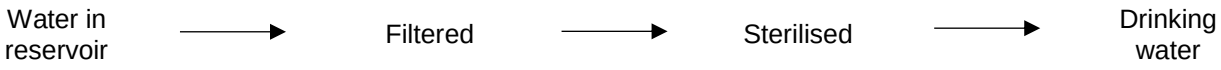
5-10 Using resources – Trilogy

1.0 This question is about water.

Water from reservoirs needs to be treated before it is safe to drink.

The flow diagram below shows how water is made suitable for drinking.



1.1 What is removed when the water is filtered?

[1 mark]

Tick **one** box.

- Bacteria ☐
- Solids ☐
- Solutions ☐
- Toxic substances ☐

1.2 Which **two** substances which can be used to sterilise water?

[2 marks]

Tick **two** boxes.

- Chlorine ☐
- Oxygen ☐
- Ozone ☐
- Salt ☐
- Sand ☐

1.3 Give **one** reason why drinking water is sterilised.

[1 mark]

_____

_____

1.4 Sea water is **not** suitable for drinking.

Suggest **one** reason why.

[1 mark]

_____

_____

2.0 Suggest **three** reasons why metals such as copper should **not** be disposed of in landfill sites.

[3 marks]

3.0 Desalination of seawater can be carried out by processes that use membranes such as reverse osmosis.

3.1 Describe one **other** way to desalinate sea water in a school laboratory.

You may include a labelled diagram in your answer.

[4 marks]

3.2 A student investigated how much solid was dissolved in sea water.

The student:

1. Measured the mass of an empty evaporating basin.
2. Measured 50 cm^3 of sea water and poured it into the evaporating basin.
3. Heated the evaporating basin gently until all of the water had evaporated.
4. Measured the mass of the evaporating basin containing the solid residue.
5. Reheated the evaporating basin and solid residue.
6. Measured the mass of the evaporating basin and solid residue.
7. Repeated steps 5 and 6 until the mass was constant.

Name two different pieces of apparatus that would be suitable for measuring:

- The mass of the evaporating basin
- 50 cm^3 of sea water

[2 marks]

Equipment to measure the mass of the evaporating basin_____

Equipment to measure 50 cm^3 of sea water _____

3.3 Why did the student keep reheating the evaporating basin and solid residue until a constant mass was obtained?

[1 mark]

_____

_____

3.4 The results the student obtained using 50 cm^3 of sea water are:

Mass of empty evaporating basin = 23.57 g
Mass of evaporating basin and dry solid residue = 25.23 g

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

[1 mark]

Mass dissolved in 1000 cm^3 = _____ g

4.1 What does 'potable water' mean?

[1 mark]

_____

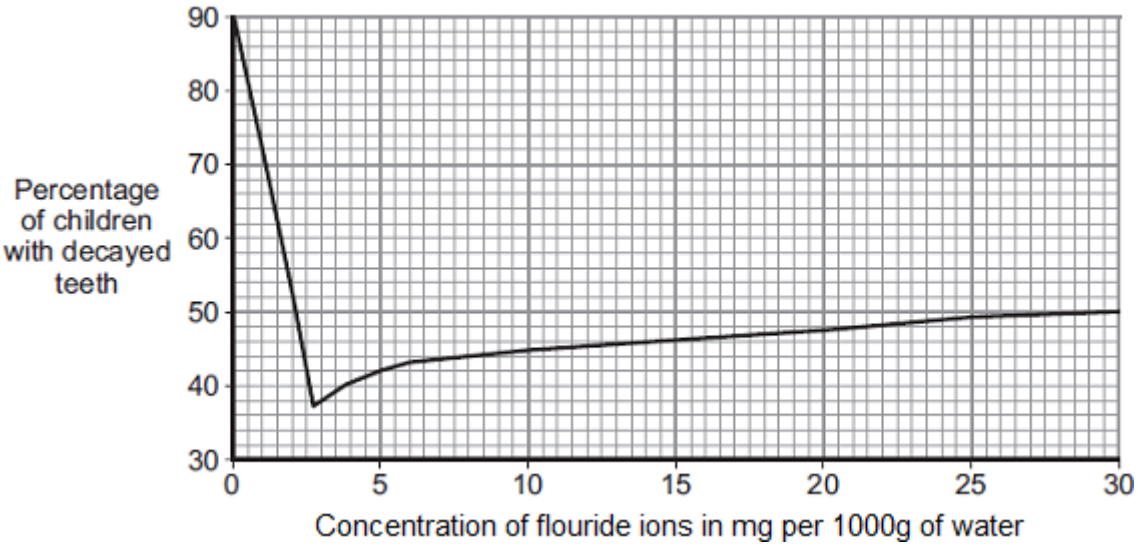
_____

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

Scientists investigated the effect of fluoride ions on tooth decay.

Graph 1 shows the concentration of fluoride ions against the percentage of children with decayed teeth.

Graph 1



Suggest the best concentration of fluoride ions to use in drinking water. Give one reason for your answer.

[2 marks]

Best concentration = _____ mg per 1000g water

Reason:_____

_____

_____

4.3 Describe two patterns shown by **Graph 1**.

[2 marks]

5.0 This question is about extracting metals.

5.1 Copper can be extracted by smelting copper-rich ores in a furnace.

The equation for one of the reactions in the process is:

$$Cu_2S(s) + O_2(g) \longrightarrow 2\ Cu(s) + SO_2(g)$$

Explain why the gaseous product should not be released into the atmosphere.

[2 marks]

5.2 Describe how copper compounds are obtained by phytomining.

[2 marks]

5.3 Aluminium is extracted from an ore, called bauxite, by electrolysis of molten aluminium oxide.

Aluminium is also widely recycled and the metal is obtained from the recycling process.

Use your knowledge and understanding to compare these methods of producing aluminium.

Your answer should include

- The energy requirement;
- Availability of resources;
- Purity of the products.

[6 marks]

MARK SCHEME

Qu No.		Extra Information	Marks
1.1	Solids		1
1.2	Chlorine Ozone		1 1
1.3	To kill microbes / bacteria	Allow to make the water safe to drink	1
1.4	Contains (large amounts of) dissolved solids	Allow salty Allow makes you thirsty / vomit Allow polluted / untreated / contaminated	1

Qu No.		Extra Information	Marks
2.0	Any **three** from: • Copper ores are limited / running out • Copper can be recycled / reused • Copper is expensive • Landfill sites are filling up • Copper compounds are toxic	Ignore not biodegradable or does not decay	3

Qu No.		Extra Information	Marks
3.1	Distillation Heat a flask (containing sea water) until it boils Use of a condenser / delivery tube Collect (pure water) in a boiling tube / beaker / flask	 Allow evaporate sea water The last three marks can be obtained from a suitably labelled diagram	1 1 1 1
3.2	(Top pan) balance Measuring cylinder		1 1
3.3	To make sure that all of the water had evaporated		1
3.4	33.2 (g)		1

Qu No.		Extra Information	Marks
4.1	Fit/safe to drink		1
4.2	2.75 (mg per 1000 g of water) As this has the greatest effect on tooth decay	Allow answers in range 2.5 – 3.0 Allow lowest rate of tooth decay	1 1
4.3	As the percentage of fluoride ions increases the number of children with tooth decay decreases until the fluoride ion concentration is 2.75 (mg per 1000 g of water) After a fluoride ion concentration of 2.75 (mg per 1000 g of water), the number of children with tooth decay increases as the fluoride ion concentration increases	Allow ecf in value from 3.5 Allow as the percentage of fluoride ions increases initially the number of children with tooth decay decreases	1 1

Qu No.		Extra Information	Marks
5.1	Sulfur dioxide is an environmental pollutant causing acid rain		1 1
5.2	Grow plants on land containing copper ores, then burn the plants Ash (from burning) contains copper compounds		1 1
5.3			
Level 3:	A detailed and coherent comparison is given, which demonstrates a broad knowledge and understanding of the key scientific ideas. The response makes logical links between the points raised and uses sufficient examples to support these links.		5-6
Level 2:	A description is given which demonstrates a reasonable knowledge and understanding of the key scientific ideas. Comparisons are made but may not be fully articulated and / or precise.		3-4
Level 1:	Simple statements are made which demonstrate a basic knowledge of some of the relevant ideas. The response may fail to make comparisons between the points raised.		1-2
	No relevant content		0
Indicative content			
Extraction from bauxite • High temperature needed to melt bauxite/ore; • Large amount of electricity used; • Higher energy costs; • Uses more natural resources; • Bauxite must be quarried so more damage to the environment; • Purity of aluminium produced is higher. Recycling • Reduces waste going to landfill; • Uses less natural resources; • Lower energy costs; • Aluminium must be separated from other materials; • Purity of aluminium is lower.			