F

GCSE (9–1)

Combined Science B (Twenty First Century Science)

J260/02: Chemistry (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for November 2020

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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

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:

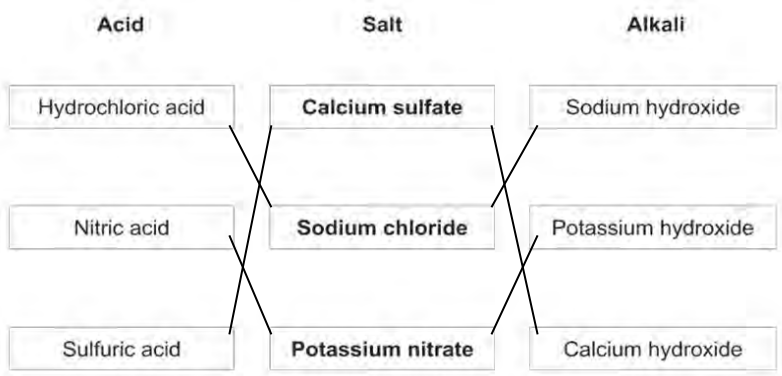
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge 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.

Question			Answer	Marks	AO element	Guidance
1	(a)	(i)	(proton) - in (the) nucleus ✓ (neutron) – 1, 0, in (the) nucleus ✓ (electron) – negligible or 0.0005 or 1/1840 or 1/2000, -1 ✓	3	1.1	**ALLOW** marking by column where this would produce an improved outcome for the candidate ie Relative Mass 1 **and** negligible(AW) Relative charge = 0 **and** -1 Location in the atom nucleus **and** nucleus
		(ii)	Group number = 16 or 6 ✓ Period number = 3 ✓	2	2.1	
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.001 (mm) award 2 marks** 10000 x 0.1 (= 1000) ✓ ÷ 1,000,000 = 1 x 10^{-3}(mm) ✓	2	 1.2 2.1	

Question			Answer	Marks	AO element	Guidance
2	(a)		**Stage in the treatment** / **What it does** aeration → breaks down organic material. bacteria added → provides oxygen. filtration → removes large objects. settlement → solid falls to bottom of tank. ✓✓	2	1.1	Three correct = 2 marks Two correct = 1 mark
	(b)		(Test -) – damp Litmus/universal indicator ✓ (Result) – (from blue to red, and then) bleached white ✓	2	1.2	
	(c)	(i)	(1890 -) 30 ✓ (1930 -) 10 ✓	2	2.2	
		(ii)	bar of 25 at 1895 ✓	1	1.2	
		(iii)	Any **one** from: Idea of less typhoid cases after 1910(ORA) ✓ Typhoid infections at lowest after 1910(ORA) ✓ **AND** Uses numbers from bar chart ✓	2	2.2	**ALLOW** eg goes down by 7 (per 100,000 from 1910 - 1915)
	(d)	(i)	Kills(AW) microorganisms/bacteria (in water) ✓	1	1.1	**IGNORE** germs / removes bacteria
		(ii)	Benefit – stops spread of waterborne diseases/reduces death from unsafe water ✓ Risk – poisonous so could kill people / allergic reaction to chlorine ✓	2	2.1	**ALLOW** does not make people ill, / kills microorganisms **DO NOT ALLOW** 'makes water safer if unqualified'

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td>electrons
transferred
electrostatic
lattice
✓✓✓</td><td>3</td><td>1.1</td><td>four correct = 3 marks
three correct = 2 marks
two correct= 1 mark</td></tr>
<tr><td></td><td>(b)</td><td></td><td>✓✓✓
<table><tr><th></th><th>Fig 3.1</th><th>Fig 3.2</th></tr><tr><td>How the ions are arranged.</td><td>✓</td><td></td></tr><tr><td>How the ions are formed.</td><td></td><td>✓</td></tr><tr><td>The charge on each ion</td><td>✓</td><td>✓</td></tr></table></td><td>3</td><td>2.1</td><td>four correct = 3 marks
three correct = 2 marks
two correct = 1 mark</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Ions ✓
don’t move in (sodium chloride) solid/only move in solution/when molten ✓</td><td>2</td><td>2.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td><u>sodium</u> (metal) AND <u>chlorine</u> (gas) ✓✓</td><td>2</td><td>2.2</td><td>ALLOW answers in either order</td></tr>
<tr><td></td><td>(d)</td><td></td><td>Heat until most of the solution has evaporated ✓
Leave hot solution to cool slowly ✓</td><td>2</td><td>1.2</td><td></td></tr>
<tr><td></td><td>(e)</td><td></td><td>Distillation ✓
Membrane filtration ✓</td><td>2</td><td>1.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
4	(a)		Crude oil is finite ✓ Plants are renewable ✓	2	1.1	
	(b)	(i)	The energy used to transport the shirts. ✓ The energy and water used to wash the shirts. ✓	2	2.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 30(MJ) award 2 marks** (97 + 33) 130 **AND** (60+40) 100 ✓ (130-100) = 30 (MJ) ✓	2	1.2	
		(iii)	**Advantages** polyester – uses less water(ORA) ✓ polyester – produces less carbon dioxide(ORA) ✓	2	3.2b	**ALLOW** correct use of relevant data for each response.
		(iv)	**Disadvantage** polyester – uses more energy ✓	1	3.2b	**ALLOW** correct use of relevant data
	(c)	(i)	Any **two** from: recycling ✓ reusing ✓ landfill ✓	2	1.1	**ALLOW** examples e.g. “donate to charity shop”, send to waste disposal **ALLOW** composting/biodegrading if linked to cotton shirts.
		(ii)	Any **one** from: Energy released can be used to generate steam which can generate a turbine ✓ Energy can be used for electricity/heating houses ✓	1	2.1	**ALLOW** heating water for a purpose eg central heating **ALLOW** energy used for manufacturing purposes

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	 ✓✓✓	3	2.1	One mark for each correct combination of acid, salt and alkali
		(ii)	(Calcium chloride – ions) Ca^{2+} AND Cl^- ✓ (Calcium chloride – relative formula mass) 111.1 ✓ (Calcium nitrate – formula) $Ca(NO_3)_2$ ✓	3	2.1	

Question			Answer	Marks	AO element	Guidance
6	(a)		$3O_2$ ✓ $2CO_2$ AND $3H_2O$ ✓	2	2.2	
	(b)	(i)	balance ✓ thermometer ✓	2	3.3a	
		(ii)	The energy given out when ethanol burns. ☐ The energy needed to boil the ethanol. ☐ The energy needed to break bonds in the ethanol molecules. ✓ The energy supplied by a catalyst. ☐ The minimum energy needed for the reaction to start. ✓	2	2.1	
	(c)	(i)	exothermic because temperature goes up ✓	1	3.2a	**DO NOT ALLOW** exothermic because it give out heat, must have reference to the results of the experiment.
		(ii)	0.4(g) ✓	1	3.1a	
		(iii)	8(°C) ✓	1	3.1a	
		(iv)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 6.72 (kJ) award 3 marks** 4200 x (200/1000) x 8 ✓ = 6720 ✓ = 6.72 (kJ) ✓	3	2.2x2 1.2	**ALLOW** ecf throughout

<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>(i)</td><td>hydrogen ✓</td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>
<table>
<tr><th>Property</th><th>True</th><th>False</th></tr>
<tr><td>They have the same molecular formula</td><td></td><td>✓</td></tr>
<tr><td>They have the same general formula</td><td>✓</td><td></td></tr>
<tr><td>They have the same boiling points</td><td></td><td>✓</td></tr>
<tr><td>They show a trend in physical properties</td><td>✓</td><td></td></tr>
</table>
</td><td>4</td><td>1.1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>
<table>
<tr><td>It is a black, sticky liquid.</td><td></td></tr>
<tr><td>It can be made into lots of other chemicals.</td><td>✓</td></tr>
<tr><td>It will never run out.</td><td></td></tr>
<tr><td>It is a source of fuels.</td><td>✓</td></tr>
<tr><td>It contains many ionic compounds.</td><td></td></tr>
</table>
</td><td>2</td><td>1.1</td><td></td></tr>
</table>

Question	Answer	Marks	AO element	Guidance
*(b)	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)** **Describes fractional distillation AND explains separation with appropriate use of data.** *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)** **Describes fractional distillation AND uses the data** **OR** **Describes fractional distillation AND explains separation** **OR** **Uses the data AND explains separation** *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)** **Basic description of fractional distillation** **OR** **Attempts to explain separation** **OR** **Some reference to data** *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**	**1.1 x 4** **3.1a x 2**	**AO1.1 Description of fractional distillation** • Crude oil heated • Boils • Vapours rise up column • Condense at different heights • Column is cooler at the top **AO1.1 Explains separation** • Separates due to different boiling points • Separates different chain lengths • Lower boiling points don't condense until tower is cooler • Smaller chains vaporise more easily **AO3.1a Uses data** • Shorter chains have lower boiling points (ORA) • Shorter chains move higher up (ORA) • Lower boiling points move higher up (ORA) • Boiling point depends on chain length

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	Gas particles leave the flask ✓	1	1.2	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.012 award 3 marks** 0.7 ÷ (1x60) ✓ = 0.01166666…. ✓ = 0.012 (g/s) (2sf) ✓	3	 2.2x2 1.2	 **ALLOW** any number of significant figures e.g. 0.01 **ALLOW** ecf from incorrect calculation
	(b)		Use more concentrated acid ✓ Use powdered calcium carbonate instead of pieces ✓	2	3.3b	
	(c)	(i)	gas syringe ✓ graduated ✓ **OR** collection over water with measuring cylinder ✓ graduations ✓	2	1.2	**ALLOW** labels to identify apparatus and graduations.
		(ii)	(Yes because) Any **one** from: Rate/volume of gas increases when temperature increases ✓ Volume of gas given off equivalent to rate ✓ Rate/volume of gas doubles every 10°C ✓ **AND** Uses data to justify proportionality/rate doubles every 10°C ✓	2	3.2b	**DO NOT ALLOW** if 'no' is selected. **NOTE** (yes because) rate of gas doubles every 10°C = 2 marks **NOTE** (no because) rate of gas doubles every 10°C = 1 mark

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>9</td><td>(a)</td><td></td><td>
<table>
<tr><td>Symbol</td><td>Na atom</td><td>F^- ion</td></tr>
<tr><td>Atomic number</td><td>11</td><td>(9)</td></tr>
<tr><td>Number of protons</td><td>(11)</td><td>(9)</td></tr>
<tr><td>Number of electrons</td><td>11</td><td>10</td></tr>
<tr><td>Number of neutrons</td><td>12</td><td>10</td></tr>
<tr><td>✓✓✓</td><td></td><td></td></tr>
</table>
</td><td>3</td><td>2.1</td><td>One mark for two correct
Two marks for three/four correct
Three marks for five correct</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>(Same period because) both have 3 shells ✓
(Different group because) different number of electrons in outer shell ✓</td><td>2</td><td>2.1</td><td>ALLOW have same number of shells</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>(Argon is) unreactive (because it has a full outer shell of electrons) ✓</td><td>1</td><td>1.1</td><td>IGNORE stable/not very reactive</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td><u>positive</u> (metal)ions / cations
(delocalised) electrons
✓</td><td>1</td><td>1.1</td><td>BOTH needed for one mark</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Malleable – ions slide past each other
Solid conducts electricity – outer shell electrons move freely
High melting point – strong attraction between ions and electrons
✓✓</td><td>2</td><td>1.1</td><td>three correct = 2 marks
two correct = 1 mark</td></tr>
</table>

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