Thermal Processes

Mark Scheme 1

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

Time Allowed: **57 minutes**

Score: **/47**

Percentage: **/100**

1 **apparatus:** [1]
(set of) different sized beakers / containers, thermometer and stop clock / watch

method: [1]
pour hot water into container (and allow to cool)
and measure temperature and time

repeat for a second container with a different surface area [1]

precautions:
any two from: [2]
same volume of hot water
same initial hot water temperature
same room temperature or other environmental condition

graph:
temperature change / rate of cooling against surface area, [1]
temperature against time,
time to cool between fixed temperatures against surface area

additional point:
any one from: [1]
- at least 5 different surface areas,
- sensible range of container sizes given,
- sensible amount of water stated,
- use of lagging / insulating material for container walls,
- same type of container
- how surface area may be calculated

[Total: 7]

2 **(a)** 23 (°C) [1]

(b) any one from:
wait for thermometer reading to stop rising
eye level with top of (mercury) thread owtte
stir water [max 1]

(c) s, °C, °C, words or symbols AND
30, 60, 90, 120, 150, 180 [1]

(d) uninsulated (owtte) OR no significant difference [1]
justified by reference to temperature differences and time [1]
relevant science, consistent with readings and conclusion
(e.g. therefore cotton wool is a good/not a good insulator OR most cooling is due to convection or radiation etc.) [1]

(e) quality poor due to small temperature differences [1]

any two improvements from:
increase initial temperature of water
ensure initial temperatures are identical
use a lid
stir to eliminate differences between top and bottom of the water
use thicker insulation
use more sensitive thermometer or datalogger [max 2]

(f) any two from:
laboratory temperature
draughts/open windows
accept temperature of hot water source [max 2]

(g) 5–50 cm^3 [1]

3 **(a** units correct, accept symbols or words [1]
t values correct: 0, 30, 60, 90, 120, 150, 180 [1]

(b) statement matching results with comparison of temperature changes over whole available range OR for 120 s from 71 °C [1]

justification with mention of 'in the same time' owtte [1]

(c) two precautions relating to temperature measurement,e.g. [2]
- thermometer at same depth
- read thermometer with reading at eye level/90° to scale/explain parallax
- wait until thermometer has stopped rising (at the start)

(d) two improvements to apparatus or procedure, e.g. [2]
- insulation all way up side of test-tube/covering bottom of test-tube
- start taking measurements at same temperature/same initial temp. of water
- same volume of water/use measuring cylinder for water
- plot cooling curves
- use metal/thinner glass test-tubes
- more layers of insulation
- make sure insulation is dry
- avoid overlapping insulation
- use same tube/same tube thickness in each experiment

[Total: 8]

4 **(a** θ_H = 92 (°C) [1]

(b) (i) table: s, °C, °C [1]

(ii) decreases [1]

justified by reference to results, giving numbers referring to temperature drops [1]

(c) any two from:
- room temperature / air conditioning / draughts / environmental conditions
- starting temperature (of thermometer) / temperature of (hot) water
- density of packing / amount of cotton wool / dryness of cotton wool [max 2]

[Total: 6]

5 **(a** 21 (°C) [1]

(b) table: s, °C, °C [1]

(c) no significant effect, justified by some reference to results [1]

wording that communicates the idea that the temperatures are the same within the limits of experimental accuracy OR almost the same rate [1]

(d) lid/cover/smaller cross-sectional area [1]

(e) any one from:
room temperature (or equivalent environmental condition)
initial water temperature
volume of water
same/dry insulation [1]

[Total: 6]

6 **(a** θ for **A** 76 (°C) and for **B** 79 (°C) [1]

(b) units all correct [1]

t values correct 0, 30, 60, 90, 120, 150, 180 [1]

(c) statement matching temperature changes with justification referring to results and involving correct comparative change in temperature [1]

justification has specific mention of temperature change in the same time owtte [1]

(d) appropriate source of inaccuracy associated with procedure e.g. any one from:

- water levels not the same
- thermometer scales not read at 90°
- initial temperatures different
- not able to stir water
- not waiting for temperature to stabilise initially / waiting time not long enough [1]

(e) any two factors relating to apparatus from:

- keep thermometer at same depth
- same size/thickness/material of test-tube / same test-tube
- same water levels/volume/quantity/amount of water
- same thickness/surface area of surface material [2]

[Total: 8]