Using Resources 2

Name: _____

Class: _____

Date: _____

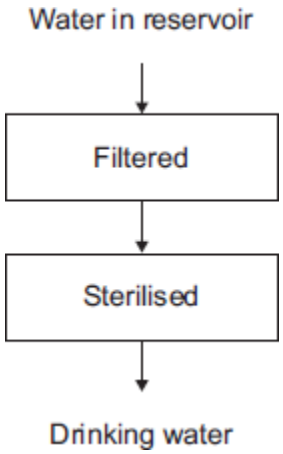
Time: **71 minutes**

Marks: **70 marks**

Comments:

1. This question is about drinking water.

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



(i) What is removed when the water is filtered?

Tick (✓) **one** box.

Gases ☐

Liquids ☐

Solids ☐

(1)

(ii) What is used to sterilise the water?

Tick (✓) **one** box.

Carbon ☐

Chlorine ☐

Sodium chloride ☐

(1)

(iii) Why is the water sterilised?

_____

_____

(1)

(b) Water can be purified by distillation.

Drinking water is **not** usually purified by distillation because distillation is expensive.

Complete the sentence.

Distillation is expensive because it requires a lot of

_____

(1)

(c) Why do some water companies add fluoride to drinking water?

_____

_____

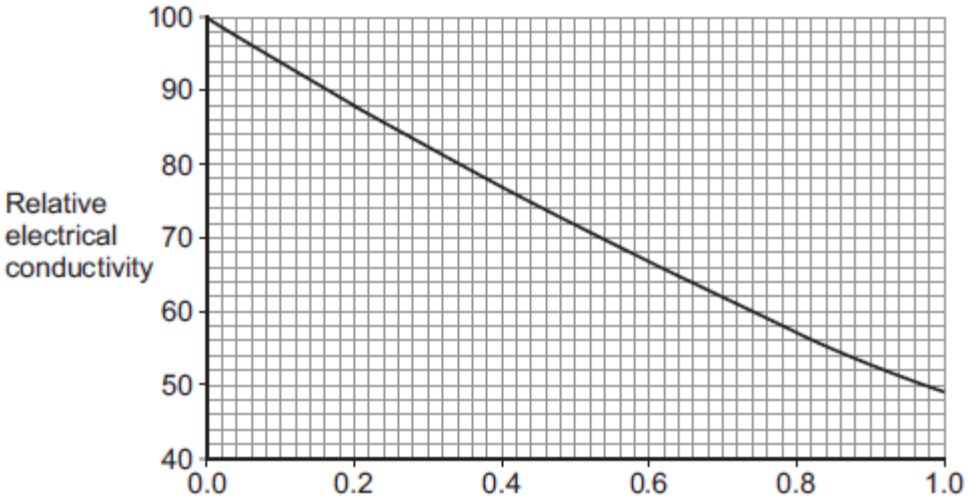
(1)

(Total 5 marks)

2. This question is about copper.

(a) Most of the copper extracted is used in electric circuits.

The figure below shows how impurities change the electrical conductivity of copper.



Copper extracted by smelting is about 99% pure.

The 99% pure copper produced by smelting is purified to 99.9999% pure copper by electrolysis.

Use values from the graph to explain why copper is purified to 99.9999%.

_____

_____

_____

_____

(2)

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

Read the information in the box.

Copper extraction

World demand for copper for the year 2011 was about 20 million tonnes.

World reserves of copper are estimated to be 700 million tonnes.

Most of the copper used is obtained from copper ores, which are mined.

The copper ore chalcopyrite is heated in a furnace to produce copper sulfide, CuS

The furnace is heated by burning fossil fuels.

Air is then blown through the hot copper sulfide, to produce copper and sulfur dioxide.

$$CuS + O_2 \rightarrow Cu + SO_2$$

A scientist made the statement: ‘Copper should be recycled’.

Use the information in the box and your own knowledge and understanding to justify the scientist’s statement.

Extra space

(6)

(c) Phytomining is used to obtain copper from land that contains very low percentages of copper compounds.

Describe how copper compounds are obtained by phytomining.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 11 marks)

3. 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.

(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.

_____

_____

(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)

4. Where copper ore has been mined there are areas of land that contain very low percentages of copper compounds.

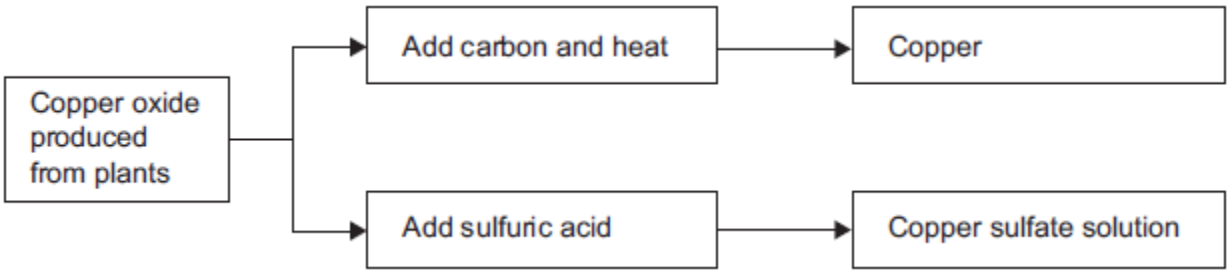
One way to extract the copper is to grow plants on the land.

The plants absorb copper compounds through their roots.

The plants are burned to produce copper oxide.

The copper oxide produced from plants can be reacted to produce copper or copper sulfate solution, as shown in **Figure 1**.

Figure 1



(a) (i) Complete the sentence.

Using plants to extract metals is called _____ .

(1)

(ii) Suggest **two** reasons why copper from these areas of land is **not** extracted by smelting.

_____

_____

_____

_____

_____

(2)

(iii) Complete and balance the chemical equation for the reaction of copper oxide with carbon.

____CuO + C ⟶ _____ + CO_2

(2)

(b) Copper is produced from copper sulfate solution by displacement using scrap iron or by electrolysis.

(i) Use the Chemistry Data Sheet to help you to answer this question.

Give **two** reasons why scrap iron is used to displace copper.

_____

_____

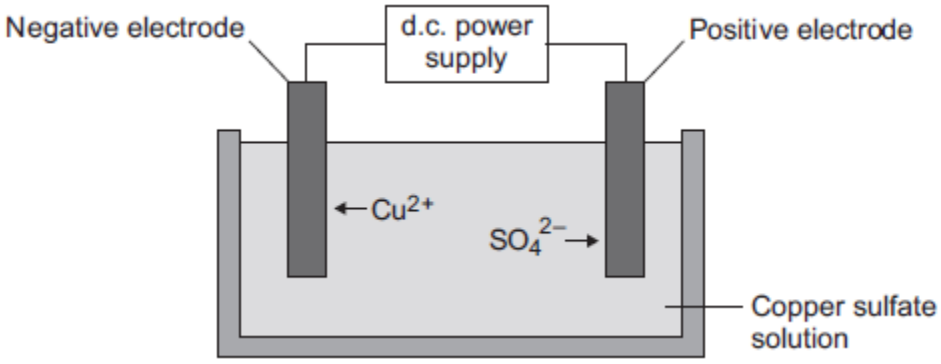
_____

_____

(2)

(ii) **Figure 2** shows the electrolysis of copper sulfate solution.

Figure 2



Describe what happens to the copper ions during electrolysis.

_____

_____

_____

_____

(2)

(Total 9 marks)

5. 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)

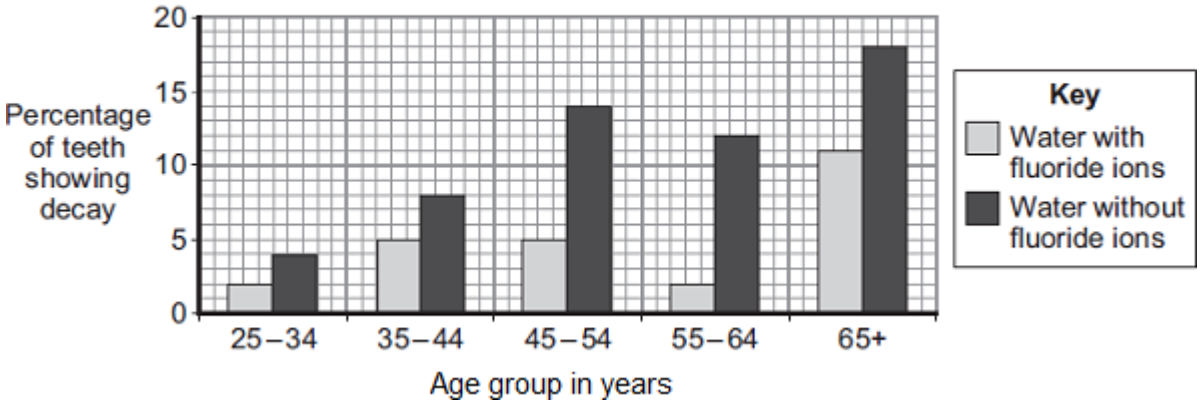
(d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

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

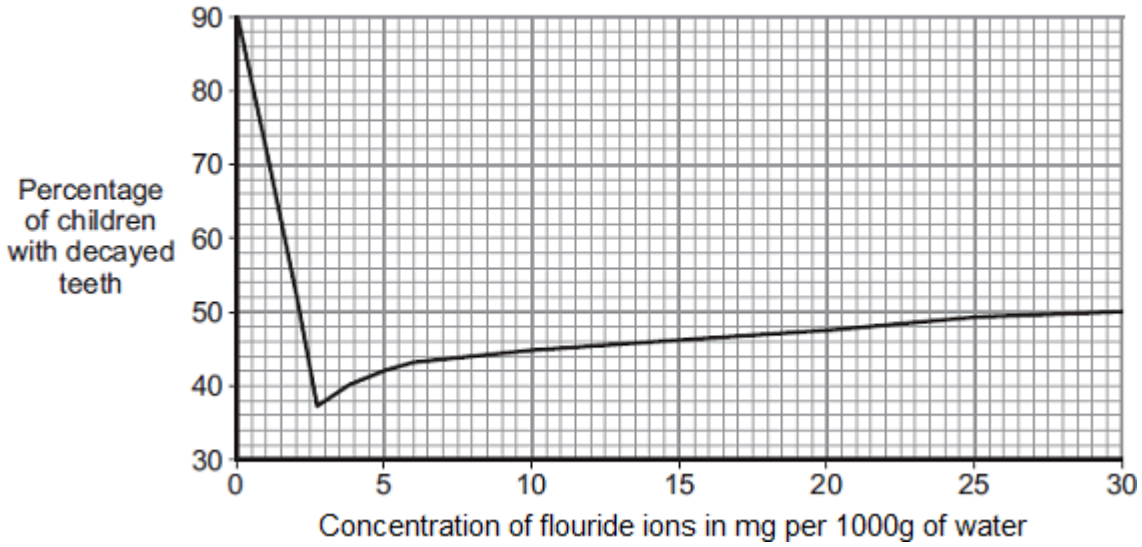
Many scientists have done research into the effects of fluoride ions in drinking water.

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

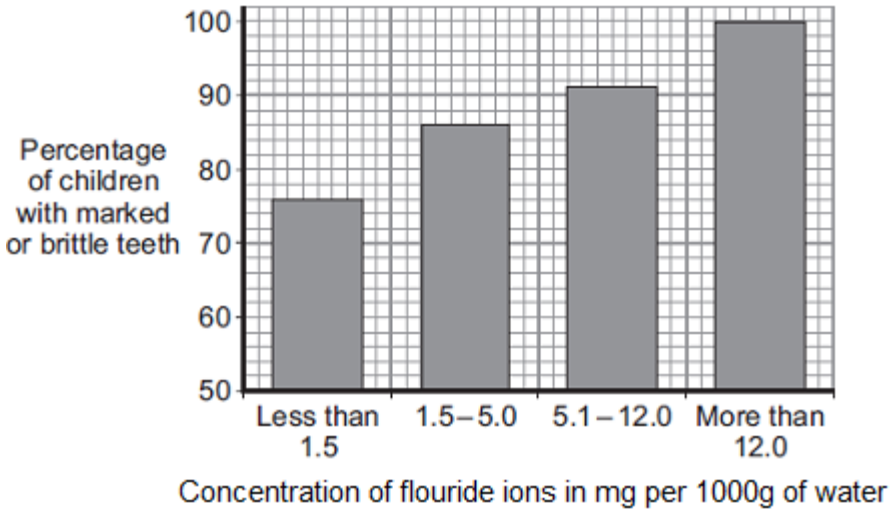
Graph 1



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)

6. Read the article and then answer the questions.

Supermarkets launch eco-friendly plastic milk bags.
Could this be the end of the milk bottle?

Milk bottles are made from glass or from plastic.

Glass milk bottles contain 0.5 litres of milk. When the milk is used up the empty bottles are returned to be re-used. Glass milk bottles are re-used 24 times on average. The glass to make new milk bottles is produced when a mixture of sand, limestone, soda and recycled glass is heated to about 1600 °C in a furnace. There are almost unlimited amounts of the raw materials needed to produce this glass. About 35% of used glass is recycled.

The most common plastic milk bottles contain 2 litres of milk. When the milk is used up the empty bottles are discarded as waste. The plastic used to make these milk bottles is poly(ethene). Poly(ethene) is produced from crude oil by first using fractional distillation, then cracking the naphtha fraction and finally polymerising the ethene. About 5% of used poly(ethene) is recycled.

The new plastic milk bags contain 2 litres of milk. The milk bags are also made from poly(ethene). A milk bag uses 75% less poly(ethene) than is used to make the poly(ethene) milk bottles. When the milk is used up the empty bags are discarded as waste.

(a) Describe what happens in fractional distillation so that fractions, such as naphtha, are separated from crude oil.

_____

_____

_____

_____

_____

_____

(3)

(b) Supermarkets claim that using milk bags instead of milk bottles would have less environmental impact.

Do you agree with this claim?

Use the information in the article and your knowledge and understanding to make appropriate comparisons to justify your answer.

(4)

(Total 7 marks)

7. Life cycle assessments (LCAs) are used to assess the environmental impact of different products.

(a) 212 million kilograms of aluminium is used for packaging in the UK each year.

68.0% of aluminium packaging is recycled.

Calculate the mass of aluminium packaging that is recycled in the UK each year.

_____

_____

_____

Mass of aluminium recycled = _____ million kg

(2)

(b) Drinks cans are made from aluminium.

An aluminium can has a mass of 15.8 g.

1000 g = 1 kg

Calculate the **whole number** of aluminium cans that can be made from 4.00 kg of aluminium.

Whole number of cans = _____

(4)

(c) The table below shows three methods used to dispose of wood and steel after use.

	Percentage (%) of material disposed of by each method		
	As waste	**Recycled**	**Burnt**
Wood	58	36	6
Steel	15	85	0

Evaluate the sustainability of the disposal of wood and steel.

(4)

(Total 10 marks)

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

There are millions of plastic bags in use. After use most of these plastic bags are buried in landfill sites. The amount sent to landfill could be reduced if the plastic bags:

- could be reused
- could be recycled by melting and making them into new plastic products
- could be burned to release energy.

Use the information above and your knowledge and understanding to give the positive and negative environmental impacts of using these methods to reduce the amount of plastic bags sent to landfill.

(Total 6 marks)

1. (a) (i) Solids

1

(ii) Chlorine

1

(iii) kill microbes / bacteria

allow to make the water safe to drink

ignore disinfect

ignore remove / get rid of microbes

1

(b) energy

allow heat

1

(c) improve dental health

allow reduce tooth decay

allow (local) government requirement

allow help teeth

1

[5]

2. (a) pure copper is twice as good a conductor as 99% pure copper

accept reverse argument

*accept answers quoting 2 correct values from the graph scores **2***

*qualitative answer (e.g. pure copper is a better conductor than impure copper) scores **1***

or

*answers quoting a conductivity value from the graph scores **1***

2

(b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response.

0 marks
No relevant content

Level 1 (1–2 marks)
Simple list of a limited number of points given, with no linking between ideas

Level 2 (3–4 marks)
A broader set of points made. There will probably not be links between ideas

Level 3 (5–6 marks)
Answer includes linking between ideas, showing the consequence of either not recycling or the advantage of recycling. Answers such as less fossil fuel needed so less carbon dioxide produced **or** less carbon dioxide produced so less global warming

examples of the points made in the response

resources
(recycling) conserves supplies of ores
copper available for longer
as (at present rate of use) copper ores will run out in about 35 years
(recycling) conserves supplies of fossil fuels **or** energy
less fuel used at a lower cost

land pollution
mining scars landscape **or** produces noise pollution
mining destroys wildlife habitats
(recycling) less need to mine ores / fossil fuels
so less habitat destroyed or less scarring of landscape
(recycling) less need to use landfill for waste

atmospheric pollution
burning fossil fuels produces carbon dioxide / greenhouse gas
which (may) cause global warming **or** climate change
extraction produces sulfur dioxide
which causes acid rain
which can kill trees / fish

6

(c) grow plants

accept plants absorb copper (through roots)

1

then plants are burned

1

ash (from burning) contains copper compounds

1

[11]

3. (a) filter

1

to remove *solids* ***or*** *insoluble particles*

OR

add coagulant (1)

flocculation / settling / remove solids (1)

1

(add) chlorine

accept ozone / UV

1

to reduce the number of microbes

accept to kill microbes / bacteria / germs

accept sterilise

allow disinfect

ignore remove microbes

1

(b) (i) ion exchange resin

allow ion exchange column

allow sodium ions / Na^+

allow hydrogen ions / H^+

1

(ii) prevent growth of microbes

accept sterilise

accept to kill microbes / bacteria / germs

accept to reduce the number of microbes

ignore remove microbes

1

(c) high cost of energy / *heating*

allow uses a lot of energy

1

(d) any **one** from:

- helps to develop / maintain bones

  allow any suitable positive effect on bones
- helps to develop / maintain teeth

  allow any suitable positive effect on teeth
- reduces heart disease

1

[8]

4. (a) (i) phytomining

1

(ii) *(the land contains)* very little <u>copper</u>

allow low grade ore ***or*** *large amounts of waste*

ignore quarrying / benefits of using plants

1

uneconomical

accept (smelting) uses a lot of energy / fossil fuels

allow expensive

1

(iii) Cu

1

2 CuO + C ➔ **2** Cu + CO_2

allow 2 CuO + C ➔ Cu_2 + CO_2 for ***1*** *mark*

1

(b) (i) iron is more reactive (than copper)

1

iron is cheap(er than copper)

allow cheaper ***or*** *uses less energy than electrolysis*

1

(ii) any **two** from:

- copper / ions move **or** are attracted to the negative electrode / *cathode*
- where they are reduced **or** gain (two) electrons
- *where they form copper (metal / atoms)*

2

[9]

5. (a) (i) distillation

1

(ii) 100 / one hundred

1

(b) (i) measuring cylinder **or** pipette **or** burette

allow phonetic spelling

do ***not*** *accept teat pipette*

ignore any additional words or volumes

1

(ii) (re)heat the evaporating basin

accept heat to constant mass for ***2*** *marks*

1

weigh (again) **or** mass will not change

if no other mark awarded allow ***1*** *mark for a chemical test for water*

1

(iii) 33.2 (g)

*correct answer with or without working scores **2** marks*

*allow mass of residue = (24.04 g − 23.21 g) = 0.83 for **1** mark*

*allow ecf (mass of residue × 40) for **1** mark*

2

(c) to kill microbes / bacteria **or** to sterilise / disinfect water

allow to prevent disease

ignore 'to make it safe to drink'

1

(d) Marks awarded for this answer will be determined by the Quality of Communication (QoC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4, and apply a 'best−fit' approach to the marking.

0 marks
No relevant content

Level 1 (1 − 2 marks)
A simple relevant comment has been made on the data from at least one of the graphs.

Level 2 (3 − 4 marks)
At least two of the graphs have been considered with a relevant comment made.

Level 3 (5 − 6 marks)
All the graphs have been considered and relevant comments made about each.
A justified conclusion may be given.

examples of chemistry points made in the response:

extra information

- (graph 1 shows) fluoride ions reduce the amount of tooth decay
- (graph 1 shows) the effect in reducing tooth decay is greatest for 55−64 year olds

  accept any in range 55 − 64
- (graph 2 shows) the fluoride ions reduce percentage with decayed teeth
- (graph 2 shows) effect is greatest at 2.5 to 3 mg per 1000 g of water then decay increases if more than 2.5 to 3 mg of fluoride ions per 1000 g water

  accept any in range 2.5 − 3
- (graph 2 shows percentage) decay decreases from 0 to 2.5 / 3 mg per 1000 g
- (graph 3 shows) more marked / brittle teeth as fluoride level increases
- above points linked together to draw a justified conclusion

6

[14]

6. (a)

allow answers referring specifically to the naphtha fraction

crude oil is <u>evaporated/vaporised</u> (by heating)

1

the vapours are <u>condensed</u> (by cooling)

1

(fractions condense) / boil at different temperatures

allow fractions have different boiling points

1

(b) any **four** from:

answer yes or no does not gain credit

ignore references to volume of milk held / number of bottles used / biodegradability / habitats / pollution / mining / dust

each marking point must be a comparison

milk bag points

- uses (75%) less **crude oil** to make (than a plastic milk bottle)

  allow eg uses 75% less

  poly(ethene) which is made from crude oil

- uses less **energy** / fuel to make (than a plastic / glass milk bottle)

- produces less **carbon dioxide** to manufacture (than a plastic / glass milk bottle)

  allow produces less greenhouse gases / causes less global warming

  allow produces less CO_2 on burning

- produces less **waste** (than a plastic / glass milk bottle)

  allow takes up less landfill (space)

  allow an argued case for more waste eg milk bags are discarded / cannot be reused

- less fuel used for **transport** than glass milk bottles

- (produces waste because) milk bags are only used once whereas glass bottles can be **re-used**

  allow milk bags are discarded but glass bottles can be reused (24 / many times)

  allow glass bottles can be reused but milk bags can't

poly(ethene) points

- uses a limited **raw material** / crude oil whereas the raw materials for glass are almost unlimited

- **less** (5%) poly(ethene) is **recycled** (compared to glass (35%))

  allow (35%) glass is recycled or (5%) poly(ethene) (bottles) recycled BUT milk bags aren't / are discarded

  or

  recycled poly(ethene) is not used to make new bags whereas recycled glass is used to make new bottles

4

[7]

7. (a)

$$\text{(mass of aluminium recycled =)}\ \frac{212 \times 68.0}{100}$$

1

= 144 (million kg)

allow 144.16 (million kg)

*allow for **1** mark only an answer of*
144 000 000 (million kg)
or
144 160 000 (million kg)

1

(b) (unit conversion 4 kg =) 4000 g

1

$$\text{(number of cans =)}\ \frac{4000}{15.8}$$

allow correct use of an incorrect / no conversion

1

= 253.16

1

= 253

allow correct whole number from an incorrectly determined number of cans using the values from the question

alternative approach 1

(unit conversion 15.8 g =) 0.0158 kg (1)

$$\text{(number of cans =)}\ \frac{4}{0.0158}\ \ (1)$$

allow correct use of an incorrect / no conversion

= 253.16 (1)

= 253 (1)

allow correct whole number from an incorrectly determined number of cans using the values from the question

alternative approach 2

(number of cans from 1000 g =) $\frac{1000}{15.8}$ (1)

= 63.29 (1)

(number of cans from 4000 g) = 63.29 × 4 (1)

allow correct use of an incorrectly determined number of cans from 1000 g

(= 253.16) = 253 (1)

allow correct whole number from an incorrectly determined number of cans using the values from the question

1

(c) **Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

3–4

Level 1: Relevant points are made. They are not logically linked.

1–2

No relevant content

0

Indicative content

- less steel (than wood) goes to waste
- (so) less space taken up in landfill

- more steel (than wood) is recycled
- (so) less non-renewable resources are needed

- no steel is burnt
- (so) no carbon dioxide produced
- (so) no contribution to climate change

- most wood is disposed of as waste
- (so) more space taken up in landfill

- least wood is disposed of by burning
- (but) still produces carbon dioxide
- (which) contributes to climate change

- most steel is disposed of by recycling
- (so) less non-renewable resources are needed

- judgement

[10]

8. Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

No relevant content.

0 marks

There is a brief description of a positive and a negative environmental impact involved with one or more methods used to reduce the amount of plastic bags sent to landfill.

Level 1 (1–2 marks)

There is some description of both positive and negative environmental impacts involved with at least 2 methods used to reduce the amount of plastic bags sent to landfill.

Level 2 (3–4 marks)

There is a clear, balanced and detailed description of both a positive and a negative environmental impact of using each of the 3 methods used to reduce the amount of plastic bags sent to landfill.

Level 3 (5–6 marks)

examples of the points made in the response

Reuse:
Reuse means less bags used so:

Positive environmental impact

- Saves raw materials/crude oil
- Saves energy
- Cuts down on CO_2 emissions
- Less global warming

Negative environmental impact

- Could cause litter
- Could still be sent to landfill

Recycle:
Bags can be recycled so:

Positive environmental impact

- Used to make new plastic bags / objects
- Saves raw materials / crude oil
- Saves energy compared to producing plastic bags from crude oil
- Cuts down on CO_2 emissions
- Less global warming

Negative environmental impact

- Collection point sites cause an eyesore / litter problem
- Transportation to recycling plant releases carbon dioxide / causes global warming

Burn:
Bags can be burned so:

Positive environmental impact

- Could provide energy for heating buildings
- Could provide energy for generating electricity

Negative environmental impact

- Increases CO_2 emissions
- Increases global warming
- Could release toxic gases
- Does not conserve raw materials / crude oil

[6]