Thermal Processes

Mark Scheme 2

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	Thermal Physics
Sub-Topic	Thermal Processes
Paper Type	Alternative to Practical
Booklet	Mark Scheme 2

Time Allowed: **54 minutes**

Score: **/45**

Percentage: **/100**

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1 **(a** 23 seen in correct place in table [1]

(b) Units all correct (symbols or words) [1]

(ii) 10°C (or ecf from **2(a)**) and 23°C [1]

(iii) Statement matching temperature changes (expect 'black') with supporting comparative comment [1]

(iv) Statement matching results (expect 'Yes') [1]
Figures from table matching correct statement
and time interval mentioned at least once [1]

(c) Any one from:
same (type of) lamp/same brightness
same distance/height
same (type of) thermometer
same area of card
same thickness of card
good contact between card and thermometer (owtte)
same start temperature/allow thermometer to cool
allow lamp to cool [1]

Appropriate matching explanation:
power output may not be the same (owtte)
different intensity of radiation (owtte)
respond differently/different heat capacity
different surface area to absorb radiant heat (owtte)
different rate of conduction (owtte)
rate of rise different at different temperatures
heating starts at different times [1]

[Total: 8]

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Question	Answer	Marks
2	**MP1** Uses same container throughout	**1**
	MP2 Hot water in container (any) and takes temperatures at intervals or at start and after a fixed time OR Hot water in container (any) and takes time for a fixed temperature fall.	**1**
	MP3 Repeats with different insulators (all three used)	**1**
	MP 4&5 Any two from: Constant room temperature Same starting temperatures (clearly stated) Same volumes of hot water (clearly stated) Same thickness/amount of insulator Use container without insulation Use of a lid Insulates bottom of container Uses the copper can only	**2**
	MP6 Table or tables as appropriate to method: Temperatures with unit °C and time with unit s (or min) and different insulators shown	**1**
	MP7 Use of readings: graph of temperature against time OR compare results and comment that longest time to cool = best insulator or smallest drop in temperature in fixed time = best insulator (or reverse arguments)	**1**
		Total 7

Question	Answer	Marks
3(a)(i)	s, °C, °C, °C	1
3(a)(ii)		1
3(b)(i)	box / sentence indicated	1
3(b)(ii)	Clear reference to readings with examples of temperature differences	1
3(c)	Any two from: • Room temperature (or suitable reference to draughts or similar) • Starting temperature (of water) • Density of packing / amount / type of insulation • Thickness of lids / identical lids	max 2
3(d)	Card or any suitable insulating material Should be a good insulator / poor conductor	1 1
3(e)	Perpendicu viewing / view at right angles / eye level Reading to bottom of meniscus	1 1
		Total: 10

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4 **(a) (i)** $\theta_H = 92\,(^oC)$ [1]

(ii) any one from:
- wait for thermometer reading to stop rising
- perpendicular viewing of scale
- stirring
- thermometer bulb in middle of water/not touching beaker [1]

(b) $\theta_A = 21\,(°C)$ allow ecf from **(i)** [1]

(c) $\theta_B = 14$, correct unit seen, °C or deg C NOT C° or ^{oC}, and not contradicted [1]

(d) any two from:
- room temperature/other environmental statement
- initial hot water temperature
- heat loss to surroundings /evaporation/conduction through sides of beaker
- time delays in adding water [max.2]

5 (a $\theta_H = 74$ AND $\theta_C = 23(°C)$ [1]

(b) (i) suitable reason, e.g. [1]
- temperature not able to reach max θ_H (in 30s)
- temperature dropped on transfer
- conduction/transfer to metal tongs

<u>matching</u> improvement, e.g. [1]
- leave block in hot water longer
- transfer more quickly
- use insulated tongs/cotton round block

(ii) suitable reason, e.g. [1]
- some (thermal) energy transferred to beaker,
- some (thermal) energy transferred to surroundings,
- evaporation/convection (into atmosphere)

<u>matching</u> improvement, e.g. [1]
- use a less conducting material for beaker/owtte
- insulate beaker
- allow for beaker in any calculation
- lid on beaker

[Total: 5]

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6 **(a** $\theta_1 = 82\,(°C)$ [1]

(b) s, °C, °C [1]

(ii) 10, 20, 30, 40, 50, 60 [1]

(c)(i)(ii) $\Delta\theta_1 = 39$ (°C) AND $\Delta\theta_2 = 8$ (°C) [1]

(iii) temperature θ_2 at time $t = 0$ less than θ_1 [1]

(d) view thermometer at right angles [1]

(e) any one from:

- room temperature / other environmental factor
- volume / mass / quantity / amount of <u>hot</u> water
- <u>initial</u> temperature of the hot water
- <u>initial</u> temperature of the cold water
- <u>initial</u> temperature of the water [1]

[Total: 7]