OCR
Oxford Cambridge and RSA

Accredited

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

H

J248/03 Paper 3 (Higher Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2.1

Time allowed: 1 hour 45 minutes

You must have:
- the Data Sheet

You may use:
- a scientific or graphical calculator
- a ruler

First name									
Last name									
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document consists of **28** pages

SECTION A

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

1 A student separates the colours in a sample of black ink using paper chromatography.

- He puts a spot of black ink onto a piece of filter paper.
- He dips the filter paper into ethanol in a beaker.

What phase describes **ethanol** in this experiment?

A Gas phase

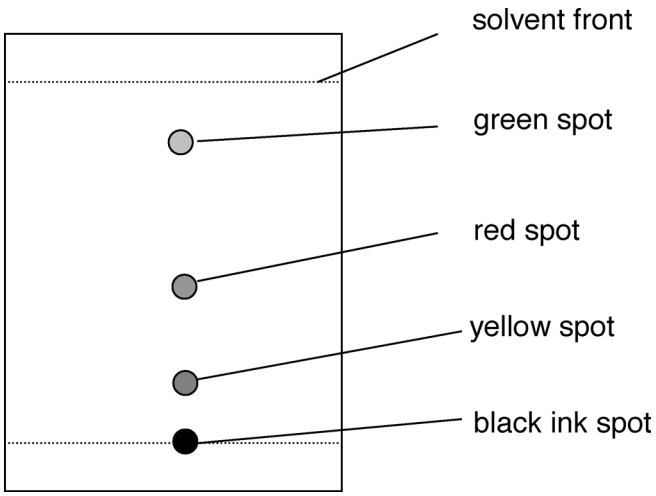
B Mobile phase

C Solid phase

D Stationary phase

Your answer ☐ **[1]**

2 Look at the chromatogram.



What is the R_f value of the **green** spot? Use a ruler to help you.

A 0.17

B 0.42

C 0.83

D 1.00

Your answer ☐ **[1]**

3 What is the best description of the particles in a liquid?

	Distance between particles	Movement of particles
A	close together	in continuous random motion
B	close together	vibrating about a fixed point
C	far apart	in continuous random motion
D	far apart	vibrating about a fixed point

Your answer ☐ **[1]**

4 The **molecular formula** of decene is $C_{10}H_{20}$.

What is the **empirical formula** of decene?

A CH_2

B C_2H_4

C C_5H_{10}

D $C_{20}H_{40}$

Your answer ☐ **[1]**

5 A student measures the pH of an acid and an alkali.

He adds magnesium metal to the acid and to the alkali.

What results should he expect?

	Acid		**Alkali**	
	pH	**Reaction with magnesium**	**pH**	**Reaction with magnesium**
A	below 7	no reaction	above 7	magnesium fizzes
B	below 7	magnesium fizzes	above 7	no reaction
C	above 7	magnesium fizzes	above 7	no reaction
D	above 7	no reaction	below 7	magnesium fizzes

Your answer ☐ **[1]**

6 A student tests the conductivity of an ionic compound.

Which row in the table shows the correct results?

	Solid ionic compound	**Ionic compound dissolved in water**	**Molten ionic compound**
A	conducts	conducts	does not conduct
B	conducts	conducts	conducts
C	does not conduct	does not conduct	conducts
D	does not conduct	conducts	conducts

Your answer ☐ **[1]**

7 What is the approximate size of an atom?

A 3×10^{-1} metres

B 3×10^{-5} metres

C 3×10^{-9} metres

D 3×10^{-13} metres

Your answer ☐ **[1]**

8 During the electrolysis of molten potassium chloride, what is made at the cathode?

A Chlorine

B Hydrogen

C Potassium

D Potassium hydroxide

Your answer ☐ **[1]**

9 Crude oil can be separated in the laboratory into fractions which have different boiling points.

Look at the table. It shows possible relationships between:

- boiling point
- number of carbon atoms in the molecule
- size of intermolecular forces.

Which letter shows the correct relationship?

	Boiling point	**Number of carbon atoms in the molecule**	**Size of intermolecular forces**
A	high	less than 20	large
B	high	more than 50	small
C	low	less than 20	small
D	low	more than 50	large

Your answer ☐ **[1]**

10 Which of these shows the balanced symbol equation for the reaction between potassium and chlorine to make potassium chloride?

A $K + Cl_2 \rightarrow KCl_2$

B $P + Cl_2 \rightarrow PCl_2$

C $2K + Cl_2 \rightarrow 2KCl$

D $2P + Cl_2 \rightarrow 2PCl$

Your answer ☐ **[1]**

11 Look at the diagrams.

Which diagram shows a solid with the **largest** surface area to volume ratio?

A 

B 

C 

D 

Your answer ☐ **[1]**

12 A student neutralises nitric acid with potassium hydroxide solution.

Which equation shows the **ionic** equation for neutralisation?

A $HNO_3 + KOH \rightarrow KNO_3 + H_2O$

B $H^+ + OH^- \rightarrow H_2O$

C $NO_3^- + K^+ \rightarrow KNO_3$

D $H^+ + NO_3^- \rightarrow HNO_3$

Your answer ☐ **[1]**

13 A student investigates some acids.

She has a solution of hydrochloric acid of concentration 0.01 mol/dm^3.

This solution has a pH of 2.

She increases the concentration of hydrochloric acid from 0.01 mol/dm^3 to 0.1 mol/dm^3.

What is the pH of this new solution?

A 0

B 1

C 3

D 12

Your answer ☐ **[1]**

14 What is the **best** explanation of what is meant by a strong acid?

A There is a large amount of acid and a small amount of water.

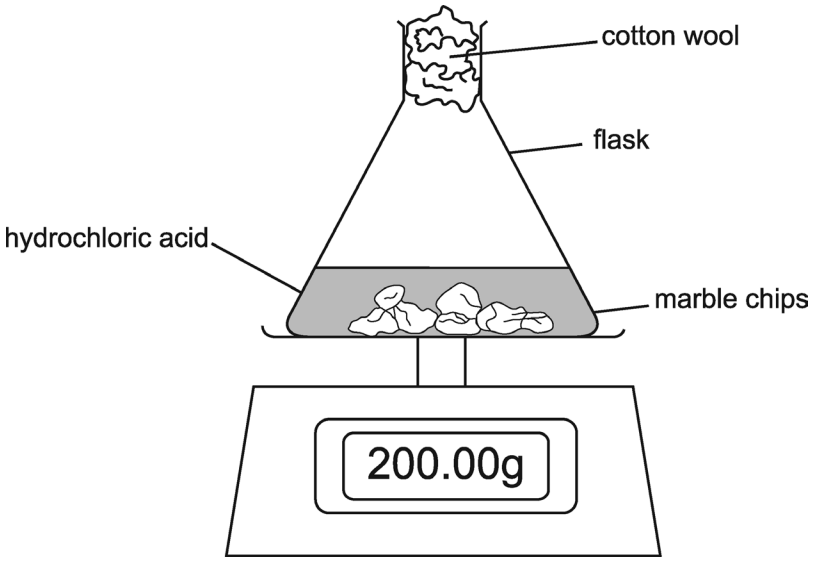
B There is a small amount of acid and a large amount of water.

C The acid is completely ionised in solution in water.

D The acid is partially ionised in solution in water.

Your answer ☐ **[1]**

15 Look at the diagram.



It shows how the reaction between hydrochloric acid and marble chips (calcium carbonate) can be monitored.

The reading on the balance **decreases** during the reaction.

Which statement is the **best** explanation?

A Acid escapes from the flask.

B Carbon dioxide gas is made which leaves the flask.

C Hydrogen gas is made which leaves the flask.

D The temperature in the laboratory changes.

Your answer ☐ **[1]**

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TURN OVER FOR THE NEXT QUESTION

SECTION B

Answer **all** the questions.

16 The table shows information about some atoms and ions.

Particle	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electronic structure
A	11	23	11	.....	11	2.8.1
B	9	19	9	10	9	.....
C	.....	37	17	.....	17	2.8.7
D	13	27	.....	.....	10	2.8

(a) **Complete** the missing information in the **Table** above. **[4]**

(b) Particle **A** is a metal **atom**, particle **D** is an **ion**.

Explain why.

.....

.....

..... **[2]**

(c) Particle **C** has the electronic structure 2.8.7.

What does this electronic structure tell you about the position of particle **C** in the periodic table?

Explain your answer.

.....

.....

.....

..... **[4]**

(d) Complete the table below to give information about protons, neutrons and electrons.

	Charge	Mass in atomic mass units
proton	.....	1
neutron	.....	.....
electron	negative	.....

[2]

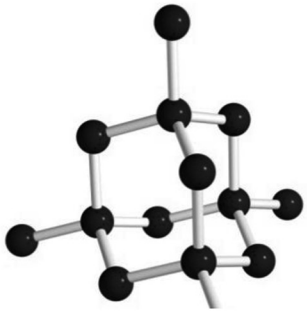
(e) Rutherford was a scientist who helped to develop the atomic model.

State how Rutherford's work contributed to the development of the atomic model.

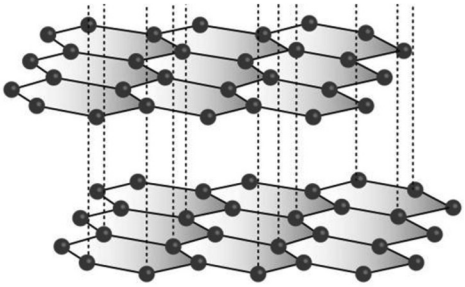
.....

..... **[1]**

17 **(a)** The diagrams show the structures of two forms of carbon.



diamond



graphite

- Graphite is a good conductor of electricity.
- Diamond does **not** conduct electricity.

Use ideas about structure and bonding in diamond and graphite to explain these observations.

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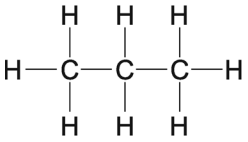
.....

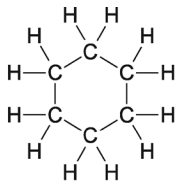
..... **[3]**

(b) Carbon can form many thousands of different compounds.

Two examples are shown below.



propane



cyclohexane

Why can carbon form many thousands of different compounds?

.....

..... **[1]**

(c) Ethanol contains carbon.

Look at some information about ethanol.

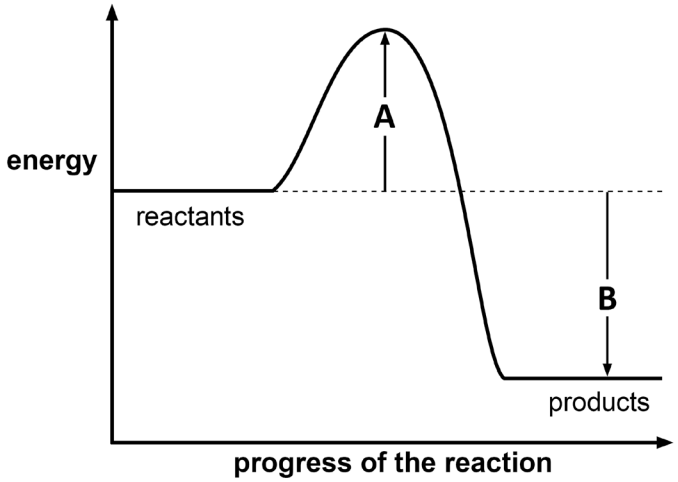
- Melting point = –114°C
- Boiling point = 78°C

Predict the state of ethanol at 25°C. How can you tell?

.....

..... **[2]**

18 Look at the energy profile for a reaction.



(a) Explain what can be concluded about this reaction?

Include the quantities **A** and **B** in your answer.

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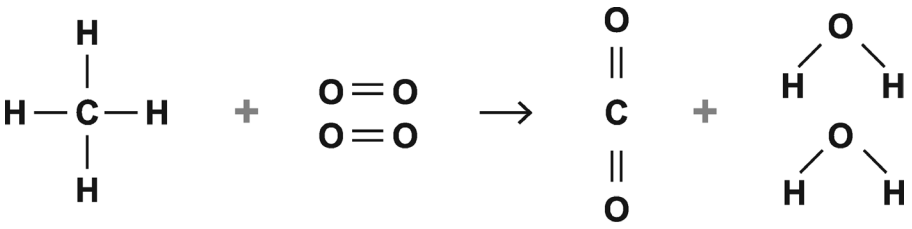
..... **[4]**

(b) Look at the equation.



methane **oxygen** **carbon dioxide** **water**

The table shows the bond energies of the bonds involved.

Bond	Bond energy (kJ/mol)
C–H	435
O=O	498
C=O	805
O–H	464

(i) What type of energy change happens when bonds are broken and when bonds are made?

Bonds broken .....

Bonds made.....**[2]**

(ii) Calculate the energy change for this reaction.

Answer = ... kJ/mol **[3]**

(c) When propane reacts with oxygen, energy is given out.

- Propane gives out 50 kJ/g.
- A propane burner is used to boil 200 g of water to make a cup of tea.
- The initial temperature of the water is 15 °C.

What mass of propane (in g) is needed to heat this water?

Use the following equation:

Energy transferred in J = 4.2 J/g°C × mass of water in g × temperature change in °C.

Answer = ... g **[5]**

19 An element, **X**, is reacted with oxygen, O_2.

- There is one product. It is the oxide of **X**, **X** oxide.
- 4.86 g of **X** reacts with 3.20 g of oxygen to make 8.06 g of **X** oxide.

(a) (i) Calculate the number of moles of **X**, oxygen and **X** oxide in the reaction.

- Relative atomic mass of **X** = 24.3
- Relative formula masses: O_2 = 32.0; **X** oxide = 40.3.

Number of moles of **X** = ...

Number of moles of O_2 = ...

Number of moles of **X** oxide = ... **[3]**

(ii) Use your answer to **(i)** to write the **balanced symbol** equation for the reaction between **X** and oxygen to make **X** oxide.

..... **[2]**

(b) The equation shows the reaction between sodium hydroxide and dilute sulfuric acid.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

sodium hydroxide + sulfuric acid → sodium sulfate + water

Calculate the mass of sodium hydroxide needed to make 30.0 g of sodium sulfate.

Give your answer to **3** significant figures.

Answer = ... g **[3]**

20 A student is separating a mixture of three substances, **A**, **B** and **C**.

Look at the table. It gives information about these substances.

Substance	State at room temperature	Melting point (°C)	Boiling point (°C)	Solubility in water
A	liquid	0	100	soluble
B	liquid	–117	78	soluble
C	solid	1535	2750	insoluble

A and **B** mix together completely.

(a)* Suggest how the student can separate the mixture to get pure samples of substances **A**, **B** and **C**.

Explain in detail how each method works.

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..... **[6]**

(b) The student has separated a **pure** sample of substance **B** from the mixture.

Suggest how the student can check that the sample of substance **B** is pure.

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.....

..... **[2]**

21 Zinc nitrate can be made by reacting zinc oxide with nitric acid, HNO_3.

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

..... **[2]**

(b) A student suggests this method for preparing zinc nitrate.

1. Measure 50 cm^3 of dilute nitric acid into a beaker.
2. Add one spatula measure of zinc oxide.
3. Heat the mixture until crystals of zinc nitrate are made.

Her method will **not** make a pure dry sample of zinc nitrate.

What improvements should she make to the method to make sure that:

- the reaction is complete
- the zinc nitrate can be separated from the nitric acid and the zinc oxide?

Explain your answer.

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..... **[4]**

(c) Describe why this reaction is a neutralisation reaction.

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..... **[2]**

22 Magnesium burns in oxygen to make magnesium oxide.

The reaction involves both oxidation and reduction.

$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

magnesium + oxygen → magnesium oxide

(a) **Complete** the sentences.

During this reaction, the oxidising agent is .....

The reducing agent is .....**[1]**

(b) Magnesium has an atomic number of 12.

Calculate the mean mass of an atom of magnesium.

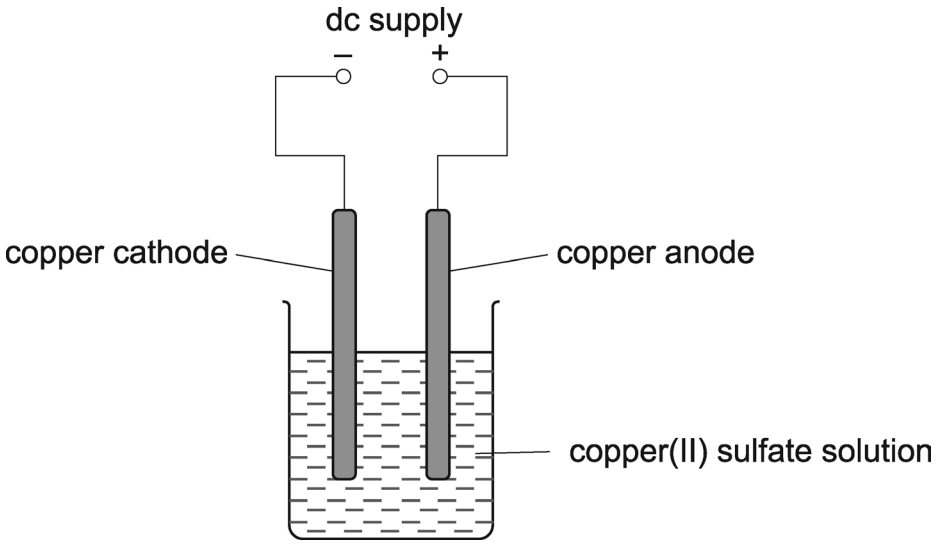
Quote your answer to 3 significant figures.

- Avogadro constant = 6.022×10^{23} atoms per mole

Answer = ... g **[2]**

23 A student electrolyses copper sulfate using copper electrodes.

Look at the diagram. It shows the apparatus she uses.



She investigates the change in mass at each electrode before and after the electrolysis.

Look at her method.

1. Using a balance, measure the mass of the copper cathode and copper anode.
2. Set up the apparatus and run the electrolysis for 30 seconds.
3. Remove the copper cathode and the copper anode and immediately place them on the balance and measure their masses again.

(a) What improvements could you make to the student's experiment?

Explain your answers.

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..... **[4]**

(b) The student finds that:

- the cathode gains mass
- the anode loses mass.

Explain these observations in terms of the reactions at each electrode.

.....

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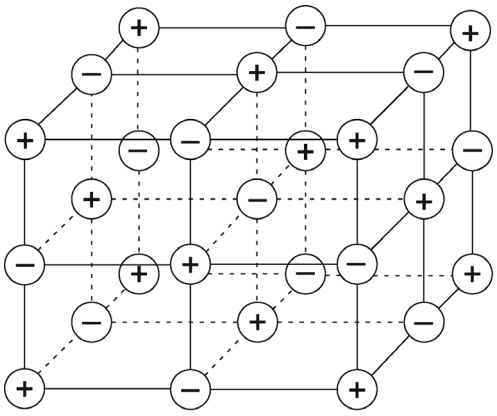
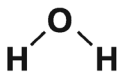
..... **[2]**

24 Look at the diagrams of sodium chloride and water.





sodium chloride **water**

(a) Sodium chloride has a melting point of 801°C.

Use the diagram of sodium chloride to explain why.

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.....

..... **[2]**

(b) Water has a low melting point and boiling point.

Explain why.

.....

.....

..... **[2]**

(c) Magnesium oxide has a similar structure to sodium chloride.

Draw ‘dot and cross’ diagrams to show the ionic bonding in magnesium oxide.

- Include the charges on the ions.
- The electronic structure of magnesium is 2.8.2.
- The electronic structure of oxygen is 2.6.

[3]

25 A student adds calcium to dilute hydrochloric acid. The mixture begins to fizz.

Write a balanced symbol equation for this reaction.

..... **[2]**

END OF QUESTION PAPER

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DO NOT WRITE ON THIS PAGE

OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

GCSE (9–1) Chemistry A (Gateway Science)
J248/03 Paper 3 (Higher Tier)

SAMPLE MARK SCHEME

uration: 1 hour 45 minutes

MAXIMUM MARK 90

This document consists of 16 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.
The communication statement determines the mark within a level.

11. Annotations

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
_	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Chemistry A:

	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.**
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	**Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.**
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

SECTION A

Question	Answer	Marks	AO element	Guidance
1	B	1	2.2	
2	C	1	2.2	
3	A	1	1.1	
4	A	1	2.1	
5	B	1	1.2	
6	D	1	1.2	
7	C	1	1.1	
8	C	1	1.2	
9	C	1	1.2	
10	C	1	2.1	
11	B	1	2.2	
12	B	1	1.2	
13	B	1	1.2	
14	C	1	1.2	
15	B	1	1.2	

SECTION B

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>16</td><td>(a)</td><td></td><td>
<table>
<tr><th>Particle</th><th>Atomic number</th><th>Mass number</th><th>Number of protons</th><th>Number of neutrons</th><th>Number of electrons</th><th>Electronic structure</th></tr>
<tr><td>A</td><td>11</td><td>23</td><td>11</td><td>12</td><td>11</td><td>2.8.1</td></tr>
<tr><td>B</td><td>9</td><td>19</td><td>9</td><td>10</td><td>9</td><td>2.7</td></tr>
<tr><td>C</td><td>17</td><td>37</td><td>17</td><td>20</td><td>17</td><td>2.8.7</td></tr>
<tr><td>D</td><td>13</td><td>27</td><td>13</td><td>14</td><td>10</td><td>2.8</td></tr>
</table>
</td><td>4</td><td>2 x 2.1
2 x 3.1b</td><td>one mark scored for each correct line</td></tr>
<tr><td></td><td>(b)</td><td></td><td>particle A – one electron in outer shell or energy level (1)
particle D – has more protons than electrons (1)</td><td>2</td><td>2.1</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>group 7 (1) as 7 electrons in outer shell (1)
period 3 (1) as 3 shells occupied (1)</td><td>4</td><td>2.1</td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th></th><th>Charge</th><th>Mass in atomic mass units</th></tr>
<tr><td>proton</td><td>positive /+</td><td>1</td></tr>
<tr><td>neutron</td><td>neutral / no charge</td><td>1</td></tr>
<tr><td>electron</td><td>negative</td><td>0.0005</td></tr>
</table>
</td><td>2</td><td>1.1</td><td>one mark scored for each correct column (2)

ALLOW
1/1760
or 1/1836
or 1/2000</td></tr>
<tr><td></td><td>(e)</td><td></td><td>idea of the nuclear atom (1)</td><td>1</td><td>1.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
Question			Answer	Marks	AO element	Guidance
17	(a)		**graphite** – has a layered structure (1) electrons can move / electrons between layers or delocalised (1) **diamond** – no free electrons or ions (1)	3	1.1	
	(b)		it can bond to itself (and make chains and rings) (1)	1	1.1	
	(c)		liquid (1) liquid above -114^{o}C and does not boil until 78^{o}C (1)	2	2.2	

Question			Answer	Marks	AO element	Guidance
18	(a)		**any four from:** reaction is exothermic (1) as reactants have more energy than products (1) **A** is the activation energy (1) activation energy is the amount of energy supplied to get the reaction started (1) **B** is the energy change for the reaction (1) the value of **B** is negative (1)	**4**	**2 x 1.1** **2 x 3.2b**	
	(b)	**(i)**	bonds broken – endothermic (1) bonds made – exothermic (1)	**2**	**1.1**	both required
		(ii)	energy needed to break bonds = 2736 (kJ) (1) energy released when new bonds form = 3466 (kJ) (1) energy change for a reaction = 730 (kJ) given out / - 730 (kJ) (1)	**3**	**2.1**	Correct answer scores 3 if no working is shown
	(c)		energy transferred = 4.2 x 200 x (100 – 15) (1) = 71400 J (1) Mass of fuel needed to boil water (g) = energy needed to boil water (J) / energy per gram 50 kJ = 50000 J (1) = 71400 / 50000 (1) = 1.43 g (1)	**5**	**2.2**	**ALLOW** 1.428 g instead of 1.43 (1)

Question			Answer	Marks	AO element	Guidance
19	**(a)**	**(i)**	no of moles of X = 0.2 (1) no of moles of oxygen = 0.1 (1) no of moles of X oxide = 0.2 (1)	**3**	**3.1a**	
		(ii)	$2X + O_2 \rightarrow 2XO$ (2) formulae (1) balancing (1)	**2**	**2.2** **3.1a**	balancing is conditional on correct formulae **ALLOW** ecf from calculations of numbers of moles
	(b)		16.9 (g) scores (3) **but if answer incorrect then** RFM of NaOH = 40.0 **and** RFM of Na_2SO_4 = 142.1 (1) idea that 2 moles of NaOH react to produce 1 mole of Na_2SO_4 (1)	**3**	**1.1** **2 x 2.1**	**ALLOW** 16.89 (2) **ALLOW** ecf from incorrect RFMs

Question			Answer	Marks	AO element	Guidance
20	(a)*		*Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** **Suggestion would enable pure samples of all three components to be obtained in the correct sequence with clear explanations of why the methods work.** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** **Suggestion would enable pure samples of two of the components of the mixture to be obtained with an attempt at an explanation.** *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** **Suggestion would enable a pure sample of one of the components to be obtained.** *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	**2 x 1.2** **2 x 2.2** **2 x 3.3a**	**AO1.2: Knowledge of process of fractional distillation** • Use fractional distillation to separate substance **A** from substance **B**. • Substance **B** will come off first as it has lowest boiling point. • Stronger forces between molecules in substance **A** / ora. **AO2.2: Apply knowledge of process of fractional distillation** • Fractional distillation works as substances **A** and **B** have different boiling points. • As substance **C** is insoluble in water. • Because there are differing forces of attraction between the molecules. **AO3.3a: Analyse information in the table to develop experimental procedure** • Heat mixture to boil off substances **A** and **B** leaving pure **C**. • Filter mixture to remove substance **C**. • Substance **C** can be washed with water and dried.

Question			Answer	Marks	AO element	Guidance

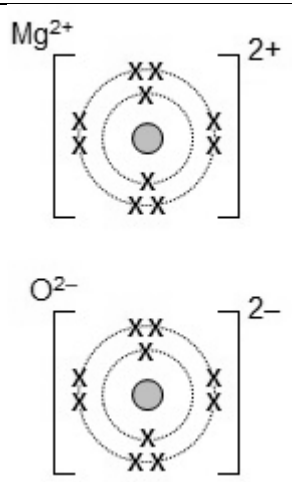
Question			Answer	Marks	AO element	Guidance
	(b)		measure its melting point or boiling point (1) if pure melting point or boiling point will be sharp / if impure melting point is lowered / if impure boiling point is elevated (1)	**2**	**1.2** **2.1**	
21	**(a)**		$ZnO + 2HNO_3 \rightarrow Zn(NO_3)_2 + H_2O$ correct formulae (1) balancing (1)	**2**	**2.2**	balancing mark is conditional on correct formulae **ALLOW** any correct multiple e.g. $2ZnO + 4HNO_3 \rightarrow 2Zn(NO_3)_2 + 2H_2O$ (2) **ALLOW** = or ⇆ or ⇌ for arrow **DO NOT ALLOW** 'and' or & for + **ALLOW** one mark for correct balanced equation with minor errors in case, subscript and superscript

Question			Answer	Marks	AO element	Guidance
						e.g. $ZnO + 2HNO^3 \rightarrow Zn(No_3)_2 + H_2$
	(b)		**Any four from:** idea that an excess of zinc oxide must be added (1) so reaction is complete / all nitric acid is reacted (1) filter off excess zinc oxide (1) evaporate off some of the water (1) allow to crystallise (1)	**4**	**3.3b**	
	(c)		reaction between nitric acid (HNO_3), an acid and zinc oxide (ZnO), a base (1) to make zinc nitrate ($Zn(NO_3)_2$, a salt and water (only) (1)	**2**	**1.1**	Only award marks if reactions and products are named in the answer **ALLOW** the use of just chemical formulae

Question			Answer	Marks	AO element	Guidance
22	**(a)**		The oxidising agent is **oxygen** and the reducing agent is **magnesium** (1)	**1**	**1.2**	
	(b)		24.3 / 6.022 x 10^{23} (1) 4.04 x 10^{-23} (1)	**2**	**2.1**	1 mark for 4.03520425 x 10^{-23} or correctly rounded up but not to 3 sig. fig.
23	**(a)**		electrolysis needs to run for longer than 30 seconds (1) otherwise insufficient change at electrodes (1) after electrolysis anode and cathode need to be washed (1) and then dried (1) before measuring the mass	**4**	**2 x 3.2a** **2 x 3.3b**	

Question			Answer	Marks	AO element	Guidance
	(b)		copper is deposited at the cathode (1) copper anode dissolves / copper ions produced at anode (1)	**2**	**1.2**	**ALLOW** higher level answers in terms of half equations e.g. at cathode $Cu^{2+} + 2e^- \rightarrow Cu$ (1) e.g. at anode $Cu \rightarrow Cu^{2+} + 2e^-$ / $Cu - 2e^- \rightarrow Cu^{2+}$ (1)

Question			Answer	Marks	AO element	Guidance
24	**(a)**		strong electrostatic force of attraction between ions (1) must be broken to melt sodium chloride (1)	**2**	**1.1**	
	(b)		weak intermolecular forces / weak forces between molecules (1) easily broken (1)	**2**	**1.1**	
	(c)			**3**	**2.1**	

Question			Answer	Marks	AO element	Guidance
			 electronic structure of magnesium ion (1) electronic structure of oxide ion (1) charges correct on both ions (1)			
25			$Ca + 2HCl \rightarrow CaCl_2 + H_2$	**2**	**1.2**	1 mark for both correct reactants 1 mark for both correct products

Summary of updates

Date	Version	Change
May 2018	2	We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website
March 2019	2.1	Diagram has been amended for Q.18 to show the activation energy and the overall energy change of the reaction are represented by single headed arrows so showing an increase or decrease of energy.

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