallisation") is often used to remove small amounts of impurities from a soluble substance. It is used mainly as a way to purify chemicals for scientific or medical uses.



This diagram represents a crystal of a useful chemical, but it has some impurities mixed with it.

To purify it, the first step is to dissolve it in a suitable solvent to make a very concentrated solution. This is often heated, for maximum solubility.

- Solvent particles
- Useful chemical
- ⊕ Soluble impurity
- Insoluble impurity

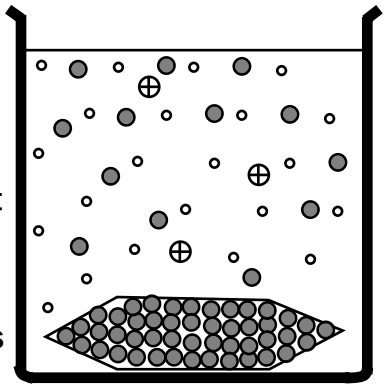


Some of the impurities do not dissolve. These can be removed by filtration.

Next, the solution is allowed to cool, or the solvent is allowed to evaporate.

The dissolved chemical now begins to form solid crystals because the solution cannot hold so much solute.

These crystals are very pure.



The soluble impurities mostly stay in solution because they are not so concentrated and do not crystallise.

This is how chemicals for laboratories or for medicines can be made 99.999% pure.

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Worksheet 3
Separating Mixtures

Choose the best method to achieve the separation described

Student Name.....

Which method of separation would you use, if you want to collect...

1. some sugar from a sugar solution? .....

2. rice grains, which have accidentally been mixed with flour? .....

3. some pure water from salty water? .....

4. some salt from salty water? .....

5. some clear water from muddy water? .....

6. sawdust, which has been mixed with sand? .....

7. copper oxide, from a suspension in water? .....

8. pure water from a solution of copper sulfate. .....

9. the steel buttons that are mixed in with plastic buttons? .....

10. clear water from a mixture containing insoluble solids.....

Worksheet 4
Methods of Separation

Student Name.....

1.
A student was given a mixture containing copper oxide (insoluble) and copper sulfate (soluble) and asked to separate them. Firstly, she stirred the mixture into water, then filtered it. Next, she evaporated the filtrate.

a) What substance was the residue in the filtration?.....
b) Describe what the filtrate was.

.....

c) What difference in properties allows substances to be separated by filtration?

.....

d) What substance was collected by evaporation?.....
e) What difference in properties allowed this separation?.....
f) The copper sulfate collected was found to be impure. What process could be used to purify it? .....

2. Fred is learning to cook, but he's better at Science than cookery. He's accidentally mixed the icing sugar with the corn flour and spilled some rice into it as well.
(Icing sugar and cornflour are both fine powders. Icing sugar is soluble, corn flour is not.)
To separate this mess, he firstly sieved it. What went through the sieve he stirred into water, and let it stand overnight. In the morning a sediment had formed. He carefully poured the clear liquid into a tray and put it into the warm oven to evaporate.

a) What was caught by the sieve? .....
b) What difference in properties allows substances to be separated by sieving?

.....

c) What was the sediment? .....
d) What solid will be in the oven tray when dry? .....
e) What other method might Fred have used to collect the substance which was a sediment? .....

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Skills Worksheet 5

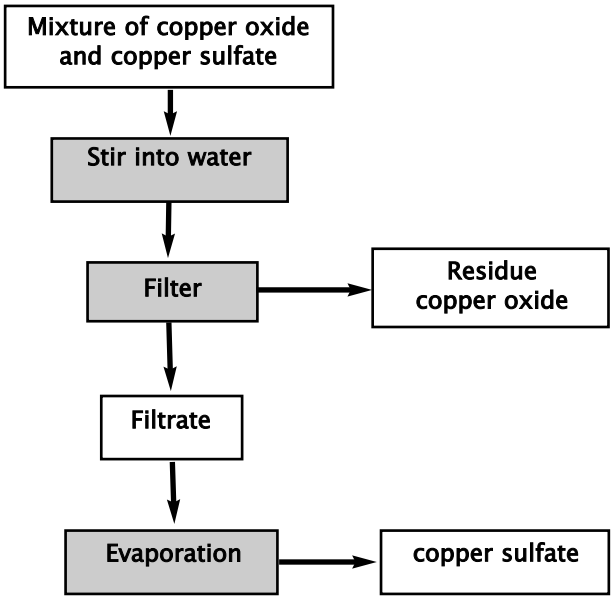
Flowcharts of Separations

Student Name.....

Example

The following diagram is a flowchart of the method used to separate the mixture described in Worksheet 4, Question 1.

Study it to get the idea, then try to make your own flowcharts for the separations described.



Problem 1

Dirty, salty water was filtered. The filtrate was then distilled.

Use a flowchart to show what was collected at each step.

Problem 2

A mixture of pebbles, fine sand and salt was sieved. What passed through the sieve was mixed with water and allowed to stand. A sediment formed. The clear liquid was poured off and evaporated. The sediment was also dried.

Use a flowchart to show the procedure and what was collected.

Problem 3

A mixture of salt, water and chalk dust (insoluble) was filtered. The residue was dried. The filtrate was divided into 2 parts. One part was evaporated, the other part was distilled.

Construct a flowchart and show what was collected at each step.

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Separating Mixtures to Obtain Resources

Most of the substances around us (land, sea, air and living things) are mixtures. To obtain the many resources we need, we often have to separate the things we want from the mixtures in which they occur. The following are just a few examples.

Sieving

(already mentioned)

Sieves are used to separate flour from the wheat husks in a flour mill.

Sieves are used to separate different sizes of gravel for making concrete and for road-building.

Gravel is a very simple natural resource, and we use millions of tonnes of it.

Distillation

Distillation is used in the production of ethanol, which is now being added to petrol to make supplies last longer.

To make ethanol, corn starch or cane sugar is first fermented. This process is basically the same as the making of beer or wine.

The fermented "brew" contains 15% ethanol. Distillation is used to separate almost pure ethanol from the water mixture.

Sedimentation & Filtration

These separation methods are often involved in collecting our most important natural resource... water!

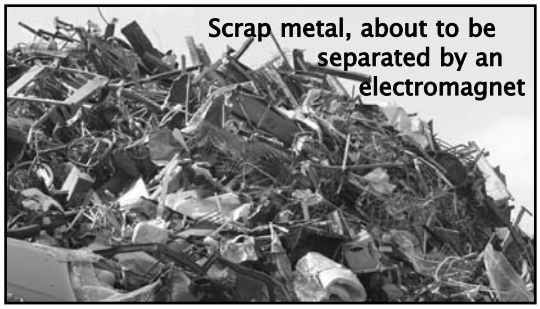
In many places, the water supply comes from a river, lake, or from underground. Often the water is "dirty" and is not safe for drinking.

Water is usually pumped into a large reservoir where it stays long enough for some of the "dirt" to settle to the bottom as a sediment.

The water may then be pumped through huge filters to trap any remaining suspended solids, so it is clear and clean for human uses.

Magnetic Separation

You know that iron and steel are attracted to magnets, while other substances are not.



Scrap metal, about to be separated by an electromagnet

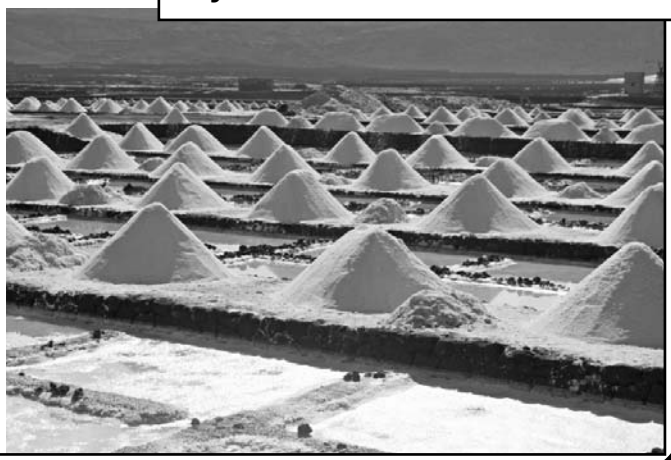
This difference in properties is used in the re-cycling industry to separate the "ferrous metals" from other re-cycled metals such as aluminium.

Evaporation

Salt is separated from sea water by evaporation.

Sea water is pumped into wide, shallow ponds. Over a period of weeks, the heat of the Sun evaporates the water leaving solid salt behind.

If necessary, the salt can be purified by crystallisation.



Topic Test - Mixtures

Answer all questions in the spaces provided.

Student Name.....

Score / 26

1. (8 marks)
For each pair of items, state clearly what is the difference between them.

a) A mixture and a pure substance

b) A solution and a suspension

c) A solvent and a solute

d) a dilute solution and a concentrated solution

2. (8 marks)

True or False?	(T or F?)
a) For most substances, solubility increases at higher temperature.	.....
b) Filtration will separate a suspension mixture.	.....
c) Sieving works because of a difference of solubility.	.....
d) Evaporation collects the solvent from a solution.	.....
e) The solid in a solution will form a sediment.	.....
f) Distillation is involved in making ethanol for use as a fuel.	.....
g) Crystallisation can separate the different dyes in some ink.	.....
h) Oxygen gas is more soluble in hot water than cold water.	.....

3. (5 marks)
What substance would be collected if:

a) you kept the filtrate after filtering a suspension of sand in water?

b) salt water is distilled?

c) an impure sample of copper sulfate was dissolved in hot water and re-crystallised?

d) pure water was evaporated?

e) you dry the residue after filtering dirty water?

4. (5 marks)
A mixture of sand, salt and sawdust was stirred into water and the mixture was allowed to stand.
a) How might you collect "pure" sawdust?

b) What is the sediment which forms?

c) The clear liquid was poured off and divided into 2 parts. One part was evaporated, and the other was distilled.
i) What substance would be collected by distillation?

ii) What would be collected from the evaporation?

iii) What difference in properties allows the separation in both evaporation and distillation?

Answer Section

Worksheet 1

a) particles b) identical
c) mixture d) gases
e) water and salt f) minerals
g) Natural h) wool, cotton
i) water, sand j) made

Match the Lists
1. C 2. F 3. A 4. E 5. B

Worksheet 2

1. solution 6. solvent
2. solute 7. concentrated
3. dilute 8. soluble
4. suspension 9. saturated
5. insoluble 10. increases it

Worksheet 3

1. evaporation 6. flotation in water
2. sieving 7. filtration
3. distillation 8. distillation
4. evaporation 9. magnetic attraction
5. filtration 10. filtration

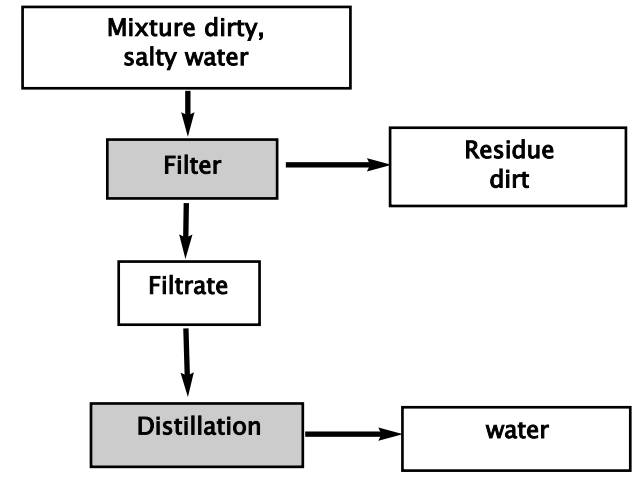
Worksheet 4

1.
a) copper oxide
b) A solution of copper sulfate
c) Particle size
d) Solid copper sulfate
e) Boiling points
f) Crystallisation

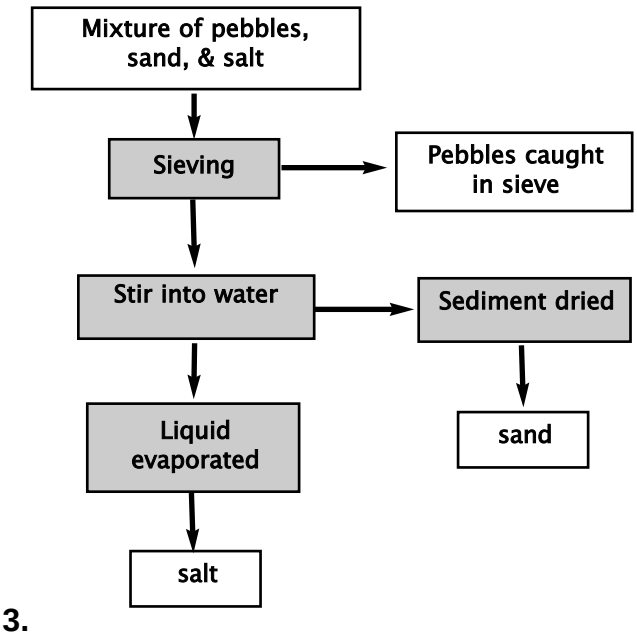
2.
a) Rice
b) Particle size
c) Corn flour
d) Icing sugar (or just sugar)
e) Filtration

Skills Worksheet 5

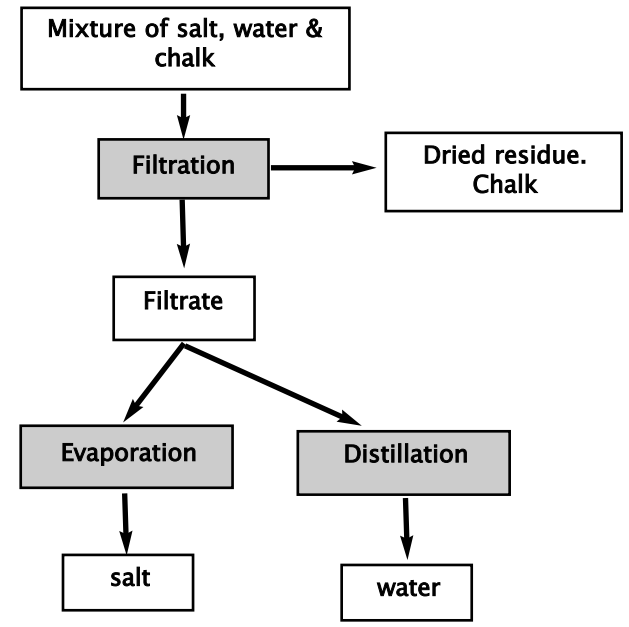
1.



2.



3.



Topic Test Answers

1.

a) A pure substance is made up of particles which are all identical. A mixture contains different particles (which are not chemically combined).

b) In a solution the solute is dissolved, and will never separate by sedimentation. In a suspension the solid is not dissolved and will form a sediment (or float).

c) A solvent is the liquid part of a solution, while a solute is the dissolved substance.

d) a dilute solution has a very small amount of solute, while a concentrated solution has a large amount of solute.

2.

a) T
b) T
c) F
d) F
e) F
f) T
g) F
h) F

3.

a) water
b) water
c) pure copper sulfate
d) nothing
e) dirt

4.

a) It floats, so scoop it off and dry it
b) sand
c) i) water
ii) salt
iii) difference in boiling points