Energy Changes in Systems

Mark Scheme

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.1 Energy
Sub-Topic	Energy Changes in Systems
Difficulty Level	Gold Level
Booklet	Mark Scheme

Time Allowed: **39 minutes**

Score: **/37**

Percentage: **/100**

Grade Boundaries:

M1.(a) water boils at the same temperature each time

1

control starting temp by allowing enough time for water and kettle to reach room temperature

1

(b) uncertainty = (302 – 298) / 2

1

uncertainty = ± 2 (s)

ignore missing ±

1

(c) (Energy transferred = Power × time)

E = 2.20 × 300

1

E = 660 (kJ)

1

*allow 660 (kJ) without working shown for **2** marks*

*allow answer calculated using incorrect value for t (298 or 302) for **1** mark*

(d) (mass × change in temperature) / mass

*allow **1** mark for any correct pair of values from the table*

1

eg 20 / 0.25

80 (°C)

1

*allow 80 (°C) without working shown for **2** marks*

(e) four points plotted correctly

*allow **1** mark for three correctly plotted points*

2

ecf their 5.3

allow ± 1mm

accurate line drawn

line should be straight and drawn with a ruler

1

line must not go through the origin

(f) values read correctly from graph

1

correct conversion into J

1

correct use of $\Delta y / \Delta x$

1

value in range 4200 – 4800

1

*allow value in range 4200 – 4800 without working shown for **4** marks*

(g) some of the energy supplied does not raise the temperature of the water

some of the energy is wasted is insufficient

1

(h) (the power of the kettle may not be 2.2kW)

(by measuring the power) the student can accurately calculate the amount of energy supplied to each mass of water

1

[17]

M2.(a) 600 kg = 5880 N

1

power = $\frac{5880 \times 35}{45}$

1

= 4573.3 (W)

*this step without the previous steps stated gains **3** marks*

1

% Eff. = $\frac{4573.3}{8000} \times 100$

1

= 57.17 (%)

*allow 57.17 with no working shown for **5** marks*

1

(b) gpe = 600 × 9.8 × 35

1

= 205 800

1

gpe = KE = ½ m v^2

1

$v = \sqrt{\frac{2 \times kE}{m}}$

1

$= \sqrt{\frac{411\,600}{600}}$

1

= 26.2 (m / s)

*allow 26.2 with no working shown for **6** marks*

1

[11]

M3.(a) conduction

1

(b) (i) there is a bigger temperature difference between the water and the surrounding air

accept the water is hottest / hotter

1

so the transfer of energy (from hot water) is faster

accept heat for energy

ignore temperature falls the fastest

1

(ii) 120

*allow **1** mark for converting kJ to J correctly, ie 4 032 000*

or

correctly calculating temperature fall as 8°C

or

allow **2** marks for correct substitution, ie 4 032 000 = m × 4200 × 8

answers of 0.12, 19.2 **or** 16.6 gain **2** marks

answers of 0.019 **or** 0.017 gain **1** mark

3

(iii) water stays hot for longer

1

so heater is on for less time

accept so less energy needed to heat water

1

so cost of the jacket is soon recovered from) lower energy costs / bills

accept short payback time

1

[9]