Simple Kinetic Molecular Model of Mater

Mark Scheme 3

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	Thermal Physics
Sub-Topic	Simple Kinetic Molecular Model of Matter
Paper Type	Alternative to Practical
Booklet	Mark Scheme 3

Time Allowed: **72 minutes**

Score: **/60**

Percentage: **/100**

1 Graph:
   Temperature axis labelled $\theta/°C$
   Suitable scales (plots occupy at least ½ grid)   [1]
   Plots correct to nearest ½ square (–1 each error)   [2]
   Lines well judged curves   [1]
   Lines thin   [1]

   (b) Statement:
         larger surface area increases rate of cooling   [1]
         Justification:
         Correct reference to gradients of lines or readings   [1]

                                                                    [Total: 8]

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** 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]

4   **(a**   **(i)** 88 (°C)   [1]

       (ii) s, °C   [1]

  (b) axes correctly labelled with quantity and unit   [1]

       suitable scales on both axes, occupying more than half the grid   [1]

       all plots correct to ½ small square   [1]

       good line judgement, not through all points   [1]

       thin, continuous line and neat plots (penalise large 'blobs')   [1]

  (c) **(i)** statement to match candidate's graph line (expect curve)   [1]

       (ii) statement to match candidate's graph line (expect (rate) decreases)   [1]

  (d) description or diagram to show one from:
- perpendicular line of sight
- reading to bottom of meniscus   [1]

                                                           [Total: 10]

5   **(a)(b**   87 and 89, both correct answer only   [1]

(c)   units correct in symbols or words, s, °C, °C   [1]

t values correct <u>0</u>, 30, 60, 90, 120, 150, 180   [1]

(d)   appropriate pattern which fully matches results
e.g. rate of temperature drop greater at start than at e
NOT stated pattern which partly matches results   [1]

(e)   statement matching temperature changes
(expect 'Yes' but accept 'No' or 'no significant difference' if ecf)   [1]

justification referring to results and involving comparative change in temperature
with specific mention of <u>in the same time</u>   [1]

(f)   any two from:
  - room temperature / external temperature (but not outside temperature)/ environmental factor such as draughts / sunshine
  - initial water temperature / start temperature
  - same amount of stirring / wait same time before reading
  - keep thermometer at same depth
  - same size/thickness / material / surface area of beaker
  - same volumes of water   [2]

[Total: 8]

6   **(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]

7   **(a)** θ_R = 23(°C)   [1]

(b) table:
 d values 11.9, 11.3, 10.8,   10.4, 10.2, 10.0, 9.9   [1]
 all d values to nearest mm   [1]
 s, °C, cm or mm   [1]

(c) **(i)**   does not go through the origin   [1]

   (ii) d not measured from 0 °C mark (o.w.t.t.e.)   [1]

(d) any l divided by any number of divisions   [1]
 l value between 89 and 119   [1]
 x = 0.98 mm to 1.00 mm (with unit)   [1]

                                                                                                [Total: 9]