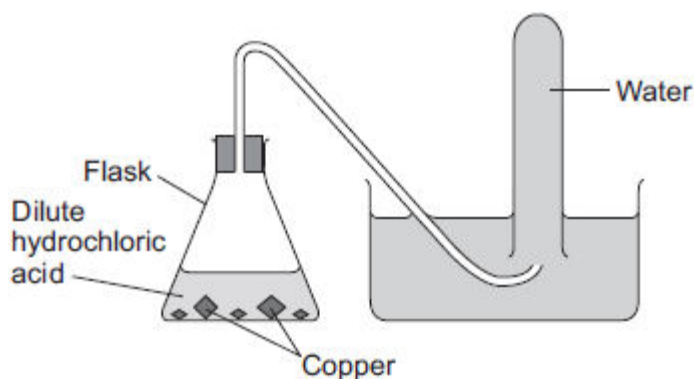


1

A student was trying to produce hydrogen gas.

Figure 1 shows the apparatus she used.

Figure 1



(a) No gas was produced.

The student's teacher said that this was because the substances in the flask did **not** react.

(i) Suggest why the substances in the flask did **not** react.

.....

.....

.....

(1)

(ii) Which two substances could the student have put in the flask to produce hydrogen safely?

Tick (✓) **one** box.

Gold and dilute hydrochloric acid

Potassium and dilute hydrochloric acid

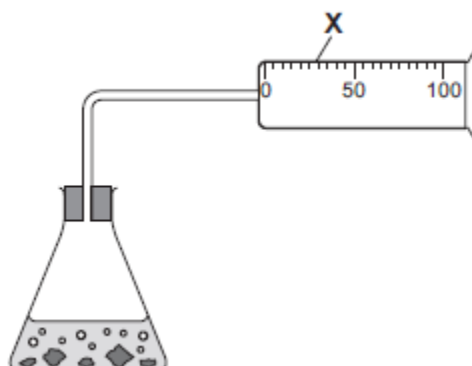
Zinc and dilute hydrochloric acid

(1)

- (b) Another student did produce hydrogen from two substances.

Figure 2 shows the apparatus the student used to collect and measure the volume of the hydrogen gas.

Figure 2



Give the name of the apparatus labelled **X**.

.....

(1)

- (c) The student did the experiment four times. Her results are shown in the table below.

| Experiment | Volume of hydrogen collected in one minute in cm ³ |
|------------|---|
| 1 | 49 |
| 2 | 50 |
| 3 | 35 |
| 4 | 48 |

- (i) One of the results is anomalous.

Which result is anomalous? Write your answer in the box.

Give a reason for your choice.

.....

(2)

(ii) Calculate the mean volume of hydrogen collected in one minute.

.....

Mean volume = cm³

(2)

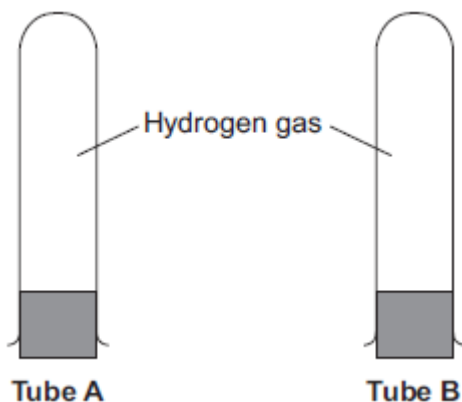
(iii) Give a reason why the experiment should be repeated several times.

.....

(1)

(d) A teacher collected two tubes full of hydrogen gas, as shown in **Figure 3**.

Figure 3



She tested tube **A** with a lighted splint as soon as she took the bung out.

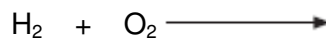
She tested tube **B** with a lighted splint a few seconds after taking the bung out.

(i) Suggest why tube **B** gave a much louder pop than tube **A**.

.....

(1)

- (ii) Complete and balance the chemical equation for the reaction that takes place when the hydrogen reacts in this test.



(2)
(Total 11 marks)

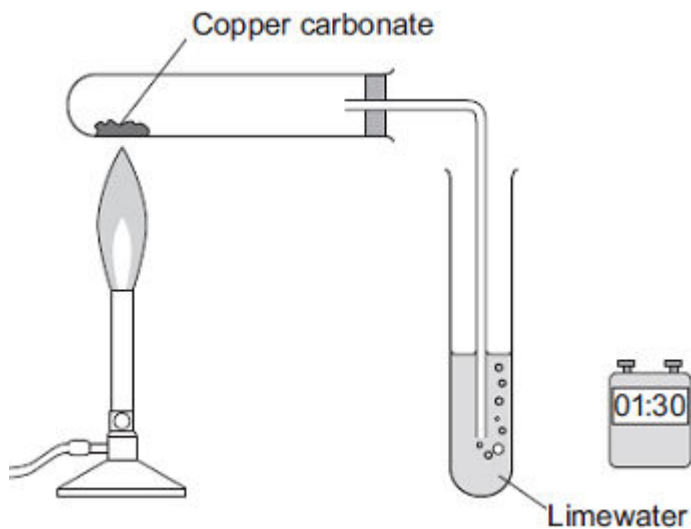
2

Carbon dioxide is produced when copper carbonate is heated.

A student investigated heating copper carbonate.

The student used the apparatus to measure how long it took for carbon dioxide to be produced.

The student also noted what happened during each minute for three minutes.



- (a) The student used changes to the limewater to measure how long it took for carbon dioxide to be produced.

Describe how.

.....

.....

.....

.....

(2)

- (b) The student wrote down her observations.

| Time interval in minutes | Observations |
|-----------------------------|--|
| Between 0 and 1 | A slow release of gas bubbles. The limewater did not change. The solid in the test tube was green. |
| Between 1 and 2 | A fast release of gas bubbles. The limewater changed at 1 minute 10 seconds. |
| Between 2 and 3 | No release of gas bubbles. The solid in the test tube was black. |

- (i) Suggest the reason for the student's observations between 0 and 1 minute.

.....

.....

.....

.....

.....

(2)

- (ii) Explain the student's observations between 1 and 2 minutes.

.....

.....

.....

.....

(2)

- (iii) Explain the student's observations between 2 and 3 minutes.

.....

.....

.....

.....

(2)

3

A bottle of washing soda was found in a school laboratory.
The chemical name of washing soda is sodium carbonate.



A student tested the washing soda to prove that it was sodium carbonate.

(a) The student did a flame test to show that washing soda is a sodium compound.
The student used a clean wire to put the washing soda into the flame.

(i) Why should the wire be clean when used for a flame test?

.....

(1)

(ii) The table shows some properties of metals.

Two of these are properties that the wire must have if it is used for a flame test.

Tick (✓) the **two** correct properties.

| Property | Tick (✓) |
|---------------------------|----------|
| Good electrical conductor | |
| High density | |
| High melting point | |
| Low boiling point | |
| Unreactive | |

(2)

(iii) Which **one** of the following flame colours shows that washing soda is a sodium compound?

Draw a ring around your answer.

brick-red

lilac

yellow-orange

(1)

(b) The student used dilute hydrochloric acid to show that washing soda was a carbonate. Carbon dioxide gas was given off.

(i) Describe what you **see** happening when a gas is given off.

.....
.....

(1)

(ii) The student used limewater to prove that the gas given off was carbon dioxide.

Complete this sentence by choosing the correct word from the box.

| | | |
|--------------|-------------------|--------------|
| clear | colourless | milky |
|--------------|-------------------|--------------|

When carbon dioxide reacts with limewater, the limewater turns

(1)

(c) Instrumental methods are used to identify chemicals.

Give **two** advantages of instrumental methods compared with chemical tests by considering:

- the length of time to carry out a test
- the amount of chemical used.

.....
.....
.....
.....

(2)

(Total 8 marks)

4

A student was investigating the reaction of lithium and water.

She added a few drops of universal indicator to water in a trough and added a piece of lithium.



The word equation for the reaction is:



(a) (i) The lithium floated on the water.

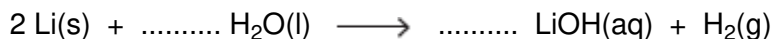
State **two** other observations that the student would **see** during the reaction.

1

2

(2)

(ii) Balance the symbol equation for the reaction of lithium and water.



(2)

(iii) Describe a simple test and the result that would show the gas was hydrogen.

.....

.....

(1)

(iv) All Group 1 metals have similar reactions with water.

State why, in terms of electronic structure.

.....

.....

(1)

- (b) Lithium and other Group 1 metals have different properties from the transition metals.

Tick (✓) **two** properties that are properties of Group 1 metals.

They react with oxygen.

They form coloured compounds.

They are strong and hard.

They have low melting points.

(2)

- (c) The electronic structure of a potassium atom is 2, 8, 8, 1

(i) Draw a diagram to show the electronic structure of a potassium ion.

Show the charge on the potassium ion.

(2)

- (ii) Potassium is more reactive than sodium.

Explain why, in terms of electronic structure.

.....

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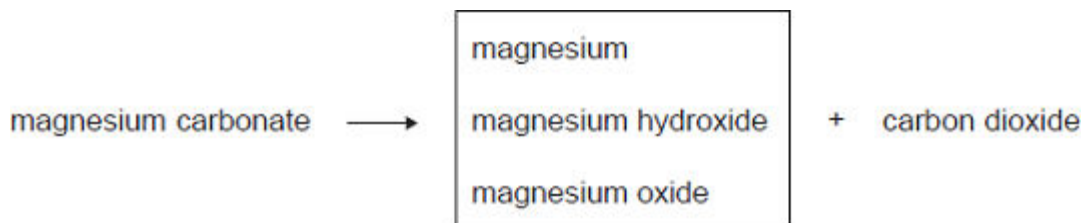
.....

(3)
(Total 13 marks)

5

Carbon dioxide is produced when metal carbonates are heated.

- (a) (i) Draw a ring around the correct answer to complete the word equation.



(1)

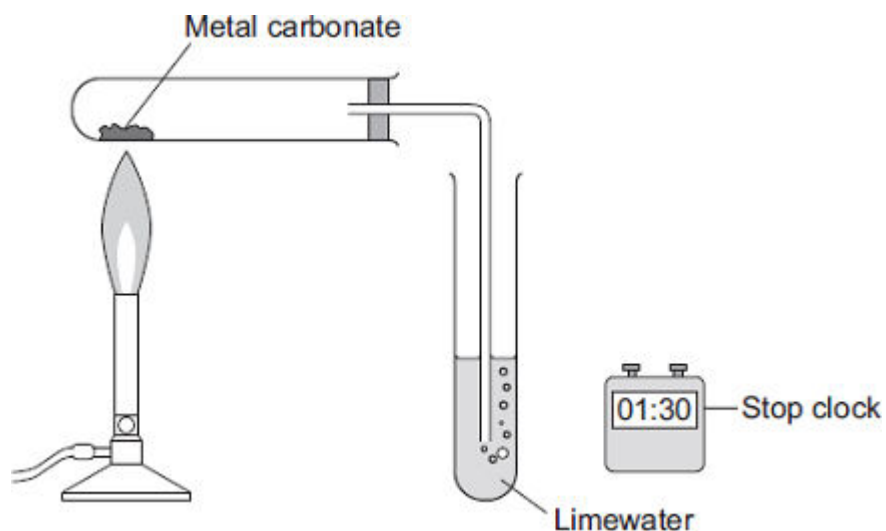
- (ii) Draw a ring around the correct answer to complete the sentence.

The reaction to produce carbon dioxide from magnesium carbonate is

| |
|----------------|
| combustion. |
| decomposition. |
| fermentation. |

(1)

- (b) A student investigated what happens when metal carbonates are heated.



The student:

- used the apparatus to investigate heating four metal carbonates
- started the stop clock at the same time as he began to heat the metal carbonate
- stopped the stop clock when carbon dioxide was produced.

The student's results are shown in the table.

| Metal carbonate | Time taken for the production of carbon dioxide to start in seconds |
|---------------------|---|
| Calcium carbonate | 163 |
| Copper carbonate | 24 |
| Magnesium carbonate | 92 |
| Zinc carbonate | 67 |

- (i) Tick (✓) the type of graph the student should draw from these results.

| Type of graph | Tick (✓) |
|---------------|----------|
| Bar chart | |
| Line graph | |
| Scatter graph | |

(1)

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

Draw a ring around the correct answer to complete the sentence.

The more reactive the metal in the carbonate the

| |
|------|
| less |
| more |
| same |

time is taken for the

production of carbon dioxide to start.

(1)

- (iii) How did the student know that carbon dioxide was produced?

Use the diagram of the apparatus to help you to answer this question.

.....

.....

.....

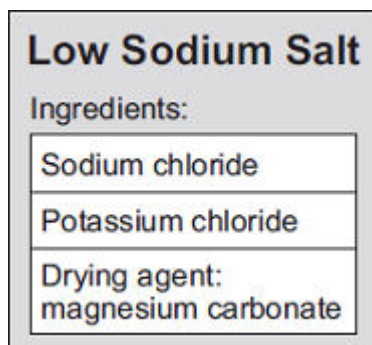
.....

(2)

(Total 6 marks)

6

Low sodium salt is used on food. This label is from a packet of low sodium salt.



A chemist tests the low sodium salt for the substances on the label.

- (a) The chemist tests for sodium ions and potassium ions using a flame test.

Draw a ring around the correct answer to complete each sentence.

- (i) In a flame test, sodium ions produce a

| |
|--------|
| lilac |
| red |
| yellow |

colour.

(1)

(ii) In a flame test, potassium ions produce a

| |
|--------|
| lilac |
| red |
| yellow |

colour.

(1)

(b) The chemist added hydrochloric acid to low sodium salt. Carbon dioxide gas was produced.

Describe the test for carbon dioxide and give the result of the test.

.....

.....

.....

.....

(2)

(c) The chemist made a solution of low sodium salt.

(i) Tick (✓) **one** box to show the chemical used to test for chloride ions.

| | Tick (✓) |
|--------------------------|----------|
| Barium chloride solution | |
| Silver nitrate solution | |
| Sodium sulfate solution | |

(1)

(ii) Sodium hydroxide solution is used to test for magnesium ions.

Draw a ring around the colour of precipitate produced by this test.

brown

green

white

(1)

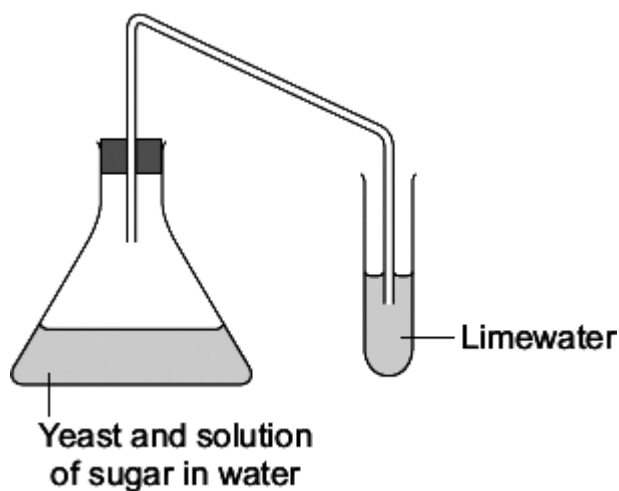
(Total 6 marks)

7

Two fuels that can be used for cars are:

- petrol from crude oil
- ethanol made from sugar in plants.

- (a) A student used the apparatus shown to investigate the reaction to make ethanol from sugar.



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

This reaction to make ethanol from sugar is

| |
|----------------|
| combustion. |
| decomposition. |
| fermentation. |

(1)

- (ii) Complete the sentences.

The limewater turns

This happens because

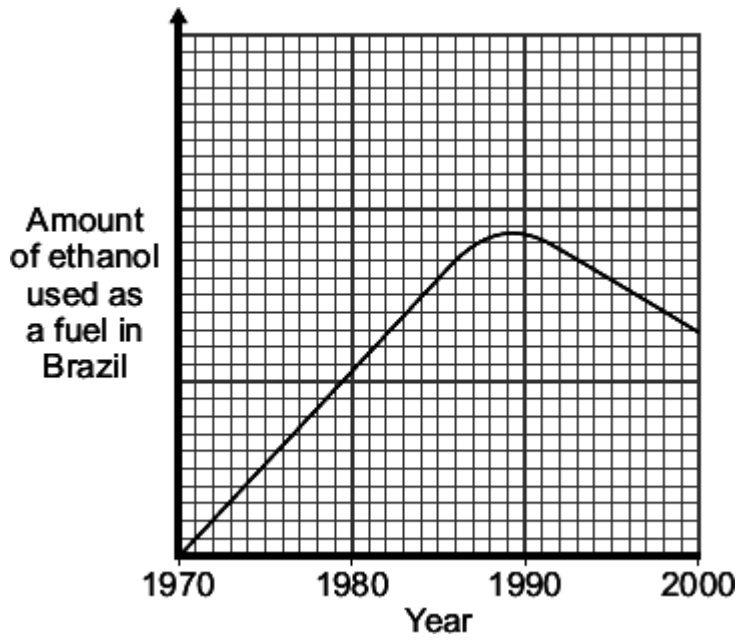
(2)

- (b) In 1970, the Brazilian Government stated that all petrol must contain more than 25% ethanol.

The reasons for this statement in 1970 were:

- Brazil did not have many oilfields
- Brazil has a climate suitable for growing sugar cane.

The graph shows the amount of ethanol used as a fuel in Brazil from 1970 to 2000.



- (i) Use the graph to describe the changes in the amount of ethanol used as a fuel in Brazil from 1970 to 2000.

.....

.....

.....

.....

(2)

- (ii) In 2011, the Brazilian Government decided to reduce the amount of ethanol in petrol to 18%.

Suggest **one** reason for their decision.

.....

.....

(1)

(Total 6 marks)

8

Limestone is used as a building material. Acid rain erodes limestone.

- (a) Limestone contains calcium carbonate.
The symbol equation for the reaction of calcium carbonate with hydrochloric acid is shown.



Describe a test to show that carbon dioxide is produced in this reaction.

Give the result of the test.

.....

.....

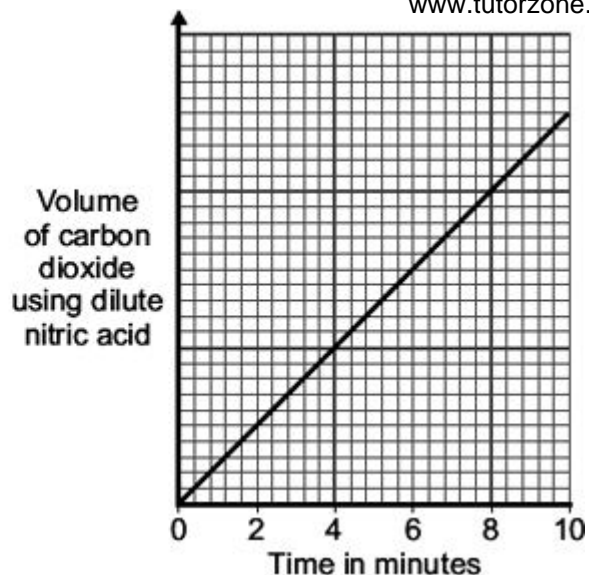
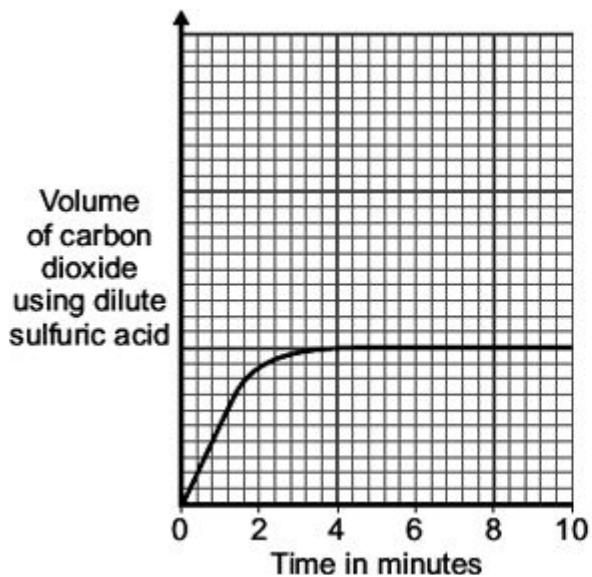
.....

.....

(2)

- (b) Gases from vehicle exhausts produce sulfuric acid and nitric acid.

A student investigated the reaction of these two acids with calcium carbonate (limestone). The type of acid was changed but all other variables were kept the same. The student measured the volume of carbon dioxide produced each minute for a total of 10 minutes. He did this first for the reaction between dilute sulfuric acid and a cube of calcium carbonate (limestone). The student repeated the experiment using dilute nitric acid in place of the dilute sulfuric acid. The results are shown below.



(i) State **two** variables that must be kept the same for this investigation.

.....

.....

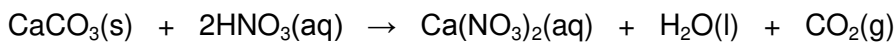
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(2)

- (i) Reacting calcium carbonate with sulfuric acid gave different results to nitric acid.

The symbol equations for the reaction of calcium carbonate with sulfuric acid and with nitric acid are shown below.



Describe how the results for sulfuric acid are different **and** use the symbol equations to explain this difference.

.....

.....

.....

.....

.....

.....

.....

.....

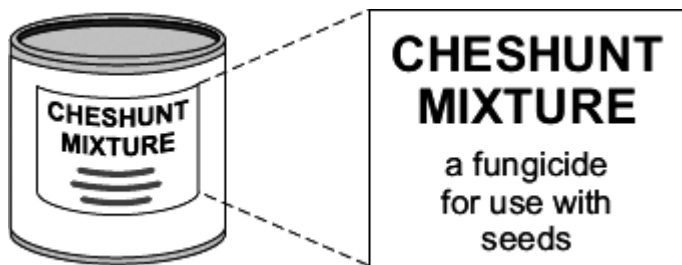
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.....

(3)
(Total 7 marks)

9

Cheshunt mixture is a powder containing copper sulfate, CuSO_4 , and ammonium carbonate, $(\text{NH}_4)_2\text{CO}_3$



- (a) A student tested the Cheshunt mixture.
- (i) Hydrochloric acid was added.
A gas was produced that turned limewater milky.

Complete the sentence.

The gas was which shows
that ions are in the mixture.

(2)

- (ii) Sodium hydroxide solution was added.
A gas was produced that indicates that ammonium ions are in the mixture.

Complete the sentence.

The gas was which turns
damp red blue.

(2)

- (b) Cheshunt mixture is dissolved in water before it is used.
When the student dissolved the Cheshunt mixture in water it formed a blue solution.

- (i) Suggest how the student knew that copper ions are in this solution.

.....
.....

(1)

- (ii) The student tested the Cheshunt solution and the result of the test indicated that sulfate ions are in the solution.

Complete the sentence.

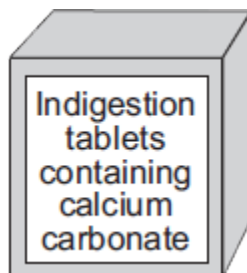
The student added a solution of in the presence of
dilute hydrochloric acid and a precipitate was produced.

(2)

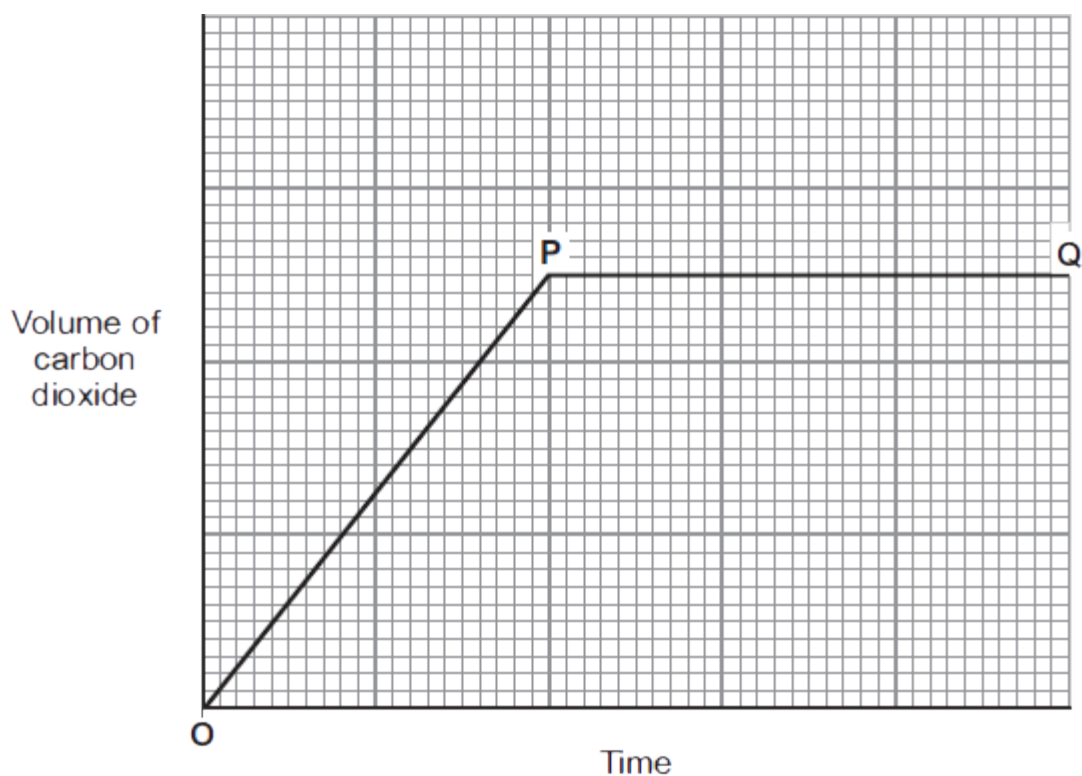
(Total 7 marks)

10

Human stomachs contain hydrochloric acid.
Stomach ache can be caused by too much acid in the stomach.
Indigestion tablets can be used to reduce the amount of acid in the stomach.



- (a) The graph shows how the volume of carbon dioxide produced changes with time, after some calcium carbonate is added to hydrochloric acid.



- (i) Complete the sentence to explain what happens between **O** and **P**.

Between **O** and **P** the calcium carbonate and hydrochloric acid

(1)

- (ii) Complete the sentence to explain what happens at **P**.

At **P** the calcium carbonate and hydrochloric acid

because

(2)

(iii) Describe the test for carbon dioxide gas.

Test

Result of the test

(2)

(b) Calcium carbonate is found in limestone.
Limestone is removed from the ground by quarrying.



Photograph supplied by Stockbyte/Thinkstock

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of quarrying limestone.

| Statement | Advantage Tick (✓) | Disadvantage Tick (✓) |
|--|-----------------------|--------------------------|
| Quarrying limestone destroys the shells and skeletons of marine organisms that formed the limestone. | | |
| Quarrying limestone releases dust, and lorries release carbon dioxide from burning diesel fuel. | | |
| Quarrying limestone provides building materials, employment and new road links. | | |
| Quarrying limestone removes ores from the ground. | | |

(2)

(Total 7 marks)

11

A student investigated an egg shell.



Trish Steel [CC-BY-SA-2.0], via Wikimedia Commons

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

(i) **Test 1**

Dilute hydrochloric acid was added to the egg shell.

Carbon dioxide gas was produced which turned limewater

milky.

blue.

red.

This test shows that the egg shell must contain

carbonate ions.

chloride ions.

sulfate ions.

(2)

(ii) **Test 2**

The student then did a flame test.

He used the solution remaining after dilute hydrochloric acid was added to the egg shell.

The flame test showed that the egg shell contained calcium ions because

the flame was

| |
|--------|
| red. |
| blue. |
| lilac. |

(1)

- (b) Some scientists investigated the amount of lead found in egg shells. They used a modern instrumental method which was more *sensitive* and more *accurate* than older methods.

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

The modern instrumental method is more *sensitive*, which means that

it can measure

| |
|-------------|
| larger |
| much larger |
| smaller |

amounts of lead than older methods.

(1)

- (ii) Tick (✓) the meaning of more *accurate*.

| | Tick (✓) |
|--|----------|
| The measurement is given to more decimal places. | |
| The answer obtained is closer to the true value. | |
| The equipment used is more expensive. | |

(1)
(Total 5 marks)

12

A student investigated an egg shell.



Trish Steel [CC-BY-SA-2.0], via Wikimedia Commons

(a) The student did some tests on the egg shell.

The student's results are shown in the table below.

| Test | | Observation |
|------|---|---|
| 1 | Dilute hydrochloric acid was added to the egg shell. | A gas was produced. The egg shell dissolved, forming a colourless solution. |
| 2 | A flame test was done on the colourless solution from test 1. | The flame turned red. |
| 3 | Sodium hydroxide solution was added to the colourless solution from test 1. | A white precipitate formed that did not dissolve in excess sodium hydroxide solution. |
| 4 | Silver nitrate solution was added to the colourless solution from test 1. | A white precipitate formed. |

(i) The student concluded that the egg shell contains carbonate ions.

Describe how the student could identify the gas produced in test 1.

.....

.....

.....

.....

(ii) The student concluded that the egg shell contains aluminium ions.

Is the student's conclusion correct? Use the student's results to justify your answer.

.....
.....
.....
.....

(2)

(iii) The student concluded that the egg shell contains chloride ions.

Is the student's conclusion correct? Use the student's results to justify your answer.

.....
.....
.....
.....

(2)

(b) Some scientists wanted to investigate the amount of lead found in egg shells. They used a modern instrumental method which was *more sensitive* than older methods.

(i) Name **one** modern instrumental method used to identify elements.

.....
.....

(1)

(ii) What is the meaning of *more sensitive*?

.....
.....

(1)

(Total 8 marks)

13

Read the information in the box and then answer the questions.

Seidlitz Powder is a medicine.

Seidlitz Powder comes as two powders. One powder is wrapped in white paper and contains tartaric acid. The other powder is wrapped in blue paper and contains sodium hydrogencarbonate.

The contents of the blue paper are dissolved in water and the contents of the white paper are added. This causes a reaction that produces carbon dioxide gas. The mixture is safe to drink when the reaction stops.

- (a) Suggest why Seidlitz Powder comes as two separate powders.

.....

(1)

- (b) The reaction produces carbon dioxide gas.

- (i) What would you see during the reaction?

.....

(1)

- (ii) Which state symbol in a chemical equation shows that carbon dioxide is a gas?

Draw a ring around **one** answer.

(s)

(l)

(aq)

(g)

(1)

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

Carbon dioxide can be identified because it turns

limescale

limestone

limewater

milky.

(1)

- (c) Sodium hydrogencarbonate contains sodium ions. Sodium ions can be identified by flame tests.

Draw a ring around the correct answer to complete the sentence.

Sodium ions give
a

| |
|--------|
| blue |
| red |
| yellow |

flame.

(1)

- (d) Some Seidlitz Powder was bought on the Internet for £5. However, when tested, it was found to be only magnesium sulfate, worth a few pence.

Draw a ring around the correct answer to complete each sentence.

(i) The test for sulfate ions uses

| |
|------------------|
| barium chloride |
| silver nitrate |
| sodium hydroxide |

solution.

(1)

(ii) A positive test for sulfate ions produces
a

| |
|-------|
| blue |
| red |
| white |

precipitate..

(1)

- (iii) Suggest **one** disadvantage of buying medicines on the Internet.

.....
.....

(1)

(Total 8 marks)

14

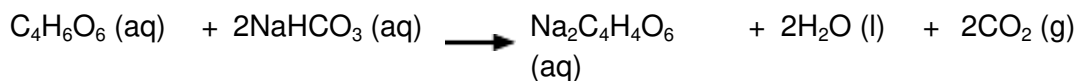
Read the information in the box and then answer the questions.

Seidlitz Powder is the name of a medicine.

Seidlitz Powder comes as two powders. One powder is wrapped in white paper and contains tartaric acid ($C_4H_6O_6$). The other powder is wrapped in blue paper and contains potassium sodium tartrate ($KNaC_4H_4O_6$) and sodium hydrogencarbonate ($NaHCO_3$).

The contents of the blue paper are completely dissolved in water and then the contents of the white paper are added.

The equation which represents this reaction is:



- (a) Describe and give the result of a test to identify the gas produced in this reaction.

.....

(2)

- (b) One of the chemicals in Seidlitz Powder is potassium sodium tartrate ($KNaC_4H_4O_6$).

Suggest why it would be difficult to identify **both** potassium ions and sodium ions in potassium sodium tartrate using a flame test.

.....

(1)

(c) Some Seidlitz Powder was bought on the Internet. However, when tested, it was found to be only magnesium sulfate.

(i) Describe and give the result of a chemical test to show that magnesium sulfate contains sulfate ions.

Test

.....

Result

.....

(2)

(ii) Magnesium sulfate contains magnesium ions.

Describe what you **see** when sodium hydroxide solution is added to a solution of magnesium sulfate.

.....

.....

(1)

(Total 6 marks)

15

A bottle of washing soda was found in a school laboratory. The modern name of washing soda is sodium carbonate.



A student tested the washing soda to prove that it was sodium carbonate.

(a) The student did a flame test to show that washing soda is a sodium compound.

The student used a clean wire to put the washing soda into the flame.

(i) Why should the wire be clean when used for a flame test?

.....

(1)

(ii) The table shows some properties of metals.

Two of these are properties that the wire must have if it is used for a flame test.

Put a tick (✓) next to the **two** correct properties.

| Property | (✓) |
|---------------------------|-----|
| Good electrical conductor | |
| High density | |
| High melting point | |
| Low boiling point | |
| Unreactive | |

(2)

(iii) Which **one** of the following flame colours shows that washing soda is a sodium compound?

Draw a ring around your answer.

brick-red lilac yellow-orange

(1)

(b) The student used dilute hydrochloric acid to show that washing soda was a carbonate. Carbon dioxide gas was given off.

(i) Describe what you **see** happening when a gas is given off.

.....

(1)

(ii) The student used limewater to prove that the gas given off was carbon dioxide.

Complete this sentence by choosing the correct word from the box.

| | | |
|--------------|-------------------|--------------|
| clear | colourless | milky |
|--------------|-------------------|--------------|

When carbon dioxide reacts with limewater, the limewater turns

.....

(1)

(c) Instrumental methods are used to identify chemicals.

Describe some advantages of instrumental methods compared with chemical tests by considering:

- the length of time needed to carry out a test
- the amount of chemical used.

.....

.....

.....

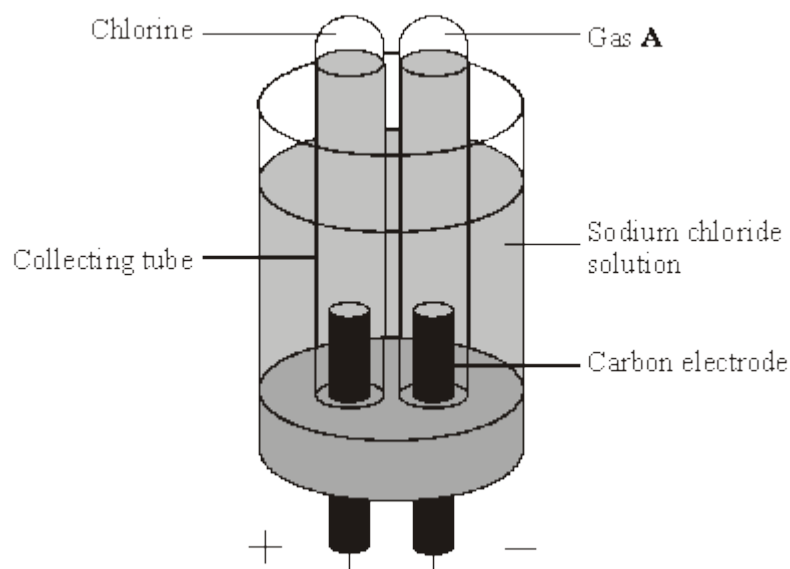
.....

.....

(2)
(Total 8 marks)

16

The electrolysis of sodium chloride solution is an important industrial process. The apparatus shown below can be used to show this electrolysis in the laboratory.



(a) Name gas A.

(1)

(b) Chlorine is produced at the positive electrode. Describe and give the result of a chemical test to prove that the gas is chlorine.

.....
.....
.....
.....

(2)

(c) Chloride ions move to the positive electrode. Explain why.

.....
.....

(1)

(d) A small quantity of chlorine is added to drinking water. Explain why.

.....
.....

(1)

(e) The solution around the negative electrode becomes alkaline. Name the ion which makes the solution alkaline.

.....
.....

(1)

(Total 6 marks)

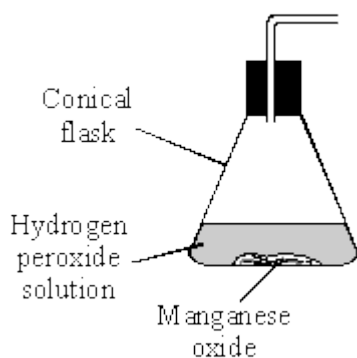
- (b) The rate of decomposition of hydrogen peroxide at room temperature is very slow. Manganese oxide is a catalyst which can be used to speed up the decomposition. Complete the sentence.

A catalyst is a substance which speeds up a chemical reaction. At the end of the reaction, the catalyst is

(1)

- (c) Two experiments were carried out to test if the amount of manganese oxide, MnO_2 affected the rate at which the hydrogen peroxide decomposed.

- (i) Complete the diagram to show how you could measure the volume of oxygen formed during the decomposition.

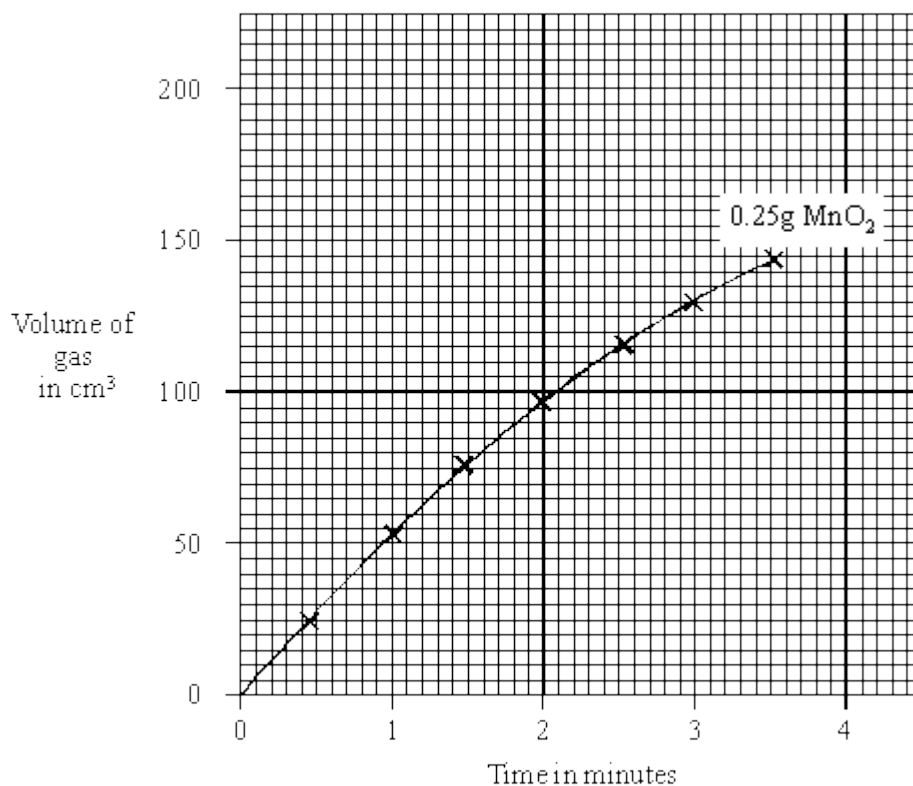


(2)

(ii) The results are shown in the table.

| | | | | | | | | |
|---|---|-----|----|-----|-----|-----|-----|-----|
| Time in minutes | 0 | 0.5 | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 |
| Volume of gas in cm³ using 0.25 g MnO₂ | 0 | 29 | 55 | 77 | 98 | 116 | 132 | 144 |
| Volume of gas in cm³ using 2.5 g MnO₂ | 0 | 45 | 84 | 118 | 145 | 162 | 174 | 182 |

Draw a graph of these results. The graph for 0.25 g MnO₂ has been drawn for you.



(3)

(iii) Explain why the slopes of the graphs become less steep during the reaction.

.....

.....

.....

(2)

- (iv) The same volume and concentration of hydrogen peroxide solution was used for both experiments. What **two** other factors must be kept the same to make it a fair test?

1

.....

2

.....

(2)

(Total 15 marks)

19

Acids and bases are commonly found around the home.

- (a) Baking powder contains sodium hydrogencarbonate mixed with an acid.

- (i) When water is added, the baking powder releases carbon dioxide. How could you test the gas to show that it is carbon dioxide?

Test

Result of test

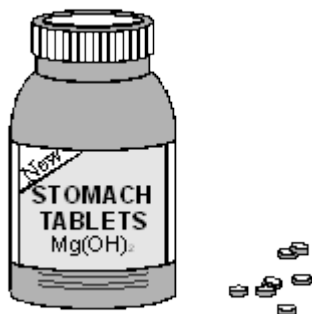
(2)

- (ii) Complete and balance the chemical equation for the reaction of sodium hydrogencarbonate with sulphuric acid.

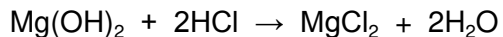


(2)

- (b) Indigestion tablets contain bases which cure indigestion by neutralising excess stomach acid.



- (i) One type of indigestion tablet contains magnesium hydroxide. This base neutralises stomach acid as shown by the balanced chemical equation.



Write a balanced **ionic** equation for the neutralisation reaction.

.....

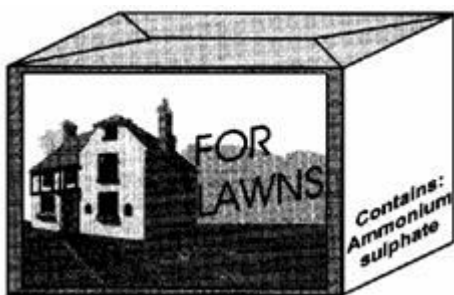
(2)

- (ii) How does the pH in the stomach change after taking the tablets?

.....

(1)

- (c) Ammonium sulphate is used as a lawn fertiliser.



Using ammonia solution, describe how you would make the fertiliser ammonium sulphate.

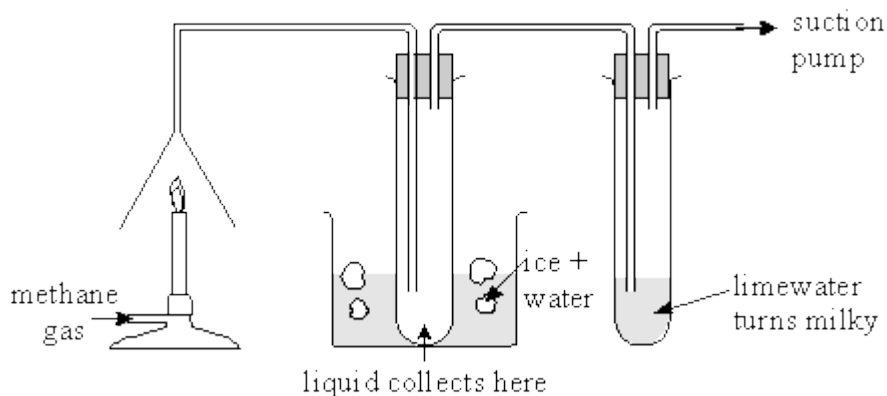
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(3)

(Total 10 marks)

20

Methane CH_4 contains the elements carbon and hydrogen only. A student wanted to find out which new substances are produced when methane is burned. The student set up the apparatus shown below.



- (a) Which gas in the air reacts with methane when it burns?

.....

(1)

- (b) Name the liquid collected.

.....

(1)

- (c) Name the gas which turns limewater milky.

.....

(1)

- (d) When methane burns an exothermic reaction takes place. What is meant by an exothermic reaction?

.....

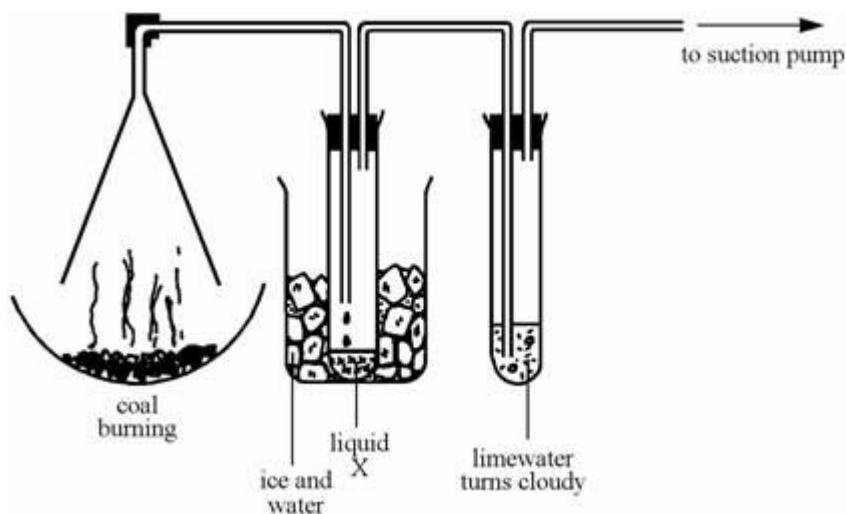
.....

(2)

(Total 5 marks)

21

The gases produced when coal burns are cooled by ice and then bubbled through limewater.



(a) Complete these sentences.

- (i) The coal is reacting with when it burns.
- (ii) During burning, elements in the coal are converted to compounds called

(2)

(b) Choose words from this list to complete the sentences.

carbon carbon dioxide sulphur sulphur dioxide
sodium water

- (i) Liquid X is a compound made from hydrogen and oxygen.
It is called
- (ii) Sulphur dioxide is an acidic gas. It is given off when coal burns, because coal contains the element
- (iii) Most fuels are compounds of hydrogen and

(3)

(c) Burning coal is an exothermic reaction.

Explain what "exothermic" means.

.....

(1)

(d) (i) Which gas turns limewater cloudy?

.....

(ii) Which element in the coal is oxidised to form this gas?

.....

(2)
(Total 8 marks)

22

Choose words from this list to complete the sentences,

- ammonia** **carbon dioxide** **hydrogen** **nitrogen**
- electrical** **heat** **solar** **sound**

(a) In air, the two most common gases are oxygen and

(b) When natural gas burns, energy is released mainly as

(c) When natural gas burns, a gas is produced which turns limewater milky.

The gas is

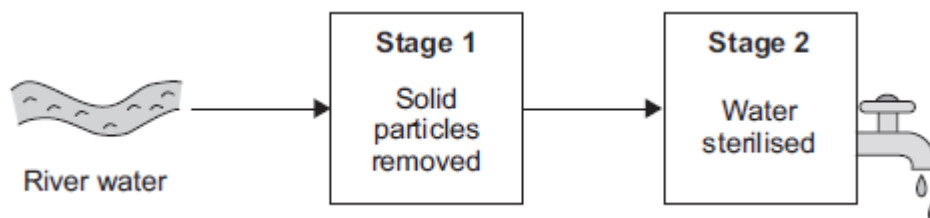
(Total 3 marks)

23

This question is about water.

River water needs to be treated before it is safe to drink.

(a) The diagram shows two stages of the treatment of river water.



(i) What is the name of the process used to remove solid particles in **Stage 1**?

Tick (✓) **one** box.

Crystallisation

Fermentation

Filtration

(1)

(ii) What is added in **Stage 2** to sterilise the water?

Tick (✓) **one** box.

Chlorine

Fluoride

Potassium

(1)

(b) Toxic substances in river water are removed by adding very small amounts of iron oxide nanoparticles.

(i) How is the size of nanoparticles different from normal-sized particles?

.....
.....

(1)

(ii) Nanoparticles are needed in only very small amounts.

Suggest why.

.....
.....

(1)

(c) In certain areas of the UK, tap water contains aluminium ions.

What would you **see** when sodium hydroxide solution is added drop by drop to tap water containing aluminium ions?

.....
.....
.....
.....

(2)

(Total 6 marks)

24

This question is about atoms.

Atoms contain electrons, neutrons and protons.

(a) (i) Which of these particles has a positive charge?

Tick (✓) **one** box.

Electron

Neutron

Proton

(1)

(ii) Which of these particles does **not** have an electrical charge?

Tick (✓) **one** box.

Electron

Neutron

Proton

(1)

(b) How are the elements in the periodic table arranged?

Tick (✓) **one** box.

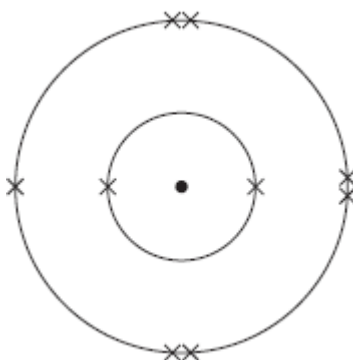
In order of increasing atomic number

In order of increasing mass number

In order of increasing reactivity

(1)

(c) The diagram shows the arrangement of the electrons in an atom of fluorine.



(i) How many protons are in an atom of fluorine?

Tick (✓) **one** box.

2

7

9

(1)

- (ii) The boiling point of fluorine is $-188\text{ }^{\circ}\text{C}$.

What is the state of fluorine at room temperature?

Tick (✓) **one** box.

Solid

Liquid

Gas

(1)

- (d) Fluorine reacts with copper to form an ionic compound.

- (i) Explain, in terms of electrons and electronic structure, what happens to a fluorine atom when it reacts with copper.

Use Above **Figure** to help you to answer this question.

.....
.....
.....
.....
.....

(2)

- (ii) Describe a chemical test which would show that a solution contains copper(II) ions.

.....
.....
.....
.....
.....

(2)

(Total 9 marks)

25

This question is about chemical tests.

- (a) Solutions of copper(II) ions and iron(III) ions produce coloured precipitates with sodium hydroxide solution.

Draw **one** line from each metal ion to the colour of the precipitate it produces.

| Metal ion | Colour of precipitate |
|---------------------------------|-----------------------|
| Copper(II) (Cu^{2+}) | Blue |
| | Brown |
| | Green |
| Iron(III) (Fe^{3+}) | White |

(2)

- (b) Sodium hydroxide solution was added to a solution containing ions of a metal.

A white precipitate was produced. The white precipitate dissolved in excess sodium hydroxide solution.

Use the correct answer from the box to complete the sentence.

aluminium magnesium potassium

The ions in the solution were ions of

(1)

- (c) Low sodium salt contains sodium chloride and potassium chloride.

A student used a flame test on low sodium salt.

- (i) What is the colour produced by sodium ions in a flame test?

.....

(1)

- (ii) What is the colour produced by potassium ions in a flame test?

.....

(1)

- (iii) Why is it
- not**
- possible to tell from the flame test that both ions are present in low sodium salt?

.....

.....

(1)

(Total 6 marks)

26

This question is about chemical analysis.

- (a) A student has solutions of three compounds,
- X**
- ,
- Y**
- and
- Z**
- .

The student uses tests to identify the ions in the three compounds.

The student records the results of the tests in the table.

| Compound | Test | | | |
|----------|--------------|-------------------------------|--|---|
| | Flame test | Add sodium hydroxide solution | Add hydrochloric acid and barium chloride solution | Add nitric acid and silver nitrate solution |
| X | no colour | green precipitate | white precipitate | no reaction |
| Y | yellow flame | no reaction | no reaction | yellow precipitate |
| Z | no colour | brown precipitate | no reaction | cream precipitate |

Identify the **two** ions present in each compound, **X**, **Y** and **Z**.

X

Y

Z

(3)

- (b) A chemist needs to find the concentration of a solution of barium hydroxide. Barium hydroxide solution is an alkali.

The chemist could find the concentration of the barium hydroxide solution using two different methods.

Method 1

- An excess of sodium sulfate solution is added to 25 cm³ of the barium hydroxide solution. A precipitate of barium sulfate is formed.
- The precipitate of barium sulfate is filtered, dried and weighed.
- The concentration of the barium hydroxide solution is calculated from the mass of barium sulfate produced.

Method 2

- 25 cm³ of the barium hydroxide solution is titrated with hydrochloric acid of known concentration.
- The concentration of the barium hydroxide solution is calculated from the result of the titration.

Compare the advantages and disadvantages of the two methods.

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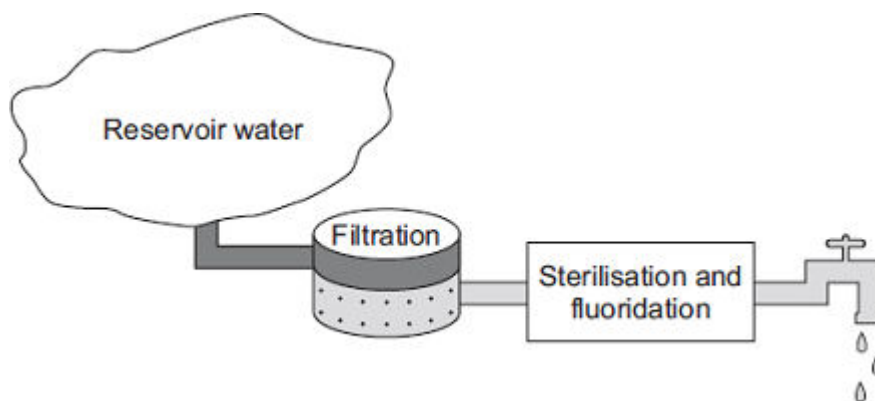
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(5)
(Total 8 marks)

27

The diagram shows three stages in the treatment of reservoir water.



(a) (i) What is separated from the reservoir water during filtration?

Tick (✓) **one** box.

Bacteria

Dissolved nitrates

Solids

(1)

(ii) What is added to sterilise the water?

Tick (✓) **one** box.

Calcium

Chlorine

Magnesium

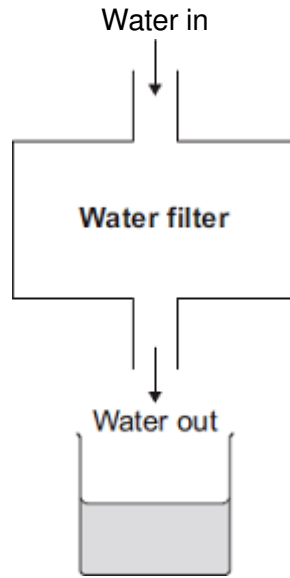
(1)

(iii) State **one** advantage of adding fluoride to drinking water.

.....
.....

(1)

(b) The diagram shows a water filter used in the home.



A student collected a sample of water from the filter.

The student could show that the filtered water contains dissolved salts without using a chemical test.

Describe how.

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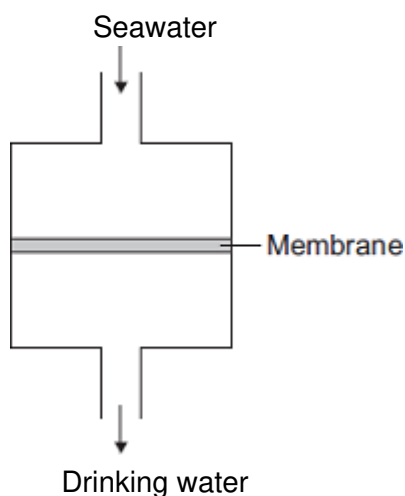
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(2)

- (c) Seawater is forced through a membrane to make drinking water.



Suggest why water molecules can pass through the membrane, but sodium ions and chloride ions cannot.

.....

.....

(1)
(Total 6 marks)

28

A student was investigating a magnesium salt, **X**.

The student found that **X**:

- has a high melting point
- does not conduct electricity
- dissolves in water and the solution conducts electricity.

- (a) (i) What is the type of bonding in magnesium salt **X**?

.....

(1)

- (ii) Explain why solid **X** does **not** conduct electricity but a solution of **X** does conduct electricity.

.....

.....

.....

.....

(2)

(b) The student dissolved **X** in water.

The student added dilute nitric acid and silver nitrate solution to the solution of **X**.

A white precipitate was formed.

Salt **X** contains chloride ions.

Explain why a white precipitate was formed.

.....
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.....

(2)

(c) The student dissolved **X** in water.

The student added a few drops of sodium hydroxide solution to the solution of **X**.

A white precipitate was formed.

(i) Salt **X** contains magnesium ions.

Name **two** other metal ions that would give a white precipitate when a few drops of sodium hydroxide solution are added.

1

2

(2)

- (ii) Describe the **two** further tests the student would have to do to show that salt **X** contains magnesium ions, and **not** the two metal ions you identified in part (c) (i).

Give the expected results of each test.

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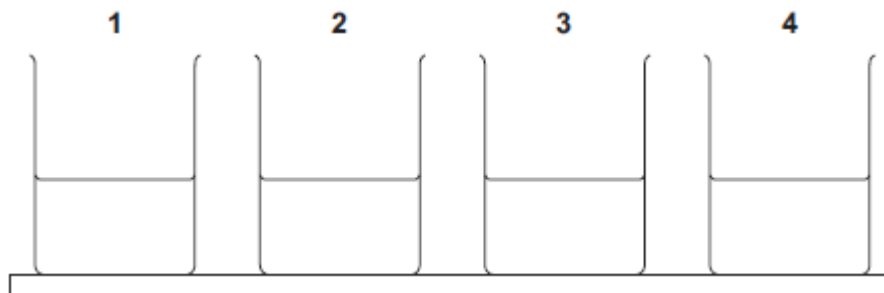
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(4)
(Total 11 marks)

29

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

A group of students had four different colourless solutions in beakers **1**, **2**, **3** and **4**, shown in the figure below.



The students knew that the solutions were

- sodium chloride
- sodium iodide
- sodium carbonate
- potassium carbonate

but did **not** know which solution was in each beaker.

The teacher asked the class to plan a method that could be used to identify each solution.

She gave the students the following reagents to use:

- dilute nitric acid
- silver nitrate solution.

The teacher suggested using a flame test to identify the positive ions.

Outline a method the students could use to identify the four solutions.

You should include the results of the tests you describe.

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(Total 6 marks)

30

- (a) The colours of fireworks are produced by chemicals.



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Three of these chemicals are lithium sulfate, potassium chloride and sodium nitrate.

- (i) A student wants to carry out flame tests on these three chemicals.

Describe how to carry out a flame test.

.....

.....

.....

.....

(2)

- (ii) Draw **one** line from each chemical to the correct flame colour.

The first one has been done for you.

| Chemical | Flame colour |
|--------------------|--------------|
| lithium sulfate | green |
| potassium chloride | crimson |
| sodium nitrate | yellow |
| | lilac |

(2)

- (iii) Dilute nitric acid and silver nitrate solution are added to solutions of the three chemicals.

A white precipitate forms in one of the solutions.

Which chemical produces the white precipitate?

.....

(1)

- (b) The student tests a fourth chemical, **X**.

- (i) The student adds sodium hydroxide solution to a solution of chemical **X**.

A blue precipitate is formed.

Which metal ion is in chemical **X**?

.....

(1)

- (ii) The student adds dilute hydrochloric acid to a solution of chemical **X** and then adds barium chloride solution.

A white precipitate is formed.

Which negative ion is in chemical **X**?

Draw a ring around the correct answer.

chloride

nitrate

sulfate

(1)

(Total 7 marks)

31

The colours of fireworks are produced by chemicals.



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- (a) Information about four chemicals is given in the table.

Complete the table below.

| Chemical | Colour produced in firework |
|-----------------|-----------------------------|
| barium chloride | green |
| carbonate | crimson |
| sodium nitrate | |
| calcium sulfate | red |

(2)

- (b) Describe a test to show that barium chloride solution contains chloride ions.

Give the result of the test.

.....

.....

.....

.....

(2)

(c) A student did two tests on a solution of compound **X**.

Test 1

Sodium hydroxide solution was added.

A blue precipitate was formed.

Test 2

Dilute hydrochloric acid was added.

Barium chloride solution was then added.

A white precipitate was formed.

The student concluded that compound **X** is iron(II) sulfate.

Is the student's conclusion correct?

Explain your answer.

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(3)
(Total 7 marks)

32

Four bottles of chemicals made in the 1880s were found recently in a cupboard during a Health and Safety inspection at Lovell Laboratories.



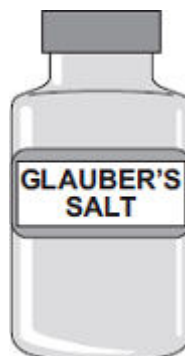
Sodium carbonate



Sodium chloride



Sodium nitrate



Sodium sulfate

The chemical names are shown below each bottle.

(a) You are provided with the following reagents:

- aluminium powder
- barium chloride solution acidified with dilute hydrochloric acid
- dilute hydrochloric acid
- silver nitrate solution acidified with dilute nitric acid
- sodium hydroxide solution.
- limewater
- red litmus paper

(i) Describe tests that you could use to show that these chemicals are correctly named.

In each case give the reagent(s) you would use **and** state the result.

Test and result for carbonate ions:

.....

.....
Test and result for chloride ions:

.....
.....
.....

Test and result for nitrate ions:

.....
.....
.....

Test and result for sulfate ions:

.....
.....
.....

(4)

(ii) Suggest why a flame test would **not** distinguish between these four chemicals.

.....

(1)

(b) Instrumental methods of analysis linked to computers can be used to identify chemicals.

Give **two** advantages of using instrumental methods of analysis.

.....
.....
.....
.....

(2)

(Total 7 marks)

33

Low sodium salt is used on food. This label is from a packet of low sodium salt.



A student tests the low sodium salt for the substances on the label.

(a) (i) The same test can be used to identify sodium ions and potassium ions.

Describe the test.

Give the result of the test for sodium ions and for potassium ions.

.....
.....
.....
.....
.....
.....
.....
.....
.....

(3)

(ii) It is difficult to identify potassium ions when sodium ions are present.

Suggest why.

.....
.....

(1)

- (b) Describe how the student would test a solution of the low sodium salt for chloride ions.

Give the result of the test.

.....
.....
.....
.....
.....
.....

(3)

- (c) To test for magnesium ions, the student adds a few drops of sodium hydroxide solution to a solution of the low sodium salt.

A white precipitate is produced.

This test also gives a white precipitate with aluminium ions and calcium ions.

- (i) Describe how the student could confirm that the low sodium salt contains magnesium ions and **not** aluminium ions.

.....
.....
.....
.....
.....

(2)

- (ii) Describe a test the student could do to confirm that the low sodium salt does **not** contain calcium ions.

.....
.....
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.....
.....

(2)

(Total 11 marks)

Read the information about protecting the bottoms of ships.

A Copper-bottomed Investment



From the 16th to the 19th century, the bottoms of many wooden ships were protected from marine organisms by being covered with sheets of metal.

At first lead was used on the bottoms of ships, then copper was used until 1832 when Muntz Metal replaced it. Muntz Metal is an alloy of two transition metals, copper and zinc.

Table of data

| | Lead | Copper | Muntz Metal |
|---|-------------|---------------|--------------------|
| Cost (£/kg) | £1.20 | £3.20 | £2.30 |
| Melting point (°C) | 327 | 1083 | 904 |
| Stops sea worms attacking wood | Yes | Yes | Yes |
| Stops barnacles and seaweed sticking to the bottom of the ship | No | Yes | Yes |

- (a) Use the information to answer the following questions.
- (i) Suggest why copper replaced lead.

.....
.....

(1)

(ii) Suggest why Muntz Metal replaced copper.

.....
.....

(1)

(b) A sample of Muntz Metal contains a very small amount of iron as an impurity.

(i) Name an instrumental method of analysis that could be used to detect iron.

.....

(1)

(ii) Suggest why an instrumental method would detect the iron in this sample of Muntz Metal but a chemical method is **not** likely to be successful.

.....
.....

(1)

(c) Today, ships are made from steel. Steels are alloys of iron, a transition metal.

Give **two** properties of transition metals that make them suitable for making ships.

Property 1

.....

Property 2

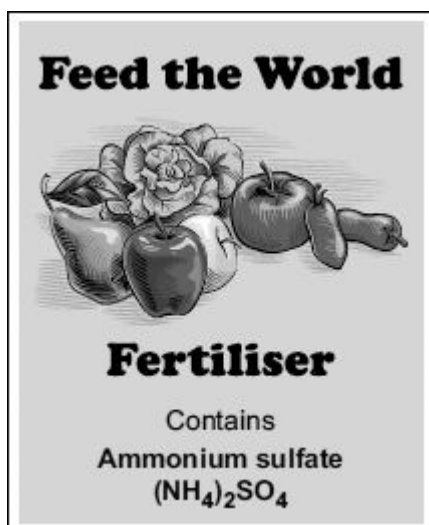
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(2)

(Total 6 marks)

35

Ammonium sulfate is an artificial fertiliser.



- (a) (i) When this fertiliser is warmed with sodium hydroxide solution, ammonia gas is given off.
Describe and give the result of a test for ammonia gas.

Test

.....

Result

.....

(2)

- (ii) Describe and give the result of a chemical test to show that this fertiliser contains sulfate ions (SO_4^{2-}).

Test

.....

Result

.....

(2)

- (b) Ammonium sulfate is made by reacting sulfuric acid (a *strong* acid) with ammonia solution (a *weak* alkali).

- (i) Explain the meaning of *strong* in terms of ionisation.

.....

(1)

- (ii) A student made some ammonium sulfate in a school laboratory.

The student carried out a titration, using a suitable indicator, to find the volumes of sulfuric acid and ammonia solution that should be reacted together.

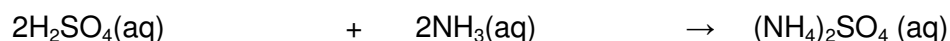
Name a suitable indicator for strong acid-weak alkali titrations.

.....

(1)

- (iii) The student found that 25.0 cm³ of ammonia solution reacted completely with 32.0 cm³ of sulfuric acid of concentration 0.050 moles per cubic decimetre.

The equation that represents this reaction is:



Calculate the concentration of this ammonia solution in moles per cubic decimetre.

.....
.....
.....
.....
.....

Concentration = moles per cubic decimetre

(3)

- (iv) Use your answer to (b)(iii) to calculate the concentration of ammonia in grams per cubic decimetre.

(If you did not answer part (b)(iii), assume that the concentration of the ammonia solution is 0.15 moles per cubic decimetre. This is **not** the correct answer to part (b)(iii).)

Relative formula mass of ammonia (NH_3) = 17.

.....

Concentration = grams per cubic decimetre

(2)
 (Total 11 marks)

36

Alums are salts. They have been used since ancient times in dyeing and medicine and still have many uses today.

Three alums are shown in the table:

| Name | Ions present |
|----------------|---|
| Ammonium alum | NH_4^+ Al^{3+} SO_4^{2-} |
| Potassium alum | K^+ Al^{3+} SO_4^{2-} |
| Sodium alum | Na^+ Al^{3+} SO_4^{2-} |

A student tested these alums to show which ions were present.

- (a) The student did a flame test on these alums. A sample of each alum was held on a wire in a colourless flame.

In (a)(i) and (a)(ii) use the correct word from the box to complete each sentence.

| | | | |
|-------------|--------------|---------------|--------------|
| blue | lilac | yellow | green |
|-------------|--------------|---------------|--------------|

- (i) Sodium ions give a flame.

(1)

- (ii) Potassium ions give a flame.

(1)

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

The wire used in a flame test should have a high

| |
|--------------------------|
| density. |
| electrical conductivity. |
| melting point. |

(1)

(b) Draw a ring around the correct word to complete the sentences.

(i) The student tested a solution of each salt for sulfate ions (SO_4^{2-}).

The student added dilute hydrochloric acid and

| |
|-----------------|
| barium chloride |
| nitric acid |
| silver nitrate |

solution and

a
white

| |
|--------|
| gas |
| liquid |
| solid |

was formed.

(2)

(ii) The student tested a solution of each salt for aluminium ions (Al^{3+}).

The student added sodium hydroxide solution and a

| |
|-------|
| green |
| red |
| white |

precipitate

was formed. When excess sodium hydroxide solution was added, the

precipitate

| |
|------------|
| boiled. |
| condensed. |
| dissolved. |

(2)

(Total 7 marks)

37

Alums are salts. They have been used since ancient times in dyeing and medicine and still have many uses today.

Three alums are shown in the table:

| Name | Ions present |
|----------------|---|
| Ammonium alum | NH_4^+ Al^{3+} SO_4^{2-} |
| Potassium alum | K^+ Al^{3+} SO_4^{2-} |
| Sodium alum | Na^+ Al^{3+} SO_4^{2-} |

- (a) These alums contain sulfate ions (SO_4^{2-}).

Describe and give the result of a chemical test to show this.

Test

.....

Result

.....

(2)

- (b) These alums contain aluminium ions (Al^{3+}).

Describe how sodium hydroxide solution can be used to show this.

.....

.....

.....

.....

.....

(2)

- (c) Aluminium ions do not give a colour in flame tests. However, flame tests can be used to distinguish between these three alums.

Explain how these three alums could be identified from the results of flame tests.

.....

.....

.....

.....

.....

(2)
(Total 6 marks)

38

Chemical tests can be used to detect and identify elements and compounds.

A jar of a chemical from 1870 is shown.



Copperas was a name used for iron(II) sulfate, FeSO_4 . It does not contain any copper!

(a) A student tested solutions of copperas to show which ions it contained.

Draw a ring around the correct answer to complete each sentence.

(i) The student tested for iron(II) ions, Fe^{2+}

The student added a solution of

barium chloride.
silver nitrate.
sodium hydroxide.

The colour of the precipitate formed was

green
red.
white

The precipitate was a

liquid.
gas.
solid

(3)

(ii) The student tested for sulfate ions, SO_4^{2-}

The student added dilute hydrochloric acid and

| |
|------------------|
| barium chloride |
| silver nitrate |
| sodium hydroxide |

solution.

The colour of the precipitate formed was

| |
|-------|
| green |
| red. |
| white |

Sulfuric acid (H_2SO_4) should **not** be used instead of hydrochloric acid (HCl) when

testing for sulfate ions. This is because sulfuric acid contains

| |
|----------------------------------|
| chloride ions, Cl^- |
| nitrate ions, NO_3^- |
| sulfate ions, SO_4^{2-} |

(3)

(b) A flame test can be used to identify the metal ions in a compound.

How do you carry out a flame test?

.....

(1)

(c) The elements in a compound can also be detected and identified using instrumental methods of analysis.

State **one** advantage of using instrumental methods compared with chemical tests.

.....

(1)

(Total 8 marks)

39

Ethene can be identified using instrumental methods.

- (i) Name **one** instrumental method used to identify elements or compounds.

.....

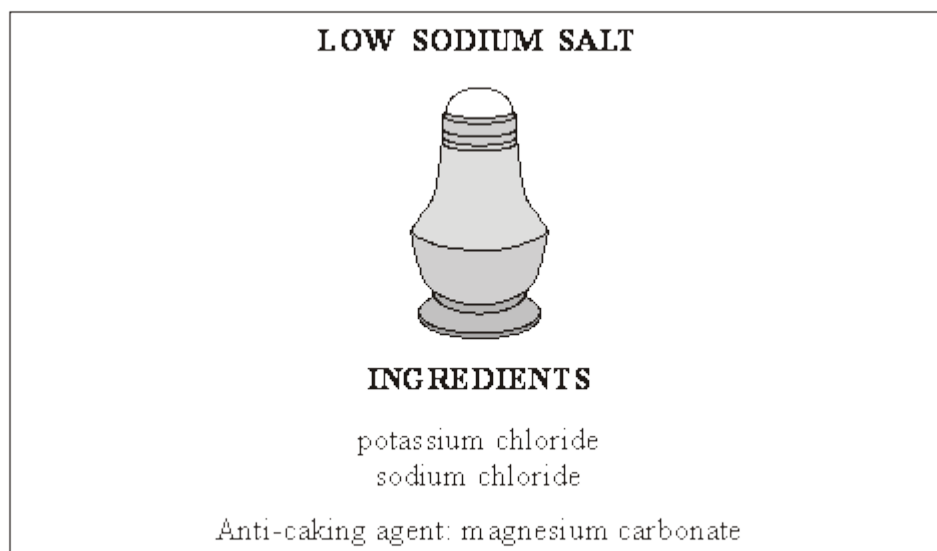
(1)

- (ii) Give **one** advantage of using instrumental methods compared with chemical tests.

.....

(1)**(Total 2 marks)****40**

The label is from a packet of Low Sodium Salt.



- (a) A student tested some Low Sodium Salt to show that it contains carbonate ions and chloride ions.

- (i) Describe and give the result of a test for carbonate ions.

.....

(2)

- (ii) A student identified chloride ions using acidified silver nitrate solution.

State what you would **see** when acidified silver nitrate solution is added to a solution of Low Sodium Salt.

.....

(1)

- (iii) Flame tests can be used to identify potassium ions and sodium ions.

Suggest why it is difficult to identify **both** of these ions in Low Sodium Salt using a flame test.

.....

.....

(1)

- (b) Read the following information and then answer the questions.

Salt – friend or foe?

Sodium chloride (salt) is an essential mineral for our health. It is used to flavour and preserve foods. Too much sodium in our diet may increase the risk of high blood pressure and heart disease. Heart disease is the biggest cause of death in the United Kingdom. Some people claim that excess sodium is a poison that can cause cancer, while others say that more evidence is needed.

Many processed foods contain salt, so it is easy to exceed the recommended daily upper limit of about 5 g of salt per person. A ‘healthier’ amount should be about 3 g. In the United Kingdom many people consume over 10 g of salt each day.

One way to reduce sodium in our diet is to use Low Sodium Salt. This has two thirds of the sodium chloride replaced by potassium chloride.

A national newspaper asked readers for their views on two options.

Option 1: Ban the use of sodium chloride in foods.

Option 2: Reduce the amount of sodium chloride in all foods to a ‘healthier’ level.

- (i) Suggest why Option **1** was rejected.

.....

.....

(1)

- (ii) Suggest **two** advantages and **one** disadvantage of Option 2.

.....

.....

.....

.....

.....

.....

.....

(3)
(Total 8 marks)

41

Chemical tests can be used to identify ions in solutions.

- (a) List **A** gives the names of two sulfates in solution.
List **B** gives the results of adding sodium hydroxide solution.

Draw a straight line from each sulfate in List **A** to its correct test result in List **B**.

List A

**Name of sulfate
in solution**

Copper sulfate

Iron(II) sulfate

List B

**Result of adding
sodium hydroxide solution**

A blue precipitate formed

A white precipitate formed

A green precipitate formed

(2)

- (b) Suggest why clean test tubes were used for each test.

.....

.....

(1)

(c) Draw a ring around the correct colour to complete this sentence.

Sulfate solutions react with barium chloride solution to give a

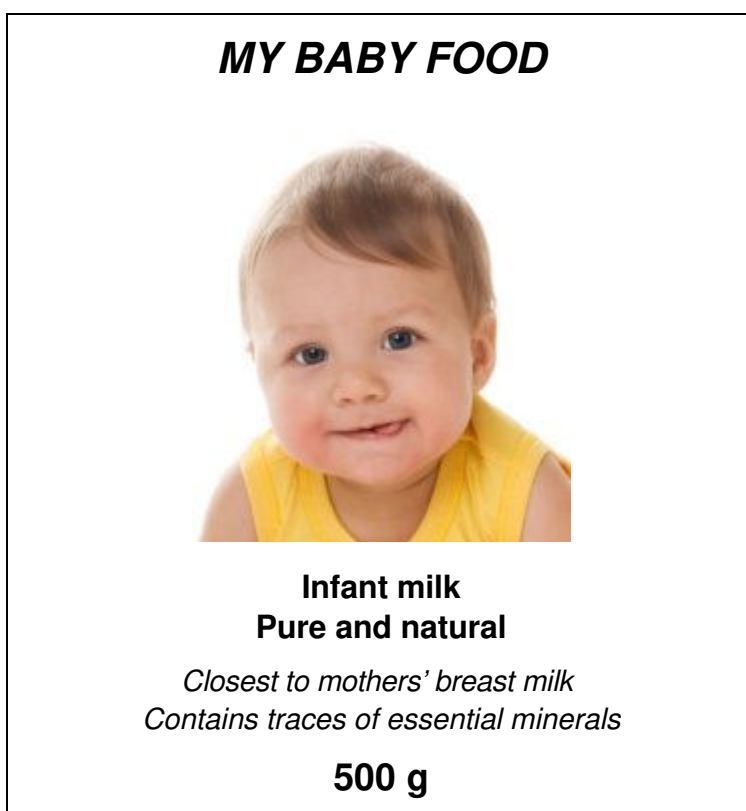
| |
|-------|
| blue |
| green |
| white |

precipitate.

(1)
(Total 4 marks)

42

This label has been taken from a packet of *My Baby Food*.



One of the minerals in *My Baby Food* is calcium carbonate, CaCO_3 .

(a) Chemical tests are used to identify elements and compounds.

- (i) A flame test can be used to identify calcium ions.
What colour do calcium ions give in a flame test?

.....

(1)

- (ii) When a flame test was carried out on *My Baby Food*, the presence of calcium ions was **not** seen. A yellow flame was produced.
Name the ion which gives a yellow flame test.

.....

(1)

- (iii) Suggest **one** advantage of using an instrumental method to detect the elements present in *My Baby Food*.

.....

.....

(1)

(iv) Name an instrumental method for detecting elements.

.....

(1)

(b) Read the information in the box below and then answer the question.

Calcium carbonate occurs naturally as marble and limestone. They are important building materials and are often used for gravestones.

Calcium carbonate is also an essential mineral for good health and is present in many baby foods in small amounts.

My Baby Food is recommended as being the closest to a mother's own breast milk. It is given free to mothers in the developing world – without it their babies might die of malnutrition.

Responsible Mothers Are Us (RMAU) is a United Kingdom pressure group. They want to ban chemicals in baby foods. The group was founded by Mrs I. M. Right who has made a career in 'goodness' and is paid from donations given to *RMAU* by members of the public.

When interviewed, she said: "Calcium carbonate is a chemical and so it is a pollutant. *My Baby Food* must be banned to prevent the mass medication of babies. I don't feed my baby the stuff of gravestones."

Many people do **not** agree with Mrs Right's ideas.

Suggest why.

.....
.....
.....
.....
.....
.....
.....

(3)
(Total 7 marks)

43

Chlorine and bromine are important Group 7 elements.

- (a) Explain why chlorine is added to drinking water.

.....

(1)

- (b) Describe what you would **see** when bromine water is added to an unsaturated organic compound.

.....

(1)

- (c) Bromine can be extracted from seawater. The dissolved bromide ions are reacted with chlorine. Bromine and chloride ions are formed.

- (i) Complete and balance the equation below, which represents the reaction between chlorine and bromide ions.



(1)

- (ii) Describe what you **see** when chlorine is added to a solution containing bromide ions.

.....

(1)

- (d) In terms of electronic structure:

- (i) state why bromine and chlorine are both in Group 7

.....

(1)

(ii) explain why bromine is less reactive than chlorine.

.....
.....
.....
.....
.....
.....
.....

(3)

(e) What is the result of adding acidified silver nitrate solution to a solution containing:

(i) chloride ions

.....

(1)

(ii) bromide ions?

.....

(1)

(Total 10 marks)

44

- (a) Four bottles of chemicals made in the 1880s were found recently in a cupboard during a Health and Safety inspection at Lovell Laboratories.



Sodium carbonate



Sodium chloride



Sodium nitrate



Sodium sulfate

The chemicals are correctly named.

You are provided with the following reagents:

- aluminium powder
- barium chloride solution acidified with dilute hydrochloric acid
- dilute hydrochloric acid
- silver nitrate solution acidified with dilute nitric acid
- sodium hydroxide solution.

(i) Describe tests to show that these chemicals are correctly named.

In each case give the reagent(s) you would use and state what you would see.

Test and result for carbonate ions:

.....
.....

Test and result for chloride ions:

.....
.....

Test and result for nitrate ions:

.....
.....

Test and result for sulfate ions:

.....
.....

(5)

(ii) Suggest why a flame test would **not** distinguish between these four chemicals.

.....

(1)

(b) Instrumental methods of analysis linked to computers can be used to identify chemicals.

Describe **two** advantages of using instrumental methods of analysis.

.....
.....
.....
.....

(2)

(Total 8 marks)

45

Chemical tests can be used to identify compounds.

- (a) List **A** gives the names of four compounds in solution. List **B** gives tests and the result of the tests.

Draw a straight line from each compound in List **A** to its test and test result in List **B**. The first one has been done for you.

| List A Name of compound in solution | List B Test and result of the test |
|---|--|
| Calcium chloride | Add barium chloride solution and dilute hydrochloric acid. A white precipitate formed. |
| Lithium sulphate | Do the flame test. Yellow flame produced. |
| Potassium carbonate | Add silver nitrate solution and dilute nitric acid. A white precipitate formed. |
| Sodium nitrate | Add hydrochloric acid. Carbon dioxide gas given off. |

(2)

- (b) State what you would **see** when sodium hydroxide solution reacts with copper sulphate solution.

.....

(2)

(Total 4 marks)

46

Chemical tests can be used to identify compounds.

The table shows the results of some tests carried out on three solutions, **A**, **B** and **C**.

| Solution | Flame Test | Hydrochloric acid is added | Sodium hydroxide solution is added | Silver nitrate solution is added |
|----------|------------|-----------------------------|---|----------------------------------|
| A | Yellow | Carbon dioxide gas produced | | |
| B | Brick-red | | White precipitate insoluble in excess sodium hydroxide solution | White precipitate |
| C | | | Dark green precipitate | |

Use the information in the table to identify solutions **A**, **B** and **C**.

Give the name of:

- (a) solution **A**; (2)
- (b) solution **B**; (2)
- (c) the metal ion in solution **C**. (1)
- (Total 5 marks)**