AQA Chemistry Unit 14

The Earth's Resources

Crompton House Chemistry

		Learned it	Revised it
1	I can give some examples of natural resources and describe how they are used by humans		
2	I can explain that Earth's resources are finite, and they are processed to provide energy and materials for consumption.		
3	I can explain what sustainable development is and discuss the role chemistry plays in sustainable development, including improving agricultural and industrial processes.		
4	I can discuss the importance of water quality for human life and how to produce potable water.		
5	I can describe waste water as a product of urban lifestyles and industrial processes and describe sewage treatment.		
6	**HT I can name, describe alternative biological methods for extracting metals. Including Phyto mining and bioleaching**		
7	I can describe, carry out and interpret simple comparative LCA of materials or products, describing advantages and disadvantages of LCAs		
8	I can discuss how to reduce the consumption of raw resources by reducing use, reusing, and recycling products		

DODDLE QUIZZES

AQA Water Purification (Practical Quiz) _____%

AQA Water Treatment _____%

Kerboodle Extension Quizzes

Positive Points/postcards for completion

C14 Homework The Earth's Resources 1 _____%

C14 Homework The Earth's Resources 2 _____%

C14 Progress Quiz: The Earth's Resources 1 _____%

C14 Progress Quiz: The Earth's Resources 2 _____%

C14 Checkpoint quiz: The Earth's Resources _____%

Self Reflection

WWW:

EBI:

Checked by Teacher:

Date:

Chapter 14: The Earth's resources 1

Knowledge organiser

Natural and synthetic resources

We use the Earth's resources to provide us with warmth, fuel, shelter, food, and transport.

- Natural resources are used for food, timber, clothing, and fuels.
- Synthetic resources are made by scientists. They can replace or supplement natural resources.

When choosing and synthesising resources, it is important to consider **sustainable development**. This is development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.

Finite and renewable resources

Some resources are **finite**. This means that they will eventually run out.

Fossil fuels are an example of a finite resource. They take so long to form that we use them faster than they are naturally formed.

Resources that will not run out are called **renewable** resources.

Wood is an example of a renewable resource. Trees can be grown to replace any that are cut down for wood.

Potable water

Water is a vital resource for life. **Potable** water is water that is safe to drink. However, most water on Earth is not potable.

Type of water	What it has in it
pure water	just water molecules and nothing else
potable water	water molecules, low levels of salts, safe levels of harmful microbes
salty water (sea water)	water molecules, dangerously high levels of salt, can have high levels of harmful microbes
fresh water (from rivers, lakes, or underground)	water molecules, low levels of salt, often has harmful microbes at high levels

Fresh water

In the UK, potable water is produced from rain water that collects in lakes and rivers. To produce potable water:

1. Choose an appropriate source of fresh water.
2. Pass the water through filters to remove large objects.
3. **Sterilise** the water to kill any microbes using ozone, chlorine, or UV light.

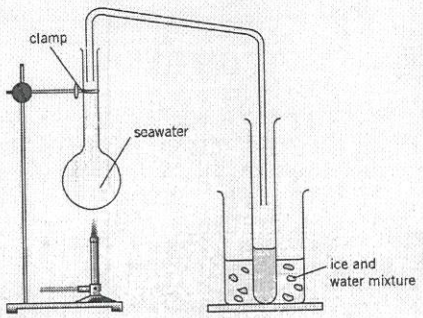
Salty water

Some countries do not have lots of fresh water available. **Desalination** is the process to turn saltwater into potable water. This requires a lot of energy and can be done by:

- distillation
- **reverse osmosis**

Reverse osmosis involves using membranes to separate the salts dissolved in the water. The water needs to be pressurised and the salty water corrodes the pumps. As such, it is an expensive process.

Distillation



Waste water

Human activities produce lots of waste water as sewage, agricultural waste, and industrial waste.

- **Sewage** and agricultural waste contain organic matter and harmful microbes.
- Industrial waste contains organic matter and harmful chemicals.

These need to be removed before the water can be put back into the environment.

Treating sewage water

screening and grit removal
The sewage passes through a metal grid that filters out large objects.

sedimentation
The sewage is left so that solid sediments settle out of the water. The sediments sink to the bottom of the tank. The liquid sits above the sediment.

Treating sludge

sewage sludge
This sediment is called **sludge**. Sludge contains organic matter, water, dissolved compounds, and small solid particles.

anaerobic treatment
Bacteria are added to digest the organic matter. These bacteria break down the matter anaerobically – with a limited supply of oxygen.

biogas
The anaerobic digestion of sludge produces biogas. Biogas is a mixture of methane, carbon dioxide and hydrogen sulfide. It can be used as fuel.

remaining sludge used as fuel
The remaining sludge can be dried out and can also be burnt as a fuel.

Treating effluent

effluent
The remaining liquid is called **effluent**. This effluent has no solid matter visible, but still contains some matter and harmful microorganisms.

aerobic treatment
Bacteria are added to the effluent. These bacteria feed on organic matter and the harmful microorganisms in the effluent. The bacteria break down the matter by aerobic respiration – oxygen needs to be present.

bacteria removed
The bacteria are allowed to settle out of the water.

discharged back to rivers
The water is now safe enough to be released back into the environment.

Chapter 14: The Earth's resources 2

Knowledge organiser

Metal extraction (HT only)

Metals are used for many different things. Some metals can be extracted from their ores by reduction or electrolysis.

However, metal ores are a finite resource and these processes require lots of energy.

Scientists are looking for new ways to extract metals that are more sustainable.

Phytomining and **bioleaching** are two alternative processes used to extract copper from low grade ores (ores with only a little copper in them).

Phytomining

1. Grow plants near the metal ore.
2. Harvest and burn the plants.
3. The ash contains the metal compound.
4. Process the ash by electrolysis or displacement with scrap metal.

Bioleaching

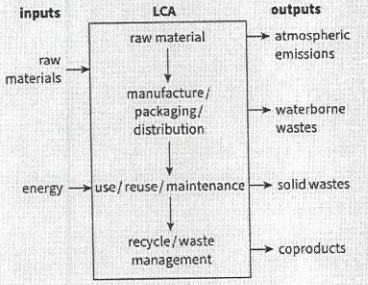
1. Grow bacteria near the metal ore.
2. Bacteria produce leachate solutions that contain metal compound.
3. Process the leachate by electrolysis or displacement with scrap metal.

Both of these methods avoid the digging, moving, and disposing of large amounts of rock associated with traditional mining techniques.

Life cycle assessment

A **life cycle assessment (LCA)** is a way of looking at the whole life of a product and assessing its impact on the environment and sustainability. It is broken down into four categories:

- extracting and processing raw materials
- manufacturing and packaging
- use and operation during its lifetime
- disposal at the end of its useful life, including transport and distribution at each stage



Some parts of an LCA are objective, such as the amount of water used or waste produced in the production of a product.

However, other parts of an LCA require judgements, such as the polluting effect, and so LCAs are not a completely objective process.

Key terms

Make sure you can write a definition for these key terms.

aerobic, anaerobic, biodegrade, bioleaching, distillation, effluent, finite resources, life cycle assessment, phytomining, potable water, recycling, renewable resources, reverse osmosis, screening, sedimentation, sewage, sludge, sterilisation, sustainable development

Disposal of products

When someone finishes with a product, it can be

- added to a landfill
  This can cause habitat loss and other problems in the local ecosystem. Some items persist in landfills as they do not **biodegrade** and could be there for hundreds of years.
- incinerated
  Some products can be incinerated to produce useful energy. However, the combustion can often be incomplete and result in harmful pollutants being released to the atmosphere.
- reused
  This is when an item is used again for a similar purpose.
- **recycled**
  Recycling requires energy, but conserves the limited resources and often requires less energy than needed to make brand new materials.

The table shows information about the extraction, processing, and disposal of some common materials. This information is used when making a LCA.

Material	Extraction/processing	Disposal
metal	• quarrying and mining cause habitat loss • machinery involved in mining release greenhouse gases • extraction from metal ores require lots of energy	• metals can normally be recycled by melting them down and then casting them into new shapes • metals in landfill can persist for a long time
plastic	normally come from fossil fuels that are non-renewable	• many plastic products can be reused and recycled • plastics often end up in landfills where they persist as they are not biodegradable • incinerating plastics releases lots of harmful pollutants like carbon monoxide and particulates
paper	produced from trees that require land and lots of water to grow lots of water also used in the production process	• many paper products can be recycled • paper products can also be incinerated or they can decay naturally in a landfill • incineration and decay release greenhouse gases
glass	produced by heating sand, which requires a lot of energy	• many glass products can be reused, or crushed and recycled • if glass is added to landfills it persists as it is not biodegradable
ceramics	• come from clay and rocks • generally require quarrying, which requires energy, releases pollutants from heavy machinery, and causes habitat loss	• most ceramics are not commonly recycled in the UK, and once broken cannot be reused • ceramics tend to persist in landfills

WATER (A)

1 Which type of water is each of the following categorised as:

a ice in glaciers .....

b water in aquifers .....

c water put down drains from homes .....

d water that is fit to drink .....

e water in rivers .....

f water in oceans .....

2 Sea water can be made fit to drink by distillation or reverse osmosis. Complete the table about these processes.

process	what happens	how it works	main cost
reverse osmosis			
distillation			

3 Waste water can be made fit to return to rivers by a number of processes.

a What happens in the aeration tank? .....

.....

.....

b How is sludge removed from the water? .....

.....

c What is done to sludge to form methane, and what is done with this methane?

done to sludge .....

.....

done with methane formed .....

.....

Q1. Water in Britain is taken from reservoirs to use as drinking water.

(a) What are the **two** main steps used to treat water from reservoirs?

Give **one** reason for each step.

add Chlorine (1)

kill microbes (1)

filter (1)

remove solids (1)

(4)

(b) Some people use water filters to treat water before drinking it.

(i) Water filters remove hardness from hard water.

What is in water filters that removes hardness from water?

(1)

(ii) Suggest why water filters used in the home contain particles of silver.

Sterlise

(1)

(c) Pure water can be produced by distillation.

Why is distillation **not** usually an economic method of treating water for drinking?

_____

_____

(1)

(d) Drinking hard water has health benefits.

State **one** health benefit of drinking hard water.

_____

_____

(1)

(Total 8 marks)

Q2. Most water contains dissolved compounds.

The concentrations of these dissolved compounds are higher in sea water than in drinking water.

(a) (i) Draw a ring around the correct answer to complete the sentence.

Pure water can be obtained from sea water by

distillation.
filtration.
neutralisation.

(1)

(ii) What is the boiling point of pure water? _____ °C

(1)

(b) A student wanted to find out how much solid was dissolved in sea water.

This is the method the student used:

- measure the mass of an empty evaporating basin
- measure 25 cm^3 of sea water and pour it into the evaporating basin
- heat the evaporating basin gently until all of the water has evaporated
- measure the mass of the evaporating basin containing the solid residue.

(i) What piece of apparatus would be suitable for measuring 25 cm^3 of sea water?

_____

(1)

(ii) How could the student check that all of the water had evaporated?

_____

_____

_____

(2)

(iii) The results the student obtained using 25 cm^3 of sea water are:

mass of empty evaporating basin = 23.21 g
mass of evaporating basin and dry solid residue = 24.04 g

Calculate the mass of solid dissolved in 1000 cm^3 of the sea water.

_____

_____

_____

Mass dissolved in 1000 cm^3 = _____ g

(2)

(c) In many countries chlorine is added to drinking water supplies.

Why is chlorine added to drinking water?

_____

_____

(1)

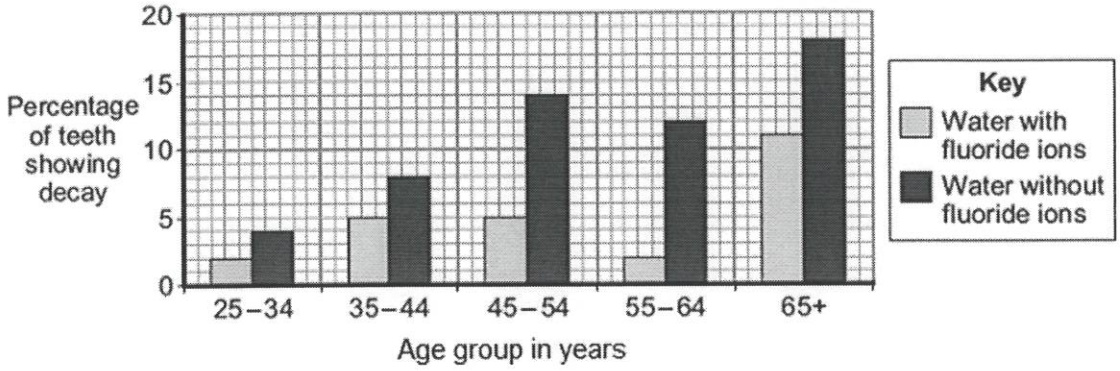
(d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Compounds containing fluoride ions are added to some drinking water supplies.

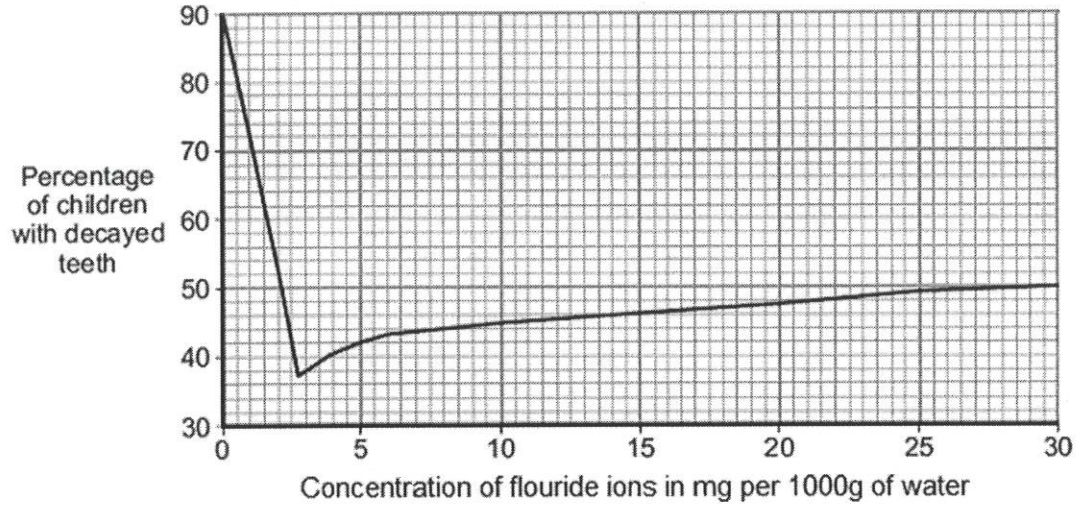
Many scientists have done research into the effects of fluoride ions in drinking water.

Graphs 1, **2** and **3** show some of the results obtained.

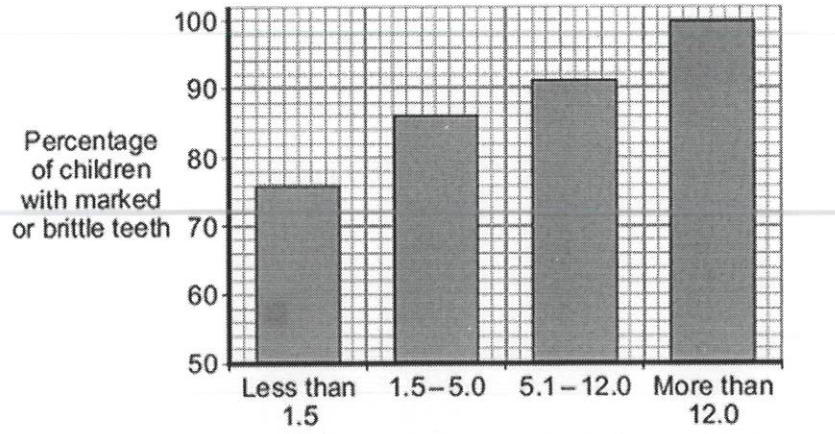
Graph 1



Graph 2



Graph 3



Evaluate the advantages and disadvantages of adding fluoride ions to drinking water.

You should support your answer with evidence from **all three** graphs.

(6)

(Total 14 marks)

Q3.

(a) The hydrocarbon $C_{16}H_{34}$ can be cracked.

Balance the equation for cracking $C_{16}H_{34}$

$C_{16}H_{34} \rightarrow$ _____ $C_2H_4 + C_8H_{18}$

(1)

(b) Describe the differences between cracking and distillation.

(2)

(c) What type of reaction is cracking? Tick **one** box.

Combustion ☐ Decomposition ☐

Neutralisation ☐ Precipitation ☐

(1)

(d) Ethene is used to make poly(ethene).

Poly(ethene) is used to make plastic bags.

the table below shows data from a Life Cycle Assessment (LCA) for a plastic bag and a paper bag.

	Plastic bag	**Paper bag**
Raw materials	Crude oil or natural gas	Wood
Energy used in MJ	1.5	1.7
Mass of solid waste in g	14	50
Mass of CO_2 produced in kg	0.23	0.53
Volume of fresh water used in dm^3	255	4 520

A company stated: 'A Life Cycle Assessment shows that using plastic bags has less environmental impact than using paper bags'.

Evaluate this statement. Use your knowledge and the information from above the table above.

(6)

(Total 10 marks)