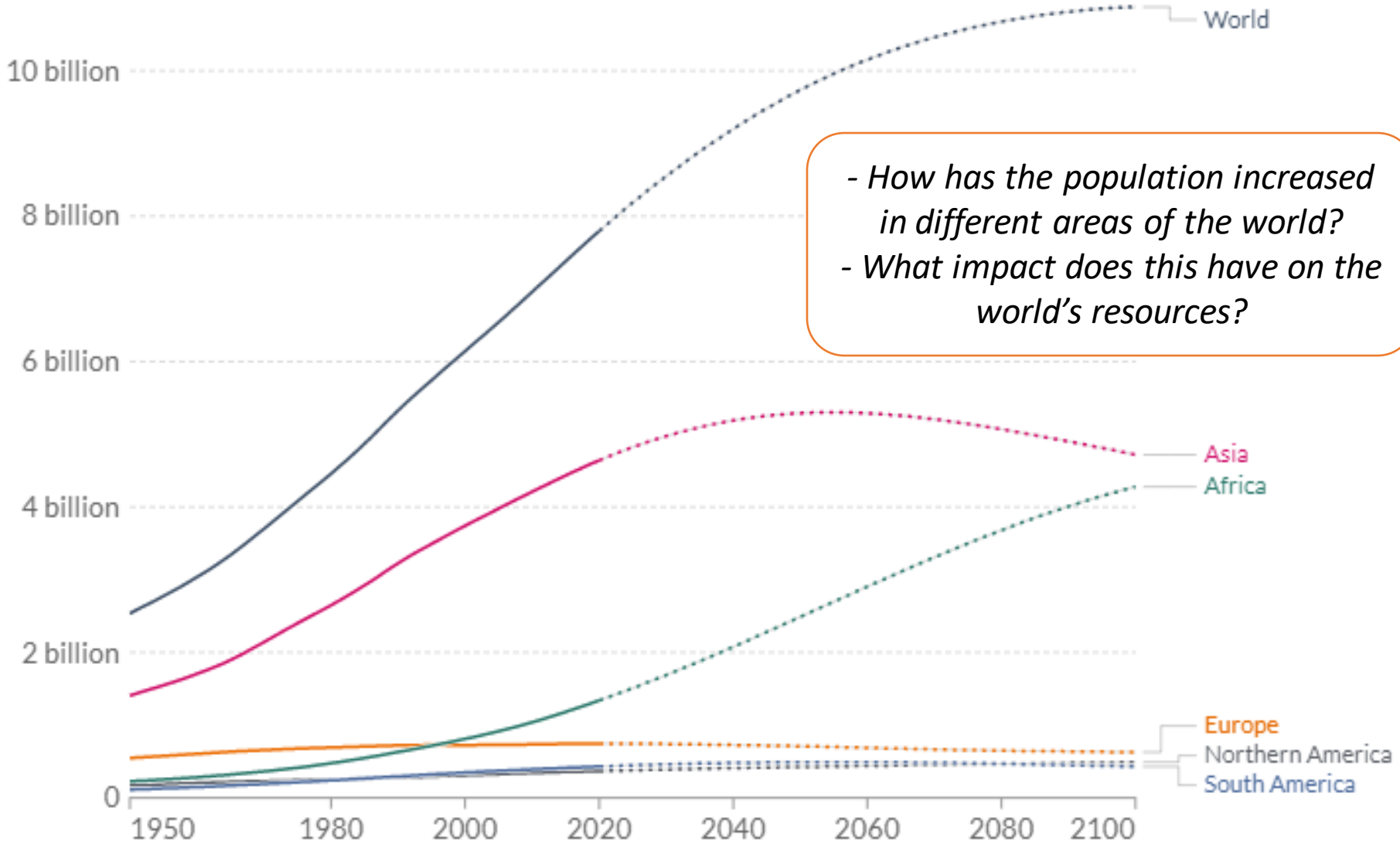
C10 REVISION

LO: Define sustainability.



- How has the population increased in different areas of the world?
- What impact does this have on the world's resources?

https://ourworldindata.org/world-population-growth

LO: Define sustainability.

Sustainability means *development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.*

It is important to all of us, that sustainable development is achieved.

This involves each of us as individuals, and careful planning at local, regional and global levels.

DECODE IT NOW

Word:

Resource

Define it:

A supply of natural materials that can be used to support human life.

Write a sentence of your own that uses the word **resources.**

Write your own definition of the word **resources.**

Which subjects or topics will this word be relevant to?

Digging Deeper:

A person can be described as '***resourceful***' if they are able to find clever ways to overcome difficulties e.g. *"she had a reputation for being a resourceful problem-solver".*

Link it (similar words):

Asset, source, supply

Deconstruct it (Root word):

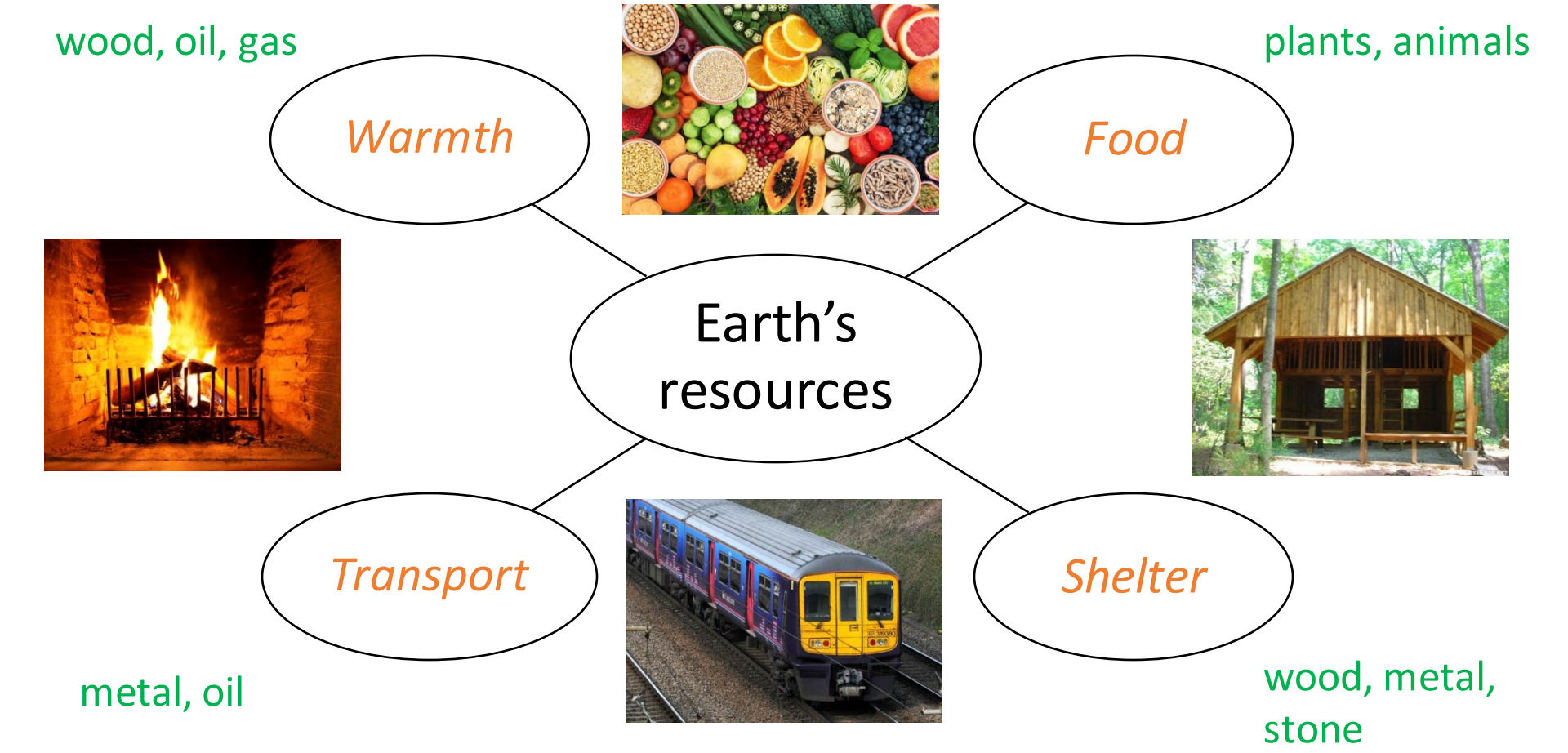
From French word '*ressourse*', meaning '*recover*'.

Use it:

Coal, oil and gas are all examples of non-renewable energy resources.

LO: Identify examples of natural products replaced by synthetics.

***Task**: Use the pictures to give four examples of Earth's resources that humans use every day.*



***Challenge** – Where do the **raw materials** come from?*

LO: Identify examples of natural products replaced by synthetics.

The Earth's natural resources are supplemented by **agriculture** (farming crops and animals):

Example 1:

Natural resource: ***chicken***

supplemented by

Agriculture: ***chicken farm*** – provides feed, warmth for chickens

Example 2:

Natural resource: ***wheat crop***

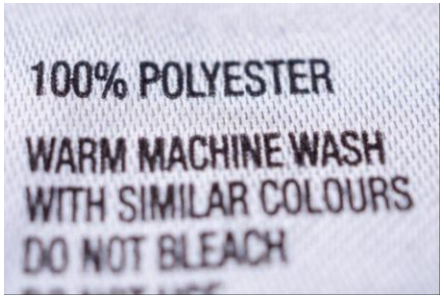
supplemented by

Agriculture: use ***fertiliser*** to increase amount of crop

LO: Identify examples of natural products replaced by synthetics.

Scientists can provide new **synthetic** products which supplement or replace natural products.

This helps reduce our reliance on natural products:

Natural product	***Use***	***Synthetic product that supplements or replaces it***
Cotton 	Clothing 	Polyester 
Wood 	Construction material 	PVC 

LO: Distinguish between finite and renewable resources.

Link back to physics!

In year 8 and year 10 physics, you have looked at energy resources. Let's recap:

1. Define renewable and non-renewable (finite).
   Renewable: can be replenished as it is used.
   Non-renewable: cannot be replaced as quickly as it is being used up.
2. Give three examples of non-renewable energy resources.
   Coal, oil, gas, nuclear

3. Give three examples of renewable energy resources.
   Solar, wind, tidal, geothermal, hydroelectric.

4. Give one advantage and one disadvantage of non-renewable energy resources.
   Advantage: reliable
   Disadvantage: releases carbon dioxide, will eventually run out
5. Give one advantage and one disadvantage of renewable energy resources.
   Advantage: does not release carbon dioxide, will not run out
   Disadvantage: not reliable

LO: Distinguish between finite and renewable resources.

1. *Name each resource*
2. *Classify each resource as either <u>finite</u> or <u>renewable</u>*

coal

cotton

natural gas

wood

metal

crude oil

nuclear fuels

leather

solar power

Potable water

Water of appropriate quality is essential for life.
For humans, drinking water should have sufficiently **low levels of dissolved salts and microbes**.

Water that is **safe to drink is called potable water**.
Potable water is **not pure water** in the chemical sense because it **contains dissolved substances**.

Potable water

In the United Kingdom (UK), rain provides water with low levels of dissolved substances (fresh water) that collects in the ground and in **lakes and rivers = FRESH WATER**

Most potable water is produced by:

1. Choosing an appropriate source of fresh water.
2. Passing the water through filter beds.
3. Sterilising the water (using chlorine, ozone or UV light)

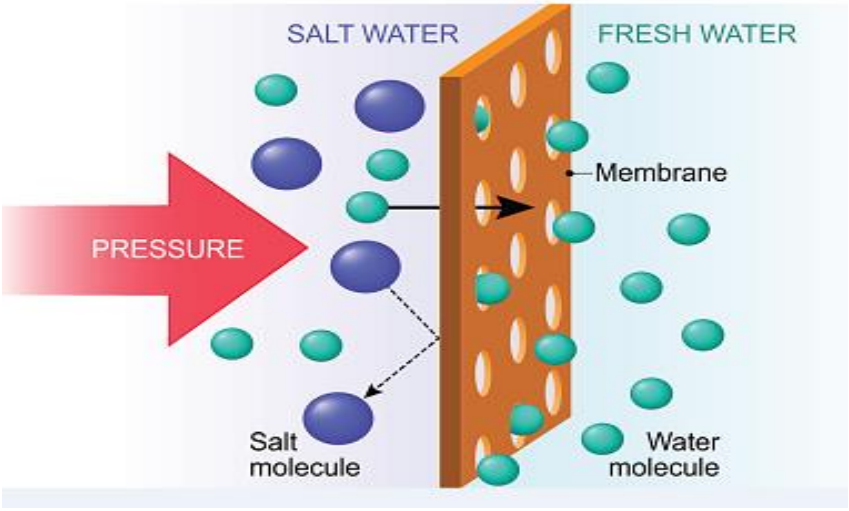
Obtaining potable water

- If fresh water supplies are limited, then we may have to desalinate salty water and/or sea water.

remove salt

If supplies of fresh water are limited, **desalination** of salty water or sea water may be required. Desalination can be done by **distillation** or by the processes that use membranes such as **reverse osmosis**.

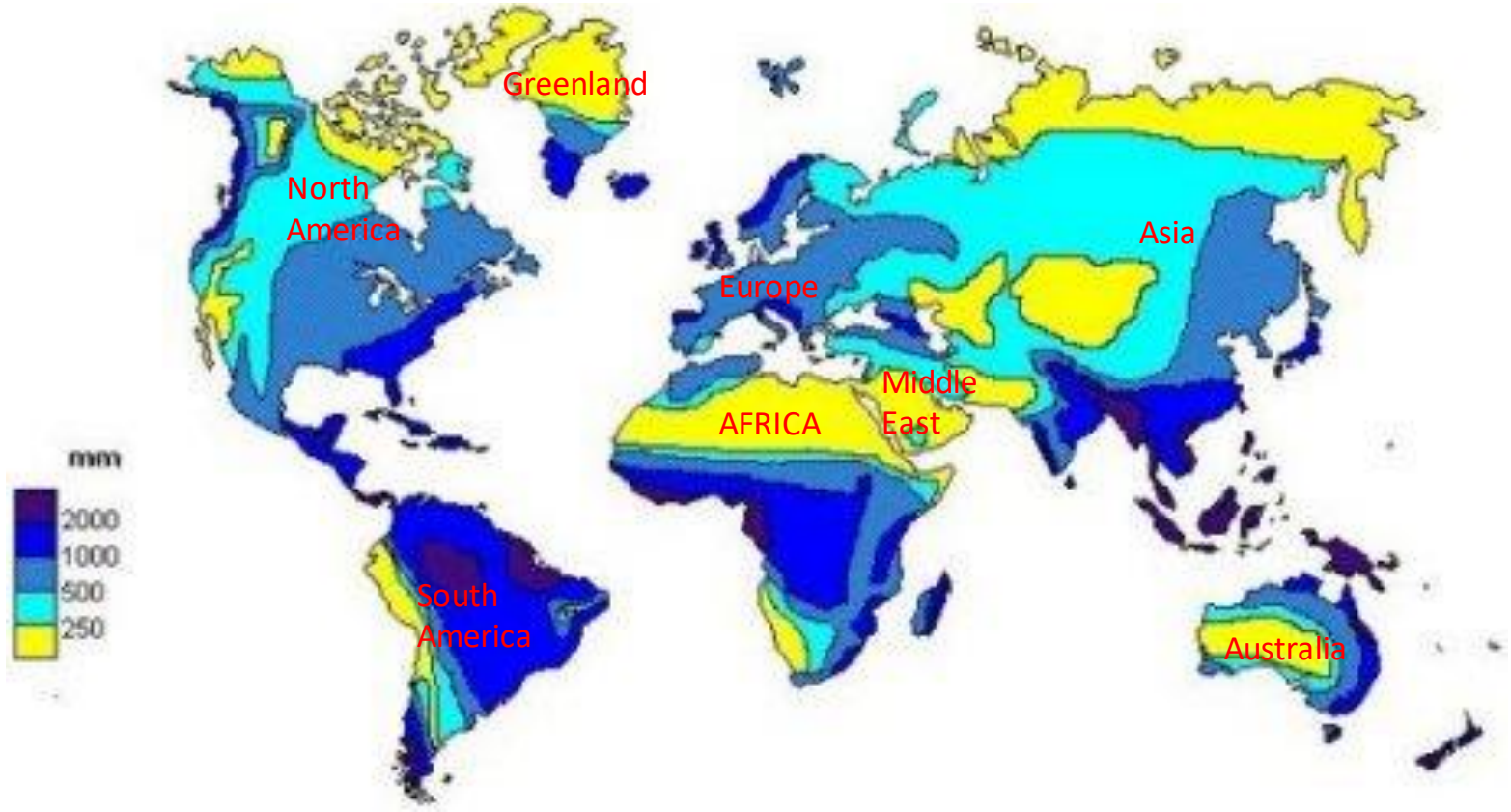
Desalination by distillation in Hamburg Germany



Desalination by reverse osmosis using a **membrane**

Both types of desalination require **large amounts of energy = EXPENSIVE!**

Why will methods of obtaining pure water depend on where we live?



Which countries would use freshwater?
Which countries would have to desalinate salt water?

Water purification required practical method 1

Step 1: Testing pH
Place a few drops of the water sample onto universal indicator paper. Record your observations.

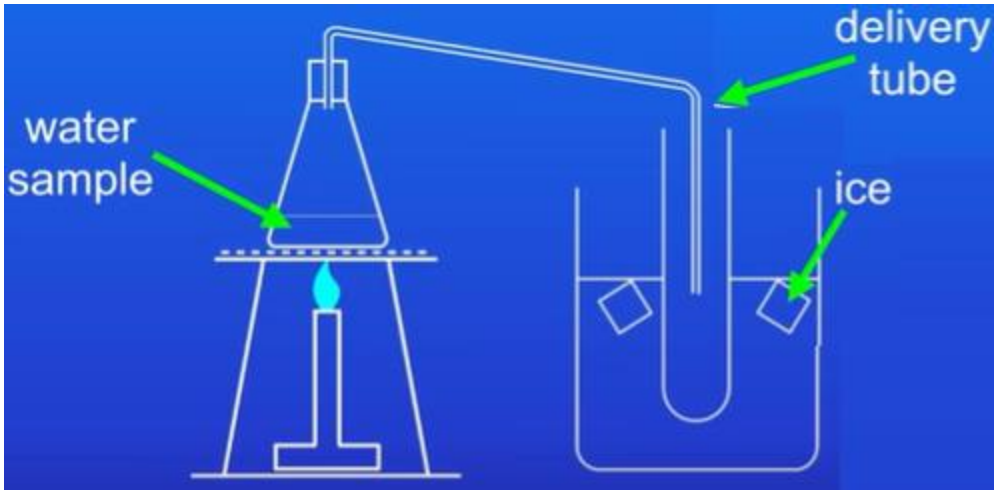
Step 2: Testing for dissolved solids
Weigh an empty evaporating basin and record the mass.

Step 3: Testing for dissolved solids
Fill the evaporating basin with the water sample. Heat the sample using a Bunsen burner until all water has evaporated.

Step 4: Testing for dissolved solids
Leave the evaporating dish to cool and then weigh it again. If the sample contained any dissolved solids, then the mass would increase.

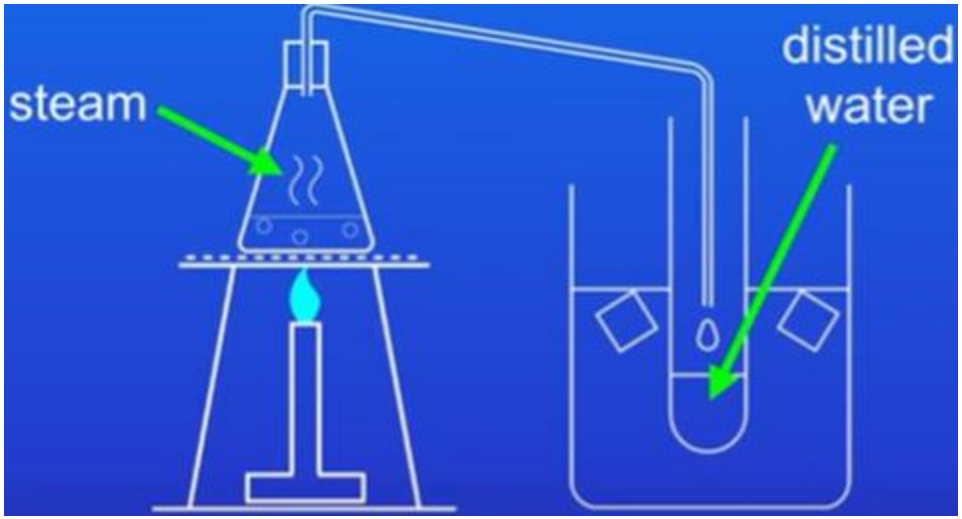
Water purification required practical method 2

Step 1: Distillation
Set up the equipment as shown:



Step 2: Distillation
Heat the water sample using a Bunsen burner. The pure water will evaporate.

Step 3: Distillation
As the steam moves away from the Bunsen burner, it will cool and condense as pure water. Any dissolved solids will be left in the conical flask.



Seawater can be changed into potable water by desalination.

(a) Name the substance removed from seawater by desalination.

_____

(1)

(b) Desalination requires large amounts of energy.

Desalination is only used when there is no other source of potable water.

Give **one** reason why.

_____

_____

(1)

Water from lakes and rivers can be treated to make it potable.

(c) The first stage is to filter the water from lakes and rivers.

Why is the water filtered?

_____

_____

(1)

(d) Chlorine gas is then added to the filtered water.

Why is chlorine gas used to treat water?

_____

_____

(1)

(a) sodium chloride

or

salt

allow dissolved salts

1

(b) expensive

1

(c) to remove solids

1

(d) to sterilise the water

allow to kill microorganisms

1

Urban lifestyles and industrial processes produce large amounts of waste water.

This water requires <u>treatment</u> before being released into the environment.

Waste water can come from:

Households (sewage)

Agriculture (farming)

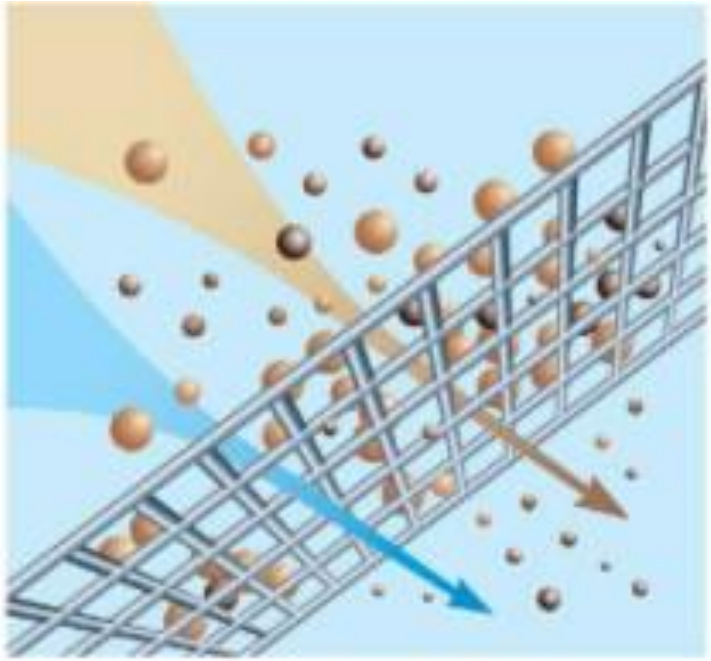
Industry (factories)

Requires removal of:
- Organic matter (living things)
- Harmful <u>microbes</u>

Requires removal of:
- Organic matter (living things)
- Harmful <u>chemicals</u>

Sewage Treatment

1. Screening removes large solid particles i.e. grit by passing the sewage through a screen:



1
Screening and grit removal

2
Sedimentation – to produce sewage sludge and effluent

3
Anaerobic digestion of sewage **sludge**

4
Aerobic biological treatment of **effluent**

Sewage Treatment

2. Sedimentation allows the small solid particles to sink to the bottom of the tank (to form **sewage sludge)** while the liquid (**effluent**) remains above.

1
Screening and grit removal

2
Sedimentation – to produce sewage sludge and effluent

3
Anaerobic digestion of sewage **sludge**

4
Aerobic biological treatment of **effluent**

Sewage Treatment

3. The sewage sludge is <u>dried</u> and <u>anaerobically digested</u> (broken down by microorganisms in the absence of oxygen).

- Dried sludge can be used as **fertiliser**.
- **Biogas** is also produced which can be used to generate electricity.

1
Screening and grit removal

2
Sedimentation – to produce sewage sludge and effluent

3
Anaerobic digestion of sewage sludge

4
Aerobic biological treatment of effluent

Sewage Treatment

4. The effluent is <u>aerobically digested</u> (broken down by microorganisms in the presence of oxygen). It can then be released to the environment.

http://www.bbc.co.uk/education/clips/zxrg9j6

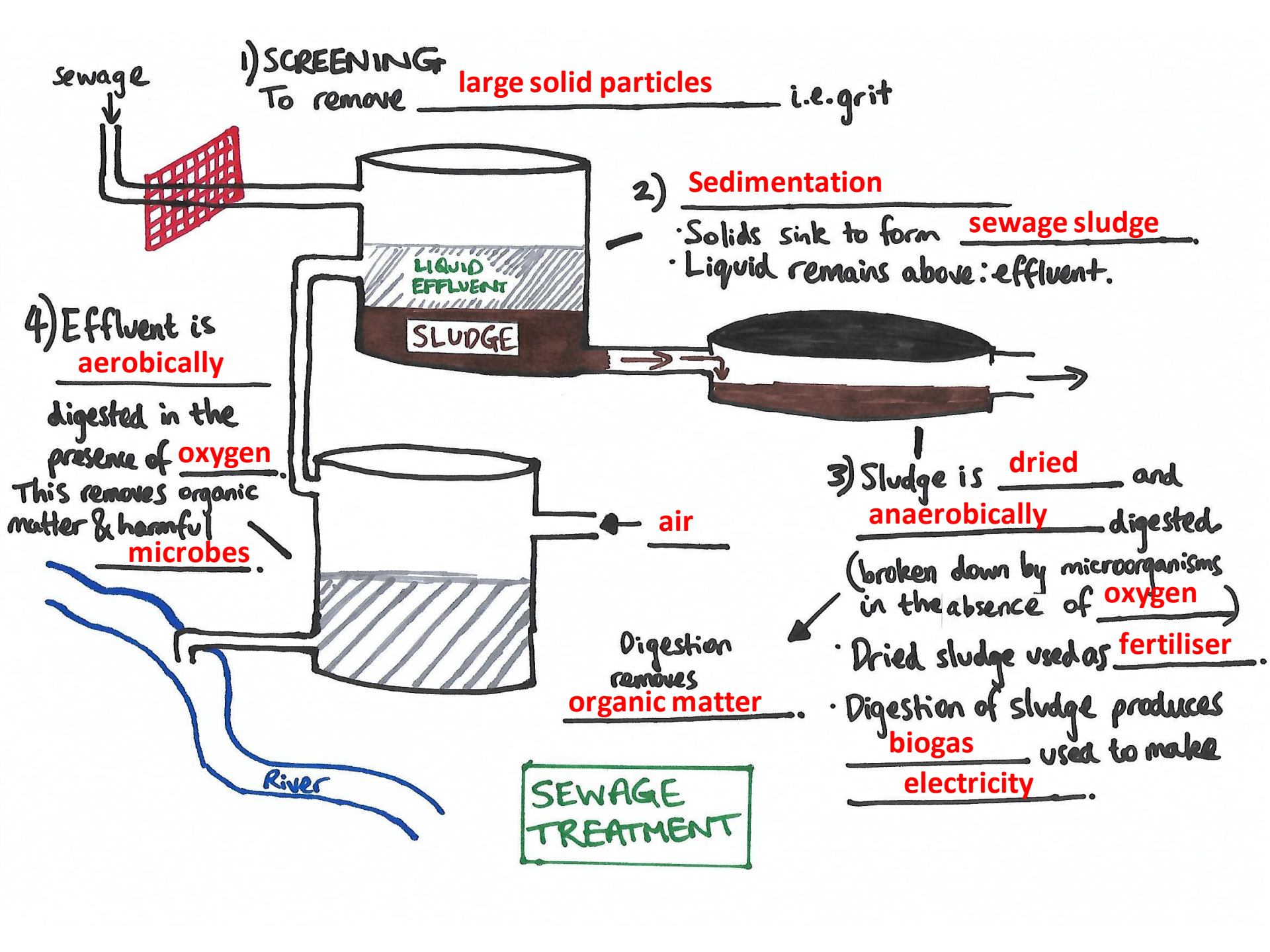
1
Screening and grit removal

2
Sedimentation – to produce sewage sludge and effluent

3
Anaerobic digestion of sewage sludge

4
Aerobic biological treatment of effluent

SEWAGE TREATMENT



Obtaining potable water

Potable water can be obtained from:

- Fresh water supplies or groundwater
- Desalination of salty water
- Treatment of waste water

...which is easiest?

Fresh water / ground water	***Desalination***	***Treatment of waste water***
Filtration and sterilisation **Requires sterilising agents and filtration equipment**	Distillation or using membranes e.g. reverse osmosis **Both require lots of energy**	Screening, sedimentation, digestion (aerobic and anaerobic) **Several steps, requires large treatment plant**

Easiest – least equipment/ energy/cost

Hardest – requires most energy

Moderate – requires equipment but less energy

Q1. This question is about pollutants.

(a) Wastewater has harmful substances removed before being released into the environment. Complete the sentences.

Agricultural wastewater requires the removal of harmful microbes.

Industrial wastewater may require the removal of harmful chemicals.

(2)

(b) How is sewage sludge treated before being released into the environment? Tick **one** box.

Aerobic biological treatment	☐
Anaerobic digestion	✓
Grit removal	☐
Screening	☐

(1)

(c) Seawater can be desalinated by distillation. Name **one** other method of desalination.

reverse osmosis

(1)

(a) Name the **two** processes happening in tank **A**.

1 Screening

2 Sedimentation

(2)

(b) Explain the processes happening in tank **C**.

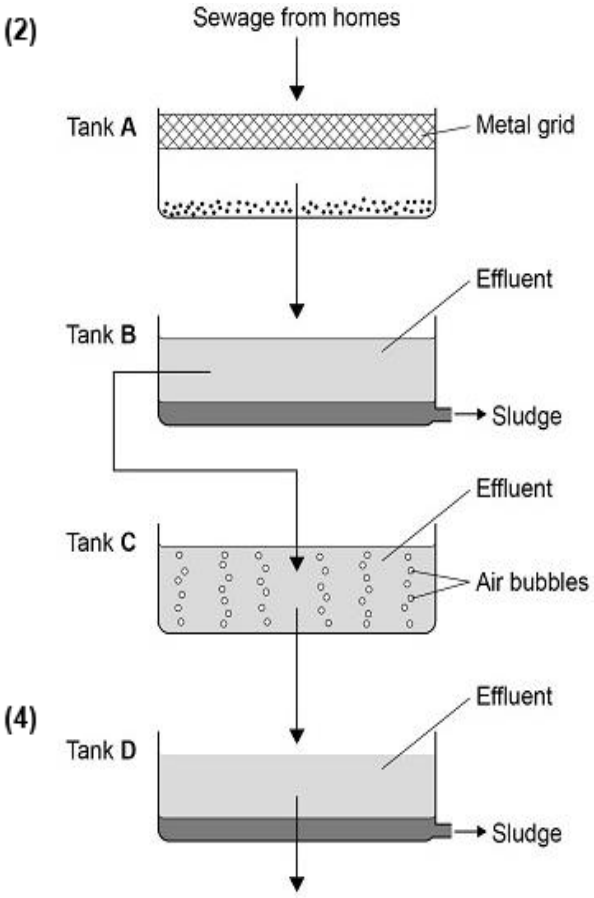
There are bubbles of oxygen (1)

For aerobic respiration (1)

By microorganisms (1)

Which digest the waste (1)

(4)



(c) The water from tank **D** is sterilised.

Why is the water from tank **D** sterilised?

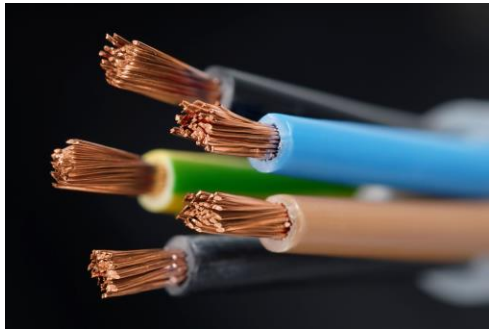
To kill bacteria

(1)

HT ONLY

Copper ores are running out.

There are two new methods that can be used to extract copper from low-grade ores (that do not contain a lot of copper):



1. **Phytomining**
2. **Bioleaching**

These methods avoid traditional methods of mining.

Eyesore, destroys habitats, waste from mining pollutes air and ground.

HT ONLY

Phytomining uses plants to absorb metal compounds. The plants are harvested and then burned to produce ash that contains metal compounds.

The metals can then be extracted using:

- Displacement using scrap iron
- Electrolysis

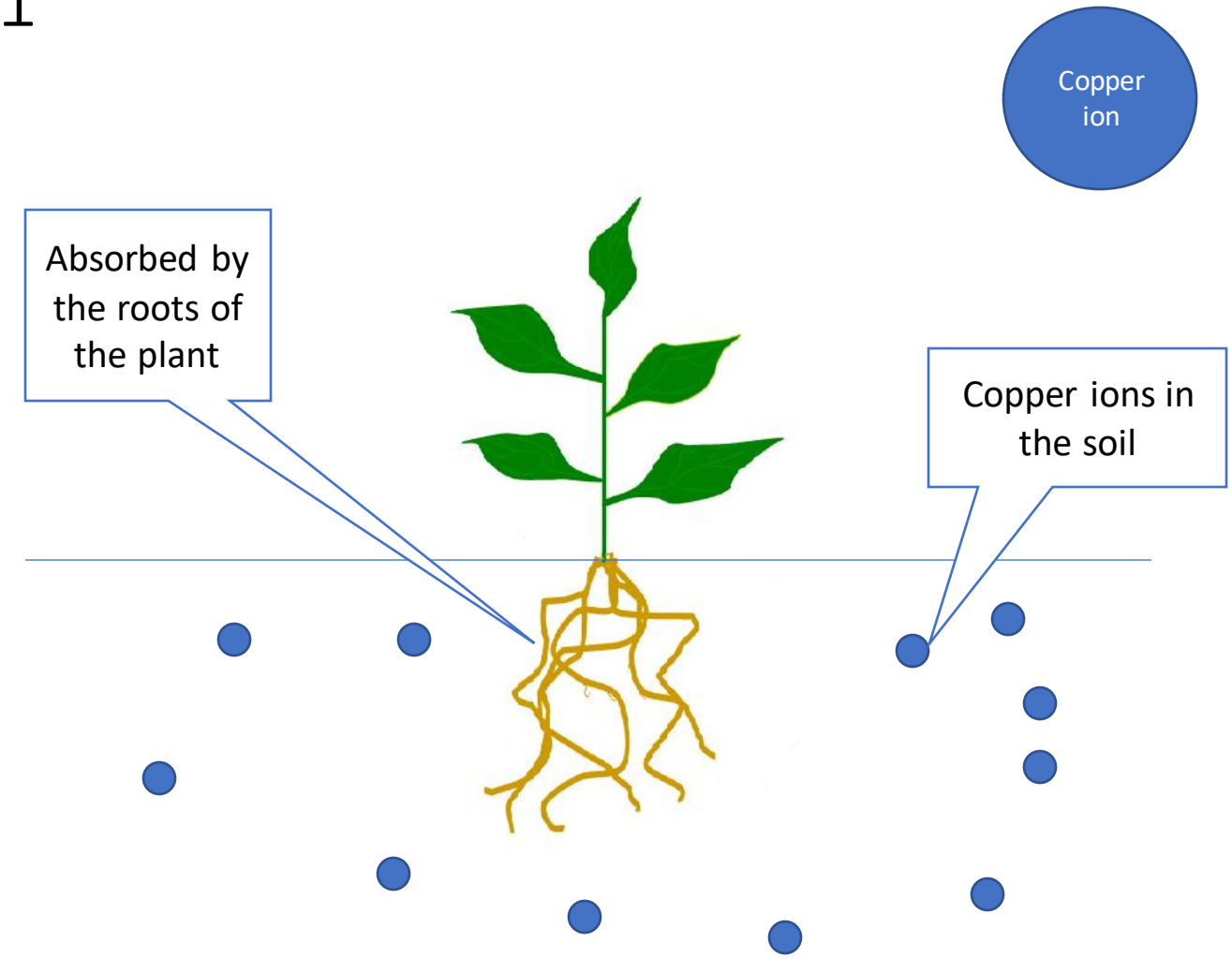
Challenge: Some plants use for phytoextraction are ***hyperaccumulators*** and some are ***hypoaccumulators***. What do you think this might mean?

Many plants will die when they absorb the metals so metals can't build up in the plant. These plants are called ***hypoaccumulators***. Some plants survive, and the metals can build up in their tissues. These plants are called ***hyperaccumulators***.

HT ONLY

PHYTOMINING

Step 1



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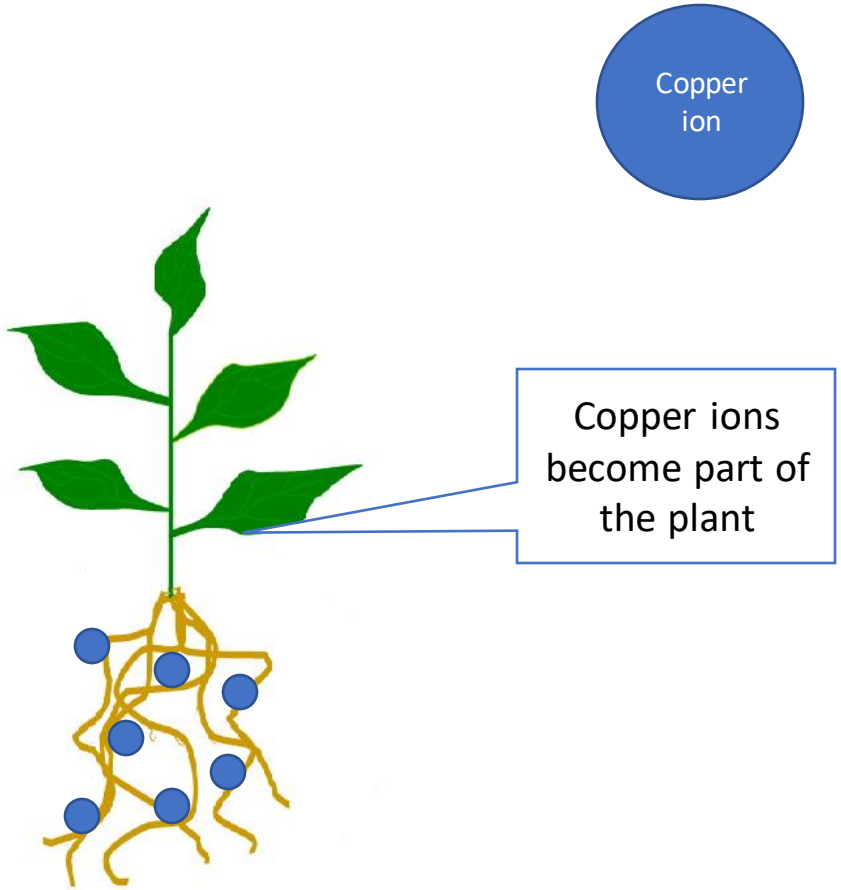
Step 2

PHYTOMINING



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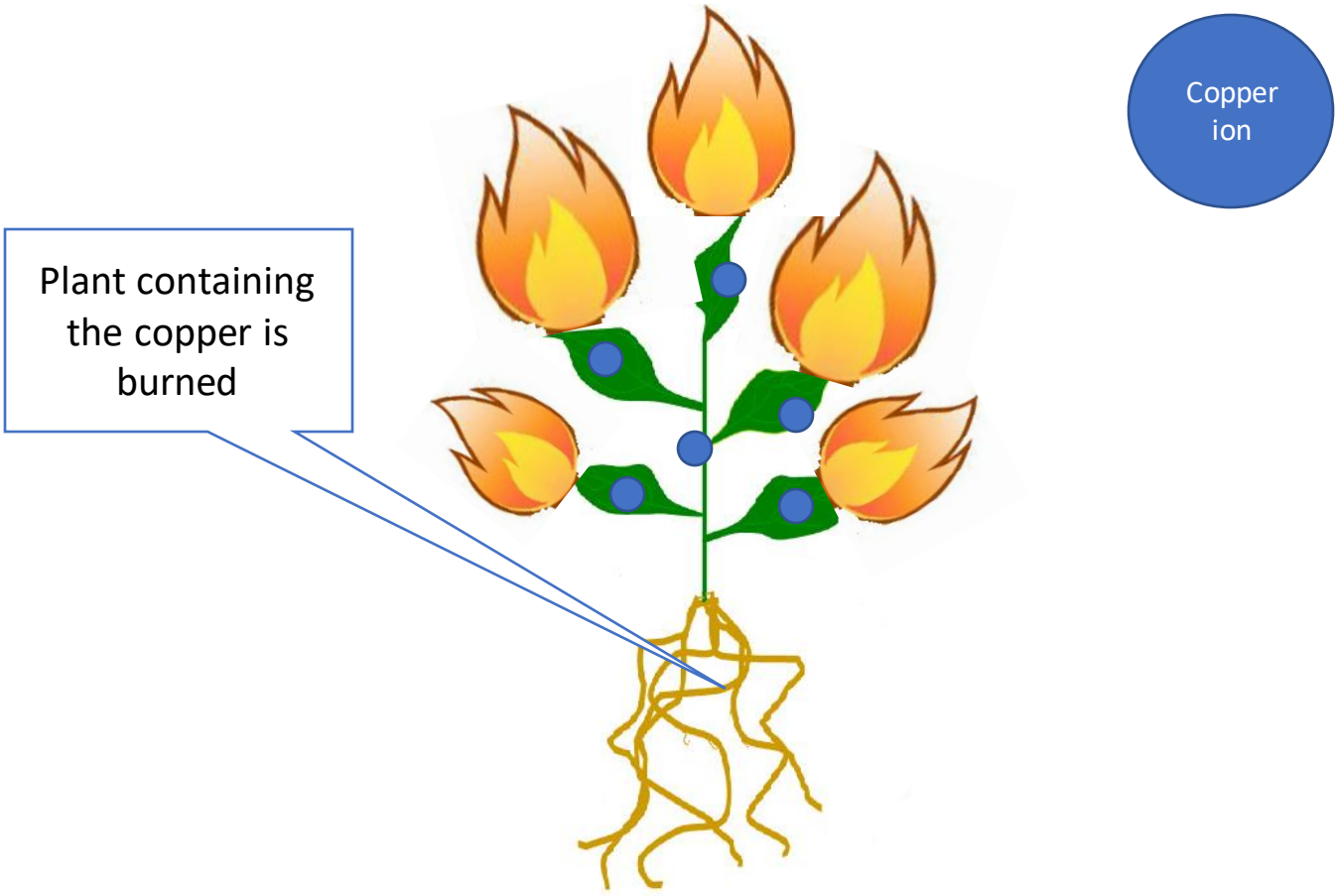
Step 3

PHYTOMINING



HT ONLY

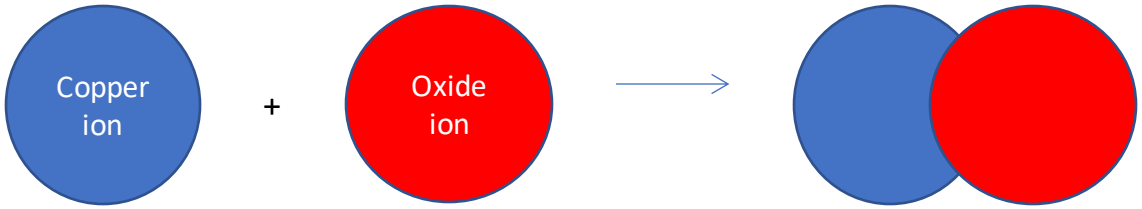
Step 4

PHYTOMINING

Copper ions join with oxide ions from the air during burning

Copper + Oxide → Copper oxide

Copper ion + Oxide ion →



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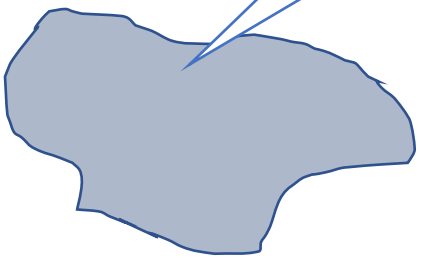
Step 5

PHYTOMINING

Ash containing copper oxide



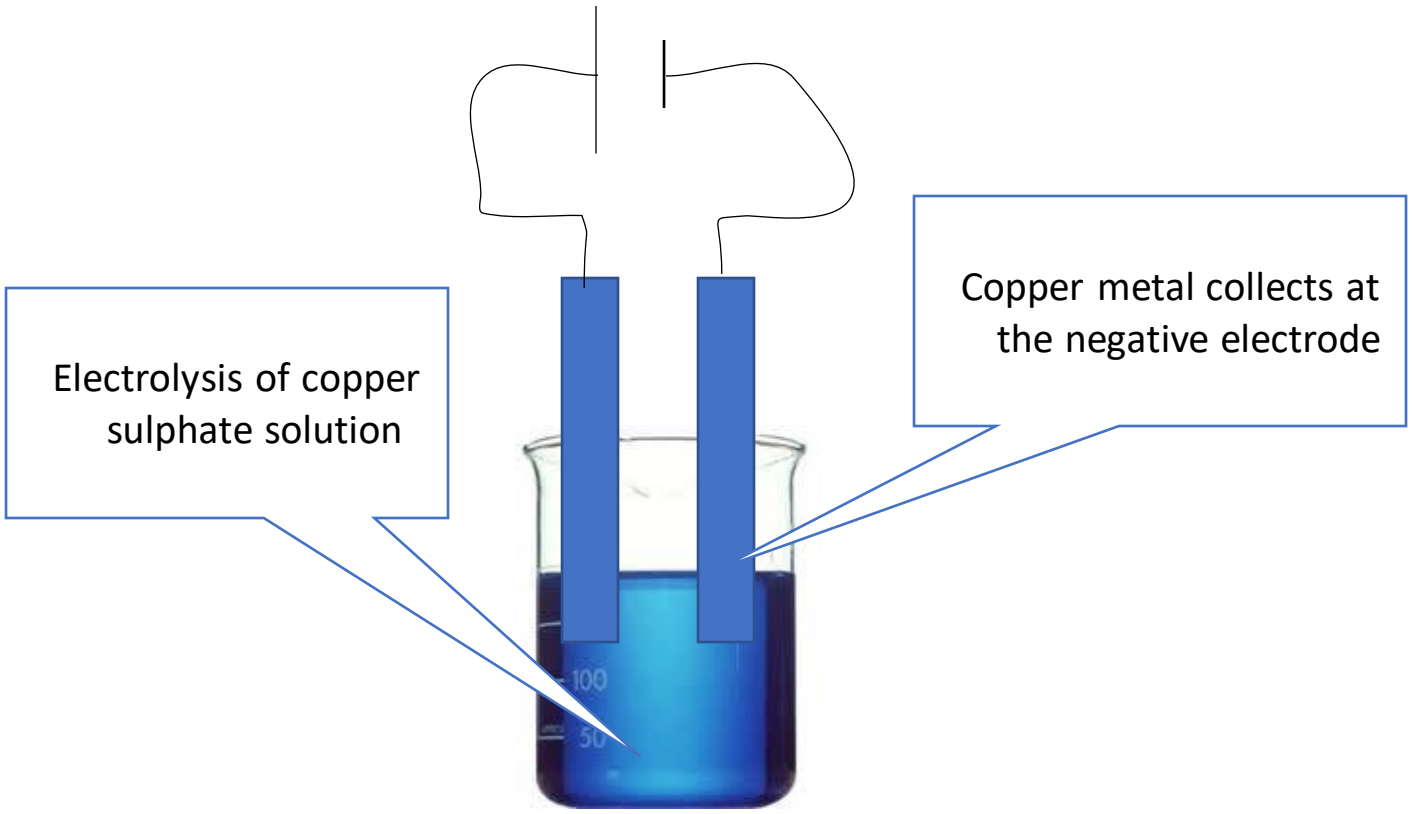
Reacted with sulphuric acid

Once filtered a solution of copper sulphate is produced

HT ONLY

Step 6

PHYTOMINING



HT ONLY

Bioleaching uses bacteria grown on low grade ore. The bacteria produce a 'leachate' solution, which contain the metal compounds.

These can then be extracted from the leachate using:

- Displacement using scrap iron
- Electrolysis

Bioleaching can be used to clean up toxic sites which have been contaminated with metals.

This Spanish river (Rio Tinto river) has been heavily contaminated with iron. Bioleaching could make this environment habitable again.

Challenge: Bioleaching is a slow process and a by-product is sulfuric acid. Explain how this might influence whether or not bioleaching is used.

HT ONLY

PHYTOMINING AND BIOLEACHING

Advantages

- Uses low grade copper ore.
- Requires less energy than smelting.
- Produces less air pollution.
- Reduces amount of waste rock.
- Bioleaching can decontaminate soil.
- Less damage to the landscape than mining.

Disadvantages

- Can produce toxic chemicals
- Much slower process
- Electrolysis requires large amounts of electricity.
- Phytomining is dependent on plant growth (seasonal).

HT ONLY

4.1 Explain how the process of phytomining is used to produce a substance which contains copper compounds.

.....

.....

.....

.....

[4]

4.2 Describe **two** ways in which copper metal can be extracted from the product of phytomining.

.....

.....

[2]

4.3 Explain why phytomining cannot ultimately provide a sustainable source of copper metals. Suggest **one** thing that can be done to make use of copper more sustainable.

.....

.....

.....

[3]

HT ONLY

1. Plants are grown on soil containing copper compounds (1 mark), so as they grow, copper builds up in their tissue (1 mark). The plants are burned (1 mark). The resulting ash contains copper compounds (1 mark).

2. By electrolysis of a solution containing the copper compounds (1 mark), or by displacement using scrap iron (1 mark).

3. Copper is a finite resource (1 mark), and will eventually run out (1 mark). Recycling copper makes it more sustainable (1 mark).

Life cycle assessments (LCAs) are carried out to assess the **impact on the environment** of the **different stages** in a product's 'life'.

There are 4 main stages to a product life cycle:

1. **Obtaining and processing raw materials.**
   - *Is it made from a finite resource?*
   - *How are the materials processed?*
   - *How are they transported?*
2. **Manufacturing and packaging the product.**
   - *How much energy is required?*
   - *Where does the energy come from?*
   - *What is the packaging made from?*
3. **Using the product.**
   - *What is the product used for?*
   - *Does it require energy?*
4. **Disposal of the product.**
   - *Are the materials biodegradable?*
   - *Can it be recycled?*

Including **transport** and **distribution** at each stage

Life Cycle Assessment

https://www.youtube.com/watch?v=ScY_Yb1V8AY

Problems with LCAs

allocate a numerical value to

In the real world it is easy to quantify:

- Use of water
- Use of resources
- Amount of energy used
- How much waste is produced

But it is not easy to quantify the effects of pollutants... Why?

We can't be sure what the overall total effect will be!

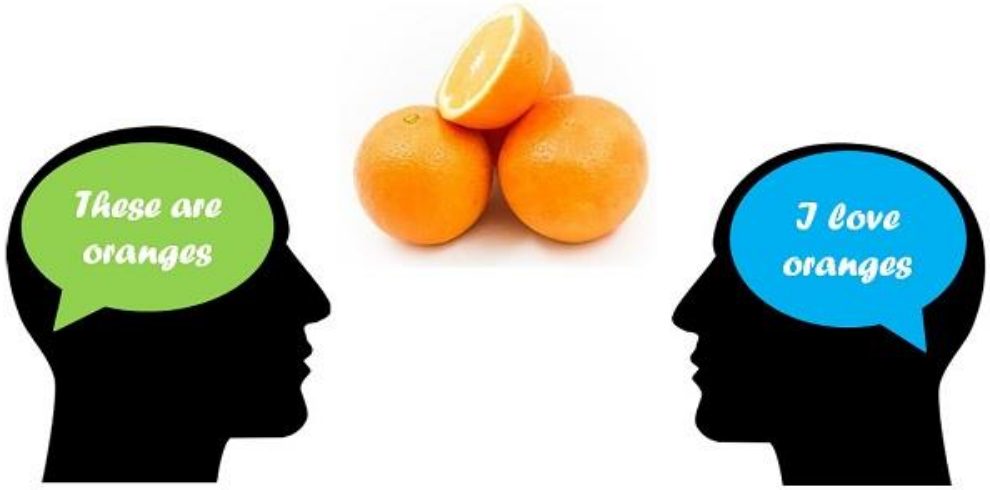
This means we have to use **value judgements**

e.g. the scores you came up with in the task.

What is the problem with using value judgements?

Problems with LCAs

Objective = fact



Subjective = opinion

Because LCAs use a mix of numerical values and value judgements, LCAs are <u>not</u> a purely objective process.

Challenge – Subjective or objective?

a) Plastic bags are more environmentally friendly than paper bags.

b) It takes 0.48MJ of energy to make a plastic bag, and 1.6MJ of energy to make a paper bag.

Comparing LCAs of plastic/paper bags

LCA Stage	**Plastic bag**		**Paper bag**	
	Description	Score (1-10)	Description	Score (1-10)
Extraction and processing of raw materials	*Crude oil (finite)* *Fractional distillation, cracking* *Lots of energy, little waste*		*Timber (renewable) but lots needed, pulping requires energy, lots of unusable waste*	
Manufacturing and packaging	*Processed, then cut* *Each stage uses energy* *Packaged in cardboard*		*Processed, then cut* *Each stage uses energy* *Packaged in cardboard*	
Use and reuse	*No impact of use* *Strong so reusable*		*Only used once, no more material needed*	
Disposal	*Recyclable – requires energy* *Not biodegradable* *Take up space in landfill*		*Recyclable – requires energy* *Biodegradable* *No pollution*	
Transport and distribution	*Transport from oilrig, to plant, to manufacturer, to shops*		*Transport from forest, to plant. to manufacturer, to shops*	
	Total:		**Total**:	

Metals, glass, building materials, clay ceramics and most plastics are produced from **limited raw materials**. Much of the energy to make these materials also comes from limited resources.

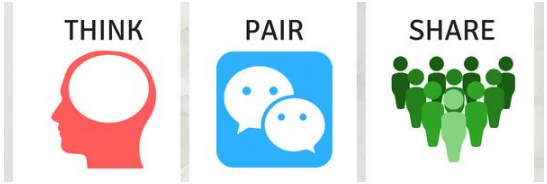
All these materials are produced from limited raw materials

AND the energy used to extract/process them comes from limited resources e.g. fossil fuels

Limited raw materials

Limited energy resources

LO: Identify ways in which we can be sustainable.



Get energy from RENEWABLE sources

Reduce

How can we be more sustainable in our everyday lives?

Recycle

Reuse

https://www.youtube.com/watch?v=JCGDWGoXi38

Challenge *– Why is recycling expensive?*

REUSE
REDUCE
RECYCLE

REUSE

Name two products that could be reused as they are.

- *Glass bottles and plastic carrier bags*

How does reusing products reduce our use of limited resources?

- *There is less demand for new products*

REDUCE

How could we reduce demand for plastic bags?

- *Bringing carrier bags to the supermarket so the supermarket has to produce fewer bags*
- *The government can (and has already) introduced a 5p charge to encourage people to bring their own bags.*
- *In the first year, plastic bag use was reduced by 83%*

RECYCLE

Both glass and metal are examples of materials that can be recycled...

https://www.youtube.com/watch?v=6R8YObQbE88

Metal recycling:

Iron is extracted from its ore at a blast furnace. Steel is a man-made iron alloy.

We can recycle scrap steel by adding it to the iron from a blast furnace. This helps reduce the amount of iron that we extract from our limited resources of iron ore.

Glass recycling:

We can recycle glass by crushing, melting and reforming it.

Why is recycling important?

- Uses less energy than making products from scratch
- Saves money on making new products
- Preserves the Earth's resources
- Saves space (less needed for landfill and manufacturing)
- Helps to preserve wildlife and habitats
- Less waste is sent to landfill
- Reduces litter and mess
- Less mining/ quarrying (more on the next slide!)

Challenge: *What are the problems associated with sending waste to landfill?*

LO: Explain the importance of recycling.

Challenge: *What are the problems associated with sending waste to landfill?*

It is an '**eyesore**' – they don't look very nice!

Toxic substances from waste can **pollute** the soil and water supply.

When waste decomposes, **methane** is produced which is a **greenhouse gas** (from last lesson!)

They cover large areas of land, which **destroys habitats** and **reduces biodiversity**.

Quarrying for building materials

Mining for metals

Digging up from the Earth

Environmental impacts of quarrying and mining:

- *Destroys habitats*
- *Can pollute land and water sources*
- *Noise*
- *Dust*
- *Visual pollution*

TO PRINT

LO: Define sustainability.

Sustainability means *development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.*

It is important to all of us, that sustainable development is achieved.

This involves each of us as individuals, and careful planning at local, regional and global levels.

DECODE IT NOW

Word:

Resource

Define it:

A supply of natural materials that can be used to support human life.

Write a sentence of your own that uses the word **resources.**

Write your own definition of the word **resources.**

Which subjects or topics will this word be relevant to?

Digging Deeper:

A person can be described as '***resourceful***' if they are able to find clever ways to overcome difficulties e.g. *"she had a reputation for being a resourceful problem-solver".*

Link it (similar words):

Asset, source, supply

Deconstruct it (Root word):

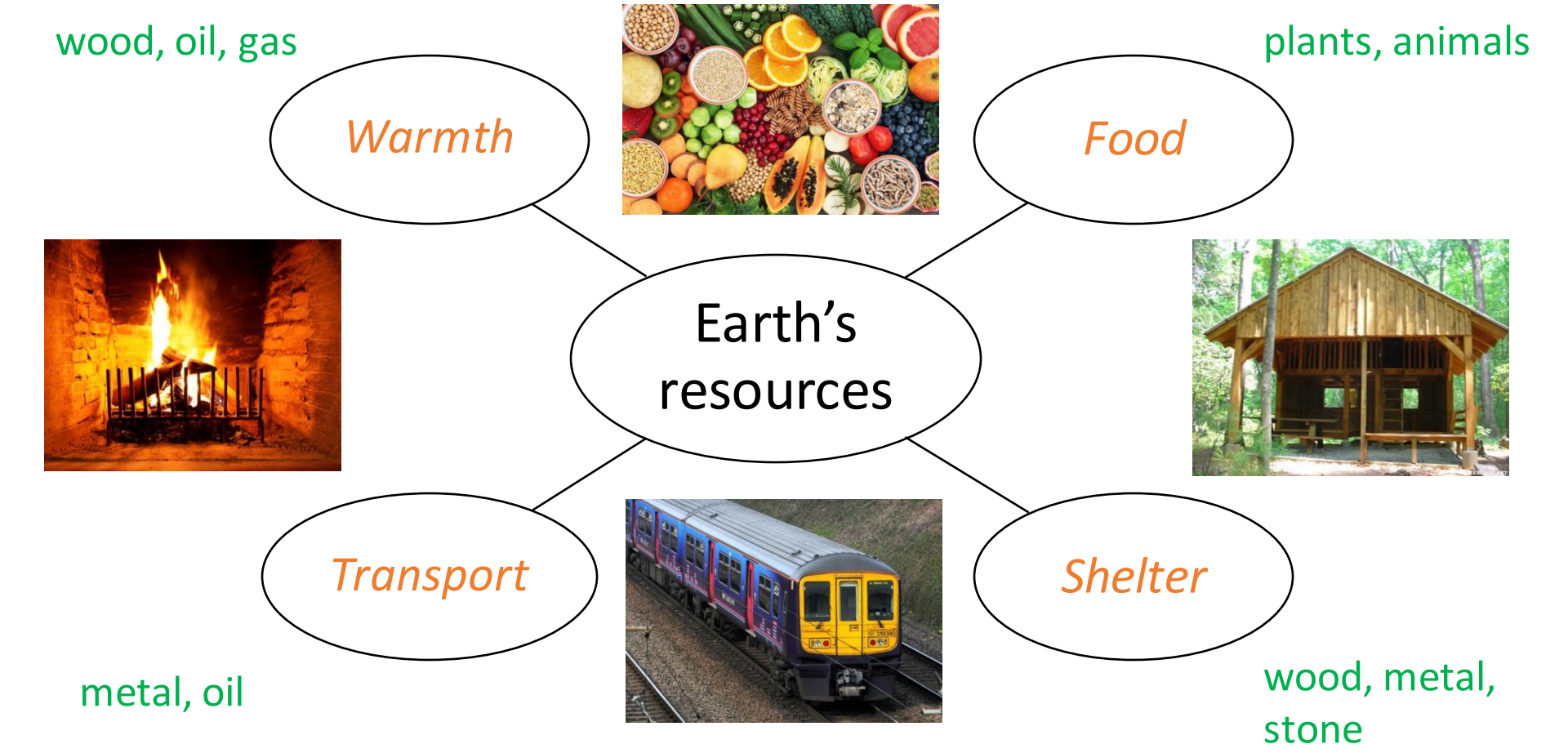
From French word '*ressourse*', meaning '*recover*'.

Use it:

Coal, oil and gas are all examples of non-renewable energy resources.

LO: Identify examples of natural products replaced by synthetics.

***Task**: Use the pictures to give four examples of Earth's resources that humans use every day.*



***Challenge** – Where do the **raw materials** come from?*

LO: Identify examples of natural products replaced by synthetics.

The Earth's natural resources are supplemented by **agriculture** (farming crops and animals):

Example 1:

Natural resource: ***chicken***

supplemented by

Agriculture: ***chicken farm*** – provides feed, warmth for chickens

Example 2:

Natural resource: ***wheat crop***

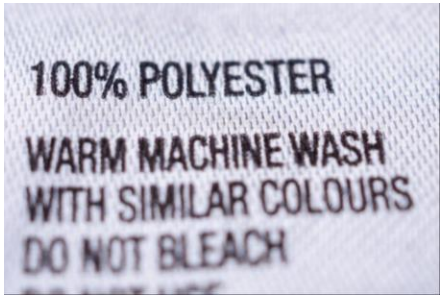
supplemented by

Agriculture: use ***fertiliser*** to increase amount of crop

LO: Identify examples of natural products replaced by synthetics.

Scientists can provide new **synthetic** products which supplement or replace natural products.

This helps reduce our reliance on natural products:

Natural product	***Use***	***Synthetic product that supplements or replaces it***
Cotton 	Clothing 	Polyester 
Wood 	Construction material 	PVC 

LO: Distinguish between finite and renewable resources.

Link back to physics!

In year 8 and year 10 physics, you have looked at energy resources. Let's recap:

1. Define renewable and non-renewable (finite).

2. Give three examples of non-renewable energy resources.

3. Give three examples of renewable energy resources.

4. Give one advantage and one disadvantage of non-renewable energy resources.

5. Give one advantage and one disadvantage of renewable energy resources.

Potable water

Water of appropriate quality is essential for life.
For humans, drinking water should have sufficiently **low levels of dissolved salts and microbes**.

Water that is **safe to drink is called potable water**.
Potable water is **not pure water** in the chemical sense because it **contains dissolved substances**.

Potable water

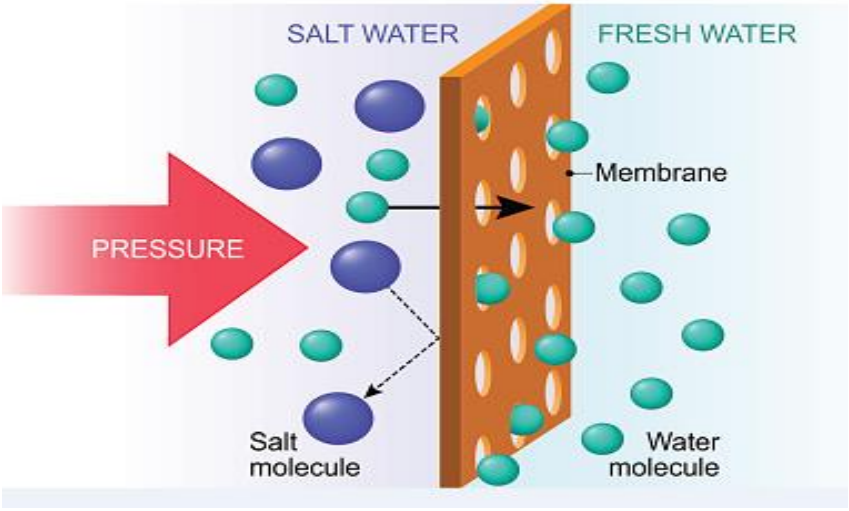
In the United Kingdom (UK), rain provides water with low levels of dissolved substances (fresh water) that collects in the ground and in **lakes and rivers = FRESH WATER**

Most potable water is produced by:

1. Choosing an appropriate source of fresh water.
2. Passing the water through filter beds.
3. Sterilising the water (using chlorine, ozone or UV light)

If supplies of fresh water are limited, **desalination** of salty water or sea water may be required. Desalination can be done by **distillation** or by the processes that use membranes such as **reverse osmosis**.

Desalination by distillation in Hamburg Germany



Desalination by reverse osmosis using a **membrane**

Both types of desalination require **large amounts of energy = EXPENSIVE!**

Water purification required practical method 1

Step 1: Testing pH
Place a few drops of the water sample onto universal indicator paper. Record your observations.

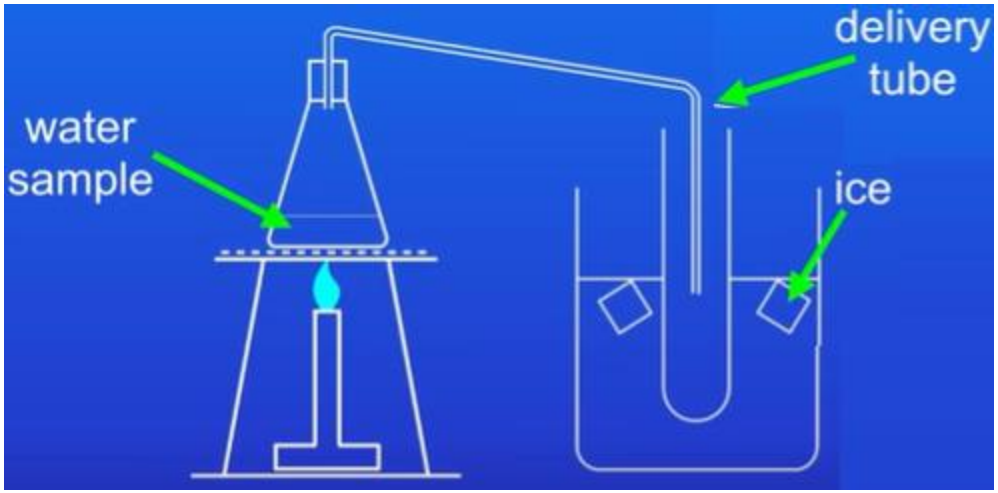
Step 2: Testing for dissolved solids
Weigh an empty evaporating basin and record the mass.

Step 3: Testing for dissolved solids
Fill the evaporating basin with the water sample. Heat the sample using a Bunsen burner until all water has evaporated.

Step 4: Testing for dissolved solids
Leave the evaporating dish to cool and then weigh it again. If the sample contained any dissolved solids, then the mass would increase.

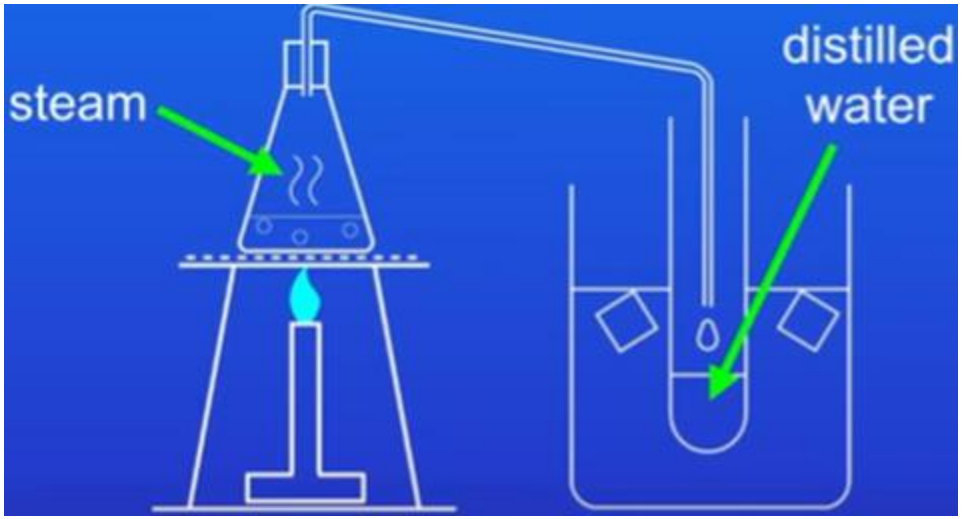
Water purification required practical method 2

Step 1: Distillation
Set up the equipment as shown:



Step 2: Distillation
Heat the water sample using a Bunsen burner. The pure water will evaporate.

Step 3: Distillation
As the steam moves away from the Bunsen burner, it will cool and condense as pure water. Any dissolved solids will be left in the conical flask.



Seawater can be changed into potable water by desalination.

(a) Name the substance removed from seawater by desalination.

_____

(1)

(b) Desalination requires large amounts of energy.

Desalination is only used when there is no other source of potable water.

Give **one** reason why.

_____

_____

(1)

Water from lakes and rivers can be treated to make it potable.

(c) The first stage is to filter the water from lakes and rivers.

Why is the water filtered?

_____

_____

(1)

(d) Chlorine gas is then added to the filtered water.

Why is chlorine gas used to treat water?

_____

_____

(1)

Urban lifestyles and industrial processes produce large amounts of waste water.

This water requires <u>treatment</u> before being released into the environment.

Waste water can come from:

Households (sewage)

Agriculture (farming)

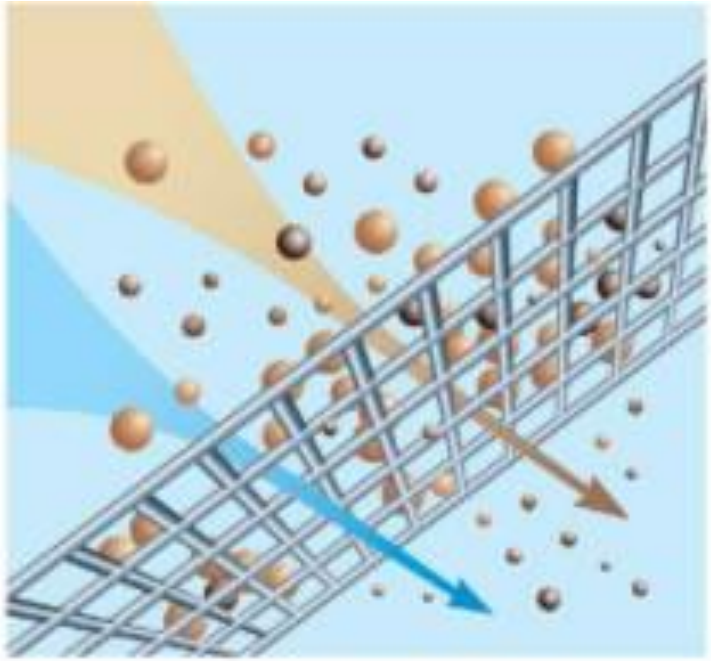
Industry (factories)

Requires removal of:
- Organic matter (living things)
- Harmful <u>microbes</u>

Requires removal of:
- Organic matter (living things)
- Harmful <u>chemicals</u>

Sewage Treatment

1. Screening removes large solid particles i.e. grit by passing the sewage through a screen:



1
Screening and grit removal

2
Sedimentation – to produce sewage sludge and effluent

3
Anaerobic digestion of sewage **sludge**

4
Aerobic biological treatment of **effluent**

Sewage Treatment

2. Sedimentation allows the small solid particles to sink to the bottom of the tank (to form **sewage sludge)** while the liquid (**effluent**) remains above.

1
Screening and grit removal

2
Sedimentation – to produce sewage sludge and effluent

3
Anaerobic digestion of sewage **sludge**

4
Aerobic biological treatment of **effluent**

Sewage Treatment

3. The sewage sludge is <u>dried</u> and <u>anaerobically digested</u> (broken down by microorganisms in the absence of oxygen).

- Dried sludge can be used as **fertiliser**.
- **Biogas** is also produced which can be used to generate electricity.

1
Screening and grit removal

2
Sedimentation – to produce sewage sludge and effluent

3
Anaerobic digestion of sewage sludge

4
Aerobic biological treatment of effluent

Sewage Treatment

4. The effluent is <u>aerobically digested</u> (broken down by microorganisms in the presence of oxygen). It can then be released to the environment.

http://www.bbc.co.uk/education/clips/zxrg9j6

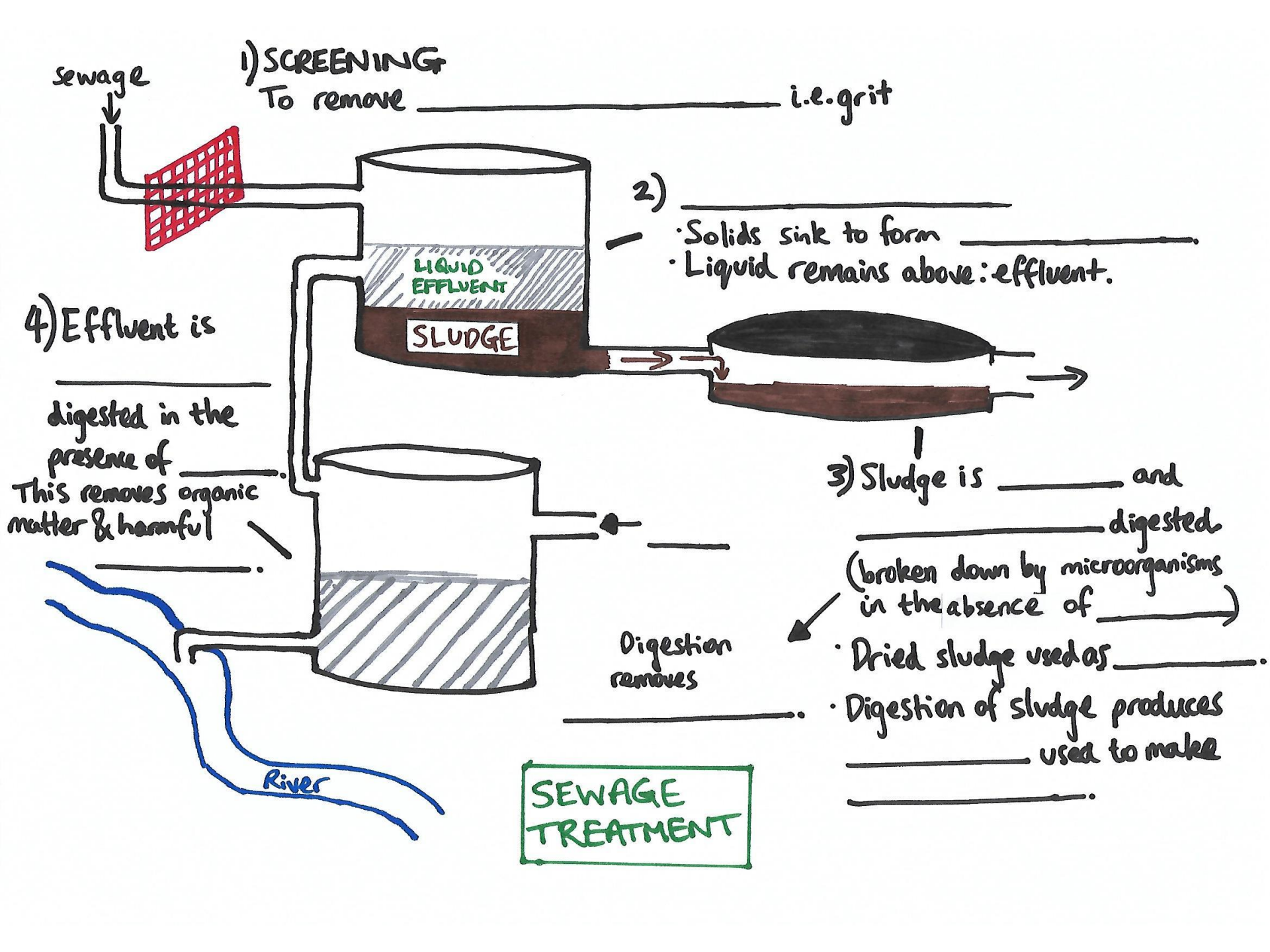
1
Screening and grit removal

2
Sedimentation – to produce sewage sludge and effluent

3
Anaerobic digestion of sewage sludge

4
Aerobic biological treatment of effluent

SEWAGE TREATMENT



Obtaining potable water

Potable water can be obtained from:

- Fresh water supplies or groundwater
- Desalination of salty water
- Treatment of waste water

...which is easiest?

Fresh water / ground water	***Desalination***	***Treatment of waste water***
Filtration and sterilisation **Requires sterilising agents and filtration equipment**	Distillation or using membranes e.g. reverse osmosis **Both require lots of energy**	Screening, sedimentation, digestion (aerobic and anaerobic) **Several steps, requires large treatment plant**

Easiest – least equipment/ energy/cost

Hardest – requires most energy

Moderate – requires equipment but less energy

Q1. This question is about pollutants.

(a) Wastewater has harmful substances removed before being released into the environment. Complete the sentences.

Agricultural wastewater requires the removal of harmful _____.

Industrial wastewater may require the removal of harmful _____.

(2)

(b) How is sewage sludge treated before being released into the environment? Tick **one** box.

Aerobic biological treatment	☐
Anaerobic digestion	☐
Grit removal	☐
Screening	☐

(1)

(c) Seawater can be desalinated by distillation. Name **one** other method of desalination.

_____

_____

(1)

(a) Name the **two** processes happening in tank **A**.

1 _____

2 _____

(2)

(b) Explain the processes happening in tank **C**.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

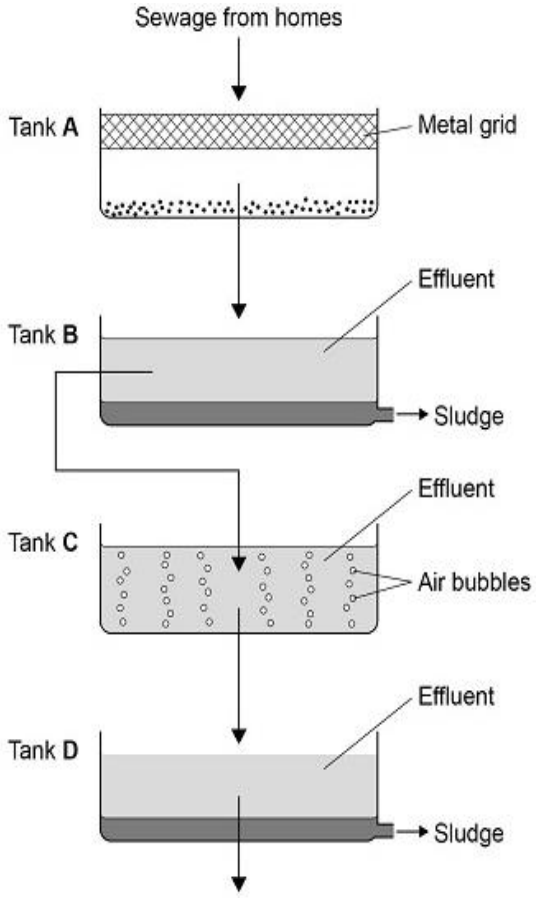
(c) The water from tank **D** is sterilised.

Why is the water from tank **D** sterilised?

_____

_____

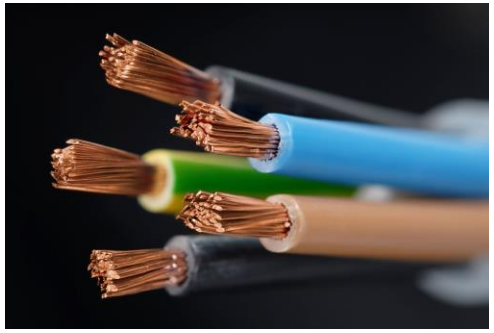
(1)



HT ONLY

Copper ores are running out.

There are two new methods that can be used to extract copper from low-grade ores (that do not contain a lot of copper):



1. **Phytomining**
2. **Bioleaching**

These methods avoid traditional methods of mining.

Eyesore, destroys habitats, waste from mining pollutes air and ground.

HT ONLY

Phytomining uses plants to absorb metal compounds. The plants are harvested and then burned to produce ash that contains metal compounds.

The metals can then be extracted using:

- Displacement using scrap iron
- Electrolysis

Bioleaching uses bacteria grown on low grade ore. The bacteria produce a 'leachate' solution, which contain the metal compounds.

These can then be extracted from the leachate using:

- Displacement using scrap iron
- Electrolysis

HT ONLY

PHYTOMINING AND BIOLEACHING

Advantages

- Uses low grade copper ore.
- Requires less energy than smelting.
- Produces less air pollution.
- Reduces amount of waste rock.
- Bioleaching can decontaminate soil.
- Less damage to the landscape than mining.

Disadvantages

- Can produce toxic chemicals
- Much slower process
- Electrolysis requires large amounts of electricity.
- Phytomining is dependent on plant growth (seasonal).

HT ONLY

4.1 Explain how the process of phytomining is used to produce a substance which contains copper compounds.

.....

.....

.....

.....

[4]

4.2 Describe **two** ways in which copper metal can be extracted from the product of phytomining.

.....

.....

[2]

4.3 Explain why phytomining cannot ultimately provide a sustainable source of copper metals. Suggest **one** thing that can be done to make use of copper more sustainable.

.....

.....

.....

[3]

Life cycle assessments (LCAs) are carried out to assess the **impact on the environment** of the **different stages** in a product's 'life'.

There are 4 main stages to a product life cycle:

1. **Obtaining and processing raw materials.**
   - *Is it made from a finite resource?*
   - *How are the materials processed?*
   - *How are they transported?*
2. **Manufacturing and packaging the product.**
   - *How much energy is required?*
   - *Where does the energy come from?*
   - *What is the packaging made from?*
3. **Using the product.**
   - *What is the product used for?*
   - *Does it require energy?*
4. **Disposal of the product.**
   - *Are the materials biodegradable?*
   - *Can it be recycled?*

Including **transport** and **distribution** at each stage

Problems with LCAs

allocate a numerical value to

In the real world it is easy to quantify:

- Use of water
- Use of resources
- Amount of energy used
- How much waste is produced

But it is not easy to quantify the effects of pollutants... Why?

We can't be sure what the overall total effect will be!

This means we have to use **value judgements**

e.g. the scores you came up with in the task.

What is the problem with using value judgements?

Comparing LCAs of plastic/paper bags

LCA Stage	**Plastic bag**		**Paper bag**	
	Description	Score (1-10)	Description	Score (1-10)
Extraction and processing of raw materials	*Crude oil (finite)* *Fractional distillation, cracking* *Lots of energy, little waste*		*Timber (renewable) but lots needed, pulping requires energy, lots of unusable waste*	
Manufacturing and packaging	*Processed, then cut* *Each stage uses energy* *Packaged in cardboard*		*Processed, then cut* *Each stage uses energy* *Packaged in cardboard*	
Use and reuse	*No impact of use* *Strong so reusable*		*Only used once, no more material needed*	
Disposal	*Recyclable – requires energy* *Not biodegradable* *Take up space in landfill*		*Recyclable – requires energy* *Biodegradable* *No pollution*	
Transport and distribution	*Transport from oilrig, to plant, to manufacturer, to shops*		*Transport from forest, to plant. to manufacturer, to shops*	
	Total:		**Total**:	

Metals, glass, building materials, clay ceramics and most plastics are produced from **limited raw materials**. Much of the energy to make these materials also comes from limited resources.

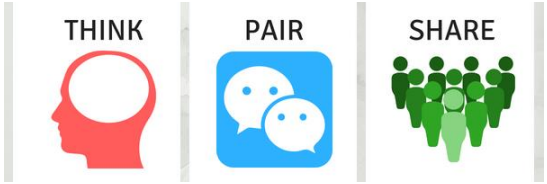
All these materials are produced from limited raw materials

AND the energy used to extract/process them comes from limited resources e.g. fossil fuels

Limited raw materials

Limited energy resources

LO: Identify ways in which we can be sustainable.



Get energy from RENEWABLE sources

Reduce

How can we be more sustainable in our everyday lives?

Recycle

Reuse

https://www.youtube.com/watch?v=JCGDWGoXi38

Challenge *– Why is recycling expensive?*

Metal recycling:

Iron is extracted from its ore at a blast furnace. Steel is a man-made iron alloy.

We can recycle scrap steel by adding it to the iron from a blast furnace. This helps reduce the amount of iron that we extract from our limited resources of iron ore.

Glass recycling:

We can recycle glass by crushing, melting and reforming it.

Why is recycling important?

- Uses less energy than making products from scratch
- Saves money on making new products
- Preserves the Earth's resources
- Saves space (less needed for landfill and manufacturing)
- Helps to preserve wildlife and habitats
- Less waste is sent to landfill
- Reduces litter and mess
- Less mining/ quarrying (more on the next slide!)

Challenge: *What are the problems associated with sending waste to landfill?*

LO: Explain the importance of recycling.

Challenge: *What are the problems associated with sending waste to landfill?*

It is an '**eyesore**' – they don't look very nice!

Toxic substances from waste can **pollute** the soil and water supply.

When waste decomposes, **methane** is produced which is a **greenhouse gas** (from last lesson!)

They cover large areas of land, which **destroys habitats** and **reduces biodiversity**.

Quarrying for building materials

Mining for metals

Digging up from the Earth

Environmental impacts of quarrying and mining:

- *Destroys habitats*
- *Can pollute land and water sources*
- *Noise*
- *Dust*
- *Visual pollution*