

Centre Number						

Candidate Number							

General Certificate of Secondary Education 2014

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.

Examiner Only Marks Remark

Multivitamin Supplement

Niacin

Calcium carbonate

Vitamin B12

Sweeteners

Salt

Orange flavouring

Citric acid

In an experiment one multivitamin tablet was added to $50\,\mathrm{cm^3}$ of water in a conical flask at a temperature of $20\,^\circ\mathrm{C}$. 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 $20\,\mathrm{seconds}$.

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

[4]

[Turn over

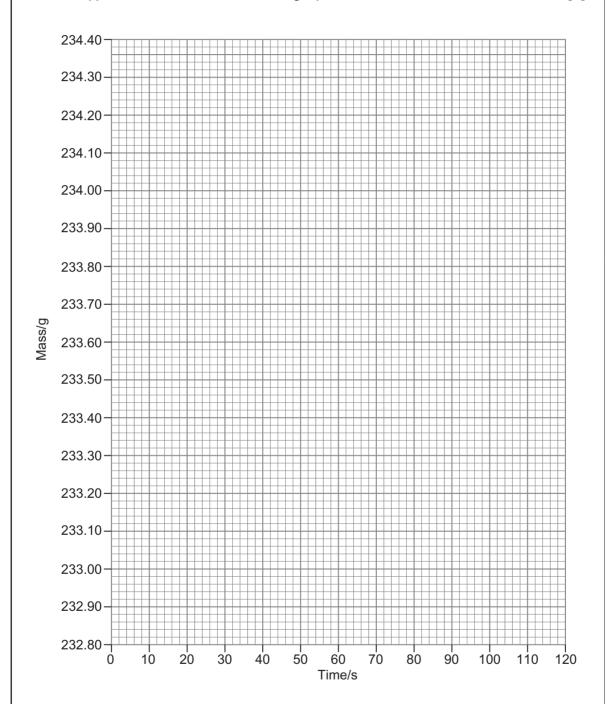


(b) The results obtained from the experiment are shown below.

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]



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	Using 1	the graph answer the following questions.		Examir Marks
	(ii) At	what time does the reaction stop?		
			[1]	
	/iii) Ca	doulate the total loss in mass		
	(III) Ca	lculate the total loss in mass.	[1]	
			ניו	
		e experiment was repeated using one tablet and 50 cm ³ of ter at 40 °C. On the same axes, sketch the graph for this		
		periment and label it B.	[3]	
	(v) Sta	ate and explain, in terms of particles, the effect of increasing		
		mperature on the rate of a chemical reaction.		
			[3]	
(c)	Fxolain	n what you understand by the term activation energy.		
(-)				
			[2]	
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2	Concentrated sulfuric acid is manufactured industrially by the Contact Process. This process occurs in four stages, one of which requires three specific conditions.	Examir Marks	er Only Remark
	Describe the chemistry of the Contact Process. Your answer should include the following:		
	 balanced symbol equations for each of the four stages names of all reactants and products in each reaction identification of the stage which requires specific conditions details of these conditions 		
	In this question you will be assessed on your written communication skills including the use of specialist scientific terms.		
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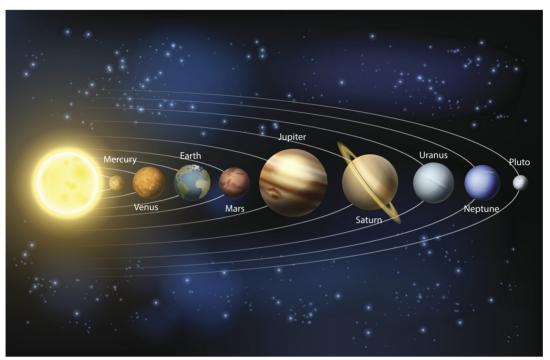
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3 The diagram below shows the Earth's solar system.



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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?

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

	[2]
	[3

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Examiner Only

Marks Remark



SHOWHILL	he table below.	of the atmosphere of	Mars is
	Gas	Composition	
	Carbon dioxide	95.0%	
	Nitrogen	3.0%	
	Noble gases	1.6%	
	Oxygen	trace	
	Methane	trace	

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(d)				phere of th		ccurred slow processes.	ly over millio	ons	Examin Marks	er Only Remark
			₆) in photo			e production below. Balar				
	C	CO ₂	+	H ₂ O	\rightarrow	$C_6H_{12}O_6$	+	O ₂		
				an endothe		ction. In term lic.	s of bonds,			
								[5]	Total Qu	
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4	The water supply in some parts of Northern Ireland may be described as being hard water.	Examiner Only Marks Remark
	(a) 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]	
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(b)		nporary hard water is found in areas where limestone rock is nmon.		Examine Marks	er Only Remark	
	(i)	Write a balanced symbol equation to show the formation of temporary hard water.				
			[2]			
	(ii)	Describe in detail how temporary hardness arises in water.				
			[3]			
	(iii)	State two methods which may be used to remove permanent hardness from water.				
		1				
		2				
			[2]			
				Total Que	estion 4	
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	(i)	State one oth	er feature of a ho	omologous series.	
				[[1]
	(ii)		alkenes are exam following table.	nples of homologous series.	
		Name of mologous series	General formula	Molecular formula of compound with three carbon atoms	1
		Alkanes		C ₃ H ₈	
		Alkenes	C_nH_{2n}		
L				ecular formula C ₃ H ₈ .	[2]
	(iii)	Name the alk	ane with the mole	ecular formula C ₃ H ₈ .	[2]
b)	(iii) Alka	Name the alk	ane with the mole	ecular formula C ₃ H ₈ [bustion reactions.	
b)	(iii) Alka	Name the alk	ane with the mole	ecular formula C ₃ H ₈ . bustion reactions. bustion?	
b)	(iii) Alka	Name the alka	ane with the mole	ecular formula C ₃ H ₈ . bustion reactions. bustion?	[1]

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(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]
	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.	
		F41
		[4]
	(ii) State one reason why PVC is used to make window frames in preference to wood.	
		[1]

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The structures of four organic	c compounds are shown below.	Examiner Marks R
H H-C-OH H A	H O H-C-C H OH B	
H H H H H-C-C-C-C-H H H H H	H H C=C H H	
(i) Name compound A.	[1]	
(ii) What is the functional gro	oup 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?	

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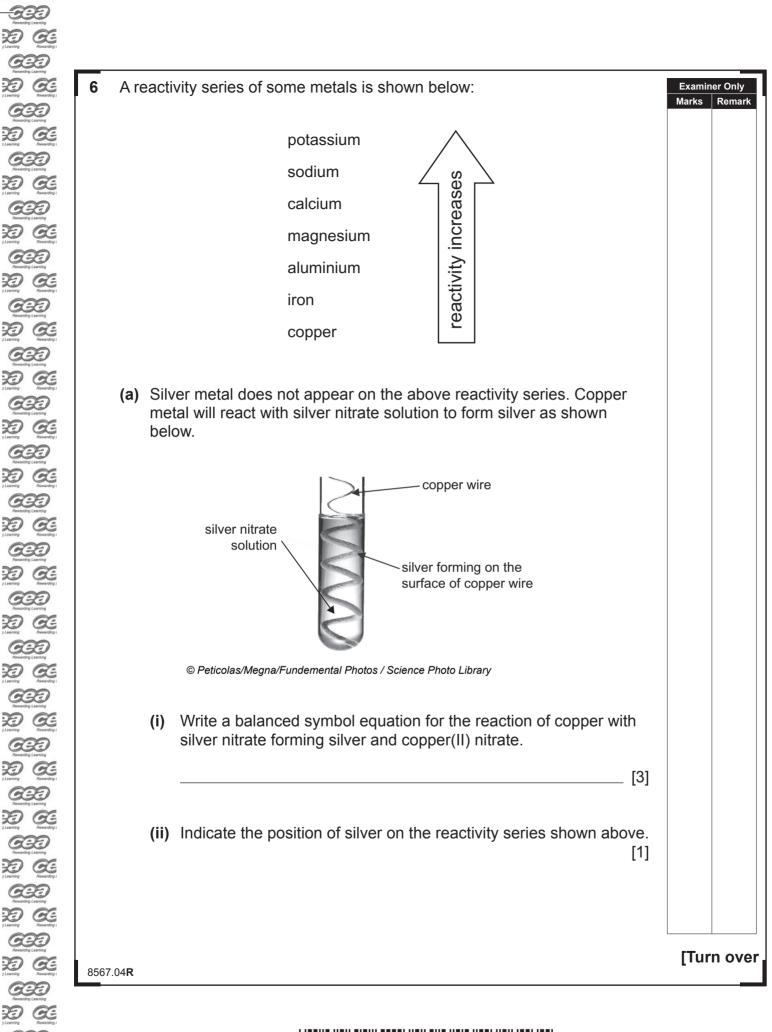
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	(iii)	Silver nitrate solution is colourless. What is the colour of the solution at the end of this reaction?	Examine Marks
		[1]	
	(iv)	Explain why copper displaces silver from a solution of silver nitrate.	
		[2]	
(b)		er particles of size 1 to 100 nanometres (nm) are used to kill teria 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)		minium is a very useful metal due to its high electrical conductivity, tively 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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(ii)	A balanced symbol equation for a reaction of aluminium is shown below:	Examir Marks	er Only Remar
	$2AI + 3CuO \rightarrow Al_2O_3 + 3Cu$		
	Write a word equation for this reaction.		
	[2]		

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Total Question 6

7	Hor	nemade wines con	tain acids such as tartaric acid.		Examiner Only Marks Remark
	(a)		ne molecular formula C ₄ H ₆ O ₆ . Calculate the gen present in tartaric acid.		marks Remark
			Percentage of oxygen	[3]	
	(b)		tration of acid in their homemade wine, wine testing kit. The label of a wine testing kit is show		
			 WINE TESTING KIT 25 cm³ syringe 30 cm³ syringe 0.1 mol/dm³ sodium hydroxide solution Phenolphthalein indicator Plastic beaker 		
		The instructions or	n the wine testing kit are:		
		syringe. Add 3 drops of phe	n ³ of wine into the plastic beaker using the 25 enolphthalein indicator. In hydroxide from the other syringe until the ind		
		State the colour ch	nange observed for the phenolphthalein indica	ator.	
		From	to	[2]	
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		QUESTION 7 CONTINUES OVERLEAF	[1]		
	(iii)	This method is suitable for white wine. Suggest why it is not use to find the concentration of acid in red wine.			
		hydroxide solution to the wine in a titration.	[1]		
	(ii)	Name the piece of apparatus used to accurately add the sodium			
	(i)	Name the piece of apparatus used to measure out accurately 25.0 cm ³ of wine.	[1]		
(c)		s method can be carried out more accurately in a laboratory using tion apparatus.	9	Examine Marks	er Only Remark

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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.

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	Initial reading (cm³)	Final reading (cm ³)	Titre (cm³)
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]



		(iii) The equation for the reaction of the tartaric acid in the white	Examine	er Only
Moles of tartaric acid		wine with sodium hydroxide is shown below. Use this equation to calculate the number of moles of tartaric acid which reacted with		Remark
(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] Total Question 7		$C_4H_6O_6 + 2NaOH \rightarrow C_4H_4O_6Na_2 + 2H_2O$		
(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] Total Question 7				
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] This is the end of the QUESTION PAPER		Moles of tartaric acid [2]		
(v) Calculate the concentration of the tartaric acid in g/dm³. Concentration of tartaric acid g/dm³ [1] THIS IS THE END OF THE QUESTION PAPER		(iv) Calculate the concentration of the tartaric acid in mol/dm ³ .		
(v) Calculate the concentration of the tartaric acid in g/dm³. Concentration of tartaric acid g/dm³ [1] THIS IS THE END OF THE QUESTION PAPER				
Concentration of tartaric acid in g/dm³. Concentration of tartaric acid g/dm³ [1] THIS IS THE END OF THE QUESTION PAPER				
Concentration of tartaric acid g/dm³ [1] This is the end of the Question Paper		Concentration of tartaric acid mol/dm ³ [2]		
THIS IS THE END OF THE QUESTION PAPER		(v) Calculate the concentration of the tartaric acid in g/dm ³ .		
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Total Marks

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