

Thermal Properties and Temperature

Mark Scheme 5

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Thermal Physics
Sub-Topic	Thermal Properties and Temperature
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 5

Time Allowed: 56 minutes

Score: /47

Percentage: /100

- 1 (a) conduction rod / target / anode B1
copper / thickness of rod B1
good conductor / increases amount of conduction (of thermal energy) B1 [3]
- (b) convection fins B1
large surface area / number of fins / spaces between fins B1
large contact with air / allows air to rise between fins B1 [3]
- (c) radiation fins / black surface / end of rod B1
black surface / large surface area B1
good emitter / large radiating surface ignore absorber B1 [3]

- 2 (a) electrical method
 lagged container + lid }
 liquid (allow) water } 5 points 3
 heater in liquid } 4 points 2
 heater connected to electrical supply (seen or stated) } 3 points 1
 voltmeter and ammeter appropriately connected (seen)
 thermometer } B3

OR

- mixtures method
 lagged container }
 liquid } 5 points 3
 hot solid/hot liquid } 4 points 2
 means of heating hot solid / liquid (seen or stated) } 3 points 1
 means of weighing hot solid / liquid / use of known mass (seen or stated)
 thermometer } B3

- (ii) electrical method
 initial & final temps of liquid OR temp rise }
 voltmeter reading (however expressed) } -1 e.e.o.o.
 ammeter reading (however expressed) }
 heating time }
 mass of liquid } B3

OR

- mixtures method
 initial and final temps of liquid OR temp rise }
 initial and final temps of added solid / liquid OR temp drop } -1 e.e.o.o.
 mass of added solid / liquid }
 mass of liquid }
 SHC of added solid / liquid } B3

- (b) $Q = mc\theta$ in any form B1
 100.6 – 12 OR 88.6 C1
 $0.8 \times 3900 \times 88.6$ C1
 276 432 J A

- (ii) $Q = Wt$ OR ($t =$) candidate's (i)/620
 445.858s ecf (i) A1 [12]

- 3 (a) energy / heat required to change state / phase / any example of change of state / phase M1
- with no change in temperature / at a specified temperature A1
 OR energy to break bonds between molecules /atoms M1
 with no change in K.E. A1
- (b) any time or range of time between 1.6 (min) and 14.0 (min) inclusive [no UP] B1
- (c) turns substance to gas / vapour OR causes evaporation OR escape from liquid C1
- energy to break bonds/separate molecules/overcome intermolecular forces A1
 Ignore move faster / PE increases
- (d) (i) Pt / 2×4 / 2000×4 / 2×240 / 2000×240 / 8 / 8000 / 480 / 480000 C1
 480 000 J OR 480 kJ A1
- (ii) ($\theta =$) 43 ($^{\circ}\text{C}$) seen anywhere C1
 $Q = mc\theta$ OR $480000 = m \times 1760 \times 43$ in any form ecf. from (i) C1
 6.34 kg or 6.3 kg ecf. A1 [10]
- 4 (a) (i) change in length / distance moved (accept "how much it expands") per unit / given temp rise OR equivalent B1
- (ii) large bulb OR thin / narrow bore / tube / capillary B1
 NOT thin / narrow thermometer
- (b) (i) difference between the highest and lowest temperatures B1
 ignore reference to fixed points
- (ii) tube (sufficiently) long / not too short B1
 OR bore wide/not too thin
 OR little/not too much liquid/bulb
 NOT change liquid
- (c) (i) idea of equal size divisions/expansion for equal temperature rises OR $\Delta l / \Delta\theta$ constant OR reference to l against θ graph straight line ignore 1 division = 1°C
- (ii) uniform bore OR alcohol/liquid expands uniformly (with temp) B1 [6]

- 5 (a) heat/energy to raise/change temperature of 1 kg/1g/unit mass through 1°C/1K (mention of change of state scores zero) M1
A1
- (b) $Q = mc\theta$ (for θ accept t , T , $\Delta\theta$, Δt , or ΔT) B1
 $23800 = 0.93 \times c \times (41.3 - 13.1)$ C1
 907.5 or 907 or 908 or 910 J/(kg °C) or J/(kg K) at least 2 sig. figs A1
 (for unit in (b) and (c)(i) condone no brackets and extra solidus)
- (c) 1212.9 or 1200 or 1210 or 1213 or 1214 J/(kg °C) or J/(kg K) B1
- (ii) more energy lost (to surroundings) B1
 (average) temperature is higher/initial temperature higher/no cooling
 time allowed/temperature rise is lower/time of heating may be longer/
 rate of heating may be lower B1
- (d) insulate block/provide lid/cover with shiny foil)
 start & finish same amount below & above room temperature) any 2 B1 + B1
 get heater up to temperature before inserting)
 put oil in gap between heater & block)

[Total: 10]