

Thermal Properties and Temperature

Mark Scheme 4

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Thermal Physics
Sub-Topic	Thermal Properties and Temperature
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 4

Time Allowed: 49 minutes

Score: /41

Percentage: /100

- 1 (a) sensitive to box 5 B1
 linear to box 3 B1
 wide range to box 2 B1 [3]
- (b) 2 different metals (need not be named but must be identified as different) M1
 volt/millivolt/am/milliammeter/galvanometer/display reading V/mV/A/mA/°C A1 [2]
 AND circuit would work
 do not allow unlabelled box/meter
 ignore hot/cold junction labels
- (ii) 1. metals will not melt/gives p.d. at high temperature/remote sensing B1
 Ignore can withstand/will not be damaged by high temperature B1 [2]
 2. small heat capacity/mass
- 2 (a) double cup not so hot (to hold) B1
 less heat transfer/sensible comment about air gap/more or better insulation B1 [2]
 ignore any explanation involving vacuum
- (b) starts at (0,80) always above original line and below 80°C, reaches 5 min M1
 always descends, straight or concave up, reaches 10 min A1 [2]
- (c) two points from:
 reduces/stops (energy losses by) convection B1
 reduces/stops (energy losses by) evaporation B1
 reduces/stops (energy losses by) radiation
 explanation of mechanism of heat loss (by convection, evaporation or radiation)
 explanation plus something like "which reduces heat losses" scores 2/2 on this part but must do more than restate question [2]

- 3 (a) $Q = mc\Delta T$ in any form or $mc\Delta T$ C1
 $\Delta T = 50$ C1
 $Q = 798\,000\text{ J}$ A1 [3]
- (b) use of $E = Pt$ OR 170×8 OR see 1 360 OR $\times 60$ C1
energy = $(170 \times 8 \times 3\,600) = 4\,896\,000\text{ J}$ A1 [2]
- (c) efficiency = output(energy)/input (energy) OR his (a) \div his (b)
accept power for energy but not wrong/mixed quantities. Accept useful for output,
ignore total for input C1
efficiency = 0.16 or 16% ecf from 6(a) and 6(b) A1 [2]
- (d) source not finite/will not run out ignore can be re-used/replaced
Give for right idea e.g. accept sun always shines B1 [1]
- (e) one point from:
doesn't work at night/cloud cover/no sun/variable output
high (initial) cost (of panels)
do not accept too low unless appropriate for a clearly stated context B1 [1]
- 4 (a) Pt OR $1.2 \times 10^4 \times 9$ OR $1.2 \times 10^4 \times (11 - 2)$ C1
 $(I=) E/m$ OR $E/0.36$ OR Pt/m OR $Pt/0.36$ C1
 $3 \times 10^5\text{ J/kg}$ A1
- (b) liquid ignore vapour/gas/water A1
- (ii) move around more rapidly / faster / more KE
ignore **start to** vibrate etc but accept starts to vibrate faster
move further apart / spreads out (NOT molecules expand) any 2 B1
break free / evaporate / overcome bonds / overcome forces of
attraction /escape / change state (accept boils)
convection (current) [6]

- 5 (a) 330 J of heat / energy required to change 1 g of ice to water at constant temperature / at melting point / at 0 degrees C B1
- (b) (i) (B to C ice is) changing to water / melting / changing to liquid / changing state B1
 (D to E water is) changing to steam / vaporising / boiling / changing to gas B1
- (ii) Sp. latent of vaporisation of water is greater than sp. latent of fusion of ice B1
- (iii) s.h.c. of ice is less than s.h.c. of water B1
 more heat required to raise temperature of water
 OR rate of temperature rise of water is slower
 OR temperature rise of water takes longer B1 [6]
- 6 (a) (i) most: gas B1
 least: solid both required
- (ii) because change of pressure (also) causes volume change (in a gas) B1
 NOT 'gas can be compressed'
- (b) two from:
 expands uniformly (over required range)
 remains liquid over required range
 expands more than glass / has high expansivity / expansion
 has (reasonably) low specific heat capacity.
 has low freezing point / lower freezing point than mercury max B2
- (ii) make (capillary) tube narrower (and longer) / thinner / smaller diameter B1
 make bulb larger (and tube longer) B1
 allow 'bore' for tube ignore 'smaller' ignore narrow thermometer
- (c) allows fast(er) flow of heat to / from alcohol
 OR allows fast response (to temperature change)
 OR because glass is a poor conductor / good insulator (so needs to be thin for fast response)
 OR heat transfer more efficient / faster
 OR glass takes up less heat B1 [7]
 ignore reference to sensitivity ignore 'easier'