Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014

GCSE Chemistry

Unit 2

Foundation Tier

[GCH21]

GCH21

THURSDAY 19 JUNE, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided. Do not write outside the box, around each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **4(c)(iii)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

8566

DO NOT WRITE ON THIS PAGE

Examiner Only	
Marks	Remark

1 Many multivitamin supplements are produced as tablets which effervesce when added to water. The label of a multivitamin supplement is shown below.

Multivitamin Supplement

Niacin
Calcium carbonate
Vitamin B12
Sweeteners
Salt
Orange flavouring
Citric acid

In an experiment one multivitamin tablet was added to 50 cm^3 of water in a conical flask at a temperature of 20 °C. The flask was loosely stoppered with a cotton wool plug and placed on an electronic balance. A stopclock was started as soon as the tablet made contact with the water. The mass was recorded every 20 seconds.

(a) (i) Draw a labelled diagram of the assembled apparatus used to carry out this experiment. **Include all apparatus**.

[4]

(ii) Explain the purpose of the cotton wool plug.

_____

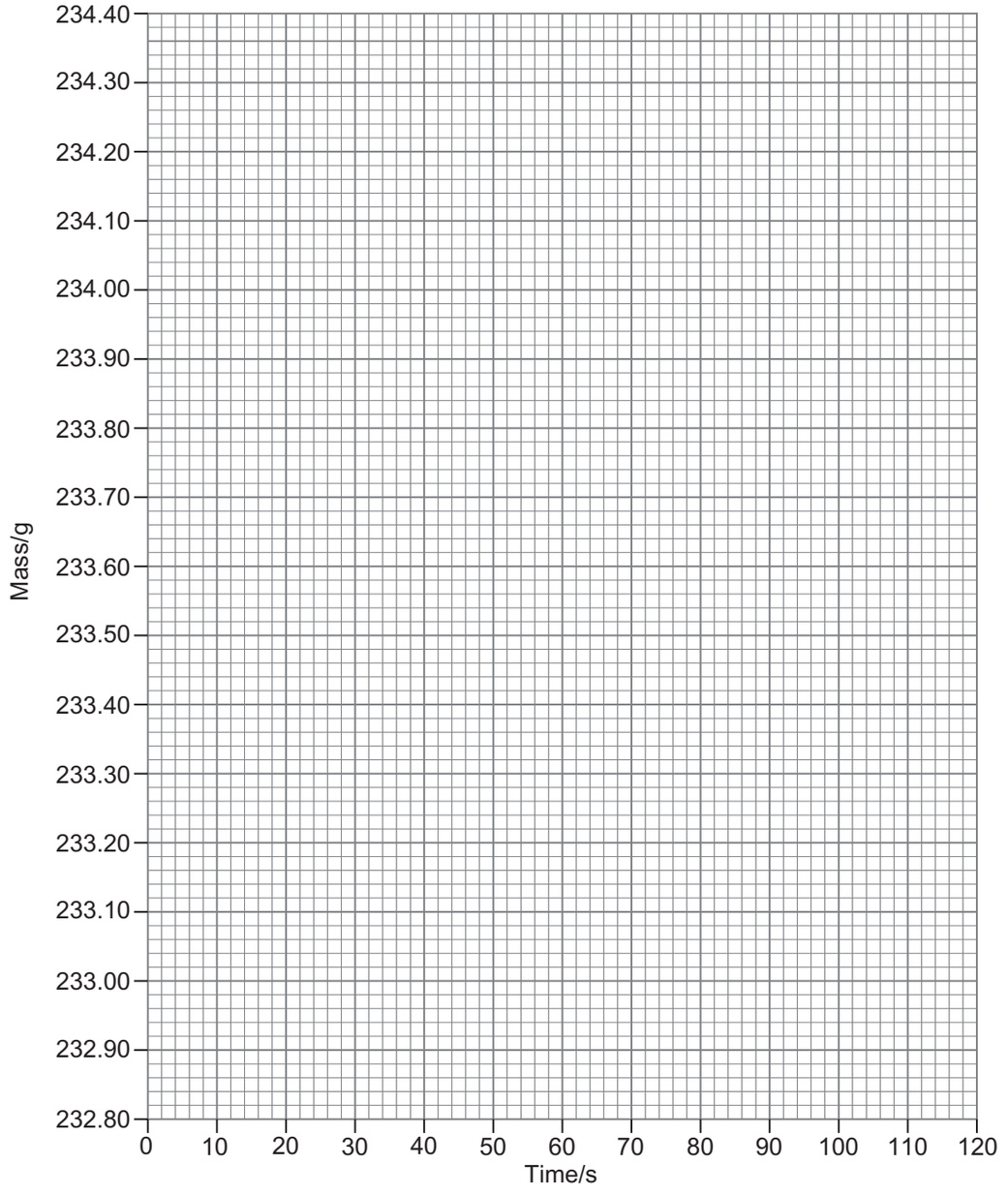
_____ [1]

[Turn over

(b) The results obtained from the experiment are shown below.

Time/s	0	20	40	60	80	100	120
Mass/g	234.10	233.70	233.40	233.20	233.05	233.00	233.00

(i) Plot these results on the graph below. [4]



Examiner Only	
Marks	Remark

Using the graph answer the following questions.

(ii) At what time does the reaction stop?

_____ [1]

(iii) Calculate the total loss in mass.

_____ [1]

(iv) The experiment was repeated using one tablet and 50 cm^3 of water at 40 °C. On the same axes, sketch the graph for this experiment and label it B. [3]

(v) Apart from temperature, state one other factor which affects the rate of a chemical reaction.

_____ [1]

Examiner Only	
Marks	Remark
Total Question 1	

[Turn over

Examiner Only	
Marks	Remark

2 **(a)** When food decays many different gases are produced, including ammonia, carbon dioxide, carbon monoxide, hydrogen, hydrogen sulfide, sulfur dioxide and methane.

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(i) Name **one** of the gases produced during decay which has a pungent smell.

_____ [1]

(ii) Complete the table below which gives details of some of the gases produced during decay.

Gas	Formula	Colour
	NH_3	
carbon dioxide	CO_2	
hydrogen		colourless
carbon monoxide	CO	colourless

[4]

(iii) Carbon monoxide burns in oxygen forming carbon dioxide. Write a balanced symbol equation for this reaction.

_____ [3]

(iv) A glass rod is dipped into concentrated hydrochloric acid and placed into a sample of ammonia gas. Describe what is observed.

_____

_____ [2]

(b) Hydrogen sulfide gas is toxic and flammable. It reacts with oxygen according to the equation:

hydrogen sulfide + oxygen → sulfur dioxide + water

(i) Write a balanced symbol equation for this reaction.

_____ [3]

(ii) Name the substance being oxidised in this reaction.

_____ [1]

(iii) State one safety precaution you would take in a laboratory when using hydrogen sulfide.

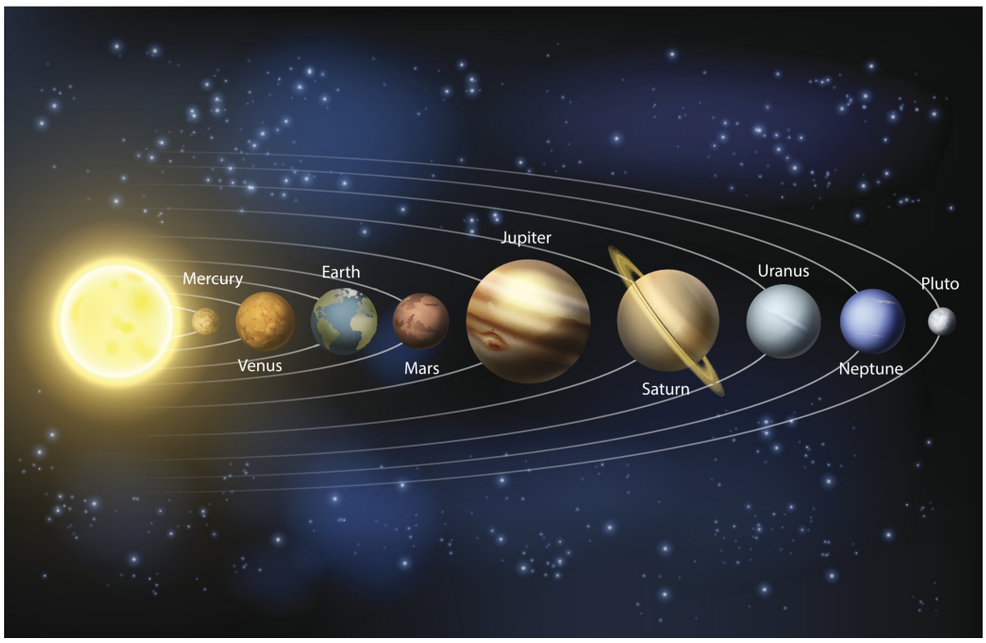
_____ [1]

Examiner Only	
Marks	Remark
Total Question 2	

[Turn over

3 The diagram below shows the Earth's solar system.

Examiner Only	
Marks	Remark



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(a) Mars is often called the red planet due to the presence of haematite on its surface. A recent study of the Huygens Crater on Mars has also shown the presence of iron(III) hydroxide and calcium carbonate.

(i) Calcium carbonate and iron(III) hydroxide undergo thermal decomposition. What is meant by the term thermal decomposition?

_____

_____ [2]

(ii) Complete the word equation for the thermal decomposition of calcium carbonate.

calcium carbonate → _____ + _____

[2]

(b) Mars does not have tectonic plates but Earth does. What may occur at the boundaries between tectonic plates?

_____

_____ [2]

(c) Atmosphere is the term used to describe the collection of gases that surround a planet. The composition of the atmosphere of Mars is shown in the table below.

Gas	Composition
Carbon dioxide	95.0%
Nitrogen	3.0%
Noble gases	1.6%
Oxygen	trace
Methane	trace

Compare the composition of nitrogen and oxygen in the Earth's atmosphere today, with that of the planet Mars.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

[Turn over

(d) Dione is a moon of the planet Saturn. In March 2012 scientists verified that Dione has an atmosphere which is made up of mainly oxygen. The discovery was made using instruments on board the unmanned Cassini spacecraft.

(i) Describe a chemical test which proves the presence of oxygen gas.

_____

_____ [2]

(ii) State two physical properties of oxygen gas.

1. _____

2. _____ [2]

(e) Changes in the atmosphere of the Earth occurred slowly over millions of years due to photosynthesis and other processes.

(i) An unbalanced symbol equation for photosynthesis is shown below. Balance this equation.

CO_2 + H_2O → $C_6H_{12}O_6$ + O_2 [1]

(ii) The composition of the Earth's atmosphere is still changing today. This could be due to the burning of fossil fuels.

displacement	endothermic	exothermic
neutralisation	oxidation	reduction

Choose two words from the box above which describe the burning of fossil fuels.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark
Total Question 3	

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

4 Water is essential for life and it makes up approximately 60 percent of the human body.

(a) Complete the table below to show the physical properties of water.

State at room temperature	Boiling point (°C)	Melting point (°C)	Colour

[4]

(b) The physical properties of water alone are not enough to positively identify it. A chemical test must be used. Complete the following table to show two chemical tests for water.

Chemical Test	Colour before adding water	Colour after adding water
	white	blue
cobalt chloride paper		

[4]

(c) The water supply in some parts of Northern Ireland is described as hard water.

(i) Explain what you understand by the term hard water.

_____

_____

_____ [2]

(ii) Which one of the four compounds below causes permanent hardness in water? Circle the correct answer.

calcium hydrogen carbonate **magnesium sulfate**

sodium carbonate **sodium chloride**

[1]

(iii) Describe in detail how a sample of water may be tested for hardness.

Your answer should include:

- how to determine that hardness is present in the water
- how to determine if the hardness present is temporary or permanent
- all practical details

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

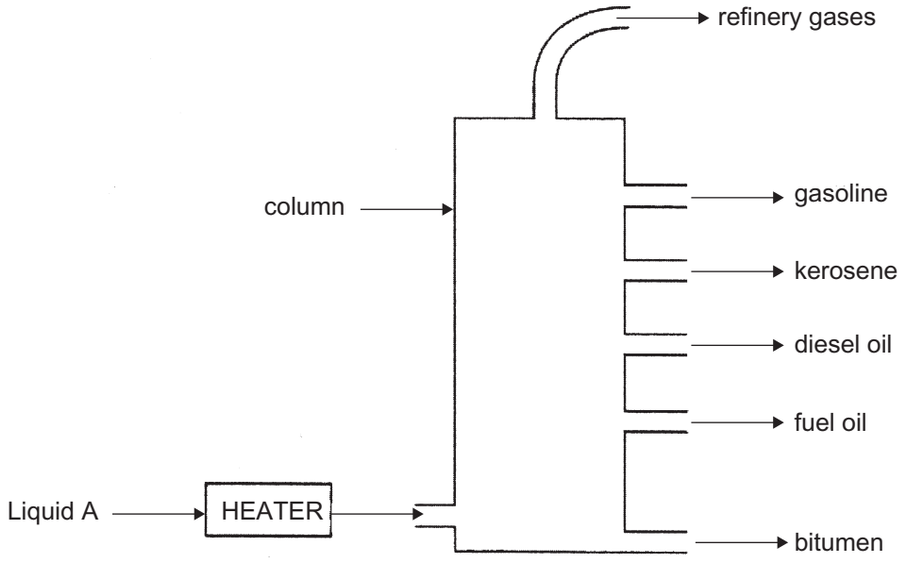
[6]

Examiner Only	
Marks	Remark
Total Question 4	

[Turn over

5 **(a)** The diagram below shows how Liquid A is separated into useful products.

Examiner Only	
Marks	Remark



(i) Name Liquid A.

_____ [1]

(ii) Fill in the missing words to complete the passage below.

Liquid A is separated by the process of _____ _____.

In this process Liquid A is heated until it _____.

As the gaseous mixture rises up the column the temperature _____ and the different parts of the mixture are collected separately. [4]

(iii) The chemicals obtained from Liquid A are hydrocarbons. A hydrocarbon is a molecule made from only two elements. Name the two elements.

1. _____

2. _____ [2]

(iv) State one use for the kerosene obtained in this separating process.

_____ [1]

(b) A homologous series is a family of organic compounds that have the same general formula and show a gradation in physical properties.

(i) State one other feature of a homologous series.

_____

_____ [1]

(ii) Alkanes and alkenes are examples of homologous series. Complete the following table.

Name of homologous series	General formula	Molecular formula of compound with three carbon atoms
Alkanes		C_3H_8
Alkenes	C_nH_{2n}	

[2]

(iii) Name the alkane with the molecular formula C_3H_8.

_____ [1]

Examiner Only	
Marks	Remark

[Turn over

(iv) Calculate the percentage of carbon by mass in C_3H_8.

$$\frac{\text{total mass of carbon}}{\text{RFM}} \times 100 = \% \text{ carbon}$$

Percentage of carbon by mass _____ % [3]

(v) Draw the structural formula of C_3H_8.

[1]

Examiner Only	
Marks	Remark
Total Question 5	

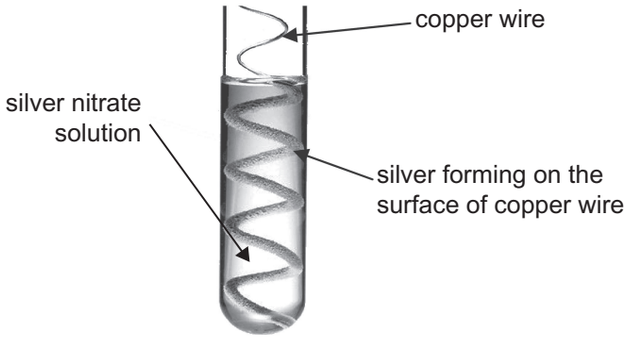
6 A reactivity series of some metals is shown below:

potassium
sodium
calcium
magnesium
aluminium
iron
copper

reactivity increases

Examiner Only	
Marks	Remark

(a) Silver metal does not appear on the above reactivity series. Copper metal will react with silver nitrate solution to form silver as shown below.



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(i) Indicate the position of silver on the reactivity series shown above. [1]

(ii) Silver nitrate solution is colourless. What is the colour of the solution at the end of this reaction?

_____ [1]

[Turn over

(iii) Explain why copper displaces silver from a solution of silver nitrate.

_____

_____ [2]

(b) Silver particles of size 1 to 100 nanometres (nm) are used to kill bacteria in wound dressings.

(i) Explain what you understand by a nanometre.

_____ [1]

(ii) Describe one risk which has been associated with the use of silver particles of this size.

_____

_____ [1]

(c) Aluminium is a very useful metal due to its high electrical conductivity, relatively low density and lack of reactivity.

(i) Explain why aluminium shows a lack of reactivity even though the reactivity series would suggest it is a moderately reactive metal.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(ii) A balanced symbol equation for a reaction of aluminium is shown below:

$$2Al + 3CuO \rightarrow Al_2O_3 + 3Cu$$

Write a word equation for this reaction.

_____ [2]

Examiner Only	
Marks	Remark
Total Question 6	

THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
Total Marks	

Examiner Number