OCR
Oxford Cambridge and RSA

GCSE (9-1)

Combined Science B (Twenty First Century)

Unit **J260/02**: Chemistry

General Certificate of Secondary Education

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	Ignore

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
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

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 Combined Science B:

	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.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>He swapped the position of some elements to fit the pattern of properties ✓

He left gaps for undiscovered elements ✓</td><td>2</td><td>2 x 1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><td>Name of element</td><td>Fluorine</td><td>Sodium</td></tr><tr><td>Group number</td><td>7 / 17 ✓</td><td></td></tr><tr><td>Atomic number</td><td></td><td></td></tr><tr><td>Relative Atomic Mass</td><td></td><td>23 ✓</td></tr><tr><td>Number of protons</td><td></td><td>11 ✓</td></tr><tr><td>Number of electrons</td><td>9 ✓</td><td></td></tr><tr><td>Number of neutrons</td><td></td><td>12 ✓</td></tr></table></td><td>5</td><td>1 x 1.1

4 x2.1</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><td></td><td>Physical change</td><td>Chemical change</td></tr>
<tr><td>Hydrogen and oxygen combine to form water.</td><td></td><td>✓</td></tr>
<tr><td>Ice melts to form water.</td><td>✓</td><td></td></tr>
<tr><td>Water vapour condenses to form water.</td><td>✓</td><td></td></tr>
<tr><td>Methane burns to form water and carbon dioxide.</td><td></td><td>✓</td></tr>
</table>
</td><td>3</td><td>3 x1.1</td><td>All correct =3
3 correct = 2
2 correct = 1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><td>State</td><td>Distance between particles</td><td>Movement of particles</td><td></td></tr>
<tr><td>Solid</td><td></td><td>Vibrate (about a fixed point)</td><td>✓</td></tr>
<tr><td>Liquid</td><td>Close together</td><td></td><td>✓</td></tr>
<tr><td>Gas</td><td>Far apart</td><td>Move freely</td><td>✓</td></tr>
</table>
</td><td>3</td><td>3 x 1.1</td><td>One mark per row
For distance between particles if close together not indicated for liquids, look for responses that clearly indicate progression from solid to liquid to gas.

For solid ALLOW Do not move / moves slightly /

For gas ALLOW move randomly / fast / rapidly / IGNORE more energy / bounce</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Forces between particles in water strongest (therefore water has highest boiling point) / ORA✓

More energy needed to separate particles in water / less energy needed to separate particles in methane and ammonia / methane needs least energy to separate particles (so lowest boiling point) ✓</td><td>2</td><td>2 x 1.1</td><td>If no other marks scored ALLOW idea that the stronger the forces between molecules / particles the higher the boiling point / ORA ✓

ALLOW heat for energy</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
3	(a)		Hydrocarbons ✓	1	1.1	
	(b)	(i)	Carbons increase by one ✓ Hydrogens increase by two ✓	2	2 x 2.1	**ALLOW** Carbon and Hydrogen **BOTH** increase for 1 mark only ✓
		(ii)	Pentane ✓ melting point is below $20^{o}C$ ✓ boiling point is above $20^{o}C$ ✓	3	3.2b 2.1 x 2	 **ALLOW** becomes a liquid at $-130^{o}C$ ✓ **ALLOW** becomes a gas at $+36^{o}C$ ✓ **ALLOW** $20^{O}C$ is between the melting point and boiling point (of pentane) for 2 marks ✓✓
		(iii)	Melting points increase ✓ Boiling points increase ✓	2	2 x 2.1	ALLOW both increase for 2 marks ✓✓
		(iv)	Propane ✓ Melting point lower than expected / trend would give ✓	2	3.2b 2.1	
	(c)		C_8 ✓ H_{18} ✓	2	2.1 2.2	
	(d)		Fractional distillation ✓	1	1.1	
	(e)		Two electrons shared with each hydrogen ✓ No extra electrons ✓	2	2 x 2.2	diagrams showing 4 outer electrons from C and each H with 1 outer electron but NOT paired up scores 1 mark ✓

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	Copper is unreactive ✓	1	1.1	
	(b)		Copper carbonate ✓ Copper hydroxide ✓	2	2 x 2.1	
	(c)	(i)	Filtration ✓	1	1.2	
		(ii)	Heats solution ✓ To evaporate water / liquid ✓ Until crystals begin to form / solution is saturated ✓ leave to cool / leave to stand ✓	4	2 x 1.2 2 x 2.2	**ALLOW** "use a Bunsen burner" only if used to describe a heating process "heat to dryness" CONS MP3 and MP4
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 2 (kg) award 2 marks** (4.0 ÷ 10) × 5 ✓ = 2 (kg) ✓	2	2 x 2.2	

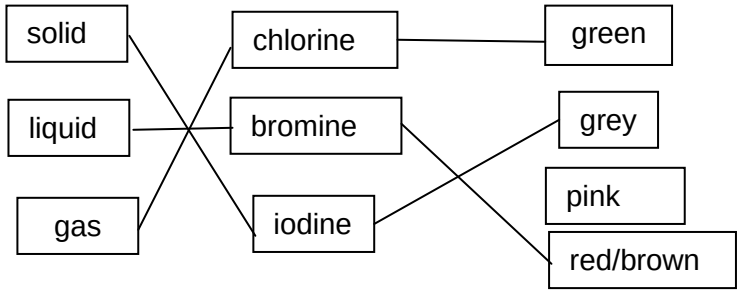
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td>
<table>
<tr><th>Statement</th><th>True for diamond</th><th>True for graphite</th><th>True for both</th></tr>
<tr><td>Every bond in the structure is the same.</td><td>✓</td><td></td><td></td></tr>
<tr><td>Solid conducts electricity.</td><td></td><td>✓</td><td></td></tr>
<tr><td>Atoms are joined in a giant structure.</td><td></td><td></td><td>✓</td></tr>
</table>
</td><td>3</td><td>3 x 1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>Atoms in graphite are in layers ✓

Forces between layers in graphite are weak✓</td><td>2</td><td>2 x 1.1</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
6*			*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)** Chooses nylon. **AND** Justifies choice by discussing the advantages or disadvantages of nylon, **and** by comparing with the other fibres. *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)** Makes a choice **AND** Justifies the choice by comparing with another fibre. **OR** Justifies choice by discussing the advantages or disadvantages of chosen fibre. *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)** Makes a choice with an advantage **or** disadvantage *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**	**3.1b x 4** **3.2b x 2**	**Indicative scientific points may include:** **AO3.1b Comparisons of advantages and disadvantages of the fibres** For example: • Manila renewable source • Kevlar/nylon not from renewable source • manila/Kevlar heavier than nylon • manila/Kevlar do not stretch very much • manila absorbs too much water • nylon/Kevlar absorb little water • Kevlar very strong • manila is the weakest **AO3.2b links these advantages and disadvantages to choice of best fibre** For example: • Nylon is the lightest because less dense • Nylon has the best stretch • Nylon absorbs less water so light when wet • Nylon less strong than Kevlar but other properties better • Kevlar strongest but poor stretch • Manila because from renewable source but other properties worse

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>
<table>
<tr><th>Statement</th><th>True</th><th>False</th></tr>
<tr><td>A formulation is a fixed mixture of pure substances.</td><td>✓</td><td></td></tr>
<tr><td>A formulation contains all the same type of atoms.</td><td></td><td>✓</td></tr>
<tr><td>A pure substance contains only one compound or element.</td><td>✓</td><td></td></tr>
<tr><td>All pure substances are safe to eat.</td><td></td><td>✓</td></tr>
</table>
</td><td>2</td><td>2 x 1.1</td><td>4 correct = 2 marks
3 or 2 correct = 1 mark
1 or 0 correct = 0 mark</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Hydrochloric acid → Calcium chloride + carbon dioxide + water ✓</td><td>1</td><td>2.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Tablet dissolves / gets smaller ✓</td><td>1</td><td>1.2</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Turns limewater cloudy ✓</td><td>1</td><td>1.2</td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>208.04(g) ✓</td><td>1</td><td>1.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>1.8(0) (g) ✓</td><td>1</td><td>1.2</td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td>Any two from:
Crush the tablets ✓
Stir the solution ✓
Add a catalyst ✓
Heat the solution ✓
Use more <u>concentrated</u> acid ✓</td><td>2</td><td>2x 3.3b</td><td>IGNORE use stronger acid</td></tr>
<tr><td></td><td>(e)</td><td>(i)</td><td>2.5(g) ✓</td><td>1</td><td>1.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.10(g) award 2 marks** appropriate marks on graph ✓ 1.1(0) (g) ✓	**2**	**2 x 2.2**	**ALLOW** ecf from e(i) provided that the appropriate construction lines are drawn onto their graph and the value is read correctly from the y-axis. **ALLOW** +/- ½ square (1.08 – 1.12 scores 2 marks)
8	**(a)**		neutralisation ✓	**1**	**1.1**	
	(b)		**BAED** (**C**) B first and D last ✓ AE together in that order ✓	**2**	**2 x 1.2**	
	(c)	**(i)**	pipette ✓	**1**	**1.2**	
		(ii)	burette ✓	**1**	**1.2**	
	(d)	**(i)**	add acid until nearly at rough trial/20-22cm^3 ✓ then add acid dropwise / slowly / idea of getting more precise reading for repeats ✓	**2**	**2 x 1.2**	
		(ii)	1.4 (cm^3) ✓	**1**	**2.2**	**ALLOW** 22.1 – 23.5 (cm^3) ✓
		(iii)	22.1(cm^3) ✓ Much lower than the rest ✓	**2**	**2 x 2.2**	**ALLOW** repeat 3 ✓ **ALLOW** value is not close to the others/AW ✓
		(iv)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 23.5(cm^3) award 3 marks** (23.4+23.5+23.5)/3 ✓ Correct evaluation of calculation = 23.466 ✓ conversion to 3sf = 23.5 (cm^3) ✓	**3**	**3 x 2.2**	If other volumes from table are included then first marking point lost but other marking points can be awarded on error carried forward.

Question			Answer	Marks	AO element	Guidance
9	(a)			3	3 x 1.1	Mark links to states and links to colours separately. all correct links = 3 marks 4/5 correct links = 2 marks 2/3 correct links = 1 mark
	(b)	(i)	Less reactive down the group / ORA ✓	1	3.1a	**ALLOW** reactions take longer / react less / more energy needed down the group.
		(ii)	(Yes because) chlorine is less reactive than fluorine ✓ More reactive than bromine ✓	2	2 x 3.1b	**ALLOW** chlorine is between fluorine and bromine for 1 mark.
	(c)	(i)	2K **AND** 2KBr ✓	1	2.2	**ALLOW** correct multiples
		(ii)	(Magnesium) 2 electrons in outer shell, (Aluminium) 3 electrons in outer shell ✓ Mg^{2+}, Al^{3+} ✓ $Mg\ Br_2$, $Al\ Br_3$ ✓	3	3 x 2.1	1 mark per column **ALLOW** Mg^{+2}, Al^{+3}

Question			Answer	Marks	AO element	Guidance
10	(a)		Provide alternative route ✓ With lower activation energy ✓	2	2 x 1.1	
	(b)		Low volume - less catalyst needed / less expensive✓ High surface area - more (chance of) collision / reaction ✓	2	2 x 2.1	**ALLOW** less metal✓
	(c)	(i)	Smaller particle size has bigger surface area to volume ratio /10 x particle size is 1/10th surface area to volume ratio ✓	1	3.1a	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.6 (nm^{-1}) award 4 marks** 10 x 10 / 100 (calculation of surface area of 1 face)✓ (10 x 10) x 6 / 600 (calculation of total surface area) ✓ 10x10x10 / 1000 (calculation of volume) ✓ Surface area ÷ volume correctly evaluated ✓	4	4 x 2.2	**ALLOW** 0.6 : 1 / 6 : 10 for 4 marks

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