

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.

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Annotations

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.

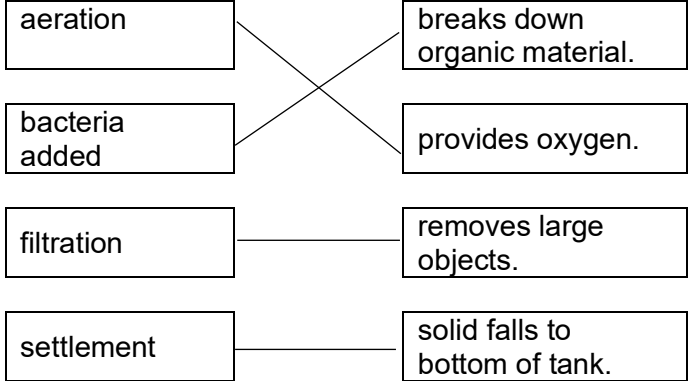
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New 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 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) <u>nucleus</u> ✓ (neutron) – 1, 0, in (the) <u>nucleus</u> ✓ (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)	<p>Stage in the treatment</p>  <p>✓✓</p>	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)	<u>Kills</u> (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'

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

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)	<table border="0" style="width: 100%; text-align: center;"> <tr> <td style="width: 33%;">Acid</td> <td style="width: 33%;">Salt</td> <td style="width: 33%;">Alkali</td> </tr> <tr> <td>Hydrochloric acid</td> <td>Calcium sulfate</td> <td>Sodium hydroxide</td> </tr> <tr> <td>Nitric acid</td> <td>Sodium chloride</td> <td>Potassium hydroxide</td> </tr> <tr> <td>Sulfuric acid</td> <td>Potassium nitrate</td> <td>Calcium hydroxide</td> </tr> </table> <p>✓✓✓</p>	Acid	Salt	Alkali	Hydrochloric acid	Calcium sulfate	Sodium hydroxide	Nitric acid	Sodium chloride	Potassium hydroxide	Sulfuric acid	Potassium nitrate	Calcium hydroxide	3	2.1	One mark for each correct combination of acid, salt and alkali
Acid	Salt	Alkali														
Hydrochloric acid	Calcium sulfate	Sodium hydroxide														
Nitric acid	Sodium chloride	Potassium hydroxide														
Sulfuric acid	Potassium nitrate	Calcium hydroxide														
	(ii) (Calcium chloride – ions) Ca^{2+} AND Cl^- ✓ (Calcium chloride – relative formula mass) 111.1 ✓ (Calcium nitrate – formula) $\text{Ca}(\text{NO}_3)_2$ ✓	3	2.1													

Question		Answer	Marks	AO element	Guidance
6	(a)	3O ₂ ✓ 2CO ₂ AND 3H ₂ O ✓	2	2.2	
	(b) (i)	balance ✓ thermometer ✓	2	3.3a	
	(ii)	<p>The energy given out when ethanol burns. <input type="checkbox"/></p> <p>The energy needed to boil the ethanol. <input type="checkbox"/></p> <p>The energy needed to break bonds in the ethanol molecules. <input checked="" type="checkbox"/></p> <p>The energy supplied by a catalyst. <input type="checkbox"/></p> <p>The minimum energy needed for the reaction to start. <input checked="" type="checkbox"/></p>	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)	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 6.72 (kJ) award 3 marks</p> <p>4200 x (200/1000) x 8 ✓ = 6720 ✓ = 6.72 (kJ) ✓</p>	3	2.2x2 1.2	ALLOW ecf throughout

Question			Answer			Marks	AO element	Guidance
7	(a)	(i)	hydrogen ✓			1	1.1	
		(ii)	Property	True	False	4	1.1	
			They have the same molecular formula		✓			
			They have the same general formula	✓				
			They have the same boiling points		✓			
			They show a trend in physical properties	✓				
		(iii)	It is a black, sticky liquid. <input type="checkbox"/> It can be made into lots of other chemicals. <input checked="" type="checkbox"/> It will never run out. <input type="checkbox"/> It is a source of fuels. <input checked="" type="checkbox"/> It contains many ionic compounds. <input type="checkbox"/>			2	1.1	

Question	Answer	Marks	AO element	Guidance
*(b)	<p>Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Describes fractional distillation AND explains separation with appropriate use of data. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>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</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Basic description of fractional distillation OR Attempts to explain separation OR Some reference to data</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>	6	1.1 x 4 3.1a x 2	<p>AO1.1 Description of fractional distillation</p> <ul style="list-style-type: none"> • Crude oil heated • Boils • Vapours rise up column • Condense at different heights • Column is cooler at the top <p>AO1.1 Explains separation</p> <ul style="list-style-type: none"> • 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 <p>AO3.1a Uses data</p> <ul style="list-style-type: none"> • 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 $0.7 \div (1 \times 60)$ ✓ $= 0.01166666\dots$ ✓ $= 0.012$ (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

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

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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