OCR
Oxford Cambridge and RSA

GCSE (9-1)

Chemistry B (Twenty First Century)

Unit **J258F/02**: Foundation Tier – Depth in 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
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	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 Chemistry 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.

Question			Answer	Marks	AO element	Guidance
1	a		(graphite) solid✓ (CO_2) gas✓	2	2x 1.1	
	b		diamond and graphite contain only carbon (atoms) ✓ carbon dioxide contains carbon and oxygen (atoms) / also contains oxygen (atoms) ✓	2	2x 1.1	**ALLOW** only one <u>type</u> of atom / all same atom **ALLOW** two <u>types</u> of atom / different atoms **IGNORE** mixtures / elements
	c		diamond and graphite contain many atoms (bonded together) / many bonds / lattice ✓ carbon dioxide is a small molecule / contains only a few / 3 atoms (bonded together) / few / 2 bonds ✓	2	2x 1.1	**IGNORE** because they are very big **ALLOW** 'they are very big molecules.

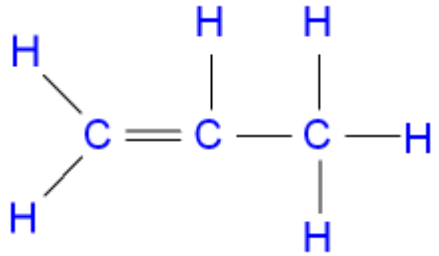
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>2</td><td>a</td><td>i</td><td>N_2 ✓

oxygen ✓</td><td>2</td><td>2 x 1.1</td><td>DO NOT ALLOW 2N</td></tr>
<tr><td></td><td></td><td>ii</td><td><table><tr><th></th><th>True</th><th>False</th></tr><tr><td>Nitrogen oxides are produced in car engines.</td><td>✓</td><td></td></tr><tr><td>Nitrogen oxides form at very high temperatures.</td><td>✓</td><td></td></tr><tr><td>NO_2 and NH_3 are examples of nitrogen oxides.</td><td></td><td>✓</td></tr></table></td><td>2</td><td>2 x 1.1</td><td>All correct = 2
2 correct = 1
1 correct = 0</td></tr>
<tr><td></td><td>b</td><td></td><td>(overall) decrease ✓

but has gone up and down ✓</td><td>2</td><td>2 x 2.1</td><td></td></tr>
<tr><td></td><td>c</td><td>i</td><td>They are harmful / cause breathing problems / health problems / named health problem e.g. cancer/blue baby syndrome ✓</td><td>1</td><td>1.1</td><td>Allow ‘acid rain’</td></tr>
<tr><td></td><td></td><td>ii</td><td>Layla: Mean (& lowest) daily concentration (has been below 100ppb / safe limit since 1990) ✓

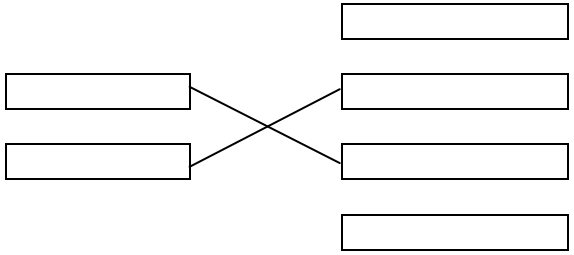
Mia: Highest (& mean & lowest /all) daily concentration (has been below 100ppb/safe limit since 2004) ✓</td><td>2</td><td>2 x 2.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
3	a		DBAC	2	2 x 1.2	G is left out ✓ others in correct order ✓
	bi		**Formula of gas:** O_2 and Cl_2 ✓ **Reason:** kills / removes bacteria ✓	2	2x 1.1	**DO NOT ALLOW** 2O or 2Cl **ALLOW** safe to drink / sterilises water **IGNORE** cleans water
	bii		Oxygen **Test:** glowing splint / spill ✓ **Result:** relights✓ Chorine **Result:** (red then) white/bleached ✓	3	3 x 1.2	 **ALLOW** description of process Mark independently **ALLOW** idea of losing colour

Question			Answer	Marks	AO element	Guidance
4	a	i	increases by one carbon and two hydrogen atoms / increases by CH_2 ✓ gives number of C and H atoms in at least two pairs of compounds as evidence: methane has one carbon atom and four hydrogen atoms, ethane has two carbon atoms and six hydrogen atoms, propane has three carbon atoms and eight hydrogen atoms, butane has four carbon atoms and ten hydrogen atoms ✓	2	2 x 2.1	
		ii	C_5H_{12} ✓	1	2.1	**DO NOT ALLOW** C5H12 or C^5H^{12}
	b	i	 One double bond shown / 3 carbons and 6 hydrogens shown in a molecule ✓ molecule shown fully correct ✓	2	2x 2.1	Fully correct structure (2) marks
		ii	Alkenes need to contain at least two carbon atoms ✓	1	2.1	
	c	i	alkenes have twice as many hydrogen atoms as carbon atoms ✓ shows working using values of 'n' for <u>at least two</u> alkenes: ethene n=2, 2n=4, propene n=3, 2n=6,	2	2x 2.1	

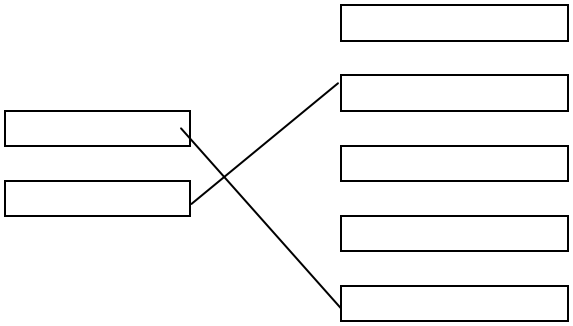
Question			Answer	Marks	AO element	Guidance
			butene n=4, 2n=8, pentene n=5, 2n=10✓			
		ii	All alkenes have twice as many hydrogen atoms as carbon atoms. ✓	1	2.1	**ALLOW** explanation of ratio

Question			Answer	Marks	AO element	Guidance
5	a		protons: 9 ✓ neutrons: 10 ✓ Group :17 / 7✓	3	3 x 2.1	
	b	i	same number of protons / atomic number / neutrons / electron shells / (relative) mass ✓ different number of electrons ✓	2	2 x 1.1	**ALLOW:** one more electron (in the ion) **ALLOW:** ion is charged and atom is neutral
		ii	F^-✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
6	a	i	(HCl) 36.5 ✓ (H_2O) 18(.0) ✓	2	2x 2.2	
		ii	13.45g ✓	1	2.2	
	b	i	solid copper oxide → filtration ✓ copper chloride crystals → evaporation ✓	2	1.2	
		ii	not all copper oxide reacted / used up / copper oxide left at the end / not enough acid used ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
7	a	i	21 – 22 (cm^3) ✓	1	2.2	
		ii	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 9-11 (cm^3) award 2 marks** Uses 31 - 32 in answer ✓ 31.5 - 21.5 = 10 ±1.0 (cm^3) ✓	2	2 x 2.2	**ALLOW ECF** from (a)(i)
	b		slows down ✓ then stops ✓	2	2 x 3.1a	**IGNORE** starts fast **IGNORE** reference to volume rather than rate
	c	i	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 3.5 (cm^3/s) award 2 marks** Uses 2.8 <u>and</u> 4.2 in working ✓ = 3.5 (cm^3/s) ✓	2	2 x 2.2	
		ii	rate increases as concentration increases ✓ when concentration doubles rate doubles ✓	2	2x 3.1a	**ALLOW** positive correlation ✓ 'when concentration doubles rate doubles' earns 2 marks (second marking point subsumes first)
		iii	rate of reaction α concentration ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
8	(a)*		*Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** Identifies all elements present and not present in both salts and justifies their answer. *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)** Identifies element(s) present in Table Salt and Healthy Salt and identifies at least one element that is absent. **OR** Identifies element(s) present in Table Salt and Healthy Salt and justifies their answer. *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)** Identifies element(s) present in Table Salt or Healthy Salt **OR** identifies element(s) not present. *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	**4x 3.2b** **2x 3.1b**	**AO3.2b Identifies elements in Table and Healthy Salt** • Healthy salt contains sodium and potassium • Table salt contains sodium • Elements identified quantifiably **AO3.2b Identify elements that Table Salt and Healthy salt do not contain.** • Table salt does not contain potassium • Both salts do not contain lithium • Both salts do not contain rubidium • Healthy salt only contains sodium and potassium • Table salt only contains sodium **AO3.1b Justifies their answer.** • If elements are present lines 'match'. • Lines are in same pattern / position / wavelength • If element is absent there are no lines matching **Ignore** any comments about how reactive the elements are – or their suitability to be used in food.

Question			Answer	Marks	AO element	Guidance
	b		**Any three from:** Advantages: automated idea ✓ does not rely on colour / judgement / less human error idea ✓ does not involve handling hazardous chemicals ✓ tests for multiple ions at the same time ✓ Disadvantages: Needs an (expensive) machine ✓ More difficult to interpret lines ✓	**3**	**1.1** **2.1 x2**	**For 3 marks must have both advantages and disadvantages** **ALLOW** more accurate / reliable **IGNORE** "quicker" **IGNORE** expensive" by itself
	c		Qualitative ….. Used to find out what chemicals are in a sample✓ Quantitative …… Used to measure the amount of chemical in a sample ✓	**2**	**2 x 1.2**	

Question			Answer	Marks	AO element	Guidance
9	(a) *		*Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** Chooses PET bottles and justifies their choice in terms of energy and waste using data from the table **AND** fully explains why all of the containers cause some harm to the environment. *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)** Chooses PET bottles and justifies their choice in terms of energy and waste. **OR** Chooses PET bottles and uses data to explain why containers cause some harm to the environment. *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)** Chooses PET bottles and makes a statement linked to energy or waste. OR Makes a statement about data linked to the harm to the environment. *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 x 3.1b** **3 x 3.2a**	**AO3.1b Links data for all containers to harm to the environment** • energy use uses fuels • energy use gives emissions / harmful gases • waste needs landfill/disposal • heavier waste linked to transport/energy use • higher volume takes up more space • glass bottle has highest mass and highest volume therefore takes up most space and harms the environment **AO3.2a Chooses and justifies PET bottles** • PET bottles use least energy • PET bottles produce lowest mass of waste • PET bottles produce lowest volume of waste • PET drinks bottles can be reused therefore using less energy than if they were recycled **ALLOW** biodegradable at level one, **ALLOW** discussion of sea pollution at Level one.

Question			Answer	Marks	AO element	Guidance
	(b)		The distances that the containers have to be transported ✓ The amount of water used to manufacture the containers✓	**2**	**2x 2.1**	

Question			Answer	Marks	AO element	Guidance
10	a		(to identify alkene) add bromine (water) ✓ (to identify acid) add indicator/ any named indicator / a carbonate ✓ **result for alkene**: bromine goes (from orange to) colourless and **result for acid**: turns indicator paper red / gives pH less than 7 with UI or pH probe / fizzes with carbonate (and remaining compound is neither) ✓	**3**	**1.2** **2x 2.1**	**IGNORE** additional reagents **ALLOW** yellow/orange colour / low pH **ALLOW** phenolphthalein goes (purple or pink to) colourless
	bi		quotes both 1.7 and 4.0 (mol/dm^3) in answer ✓ uses 'greater than or equal to' (1.7) and 'less than' (4.0) ✓	**2**	**2x 2.2**	**ALLOW** 1.7 and 3.9 **ALLOW** 3.9 for 'less than 4.0' **IGNORE** use of symbols
	bii		5(.0) or higher / quotes value ✓	**1**	**2.2**	**IGNORE** units
	biii		**Any three from:** gloves / goggles / safety screen ✓ identifies mixture hazard as flammable ✓ identifies mixture hazard as corrosive ✓ additional detail: mix chemicals before lighting any flame / use a water bath or electric heater / do not heat with a naked flame / avoid contact with skin or eyes / wash any splashes (immediately) ✓	**3**	**3x 3.3a**	 **ALLOW** it will catch fire **ALLOW** it will burn you or burn skin/eyes **ALLOW** 'protect skin/eyes'

Question			Answer	Marks	AO element	Guidance
11	a		4 ✓	1	2.1	
	b		they were not yet discovered / he didn't know about them ✓	1	2.1	
	c		In any order: Cu Zn Cr ✓✓	2	2x 2.1	**ALLOW** names **IGNORE** Fe Co Ni **DO NOT ALLOW** any other additional elements (apply list principle) All three correct = 2 marks Two or one correct = 1 mark
	d		They act as catalysts in reactions ✓	1	1.1	
	e	i	(adds UI to the acid/drops acid on paper AND) looks at (red/yellow/orange) colour ✓ compares colour to chart ✓	2	2x 1.2	
	e	ii	some salts have similar pH / all have pH of 3 or 4 / copper sulfate and iron sulfate have the same pH / zinc sulfate and nickel sulfate have the same pH / pH values are only to whole numbers ✓ use a pH probe / use full range indicator paper ✓	2	2x 3.3.b	

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