

Using Resources 5

Name: _____

Class: _____

Date: _____

Time: **55 minutes**

Marks: **51 marks**

Comments:

1.

This question is about the Earth's atmosphere and the Earth's resources.

- (a) After the formation of the Earth's early atmosphere, the amounts of nitrogen and oxygen in the atmosphere changed.

Explain the main changes in the amounts of nitrogen and oxygen in the Earth's atmosphere.

Nitrogen _____

Oxygen _____

(4)

- (b) Describe how coal was formed from the carbon dioxide present in the Earth's early atmosphere.

(4)

- (c) The combustion of 1.0 kg of coal produces more carbon dioxide than the combustion of 1.0 kg of natural gas.

Suggest why.

(1)

Metals are extracted from metal ores found in the Earth.

(d) Describe how bioleaching is used to extract copper from low grade ores.

(3)

(e) Phytomining uses plants to extract nickel from low grade ores.

The plants contain 0.792% nickel by mass.

The plants are burned to produce ash.

The ash from these plants contains 4.80% nickel by mass.

Calculate the mass of ash produced from burning 1000 kg of plants.

Give your answer in grams in standard form.

Mass of ash (in standard form) = _____ g

(4)

(Total 16 marks)

2.

Fresh water contains low levels of dissolved salts.

Water reacts with anhydrous copper sulfate in a reversible reaction.

The word equation for the reaction is:



(a) How does the equation show that the reaction is reversible?

(1)

(b) Complete the sentences.

Choose answers from the box.

blue	green	orange	white	yellow
-------------	--------------	---------------	--------------	---------------

The colour of anhydrous copper sulfate is _____.

The colour of hydrated copper sulfate is _____.

(2)

(c) The figure below shows anhydrous copper sulfate in a sealed container.



Suggest **one** reason why anhydrous copper sulfate is kept in a sealed container.

(1)

Sodium chloride dissolves in water to form sodium chloride solution.

(d) Draw **one** line from each substance to the description of the substance.

Substance	Description of substance
	Compound
Sodium chloride solution	Element
Water	Hydrocarbon
	Mixture

(2)

(e) Name the process used to obtain solid sodium chloride from sodium chloride solution.

(1)

(f) Two processes used to obtain potable water from fresh water are:

- filtering
- sterilising.

Give **one** reason why each process is used.

Filtering _____

Sterilising _____

(2)

(g) Which type of water is the easiest to obtain potable water from?

Tick (✓) **one** box.

Ground water

Salt water

Waste water

(1)

(h) Which of the following is the first stage of waste water treatment?

Tick (✓) **one** box.

Aerobic biological treatment of effluent

Anaerobic digestion of sewage sludge

Screening and removal of grit

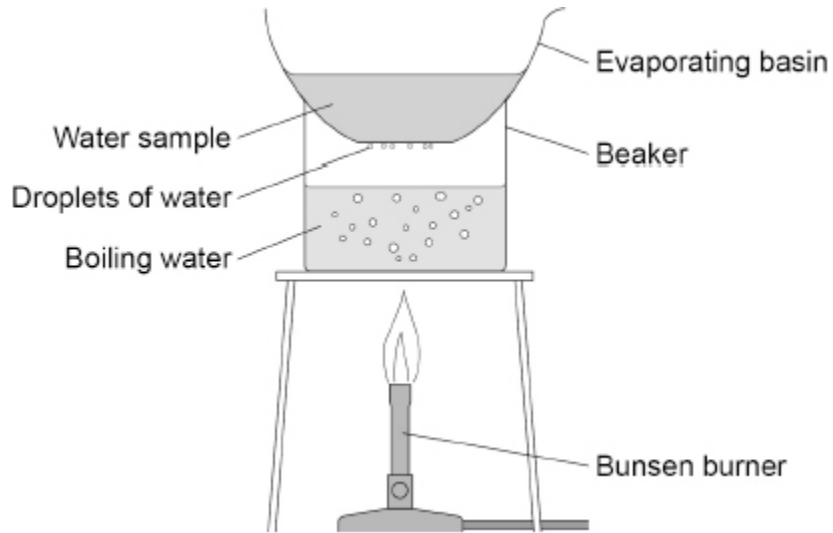
(1)

(Total 11 marks)

3.

A student investigated the mass of dissolved solids in water samples.

The diagram below shows the apparatus used.



This is the method used.

1. Record the mass of a dry evaporating basin.
 2. Pour 25 cm³ of the water sample into the evaporating basin.
 3. Place the evaporating basin on the beaker for 10 minutes.
 4. Record the mass of the evaporating basin and contents.
- (a) What is used to find the mass of the evaporating basin?

Tick (✓) **one** box.

Balance

Beaker

Measuring cylinder

Thermometer

(1)

One error is that droplets of water collect on the bottom of the evaporating basin.

(b) Suggest how this error affects the mass of the evaporating basin and contents.

(1)

(c) How can this error be corrected?

(1)

(d) Another error in the method is that not all the water was removed from the water sample.

How can this error be corrected?

Tick (✓) **one** box.

Add more boiling water to the beaker.

Heat until the mass of the evaporating basin and contents is constant.

Stir the water sample in the evaporating basin with a glass rod.

(1)

(e) The water in the water sample turns into steam.

What is the name of this process?

(1)

Another student did the experiment correctly with three water samples **A**, **B** and **C**.

The table below shows the results.

Water sample	Mass of dissolved solids in g			
	Test 1	Test 2	Test 3	Mean
A	0.23	0.23	0.20	X
B	0.03	0.07	0.02	0.04
C	1.45	1.60	1.45	1.50

(f) The range is the difference between the largest value and the smallest value.

Which water sample has the greatest range of results?

Tick (✓) **one** box.

A

B

C

(1)

(g) Calculate the mean mass **X** for water sample **A**.

Use table above.

X = _____ g

(2)

(h) What is the dependent variable in this experiment?

Tick (✓) **one** box.

Mass of dissolved solids

Time taken for water to heat

Type of water sample

Volume of boiling water

(1)

- (i) A different water sample contains 3.6 g of dissolved solids in 150 cm³

Calculate the mass of dissolved solids in 25 cm³ of this sample.

Mass = _____ g

(2)

(Total 11 marks)

4.

Water that is safe to drink contains dissolved substances.

- (a) What do we call water that is safe to drink?

Tick (✓) **one** box.

Desalinated

Filtered

Fresh

Potable

(1)

- (b) Describe a test for pure water.

Give the result of the test if the water is pure.

Test _____

Result _____

(2)

(e) A water company allows a maximum of 500 mg per dm^3 of sulfate ions in drinking water.

A sample of drinking water contains 44 mg per dm^3 of sulfate ions.

Calculate the percentage (%) of the maximum allowed mass of sulfate ions in the sample of drinking water.

Percentage (%) of the maximum allowed mass = _____ %

(2)

(Total 13 marks)

Mark schemes

1.

- (a) nitrogen increased 1
- (because of) emission from volcanoes
allow (because of) denitrifying bacteria 1
- oxygen increased 1
- (because of) photosynthesis 1
- (b) carbon dioxide is used during photosynthesis 1
- in trees 1
- (which) die and are compressed 1
- over millions of years 1
- (c) coal has higher proportion / percentage of carbon 1
- (d) uses bacteria 1
- to produce solutions containing copper compounds
allow to produce leachate solutions 1
- from which copper is obtained by displacement / electrolysis 1
- (e) 1000 (kg of plants) gives 7.92 (kg of nickel) 1
- $(\text{mass} = \frac{7.92}{4.8} \times 100 =) 165 \text{ (kg)}$ 1
- (conversion 165 kg \Rightarrow) 165 000 (g)
allow correct conversion of an incorrectly determined mass in kg 1
- $= 1.65 \times 10^5 \text{ (g)}$
allow a correctly calculated and rounded conversion to standard form of an incorrect calculation of mass in grams

OR

$$(\text{mass} =) \frac{0.792}{4.8} \times 1000 \text{ (1)}$$

$$= 165 \text{ (kg) (1)}$$

$$(\text{conversion } 165 \text{ kg} =) 165\,000 \text{ (g) (1)}$$

allow correct conversion of an incorrectly determined mass in kg

$$= 1.65 \times 10^5 \text{ (g) (1)}$$

allow a correctly calculated and rounded conversion to standard form of an incorrect calculation of mass in grams

1

[16]

2.

(a) (the symbol) =

allow description of reversible sign

1

(b) white

must be in this order

1

blue

1

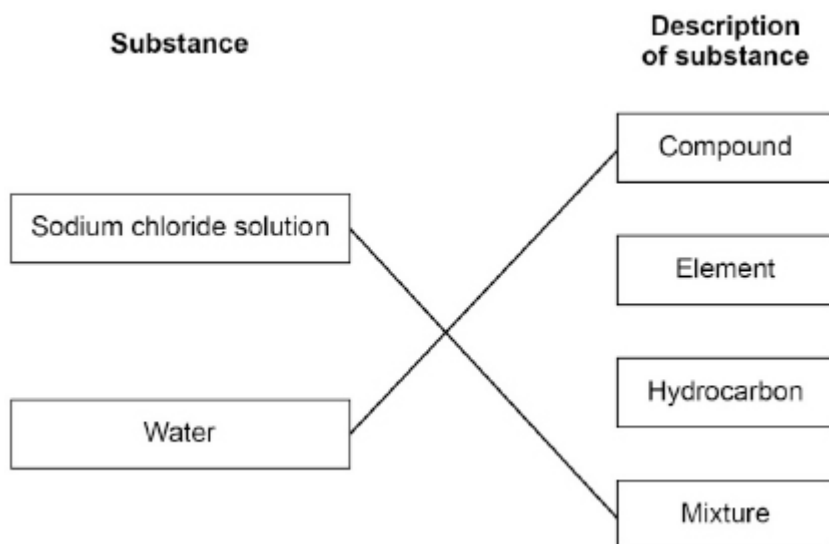
(c) to prevent reaction with water vapour (in the air)

allow to prevent reaction with moisture

allow to keep water out

1

(d)



do **not** accept more than one line from a box on the left

1

1

- (e) evaporation
or
 crystallisation 1
- (f) (filtering) to remove solids 1
- (sterilising) to kill bacteria
allow to kill microbes 1
- (g) ground water 1
- (h) screening and removal of grit 1
- [11]**
- 3.** (a) balance 1
- (b) mass was greater / more than expected 1
- (c) dry the bottom of the evaporating basin
or
 use an electric heater 1
- (d) heat until the mass of the evaporating basin and contents is constant. 1
- (e) evaporation
ignore boiling 1
- (f) **C** 1
- (g) $\frac{0.23 + 0.23 + 0.20}{3}$ **or** $\frac{0.66}{3}$ 1
- = 0.22 (g) 1
- (h) mass of dissolved solids 1

(i)

$$\frac{25}{150} \times 3.6 \text{ or } \frac{1}{6} \times 3.6$$

1

$$= 0.6 \text{ (g)}$$

1

[11]

4.

(a) potable

1

(b) boil (water)

ignore heat

*do **not** accept filter*

*do **not** accept incorrect test*

1

(boils) at 100°C

alternative approach freeze (water) (1)

(freezes) at 0°C (1)

if no other mark awarded, allow 1 mark for evaporate or distil water

and no solid left

1

allow boils at 100°C for 2 marks

(c) **Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

3-4

Level 1: The design/plan would not necessarily lead to a valid outcome. Some steps are identified, but the plan may not be logically sequenced.

1-2

No relevant content

0

Indicative content

- weigh container.
- measure volume (100 cm³) of water into container.
- evaporate / heat until dry.
- weigh container and remaining solids.
- determine mass of dissolved solids

to access Level 2 there should be an indication of using a known volume of water, heating until dry and determining the mass of solid.

(d)

an answer of 0.031 (g) scores 4 marks

(conversion of cm^3 to dm^3)

$$(250 \text{ cm}^3 =) \frac{250}{1000} \text{ or } 0.25 \text{ (dm}^3)$$

1

(conversion of mg to g)

$$(125 \text{ mg} =) \frac{125}{1000} \text{ or } 0.125 \text{ (g)}$$

1

$$(0.25 \times 0.125) = 0.03125$$

allow correct calculation from incorrect attempt(s) at conversion

1

$$=0.031 \text{ (g)}$$

allow an answer correctly rounded to 2 significant figures from an incorrect calculation that uses the values in the question

1

(e) $\frac{44}{500} \times 100$

1

$$= 8.8 \text{ (\%)}$$

allow 9 (\%)

1

an answer of 8.8 (\%) or 9 (\%) scores 2 marks

[13]