

Н

Thursday 16 May 2019 – Morning

GCSE (9–1) Combined Science (Chemistry) A (Gateway Science)

J250/09 Paper 9 (Higher Tier)

Time allowed: 1 hour 10 minutes

You must have:

- a ruler (cm/mm)
- the Data Sheet (for GCSE Combined Science A (Chemistry) inserted)

You may use:

- · a scientific or graphical calculator
- an HB pencil



Please write clearly in black ink. Do not write in the barcodes.							
Centre number					Candidate number		
First name(s)							
Last name							

INSTRUCTIONS

- The Data Sheet will be found inside this document.
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer all the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION

- The total mark for this paper is 60.
- The marks for each question are shown in brackets [].
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- · This document consists of 20 pages.

77710605836

© OCR 2019 [601/8687/2] DC (SC/FC) 173902/7 OCR is an exempt Charity

Turn over

2

SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

Write your answer to each question in the box provided.

1	Whi	ich statement best describes an atom?	
	Α	The nucleus is small compared to the atom and contains little of the atom's mass.	
	В	The nucleus is large compared to the atom and contains little of the atom's mass.	
	С	The nucleus is small compared to the atom and contains most of the atom's mass.	
	D	The nucleus is large compared to the atom and contains most of the atom's mass.	
	You	ir answer	[1]
2	Met	als can have atoms of other elements mixed with them to change their properties.	
	Wha	at is the name for the type of substance formed?	
	Α	Alloy	
	В	Compound	
	С	Solution	
	D	Suspension	
	You	er answer	[1]
3	Hov	v are atoms arranged in the modern Periodic Table?	
	Α	In order of atomic number	
	В	In order of relative atomic mass	
	С	In order of the number of neutrons	
	D	In order of reactivity	
	You	ir answer	[1]

Wh	ich separati	ion technique in the	e laboratory requires	s a condenser?					
Α	Chromato	graphy							
B Crystallisation									
С	Filtration								
D Distillation									
		able contains inforr	nation about proton	s, neutrons and electrons.	[1]				
	Particle	Relative mass	Relative charge						
	Proton	1	+1						
	Neutron	1	-1						
I	Electron	0.0005	-1						
Whi	ich correction control	on needs to be made sharge should be 0. mass should be 1. harge should be 0.			[1]				
				·					
Α	The size of	of the particles.							
В	The space	e between the partic	cles.						
С	The numb	er of particles.							
D	The force	of attraction between	en the particles.						
					[1]				
	A B C D You The Wh A B C D You The Wh A B C D You	A Chromato B Crystallisa C Filtration D Distillation Your answer The following to Particle Proton Neutron Electron One piece of in Which correction A Electron of B Electron of C Neutron of D Proton char Your answer The particle me Which of the for A The size of B The space C The numb	A Chromatography B Crystallisation C Filtration D Distillation Your answer The following table contains inform Particle Relative mass Proton 1 Neutron 1 Electron 0.0005 One piece of information in the taken which correction needs to be made at the electron charge should be 0. B Electron mass should be 1. C Neutron charge should be 0. D Proton charge should be 0. Your answer The particle model does not taken which of the following does the particles. B The space between the particles. C The number of particles. D The force of attraction between the contains and the electron charge should be the particles. The space between the particles.	A Chromatography B Crystallisation C Filtration D Distillation Your answer The following table contains information about proton Particle Relative mass Relative charge Proton 1 +1 Neutron 1 -1 Electron 0.0005 -1 One piece of information in the table is incorrect. Which correction needs to be made? A Electron charge should be 0. B Electron mass should be 1. C Neutron charge should be 0. D Proton charge should be 0. Your answer The particle model does not take into account certain Which of the following does the particle model take in A The size of the particles. B The space between the particles. C The number of particles. D The force of attraction between the particles. Your answer	C Filtration D Distillation Your answer The following table contains information about protons, neutrons and electrons. Particle Relative mass Relative charge Proton 1 +1 Neutron 1 -1 Electron 0.0005 -1 One piece of information in the table is incorrect. Which correction needs to be made? A Electron charge should be 0. B Electron mass should be 1. C Neutron charge should be 0. D Proton charge should be 0. Your answer The particle model does not take into account certain information about the particles. Which of the following does the particle model take into account? A The size of the particles. B The space between the particles. C The number of particles. D The force of attraction between the particles.				

7 Magnesium ions react with chloride ions to form magnesium chloride.

What is the correct ionic equation for this reaction?

- A $Mg^+ + Cl^- \longrightarrow MgCl$
- **B** $Mg^{2+} + Cl^{2-} \longrightarrow MgCl$
- **c** $Mg^{2+} + 2Cl^{-} \rightarrow MgCl_{2}$
- $\mathbf{D} \quad \mathrm{Mg}^{2+} + \mathrm{C} \mathit{l}^{-} \! \to \! \mathrm{Mg}_{2} \mathrm{C} \mathit{l}$

Your answer		[1]
-------------	--	-----

8 The table shows bond energies.

Bond	Bond energy (kJ/mol)
H–H	436
C <i>l</i> –C <i>l</i>	243
H–C1	432

Hydrogen reacts with chlorine to form hydrogen chloride.

$$H-H + Cl-Cl \rightarrow 2 H-Cl$$

What is the energy change, in kJ/mol?

- **A** –247
- **B** -185
- **C** +185
- **D** +247

Which diagram correctly shows the bonding in a molecule of hydrogen fluoride? В C D [1] Your answer 10 What is the mass of 2 moles of calcium hydroxide? 148.2g Α 164.1g В

C 220.1g

9

328.2g D

Your answer [1]

Turn over © OCR 2019

SECTION B

Answer all the questions.

11 A student investigates three reactions.

She wants to find out if the reactions are exothermic or endothermic.

Look at her results.

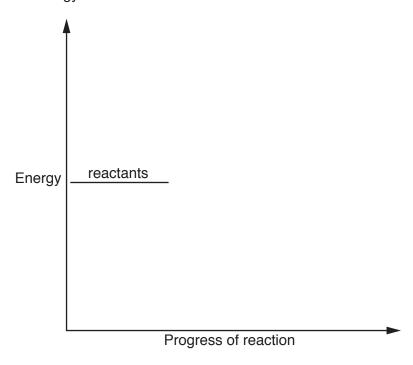
Reaction	Start temperature (°C)	Final temperature (°C)
X	21	25
Y	20	18
Z	22	24

(a)	Which reaction, X , Y or Z , is endothermic ?	
	Explain your answer.	
		[O]

(b) Draw a labelled reaction profile for an **endothermic** reaction.

Use the following labels on your reaction profile:

- products
- energy change
- activation energy.



[4]

(c)	Ano	ther student repeats the same reactions.				
	The	student does the experiment in a polystyrene cup instead of a beaker.				
	Ехр	lain why using a polystyrene cup is an improvement to the method.				
			[2			
(d)	The	reaction between iron oxide and aluminium is very exothermic.				
Look at the equation for the reaction.						
	$Fe_2O_3(s) + 2Al(s) \rightarrow Al_2O_3(s) + 2Fe(l)$					
	/:\	During this regetion the alternisis as is existing a				
	(i)	During this reaction the aluminium is oxidised .				
		Explain what is meant by the term oxidised.				
			[1			
	(ii)	Pure iron metal is produced in the reaction.				
		Draw a diagram to show the bonding in a metal.				
		Label your diagram clearly.				

[3]

12* A student carries out an experiment using paper chromatography to distinguish between three substances.

Here is his method.

- 1. Draw a pen line half way up the paper.
- 2. Put a large spot of the substance to be tested onto the line.
- 3. Stand the paper in the solvent. The solvent should be at the same level as the spot.
- 4. Leave the beaker uncovered.
- 5. Remove the paper from the beaker before the solvent reaches the top.

He calculates the $R_{\rm f}$ value for each substance.

Look at his results.

Substance	Distance moved by solvent (mm)	Distance moved by spot (mm)	R _f value
Х	95	78	1.22
Υ	95	65	1.46
Z	95	51	1.86

His teacher noticed some mistakes with his method **and** his $R_{\rm f}$ values.

Describe and explain the **mistakes** the student has made and suggest corrections.

13 Aluminium, phosphorus and magnesium are all in Period 3 of the Periodic Table.

(a)	Alur	minium has an atomic number of 13 and mass number of 27.
	(i)	Describe the nucleus of an aluminium atom in terms of sub-atomic particles.
		[2]
	(ii)	What is the overall charge on the nucleus of an atom of aluminium?
		[1]
	(iii)	Which sub-atomic particles surround the nucleus?
		[1]
(b)	Pho	sphorus has a higher atomic number and a higher mass number than aluminium.
		udent says that phosphorus must be an isotope of aluminium because it has a different ber of neutrons.
	ls th	ne student correct?
	Tick	a (✓) one box.
	Yes	
	No	
	Ехр	lain your answer.
		[2]

(c)		esphorus can react with oxygen to form oxides. One oxide of phosphorus is called sphorus pentoxide.			
	Pho	osphorus pentoxide has the molecular formula P ₄ O ₁₀ .			
	(i)	What is the empirical formula of phosphorus pentoxide?			
		[1]			
	(ii)	Aluminium oxide and phosphorus pentoxide have different types of bonding.			
		The boiling point of aluminium oxide is 2977 °C.			
		The boiling point of phosphorus pentoxide is 360 °C.			
		What conclusion can you make about the type of bonding in each oxide?			
		Explain your answers.			

		11		
(d)		student is given a sample of the metal magnesium and a solution of an unknown nitrate etal ${\bf M}$, ${\bf M}{\bf N}{\bf O}_3({\bf aq})$.		
	The	student does an experiment to identify metal M .		
		student weighs the magnesium. Then the student adds the magnesium to the solution of metal nitrate.		
	A dis	splacement reaction takes place forming metal M:		
	Mg(s	s) + $2MNO_3(aq) \rightarrow 2M(s) + Mg(NO_3)_2(aq)$		
	The	student separates the metal M and then weighs metal M .		
	Look at the student's results: Mass of magnesium = 0.729 g Mass of metal M = 6.476 g			
	(i)	Calculate the moles of magnesium used in the experiment.		
		Malas of many actives -		
		Moles of magnesium =[1]		
	(ii)	Calculate the relative atomic mass of metal M .		
		Give your answer to 3 significant figures.		
		Relative atomic mass of metal M =[3]		
	(iii)	Use your answer from (d)(ii) and the Periodic Table to identify the metal M.		

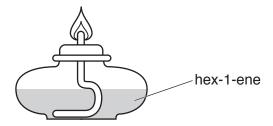
14 Brine is the name given to the solution formed when sodium chloride, NaCl, dissolves in water.

(a)	During the electrolysis of sodium chloride solution, two ions are attracted to the negative electrode (cathode).			
	(i) Identify the two ions attracted to the negative electrode (cathode).			
		1		
		2 [2]		
	(ii)	State and explain which product is formed at the negative electrode (cathode).		
		[2]		
(b)	Ele Mg(ctrolysis can also be carried out on molten ionic compounds such as magnesium oxide, D.		
		ing the electrolysis of molten magnesium oxide, magnesium ions, ${\rm Mg}^{2^+}$, are reduced at cathode.		
	Wri	te a balanced half equation for this reaction.		

		13			
15	(a)	Carbon is an element which can form a very wide range of compounds.			
		This is partly due to the number of bonds that a carbon atom can form.			
		State the type and maximum number of bonds that a carbon atom forms.			
		Type of bonds			
		Maximum number of bonds[2]			
	(b)	Hex-1-ene is a carbon-based compound with the formula C_6H_{12} .			
		20.0 g of hex-1-ene is burned in oxygen. Carbon dioxide and water are made. Look at the equation for this reaction.			
		$C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$			
		(i) Calculate the number of molecules in 20.0 g of hex-1-ene.			
		Avogadro's constant = $6.02 \times 10^{23} \text{mol}^{-1}$			
		Give your answer to 3 significant figures.			
		Number of molecules of C ₆ H ₁₂ =[4]			

(ii) Hex-1-ene was burned using a spirit burner in the laboratory.

The diagram shows the spirit burner.



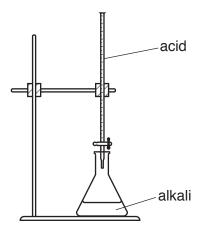
Burning 20.0 g of hex-1-ene should produce 62.9 g of carbon dioxide.

The actual mass of carbon dioxide produced in the reaction was 48.4 g.

xygen available for combustion?	conclusion can be made about the mass of c	Wha
[1]		

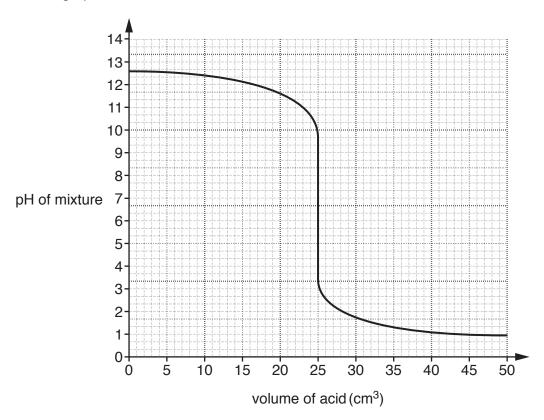
16 A student adds sulfuric acid to a solution of the alkali sodium hydroxide. A neutralisation reaction takes place.

This is the apparatus she uses.



The student measures how the pH of the solution changes as the acid is added.

Look at the graph of her results.



(a) What volume of acid is needed to neutralise the alkali?

Volume of acid =cm³ [1]

(a)	The mixture becomes less alkaline as the acid is added.		
	Describe how the pH of the mixture changes as the acid is added.		
(c)	Explain why the mixture becomes less alkaline as the acid is added.		
	Use ideas about hydrogen ions and pH in your answer.		

END OF QUESTION PAPER

17

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).					

 ,	 	
 <u> </u>	 	



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.