

GCSE

COMBINED SCIENCE: TRILOGY

Physics Paper 1 Higher Tier

Mark scheme Practice Paper Series – Set 1 SGC/S1/P/1H

Version 1.1

This mark scheme is an original resource written for sciencegcse.co.uk to accompany the Set 1 practice paper SGC/S1/P/1H. It is not an AQA mark scheme and has not been produced or endorsed by AQA. It follows the structure and conventions of AQA GCSE science mark schemes so that students and teachers can mark the practice paper in the same way that a real paper is marked.

Marking should be carried out using the Information to Examiners on the following pages. The paper has not been standardised, so raw marks should not be converted into grades using any published grade boundaries.

Specification references are to the AQA GCSE Combined Science: Trilogy (8464) specification, Physics section 6.1–6.4. AO = assessment objective; WS = working scientifically; MS = mathematical skills; RP = required practical.

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the answer(s) expected, including alternative acceptable wording, in the **Answers** column
- guidance on which answers are and are not creditworthy in the **Extra information** column
- the assessment objective (AO) and specification reference for each marking point.

Award marks positively. Do not deduct marks for incorrect additional material unless it contradicts a correct answer (see 3.1). Marks are awarded for what the student has written, not for what they might have meant.

2. Emboldening and underlining

2.1 Where a list of acceptable answers is given and more than one mark is available, **any two from** (or similar) is used, followed by the acceptable answers.

2.2 A bold **and** indicates that both parts of the answer are needed to gain the mark.

2.3 Alternative answers acceptable for the same mark are separated by **or**. Different words that are acceptable within a marking point are separated by a forward slash (/).

2.4 Words in bold in the Answers column are the essential words that must be present, or their equivalent, for the mark to be awarded.

3. Marking points

3.1 Marking of lists

For a question asking for a fixed number of responses, consider the whole answer, including extra responses. Each incorrect or contradictory response cancels one correct response; ignore neutral additions. Numbered answer lines do not limit marking to the first responses. This rule does not apply to extended answers.

3.2 Marking procedure for calculations

Full marks can be awarded for a correct numerical answer without working, unless the question asks for working to be shown. If the answer is incorrect, marks may be awarded for the correct stages of working shown in the mark scheme. Anything shown in brackets in the Answers column (for example the unit) is not required for the mark.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward

Any error in the answer to a structured question causes the loss of the mark(s) for that part only. Later parts should be marked on the assumption that the incorrect answer was correct, where the mark scheme indicates that error carried forward (ECF) applies.

3.5 Phonetic spelling

Accept misspelled or phonetic scientific terms when the intended answer is clear, unless the spelling could be confused with a different technical term. This also applies when the question asks for the name of a process or structure.

3.6 Brackets

Words shown in brackets in the Answers column are not required to gain the mark but help to set the context.

3.7 Allow

Answers that are acceptable but which would not normally be expected are shown as **allow**.

3.8 Ignore

Statements shown as **ignore** are neither creditworthy nor penalised. Mark the rest of the answer normally.

3.9 Do not accept

Statements shown as **do not accept** are incorrect and, where they contradict or replace the expected answer, mean the mark is not awarded.

4. Level of response marking instructions

Extended-response questions (question 08.1 in this paper) are marked using a level of response mark scheme. The scheme has three levels, each covering two marks, plus a level descriptor and indicative content.

Step 1 – Determine a level. Read the whole answer and decide which level descriptor best fits it. Use a 'best-fit' approach: an answer does not need to meet every part of a descriptor to be placed in that level, and a weak part of the answer need not prevent it from reaching the higher level if the overall quality matches the descriptor.

Step 2 – Determine a mark within the level. Award the higher mark in the level if the answer meets the descriptor fully and the points made are well linked; award the lower mark if the answer only just meets the descriptor or contains minor errors or omissions.

The indicative content is not a checklist: students need not include every point to reach the top level, and other relevant, correct points should be credited. An answer that lists points without linking them into a coherent answer should be placed in a lower level than one that develops and connects them.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	B		1	AO2 6.3.1.2 6.3.2.3
01.2	100 (°C)		1	AO2 6.3.1.2 MS 4a
01.3	the energy is used to break / weaken the bonds (forces) between the particles or to change the state (from solid to liquid)	allow the energy increases the (potential) internal energy of the particles	1	AO1 6.3.2.3 6.3.2.1
	(so) the energy does not increase the kinetic energy of the particles / does not make the particles move faster (so the temperature stays the same)	allow the energy is not used to heat the substance	1	AO1 6.3.2.3 6.3.2.1
01.4	($\Delta E =$) $0.50 \times 4200 \times 40$ or $0.50 \times 4200 \times (60 - 20)$	an answer of 84 000 scores 2 marks an answer of 126 000 (60 °C used as the temperature change) or 42 000 (20 °C used) scores 1 mark	1	AO2 6.3.2.2 MS 3c
	($\Delta E =$) 84 000 (J)	allow 8.4×10^4 (J) or 84 kJ	1	AO2 6.3.2.2 MS 3c
01.5	($E =$) $0.50 \times 2\,260\,000$	an answer of 1 130 000 scores 2 marks	1	AO2 6.3.2.3 MS 3c
	($E =$) 1 130 000 (J)	allow 1.13×10^6 (J) or 1130 kJ an answer of 4 520 000 ($2\,260\,000 \div 0.50$) scores 0 marks	1	AO2 6.3.2.3 MS 3c
Total			8	
02.1	the time taken for the count rate (or activity) to halve / fall to half its initial value or the time taken for the number of (radioactive) nuclei in a sample to halve	allow the time for half of the (unstable) nuclei to decay do not accept the time for the source to half decay / for half the source to disappear	1	AO1 6.4.2.3
02.2	(half-life =) 4 (days)	allow 3.8 to 4.2 (days)	1	AO2 6.4.2.3 MS 4a
	correct construction lines shown on Figure 2 , e.g. from 400 counts per second to the curve and down to the time axis	allow lines showing any correct halving, e.g. from 200 to 100 counts per second	1	AO2 6.4.2.3 MS 4a
02.3	$\frac{1}{4}$	if more than one box is ticked, no mark	1	AO2 6.4.2.3 MS 1c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(gloves) stop the radioactive material getting onto the skin / hands or reduce the risk of contamination	allow gloves stop the worker touching the source	1	AO2 6.4.2.4
	(tongs) increase the distance between the source and the worker, so less radiation reaches the worker or reduce irradiation	allow tongs keep the source further from the body ignore tongs stop the worker touching the source without reference to distance or irradiation	1	AO2 6.4.2.4
02.5	(mass number =) 237		1	AO2 6.4.2.2
	(atomic number =) 93	numbers must be in the correct positions (mass number above the atomic number)	1	AO2 6.4.2.2
Total			8	
03.1	the current is the same at all points in the circuit	if more than one box is ticked, no mark	1	AO1 6.2.2
03.2	($4.0 + 8.0 =$) 12 (Ω)		1	AO2 6.2.2 MS 1a
03.3	($I =$) $12 \div 12$	an answer of 1.0 scores 2 marks allow ECF from an incorrect answer to 03.2	1	AO2 6.2.1.3 MS 3b MS 3c
	($I =$) 1.0 (A)	allow 1 (A)	1	AO2 6.2.1.3 MS 3b MS 3c
03.4	($V =$) 1.0×8.0	an answer of 8.0 scores 2 marks allow ECF from an incorrect answer to 03.3	1	AO2 6.2.1.3 6.2.2 MS 3c
	($V =$) 8.0 (V)	allow 8 (V) an answer of 4.0 (V) (pd across the 4.0 Ω resistor) scores 1 mark	1	AO2 6.2.1.3 6.2.2 MS 3c
03.5	the current through the two resistors is the same (because they are in series)		1	AO2 6.2.2
	(and) potential difference = current $\times$ resistance, so for the same current the larger resistance has the larger potential difference	allow the potential difference is (directly) proportional to the resistance when the current is the same allow more work is done (per coulomb) pushing the charge through the larger resistance	1	AO2 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	(in parallel) there is more than one path for the current or the current through the two resistors adds together	allow the current splits between the resistors	1	AO2 6.2.2
	(so) the total current from the battery is larger for the same potential difference, so the total resistance ($= V / I$) is smaller or the total resistance is less than the smallest individual resistance	allow each resistor has the full 12 V across it, so the current through the 4.0Ω resistor alone is already 3.0 A	1	AO2 6.2.2
Total			10	
04.1	$(E_p =) 500 \times 9.8 \times 20$	an answer of 98 000 scores 2 marks	1	AO2 6.1.1.2 MS 3c
	$(E_p =) \mathbf{98\ 000}$ (J)	allow 9.8×10^4 (J) or 98 kJ	1	AO2 6.1.1.2 MS 3c
04.2	$(E_k =) 98\ 000$ (J) or $\frac{1}{2} \times 500 \times v^2 = 98\ 000$	an answer of 19.8 or 20 scores 3 marks allow ECF from an incorrect answer to 04.1	1	AO2 6.1.1.2 MS 3b MS 3d
	$v^2 = (2 \times 98\ 000) \div 500 = 392$	an answer of 392 (square root not taken) scores 2 marks	1	AO2 6.1.1.2 MS 3b MS 3d
	$(v =) \mathbf{19.8}$ (m/s)	allow 20 (m/s) allow 19.79 to 19.80 (m/s)	1	AO2 6.1.1.2 MS 3b MS 3d
04.3	(the car does work against) friction / air resistance (as it moves along the track)	allow there is friction between the wheels and the track	1	AO3 6.1.2.1
	(so) some energy is transferred to the thermal energy store of the track / air / surroundings or some energy is dissipated, so less energy is transferred to the kinetic energy store of the car	allow not all the gravitational potential energy is transferred to kinetic energy do not accept energy is lost / used up without reference to where it goes	1	AO3 6.1.2.1
04.4	$(P =) 98\ 000 \div 25$	an answer of 3920 scores 2 marks allow ECF from an incorrect answer to 04.1	1	AO2 6.1.1.4 MS 3c
	$(P =) \mathbf{3920}$ (W)	allow 3900 (W) or 3.9 kW	1	AO2 6.1.1.4 MS 3c
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$(I =) 1840 \div 230$	an answer of 8.0 scores 2 marks	1	AO2 6.2.4.1 MS 3b MS 3c
	$(I =) \mathbf{8.0}$ (A)	allow 8 (A)	1	AO2 6.2.4.1 MS 3b MS 3c
05.2	$(P =) 8.0^2 \times 0.10$ or 64×0.10	an answer of 6.4 scores 2 marks allow ECF from an incorrect answer to 05.1 an answer of 0.8 (current not squared) scores 0 marks	1	AO2 6.2.4.1 MS 3c
	$(P =) \mathbf{6.4}$ (W)		1	AO2 6.2.4.1 MS 3c
05.3	a thicker wire has a lower resistance		1	AO2 6.2.1.3 6.2.4.1
	(so) for the same current, less power is dissipated / less energy is transferred by heating in the cable (because $P = I^2 R$)	allow less energy is wasted heating the cable do not accept the current is smaller	1	AO2 6.2.1.3 6.2.4.1
05.4	(if the live wire touches the case) the earth wire provides a low-resistance path (from the case) to earth / to 0 V	allow the current flows through the earth wire instead of through the user	1	AO1 6.2.3.2
	(so) a large current flows, which melts the fuse / breaks the circuit and cuts off the supply (before the user can get an electric shock)	allow the case cannot become live	1	AO1 6.2.3.2
Total			8	
06.1	(volume =) $0.20 \times 0.10 \times 0.050 = 0.0010$ (m ³)	an answer of 2700 scores 3 marks allow 1.0×10^{-3} (m ³)	1	AO2 6.3.1.1 MS 5c
	$(\rho =) 2.7 \div 0.0010$	allow ECF from an incorrect volume	1	AO2 6.3.1.1 MS 3c
	$(\rho =) \mathbf{2700}$ (kg/m ³)	an answer of 0.00037 (volume $\div$ mass) scores 1 mark (for the volume)	1	AO2 6.3.1.1 MS 3c
06.2	2.7 (g/cm ³)	allow ECF: their answer to 06.1 $\div$ 1000	1	AO2 6.3.1.1 MS 1c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	the particles in a gas are much further apart / there is much more (empty) space between the particles (so the same mass of gas takes up a much larger volume)	allow the particles are spread out ignore the particles move faster	1	AO1 6.3.1.1 6.3.1.2
06.4	the total kinetic energy and potential energy of all the particles (that make up the system / substance)	both kinetic and potential energy are needed for the mark allow the energy stored in the system by the particles	1	AO1 6.3.2.1
06.5	(heating) increases the kinetic energy of the particles / the particles move faster		1	AO1 6.3.3.1
	(so) the particles collide with the walls more often and/or with more force, so the (total) force on the walls / the force per unit area increases	allow more collisions per second with the container walls do not accept the particles expand / get bigger	1	AO1 6.3.3.1
06.6	condensation / condensing		1	AO1 6.3.1.2
Total			9	
07.1	(mass number =) 14		1	AO2 6.4.2.2
	(atomic number =) 7	numbers must be in the correct positions (mass number above the atomic number)	1	AO2 6.4.2.2
07.2	a neutron changes into a proton		1	AO1 6.4.2.1 6.4.2.2
	(and) an electron is created (in the nucleus) and emitted / ejected from the nucleus (at high speed)	allow the beta particle is a high-speed electron ejected from the nucleus do not accept an electron from the outer shell is emitted	1	AO1 6.4.2.1 6.4.2.2
07.3	(the atomic number) increases by 1	do not accept it increases without the amount	1	AO1 6.4.2.2
07.4	(24 ÷ 8.0 =) 3 half-lives	an answer of 1 : 8 scores 3 marks	1	AO2 6.4.2.3 MS 1c MS 3c
	1600 → 800 → 400 → 200 (Bq) or 1600 × $(\frac{1}{2})^3$	allow 1600 ÷ 8	1	AO2 6.4.2.3 MS 1c MS 3c
	(ratio =) 200 : 1600 = 1 : 8	an answer of 8 : 1 (the ratio inverted) scores 2 marks allow $\frac{1}{8}$ or 0.125 for 2 marks (not in the form asked for)	1	AO2 6.4.2.3 MS 1c MS 3c

Question	Answers	Extra information	Mark	AO / Spec. Ref.								
07.5	it is not possible to predict when a particular nucleus will decay or which nucleus will decay next	allow each nucleus has the same chance of decaying in a given time	1	AO1 6.4.2.3								
	(but) for a large sample the activity follows a predictable statistical decrease / the half-life is constant	do not accept a constant overall rate of decay / activity	1	AO1 6.4.2.3								
Total			10									
08.1	<table><tr><td>Level 3 (5–6 marks)</td><td>A clear, logically ordered method that gives all the measurements needed (mass, initial and final temperature, energy supplied), describes a sensible step to reduce or allow for energy transfer to the surroundings, and states correctly how the specific heat capacity is calculated from the results.</td></tr><tr><td>Level 2 (3–4 marks)</td><td>A method that gives most of the measurements needed and describes how the specific heat capacity is calculated, but with some detail missing or steps out of order.</td></tr><tr><td>Level 1 (1–2 marks)</td><td>Simple statements of some relevant steps, for example heat the block and measure the temperature, with little detail of the measurements needed.</td></tr><tr><td>0 marks</td><td>No relevant content.</td></tr></table> Indicative content • measure the mass of the block using a balance • put the heater in the larger hole and the thermometer in the smaller hole (a few drops of water or oil in the thermometer hole improve thermal contact) • wrap the block in insulation to reduce energy transfer to the surroundings • record the starting temperature and set the joulemeter to zero • switch on the heater for a set time, or until the temperature has risen by about 10 °C • record the energy transferred shown on the joulemeter (or use an ammeter, voltmeter and stopwatch: energy = potential difference × current × time) • switch off and record the highest temperature reached (the block continues to warm for a short time after the heater is switched off) • calculate the temperature change • calculate the specific heat capacity: $c = \text{energy transferred} \div (\text{mass} \times \text{temperature change})$ • or record the temperature at regular intervals, plot temperature against energy transferred and use the gradient ($c = 1 \div (\text{mass} \times \text{gradient})$) • repeat and calculate a mean value Credit other correct, relevant points. Do not credit measuring the temperature of the heater, or calculations that use the heater's power without a time.		Level 3 (5–6 marks)	A clear, logically ordered method that gives all the measurements needed (mass, initial and final temperature, energy supplied), describes a sensible step to reduce or allow for energy transfer to the surroundings, and states correctly how the specific heat capacity is calculated from the results.	Level 2 (3–4 marks)	A method that gives most of the measurements needed and describes how the specific heat capacity is calculated, but with some detail missing or steps out of order.	Level 1 (1–2 marks)	Simple statements of some relevant steps, for example heat the block and measure the temperature, with little detail of the measurements needed.	0 marks	No relevant content.	6	AO1 6.1.1.3 RP 14
Level 3 (5–6 marks)	A clear, logically ordered method that gives all the measurements needed (mass, initial and final temperature, energy supplied), describes a sensible step to reduce or allow for energy transfer to the surroundings, and states correctly how the specific heat capacity is calculated from the results.											
Level 2 (3–4 marks)	A method that gives most of the measurements needed and describes how the specific heat capacity is calculated, but with some detail missing or steps out of order.											
Level 1 (1–2 marks)	Simple statements of some relevant steps, for example heat the block and measure the temperature, with little detail of the measurements needed.											
0 marks	No relevant content.											
08.2	some of the energy supplied (by the heater) is transferred to the surroundings / not all the energy heats the block	allow thermal energy is transferred to the air / the thermometer / the heater itself	1	AO3 6.1.1.3 RP 14								

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	(so) the energy value used in the calculation is larger than the energy actually transferred to the block or the temperature rise is smaller than it should be for that energy, giving a value of c that is too large	allow $c = E \div (m\Delta\theta)$ with E too big or $\Delta\theta$ too small gives a bigger c	1	AO3 6.1.1.3 RP 14
Total			8	
TOTAL FOR PAPER			70	