F

GCSE (9–1)

Combined Science A (Gateway Science)

J250/04: Paper 4 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2019

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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.

Seen needs to be placed on Page 24, and in the spaces after.

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science 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.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

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

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	Sodium ✓	1	2.1	
		(ii)	**Any one from:** Use a safety screen ✓ Use a small piece of D/sodium ✓ Use a fume cupboard ✓ Wear (safety) goggles ✓ Use tongs to pick up D/sodium ✓ Use cold water ✓	1	2.2	**ALLOW** children far away **ALLOW** eye protection **IGNORE** masks
		(iii)	Hydrogen: Lighted splint (into gas) **and** (loud/squeaky) pop / AW ✓ Oxygen: glowing splint (into gas) **and** splint does not relight / AW ✓	2	2×3.2b	**ALLOW** add flame **IGNORE** squeaky pop test **IGNORE** light and blow out a splint
		(iv)	**easy** to lose 1 electron / **easy** to form a positive ion ✓	1	1.1	**ALLOW** lose electrons **easily/readily** **ALLOW** they have 1 electron in outer shell
	(b)	(i)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 3 award 2 marks** 1.532 ÷ 0.534 / 2.8689….. ✓ = 3 ✓	2	2×2.2	 **ALLOW** 2.8/2.9 **ALLOW** a correctly evaluated and rounded one sf answer from an incorrect method (e.g. 1.532 - 0.534 = 0.998 **and** answer given as 1)

Question			Answer	Marks	AO element	Guidance
		(ii)	(Density = (½ (0.968 + 0.855)) =) 0.9(115) (g/cm^3) ✓	**1**	**2.2**	**ALLOW** correct rounding or truncating
		(iii)	Accept 1.40 – 2.80 (g/cm^3) ✓	**1**	**3.2a**	
	(c)	**(i)**	**2**KBr + Cl_2 → **2**KC*l* + Br_2 ✓	**1**	**2.2**	**BOTH** required **ALLOW** multiples
		(ii)	Potassium bromide ✓	**1**	**2.1**	
		(iii)	Bromine less reactive (than chlorine) / ORA ✓ Bromine displaced/replaced by chlorine ✓	**2**	**2×1.1**	Chlorine is more reactive (than bromine) Chlorine displaces bromine **DO NOT ALLOW** chloride / bromide

Question			Answer	Marks	AO element	Guidance
12	(a)	(ii)	= ✓	1	1.1	**ALLOW** equal(s)
	(b)		The **reaction** can go both ways/forwards and backwards/backwards ✓	1	1.1	**ALLOW** the **reaction**/it can (be made to) go backwards / products to reactants **IGNORE** it can be undone/it changes back to original **state**/reversible/in reverse
	(c)	(i)	(Burning) fossil fuels (in power plants/industry) ✓ (using) diesel/petrol (in vehicles) ✓ (using) diesel/petrol (in generators) ✓ (using) fuel oil (in ships) ✓ volcanoes✓	1	1.1	**ALLOW** named fossil fuel
		(ii)	**Any two from:** damages/kills/destroy / trees / crops / habitats ✓ damages/kills aquatic / marine animals / acidifies waterways ✓ corrosion of buildings / statues / limestone / marble ✓ corrodes metals ✓ respiratory/breathing problems/asthma ✓	2	2×1.1	**IGNORE** pollution **IGNORE** acid rain **IGNORE** greenhouse gas/global warming/climate change **IGNORE** kills animals unqualified **IGNORE** harmful **ALLOW** deforestation **ALLOW** erodes buildings **IGNORE** harmful unqualified /dangerous/toxic

Question			Answer	Marks	AO element	Guidance
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 49.9 (%) award 3 marks** {32.0 ÷ 64.1} × 100 ✓ = 49.92199 ..... ✓ = 49.**9** (%) (1dp) ✓	3	**2×2.2** **1.2**	**ALLOW** for 2 marks: 32.0 ÷ 64.1 = 0.49921 ..... ✓ = 0.5 ✓ **OR** 16 ÷ 64.1 = 24.96 ✓ = 25.0 ✓ **OR** A method with one error **ALLOW** for 1 mark % S {32.1 ÷ 64.1} × 100 = 50.1(%) ✓ **OR** 16/48.1 x 100 = 33.3 (%) ✓ **ALLOW** a correctly evaluated and rounded answer from an incorrect method using both 16 and 32.1 to give an answer with 1 dp (e.g. 16/32.1 = 49.8)
	(e)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 3100 (kilotonnes) award 2 marks** In 1975: amount ≈ 3200 In 2015: amount ≈ 100 ✓ Decrease = 3200 – 100 = 3100 (kilotonnes) ✓	2	**2×2.2**	**ALLOW** 3050 – 3150 inclusive for 2 marks **ALLOW** ecf from one incorrect value provided subtraction shown for 1 mark

Question			Answer	Marks	AO element	Guidance
13	(a)		CH_4 ✓	1	1.2	**ALLOW** C_1H_4
	(b)	(i)	x-axis labelled number of carbon atoms and y-axis labelled energy released (kJ / mol) ✓ sensible scale on axis labelled energy, linear and at least half the grid C1 to C8 ✓ Points plotted correctly to within ±½ square on a linear scale ✓ Line of best fit is a straight line using plotted points ✓	4	3×2.2 1.2	Axes inverted does not score this mark BUT all other marks are available 7 or more cm squares The numbers on C atom axis need to be linear BUT only from 3 **ALLOW** 5 points plotted correctly **DO NOT ALLOW** straight line through the origin
		(ii)	Energy = 800 – 1000 (kJ) ✓	1	2.2	**ALLOW** 700 – 1000 (kJ)
	(c)	(i)	hydrogen **and** gains/adds oxygen ✓	1	2.1	**ALLOW** reacts with oxygen/bonded to oxygen/oxide formed **IGNORE** forms water / forms H_2O / with oxygen
		(ii)	mass is not lost / mass is not made / atoms/matter cannot be created or destroyed / AW ✓ Because CO_2 gas and steam are formed / because CO_2 gas and water vapour are formed / products are gases / gas given off/formed AW ✓	2	2×2.1	 **DO NOT ALLOW** incorrectly named gas **IGNORE** evaporates

Question			Answer	Marks	AO element	Guidance
14	*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6marks)** Detailed explanation relating boiling points from table to intermolecular forces and average number of carbon atoms per chain. *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)** Detailed explanation relating boiling points from table to average number of carbon atoms per chain. **OR** Detailed explanation relating boiling points from table to intermolecular forces. **OR** Detailed explanation relating intermolecular forces and average number of carbon atoms per chain. *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)** An attempt to relate boiling points from table to average number of carbon atoms per chain. **OR** An attempt to relate boiling points from table to intermolecular forces. **OR** An attempt to relate intermolecular forces and average number of carbon atoms per chain.	6	3×3.1a 3×1.1	**AO1.1 Demonstrate knowledge and understanding of scientific ideas concerning the separation of crude oil by fractional distillation** • Longer/larger/more carbon hydrocarbons have stronger inter-molecular forces • Stronger/more intermolecular forces result in a higher boiling point • More energy needed to overcome stronger intermolecular forces • Different fractions condense at different heights/ boiling points/temperatures so get separated • Longer/larger hydrocarbons have stronger inter-molecular forces **AO3.1a Analyse information and ideas to interpret data from table** • Fractions with lower boiling points condense further up column • Column cooler at the top/hotter at the bottom • As column height increases, boiling points decrease / ORA • As column height increases, number of carbon atoms per chain decreases /ORA • larger molecules have higher b.pt. / ORA

Question			Answer	Marks	AO element	Guidance
			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.*			

Question			Answer	Marks	AO element	Guidance
15	(a)		Less waste sent to landfill ✓ (Because) more is recycled / more is burned (to produce energy) / public more aware of recycling/environmental issues due to landfill / want to reduce greenhouse gases / conserve finite resources / less bin collections for landfill ✓ **Or** More waste recycled ✓ (because) less waste sent to landfill / public more aware of recycling/environmental issues due to landfill / conserve finite resources / government promotion/ less bin collections for landfill ✓ **Or** More is burned (to produce energy) ✓ (because) less waste sent to landfill / Save fossil fuels / (it is an) alternative/renewable resource ✓	**2**	**3.1a** **2.1** **3.1a** **2.1** **3.1a** **2.1**	**Description and explanation are required for 2 marks** **ALLOW** other valid explanations

Question			Answer	Marks	AO element	Guidance
	(b)		**Any one from:** expensive ✓ (hot) water wasted/used ✓ (material) needs cleaning ✓ need collecting/transporting/sorting/separating ✓ lots of/more energy / fuel wasted/used ✓ time consuming ✓ pollution/emissions produced ✓ quality deteriorates ✓	1	1.1	**IGNORE** not all materials can be recycled

Question			Answer	Marks	AO element	Guidance
16	(a)		$Mg + \mathbf{2}HCl \rightarrow MgCl_2 + H_2$ Formulae ✓ Balancing ✓	2	 2.1 2.2	**ALLOW** any correct multiple, including fractions **ALLOW** = / ⇌ instead of → **NOT** and / & instead of + balancing mark is dependent on the correct formulae but **ALLOW** 1 mark (M2) for a balanced equation with a minor error in subscripts / formulae eg $MG + \mathbf{2}HCl \rightarrow MgCl_2 + H_2$
	(b)	(i)	Concentration (of the acid) ✓	1	3.3a	**IGNORE** volume/amount
		(ii)	**Any two from:** (Keep) mass/amount of Mg (constant/ the same) ✓ (Keep) temperature (constant/ the same) ✓ (Keep) surface area (of Mg the constant/ the same) ✓	2	2×3.3a	**IGNORE** volume of acid **ALLOW** (Keep) size/length of Mg (constant/ the same) **ALLOW** (Keep) type of acid (the same) ✓ **ALLOW** 1 mark for magnesium unqualified if no other mark given.

Question	Answer	Marks	AO element	Guidance
(c)	**Any one from:** Stopwatch not reset ✓ Equipment not washed out (properly after use) ✓ Concentration of acid incorrect ✓ Volume/amount of acid incorrect or mass/amount Mg added incorrect ✓ reaction mixture not stirred consistently / AW ✓	1	3.3a	**ALLOW** stopwatch started or stopped late/early **ALLOW** stopwatch misread **ALLOW** timed incorrectly **ALLOW** different sizes of magnesium **IGNORE** references to temperature
(d)	As concentration increases, rate of reaction increases / time for reaction decreases / ORA ✓ (Greater concentration means) more particles **in same volume** / ORA ✓ So more collisions per second / greater chance of a collision / more frequent collisions / ORA ✓	3	3.2a 1.1 1.1	**ALLOW** molecules/ions/atoms for particles through out **ALLOW** Rate stays constant after 0.8 (mol/dm^3) / at higher concentration **ALLOW** more crowded particles **/ AW** **DO NOT ALLOW** particles have more energy **AW**

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