Thermal Properties and Temperature
Mark Scheme 1

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	Thermal Physics
Sub-Topic	Thermal Properties and Temperature
Paper Type	Alternative to Practical
Booklet	Mark Scheme 1

Time Allowed: 60 minutes

Score: /50

Percentage: /100

Question	Answer	Marks
1	**MP1** Uses same container throughout	**1**
	MP2 Hot water in container (any) <u>and</u> takes temperatures at intervals or at start and after a fixed time OR Hot water in container (any) <u>and</u> 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) <u>and</u> 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
2(a)(i)	s, °C, °C, °C	**1**
2(a)(ii)		**1**
2(b)(i)	box / sentence indicated	**1**
2(b)(ii)	Clear reference to <u>readings</u> with examples of <u>temperature</u> differences	**1**
2(c)	Any two from: • Room temperature (or suitable reference to draughts or similar) • <u>Starting</u> temperature (of water) • Density of packing / amount / type of insulation • Thickness of lids / identical lids	**max 2**
2(d)	Card or any suitable insulating material Should be a good insulator / poor conductor	**1** **1**
2(e)	Perpendicu viewing / view at right angles / eye level Reading to bottom of meniscus	**1** **1**
		Total: 10

3 **(a** **(i)** θ_H = 92 (^{o}C) [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) θ_A = 21 ($^\circ$C) allow ecf from **(i)** [1]

(c) θ_B = 14, correct unit seen, °C or deg C NOT C° or $^\circ$C, 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]

(e) perpendicular viewing/eye level with meniscus [1]

   reading to bottom of meniscus [1]

[Total: 8]

4   **(a** θ_H = 74 AND θ_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]

5   **(a** θ_C = 22 °C   [1]

     (b)   view thermometer at right angles OR stirring OR wait for reading to stop rising OR
thermometer (bulb) not touching sides / bottom of beaker owtte   [1]

     (c) θ_A = 52.5 (°C) OR e.c.f.   [1]

     (d)   any two from:
- heat loss to surroundings / beaker OR heat loss / drop in temperature by evaporation
- delays in taking readings
- reference to uncertainty in volume measurements   [2]

     (e)   **(i)**   78 (cm^3)   [1]

           (ii)   EITHER:
Student 1 (80) – read to top of meniscus OR scale not read at right angles
OR Student 2 (79) – divisions are every 2(cm^3) not 1(cm^3)
OR Student 2 (79) – scale not read at right angles   [1]

                                                          [Total: 7]

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]

7　**(a** 　stopwatch / stopclock 　　　　　　　　　　　　　　　　　　　　　　　　　　　[1]

(b) 　any three from:
- length of rod
- diameter / thickness / area (of cross-section) of rod
- amount of wax / type of wax
- weight / size/mass of marker
- position for the markers
- (Bunsen) flame / (rate of) heating
- position of Bunsen / flame
- position of rod on tripod 　　　　　　　　　　　　　　　　　　　　　　　[max 3]

(c) 　temperature too high
or thermometer only measures up to about 100 °C
or small range 　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[1]

thermometer / bulb can't make proper contact 　　　　　　　　　　　　　　　　[1]

[Total: 6]