AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.2.1

Energy transfers in a system

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**3**
Available paper years	**2018–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

6.1.2.1 Energy transfers in a system

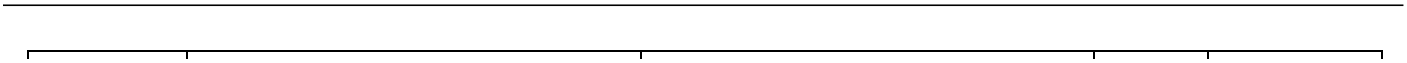
Answer 01 · Mark scheme June 2018 | 8464/P/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	the wall has two / three layers	allow the wall is thick	1	AO1 6.1.2.1
	cavity wall insulation / brick / block has a low thermal conductivity		1	
	so less energy is transferred by conduction	allow rate of energy transfer is lower ignore any reference to convection and / or radiation	1	
05.2	$T = 17.4 + \left(\frac{(20.8 - 17.4)}{2}\right)$ **or** $T = 20.8 + \left(\frac{(20.8 - 17.4)}{2}\right)$	an answer in the range 18.5–19.1 scores **2** marks	1	AO3 6.1.2.1
	T = 19.1 (°C)		1	
05.3	chemical energy store of the fuel decreases		1	AO1 6.1.2.1
	thermal energy store of the water increases	allow kinetic energy store of the water particles increases	1	
	thermal energy store of the air / atmosphere increases	allow kinetic energy store of the air particles increases	1	
05.4	E = 15 000 000 (J)	an answer of 25 000 scores **4** marks	1	AO2 6.1.1.4
	t = 600 (s)		1	
	$p = \frac{15\,000\,000}{600}$	allow a correct substitution of incorrectly / not converted values of E and / or t	1	
	P = 25 000 (W)	allow a correct calculation using incorrectly / not converted values of E and / or t	1	
Total			**12**	

6.1.2.1 Energy transfers in a system

Answer 01 · Mark scheme

June 2018 | 8464/P/1H | Original Q5



6.1.2.1 Energy transfers in a system

Answer 02 · Mark scheme November 2020 | 8464/P/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	they vibrate about fixed positions.		1	AO1 6.3.1.1
05.2	kinetic energy decreases potential energy decreases		1	AO1 6.3.2.1
05.3	metal: has a high thermal conductivity which increases the rate of energy transfer from the mixture plastic: has a low thermal conductivity which reduces the rate of energy transfer from the surroundings (to the liquid coolant at –20°C)	allow ice cream for mixture ignore references to insulation throughout	1 1 1 1	AO2 6.1.2.1
05.4	a high specific heat capacity so it can absorb a large amount of energy with only a small temperature change		1 1	AO2 6.3.2.2

6.1.2.1 Energy transfers in a system

Answer 02 · Mark scheme

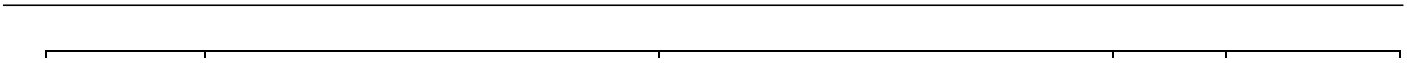
November 2020 | 8464/P/1H | Original Q5

05.5	165 kJ = 165000 J		1	AO2 6.3.2.2
	ΔE = m × 3500 × 21.5 **and** ΔE = m × 255000		1	6.3.2.3 6.1.1.3
	165000 = 75250 m + 255000 m **or** 165000 = 330250 m	this mark may be awarded if E is incorrectly/not converted	1	
	$m = \frac{165000}{75250 + 255000}$ **or** $m = \frac{165000}{330250}$	this mark may be awarded if E is incorrectly/not converted allow an answer consistent with their value of E	1	
	m = 0.499621 (kg)		1	
	m = 0.50 (kg)	this answer only If no marks awarded other than the first marking point: **either** 165 000 = m × 3500 × 21.5 scores **1** mark m = 2.192… scores **1** mark m = 2.2 (kg) scores **1** mark. these marks may be awarded if E is incorrectly/not converted **or** 165 000 = m × 255 000 scores **1** mark m = 0.647 scores **1** mark m = 0.65kg scores **1** mark. these marks may be awarded if E is incorrectly/not converted	1	
Total			**14**	

6.1.2.1 Energy transfers in a system

Answer 02 · Mark scheme

November 2020 | 8464/P/1H | Original Q5



6.1.2.1 Energy transfers in a system

Answer 03 · Mark scheme

June 2025 | 8464/P/1H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	$13\,800 = 0.75 \times c \times 20$		1	AO2 6.1.1.3 RPA14
	$c = \frac{13\,800}{0.75 \times 20}$		1	
	$c = 920$ (J/kg °C)		1	

6.1.2.1 Energy transfers in a system

Answer 03 · Mark scheme

June 2025 | 8464/P/1H | Original Q2

Question	Answers	Mark	AO / Spec. Ref.
02.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 6.1.1.3 RPA14
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content **Mass** • use a top pan balance to measure mass of block **Energy transfer** • use a joulemeter to measure energy • connect heater to a joulemeter • measure initial energy and switch on • switch off and measure final energy • calculate the difference between initial and final energy • use an ammeter, voltmeter and stopwatch • calculate energy transferred **Temperature change** • use a thermometer to measure temperature • measure the initial temperature • measure the final temperature • calculate the difference between initial and final temperature for **Level 3** answers must describe all three measurements		

6.1.2.1 Energy transfers in a system

Answer 03 · Mark scheme

June 2025 | 8464/P/1H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	the amount of wasted energy is less the temperature increase of the aluminium block is greater		1 1	AO3 6.1.1.3 6.1.2.1 RPA14

Total Question 2	11

Answer 01 · Examiner comments

June 2018 | 8464/P/1H | Original Q5

Question 5 (Standard/high and High demand)

05.1 Very few students gained more than one mark on this question. This is a new specification point this year but the answer to the question is straight recall from the specification.
Most students wrote vague answers about heat being contained inside and the cold not being allowed to enter. The starting point about the thickness of the wall was rarely mentioned and nor was the low thermal conductivity of the material.

05.2 72% of students calculated this correctly, either using the method in the mark scheme, or by calculating the midpoint using (20.8 + 17.4) /2. Of the incorrect responses, some students attempted to adjust the result to take into account the decreasing rate at which the temperature decreased, but were not always successful. Some students calculated the differences between the given temperatures, then the differences between the differences in order to determine the trend and then estimated the temperature at 30 minutes. Some students attempted to find an average temperature over a range of time, using various ranges.

05.3 49% of students scored no marks. Only 17% of students scored more than one mark and fewer than 2% scored three marks. Many students appeared confused by the reference to energy stores, rather than being asked to simply identify a chain of energy changes. Most commonly, one mark was scored for referring to thermal energy being added to the water. There were very few who considered the thermal store of the air.

A fairly common misconception was that, despite clearly shown exiting the boiler as hot water, the water would be heated enough to boil and leave the boiler as steam – the implication being that the hot exhaust gas was formed in this way.

05.4 75% of students gained at least one mark. Just over a tenth of students correctly carried out both conversions and achieved four marks. The most common mistake was in the conversion of 15 MJ into J but most students knew the equation and could substitute their sometimes incorrect conversions into the equation and calculate it correctly. A very simple answer saw 15 / 10 = 1.5 often written down and this gave the student two marks. Unfortunately a few students calculated energy × time and could only obtain the conversion marks if done correctly.

Answer 03 · Examiner comments

June 2025 | 8464/P/1H | Original Q2

Question 2 (Standard demand)

02.1 This standard demand calculation was well answered with over 80% of students gaining full marks. Nearly all students that did a correct substitution were able to rearrange correctly and calculate the final answer.

02.2 Students found this question quite demanding. Over 20% of students did not attempt the question. 40% of students were able to write something creditworthy. 85% of students wrote a creditworthy response. Half of students that gained marks wrote Level 1 responses, the most common Level 1 response just suggested measuring temperature with a thermometer. The 40% of students that wrote Level 2 or 3 answers went on to describe measuring the energy transferred with either a joulemeter or other method and/or measuring mass using a top pan balance.

02.3 Over 95% of students were able to gain at least 1 mark on this question. The majority of students who gained one mark identified that the amount of wasted energy is less. 45% of students gained a second mark for also identifying that the temperature increase of the aluminium block is greater.

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