

Thermal Process

Mark Scheme 2

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Thermal Physics
Sub-Topic	Thermal Process
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 2

Time Allowed: 54 minutes

Score: /45

Percentage: /100

- 1 (a) (i) water molecules hit copper/tank/atoms **or** copper atoms hit air molecules **or** radiation from water/tank/copper **or** describe/mention evaporation B1
vibrating (copper) atoms/molecules/particles hit neighbours pass on energy/vibration **or** vibrating (copper) atoms/molecules/particles hit electrons (through copper) B1
electrons strike copper atoms B1
- (ii) smaller temperature difference/thermal gradient (between tank and air) **or** reduced vibrations of copper atoms **or** water molecules slower/less kinetic energy **or** reduced radiation (emitted) **or** less evaporation B1
- (b) diagram of suitable vessel(s) (one shiny; one dark) B1
action – e.g. fill with hot water **and** same mass/volume B1
starting temperatures are the same B1
measure final temperature **and** compare drop **or** equivalent B1
allow detailed description of Lesley’s cube method **and** measure emission rate (for a maximum of 4 marks) [8]
- 2 (a) matt black B1
- (b) (i) L down and R up, equal amounts (by eye) B1
- (ii) on black side or on left (more) energy / heat absorbed OR greater temp rise OR heats up quicker B1
on black side or on left greater expansion of air / greater pressure of air B1 [4]

- 3 (a) (i) good conductor (of heat) (ignore electricity) B1
- (ii) black is good absorber/bad reflector (ignore emitter) B1
- (iii) reduce heat lost/conducted away (from pipes/sheet) NOT prevents heat loss o.w.t.t.e. B1
- (iv) air heated OR glass reduces/prevents convection OR greenhouse effect OR reference to far and near I.R. OR glass prevents warm air being blown away OR traps air ignore traps heat B1
- (b) 38 – 16 OR 22 C1
 $mc\theta$ OR $250 \times 4200 \times \text{his } 22$ C1
 2.31×10^7 (J) e.c.f from previous line C1
 9.24×10^7 J OR e.c.f from previous line $\times 4$ correctly evaluated A1
 No unit penalty if J seen anywhere in (b) clearly applied to an energy

[Total: 8]

- 4 (a) (i) heat for the same time B1
- take temps on both thermometers B1 [2]
- (ii) dull black box temp > white box temp OR black is hotter etc. B1 [1]
- (b) (i) large expansion/change in reading for small change in temp NOT detect/respond to small temp changes B1 [1]
- (ii) temperature rise small and/or small difference between them B1 [1]
- (iii) distance between each degree on scale is the same B1 [1]

[Total: 6]

- 5 (a) take readings of the detectors B1
 fill box with water B1
 take readings (again) B1
- (b) dull black best AND shiny white worst B1
- (c) two different metals B1
 two junctions (could be at meter) hot and cold need not be indicated B1
 any cell, max B1,B0

[Total: 6]

- 6 (a) (i) conduction B1
- (ii) particles/atoms/ions vibrate or electrons move and carry energy B1
 pass on energy from one particle to the next B1
- (b) four surfaces facing one heat source B1 [3]
 suitable detector e.g. thermometer behind surface-read all 4 B1
 precaution e.g. equal distance/time B1
 (Can not score last two marks if experiment is totally wrong) [3]

[Total: 6]

- 7 (a) (i) Thermopile / thermocouple / (blackened) thermometer /
 infra red detector or use ammeter / voltmeter in supply
 circuit B1
- (ii) One of: same distance of plate to detector or use two
 identical detectors or same time (after switching on) B1
- (iii) Dull black better radiator / radiates more than silver / or
 emits more heat / radiation B1
- (iv) Infra red (i.r.) A1 4
- (b) any correct example e.g. heating water or chimney M1
 current clear and complete A1
 direction shown correctly by arrows A1 3
 [7]