



Rewarding Learning

General Certificate of Secondary Education
2014

Centre Number

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Candidate Number

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GCSE Chemistry

Unit 2

Higher Tier



[GCH22]

GCH22

THURSDAY 19 JUNE, AFTERNOON

TIME

1 hour 45 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 seven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 115.

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 Questions **2** and **4(a)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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- 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 cm³ 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) Draw a labelled diagram of the assembled apparatus used to carry out this experiment. **Include all apparatus.**

[4]

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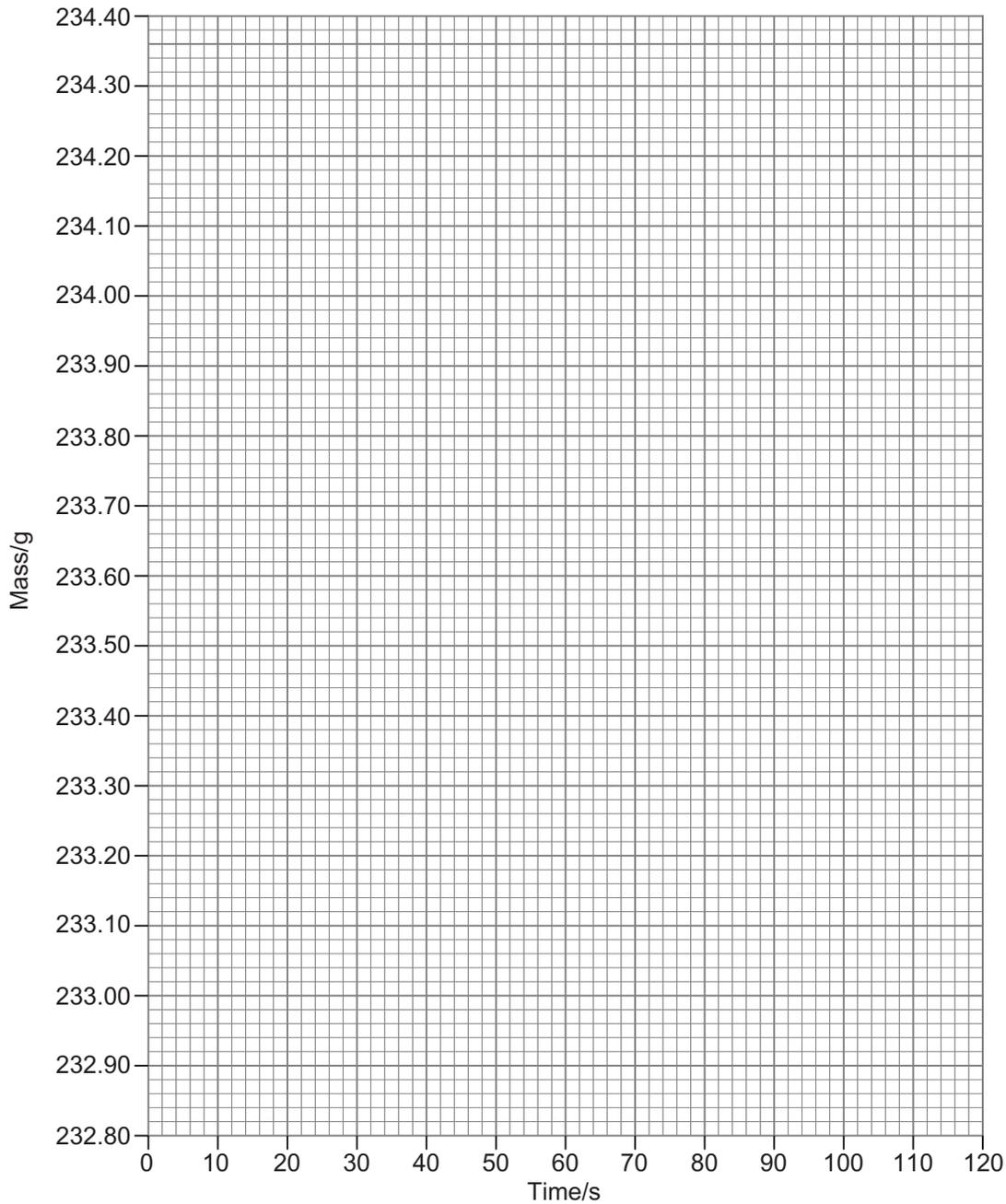


24GCH2203

(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]



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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 cm³ of water at 40 °C. On the same axes, sketch the graph for this experiment and label it B. [3]

(v) State and explain, in terms of particles, the effect of increasing temperature on the rate of a chemical reaction.

 _____ [3]

(c) Explain what you understand by the term activation energy.

 _____ [2]

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Total Question 1	

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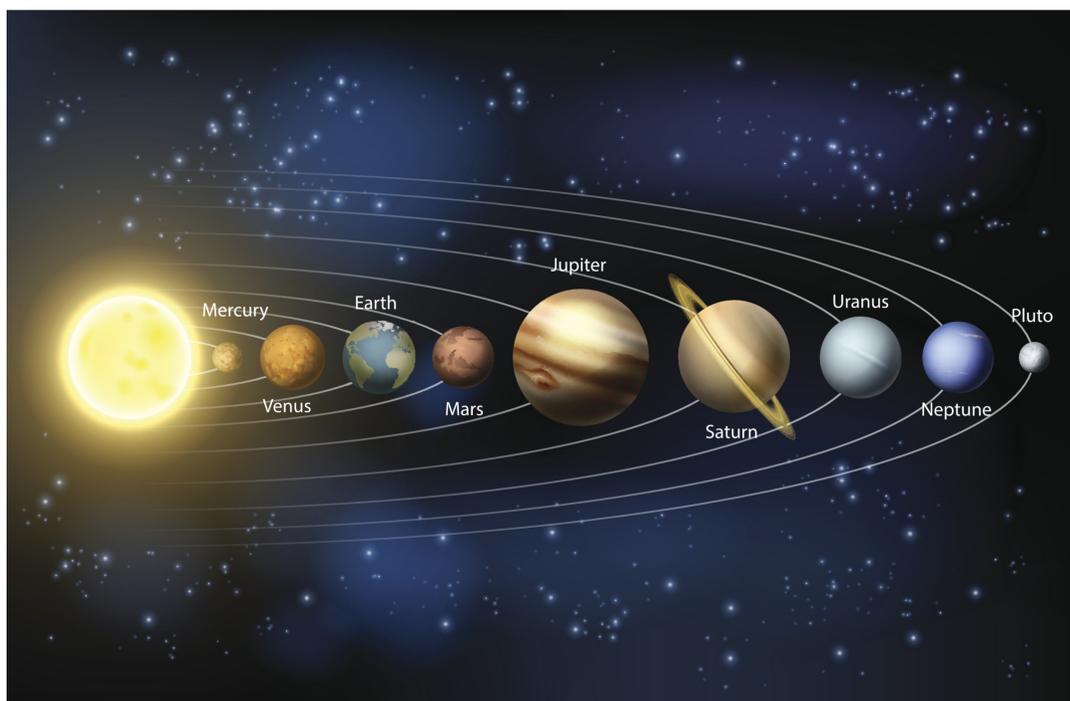
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3 The diagram below shows the Earth's solar system.



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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) Write a balanced symbol equation for the thermal decomposition of iron(III) hydroxide into iron(III) oxide and water.

_____ [3]

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Marks Remark

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(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 the Earth's atmosphere today, with that of the planet Mars.

_____ [5]

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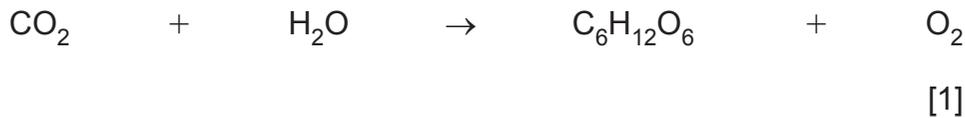


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(d) Changes in the atmosphere of the Earth occurred slowly over millions of years due to photosynthesis and other processes.

(i) An unbalanced symbol equation for the production of glucose (C₆H₁₂O₆) in photosynthesis is shown below. Balance this equation.



(ii) Photosynthesis is an endothermic reaction. In terms of bonds, explain why this reaction is endothermic.

Handwritten answer area with multiple horizontal lines for writing.

Examiner Only table with columns for Marks and Remark, and a Total Question 3 row.

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24GCH2211

5 (a) 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]

(b) Alkanes and alkenes undergo combustion reactions.

(i) What is meant by the term combustion?

 _____ [3]

(ii) Write a balanced symbol equation for the complete combustion of methane.

_____ [3]

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Marks Remark



(c) Alkenes contain the C=C functional group.

(i) What do you understand by the term functional group?

_____ [1]

(ii) Describe a chemical test which may be used to confirm the presence of the C=C in an alkene. State the result you would expect for a positive test.

_____ [3]

(d) Alkenes undergo addition polymerisation to form polymers such as polythene and PVC (polyvinyl chloride).

(i) Write a structural equation to show the formation of PVC.

_____ [4]

(ii) State one reason why PVC is used to make window frames in preference to wood.

_____ [1]

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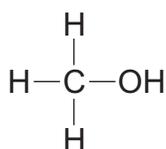
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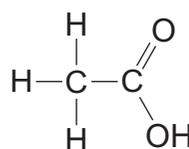


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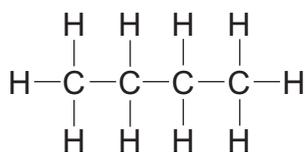
(e) The structures of four organic compounds are shown below.



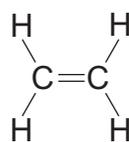
A



B



C



D

(i) Name compound **A**.

_____ [1]

(ii) What is the functional group in compound **B**?

_____ [1]

(iii) Explain why compound **C** is a hydrocarbon.

_____ [1]

(iv) Which compound (**A**, **B**, **C** or **D**) reacts with sodium carbonate?

_____ [1]

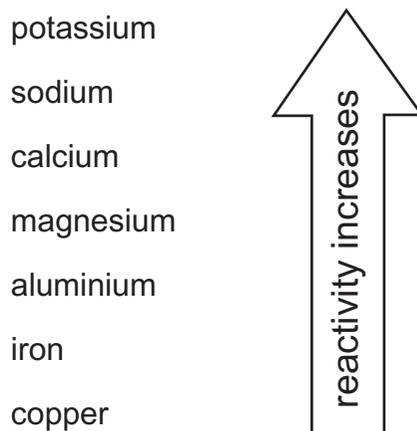
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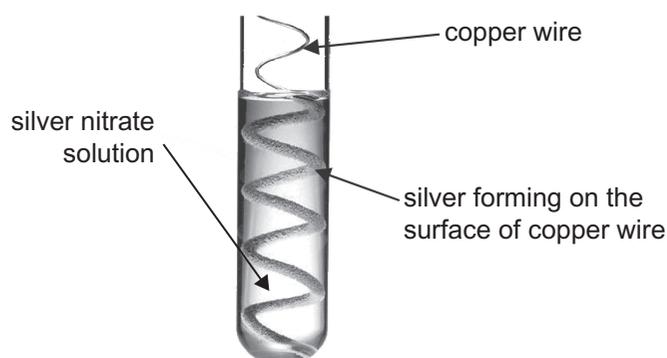
Total Question 5



6 A reactivity series of some metals is shown below:



- (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) Write a balanced symbol equation for the reaction of copper with silver nitrate forming silver and copper(II) nitrate.

_____ [3]

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

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

_____ [1]

(iv) 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]

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7 Homemade wines contain acids such as tartaric acid.

- (a) Tartaric acid has the molecular formula $C_4H_6O_6$. Calculate the percentage of oxygen present in tartaric acid.

Percentage of oxygen _____ [3]

- (b) To find the concentration of acid in their homemade wine, wine makers can use a wine testing kit. The label of a wine testing kit is shown below.

WINE TESTING KIT

- 25 cm³ syringe
- 30 cm³ syringe
- 0.1 mol/dm³ sodium hydroxide solution
- Phenolphthalein indicator
- Plastic beaker

The instructions on the wine testing kit are:

Measure out 25 cm³ of wine into the plastic beaker using the 25 cm³ syringe.

Add 3 drops of phenolphthalein indicator.

Slowly add sodium hydroxide from the other syringe until the indicator changes colour.

State the colour change observed for the phenolphthalein indicator.

From _____ to _____ [2]

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- (d) In a laboratory experiment 25.0 cm³ of white wine were placed in a conical flask and a few drops of phenolphthalein indicator added. Sodium hydroxide solution of concentration 0.1 mol/dm³ was then added slowly to the conical flask. The results of the titration are shown in the table below.

	Initial reading (cm ³)	Final reading (cm ³)	Titre (cm ³)
Titration 1 (rough)	0.0	20.0	20.0
Titration 2	0.0	18.9	18.9
Titration 3	0.0	19.1	19.1

- (i) Calculate the average titre.

Average titre _____ cm³ [2]

- (ii) Calculate the number of moles of sodium hydroxide solution used in this titration.

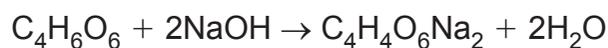
Moles of sodium hydroxide _____ [2]

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Marks Remark



- (iii) The equation for the reaction of the tartaric acid in the white wine with sodium hydroxide is shown below. Use this equation to calculate the number of moles of tartaric acid which reacted with the sodium hydroxide solution.



Moles of tartaric acid _____ [2]

- (iv) Calculate the concentration of the tartaric acid in mol/dm³.

Concentration of tartaric acid _____ mol/dm³ [2]

- (v) Calculate the concentration of the tartaric acid in g/dm³.

Concentration of tartaric acid _____ g/dm³ [1]

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Marks	Remark
Total Question 7	



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Question Number	Marks
1	
2	
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Total Marks	
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