

# Simple Kinetic Molecular Model of Mater

## Question Paper 2

<b>Level</b>	IGCSE
<b>Subject</b>	Physics
<b>Exam Board</b>	CIE
<b>Topic</b>	Thermal Physics
<b>Sub-Topic</b>	Simple Kinetic Molecular Model of Matter
<b>Paper Type</b>	Alternative to Practical
<b>Booklet</b>	Question Paper 2

**Time Allowed:** 54 minutes

**Score:** /45

**Percentage:** /100

1 An IGCSE student is investigating methods of preventing loss of thermal energy.

The student is using two beakers labelled **A** and **B**, as shown in Fig. 2.1.

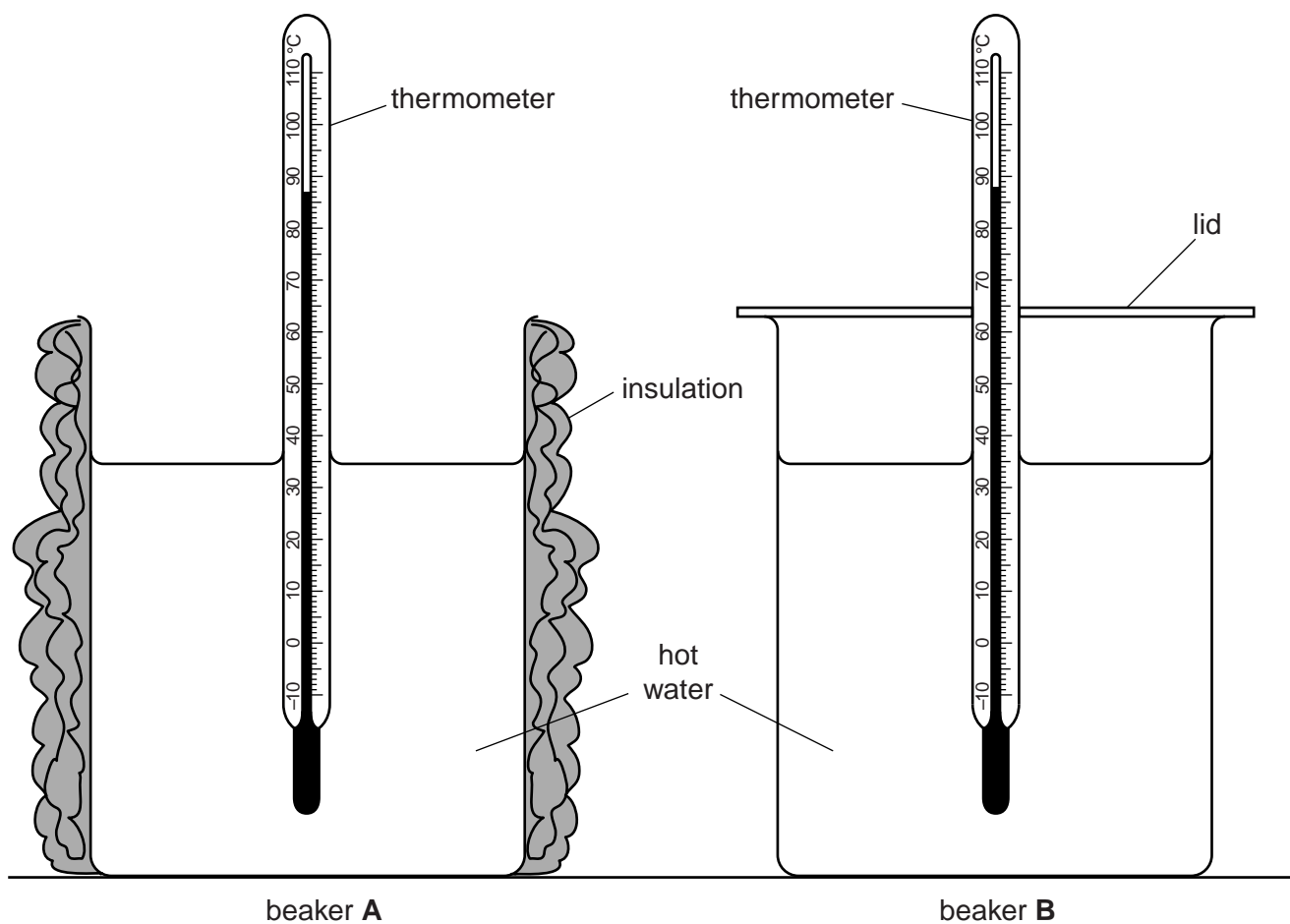


Fig. 2.1

Beaker **A** has a layer of insulation and beaker **B** has a lid but no insulation.

The beakers contain hot water at the start of the experiment. The initial temperatures are as shown in Fig. 2.1.

- (a) Read, and record in the first row of Table 2.1, the temperatures of the water in beakers **A** and **B** at time  $t = 0$ . [1]
- (b) The temperatures of the hot water after 30s, 60s, 90s, 120s, 150s and 180s are shown in Table 2.1.

Complete the column headings and enter the values of  $t$  in the table.

[2]

Table 2.1

	beaker A	beaker B
<i>t/</i>		
	85.0	87.0
	83.5	85.5
	82.0	84.5
	81.0	84.0
	79.5	83.0
	78.5	82.5

- (c) State from which beaker, if either, the rate of loss of thermal energy is the greater. Justify your answer by referring to the results.

beaker .....

justification .....

.....

.....

[2]

- (d) State one condition that should be controlled to ensure that the comparison between beaker A and beaker B is a fair one.

.....

..... [1]

- (e) A student points out that the experiment does not test the effectiveness of insulation in reducing thermal energy loss.

Suggest a change to this experiment which could be made so that the effect of insulation could be investigated. Explain why this change would help.

suggestion .....

.....

explanation .....

.....

.....

[2]

[Total: 8]

2 The IGCSE class is investigating the rate of cooling of water.

The apparatus is shown in Fig. 2.1.

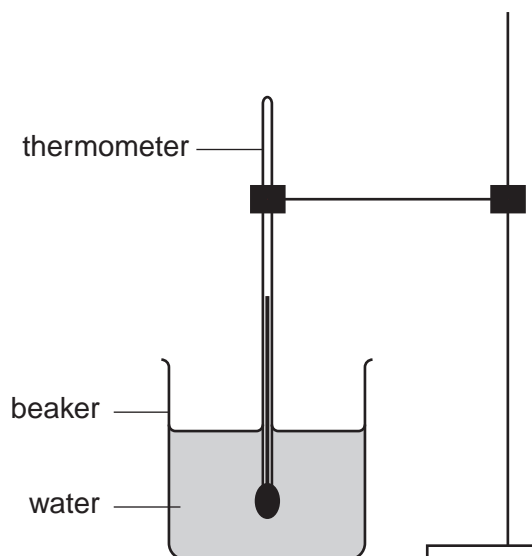


Fig. 2.1

(a) Record room temperature  $\theta_R$  as shown on the thermometer in Fig. 2.2.

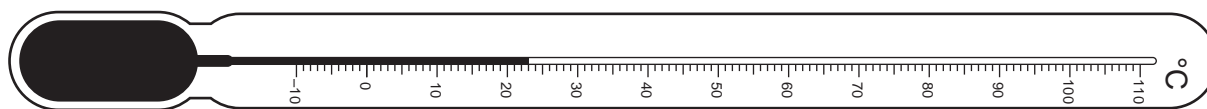


Fig. 2.2

$\theta_R = \dots\dots\dots$ [1]

(b) The beaker contains 200 cm<sup>3</sup> of hot water. A student takes temperature readings as the water cools, as shown in Table 2.1.

Table 2.1

$t/$	$\theta/$
0	79
30	65
60	58
90	55
120	53
150	52
180	51

(i) Complete the column headings in Table 2.1.

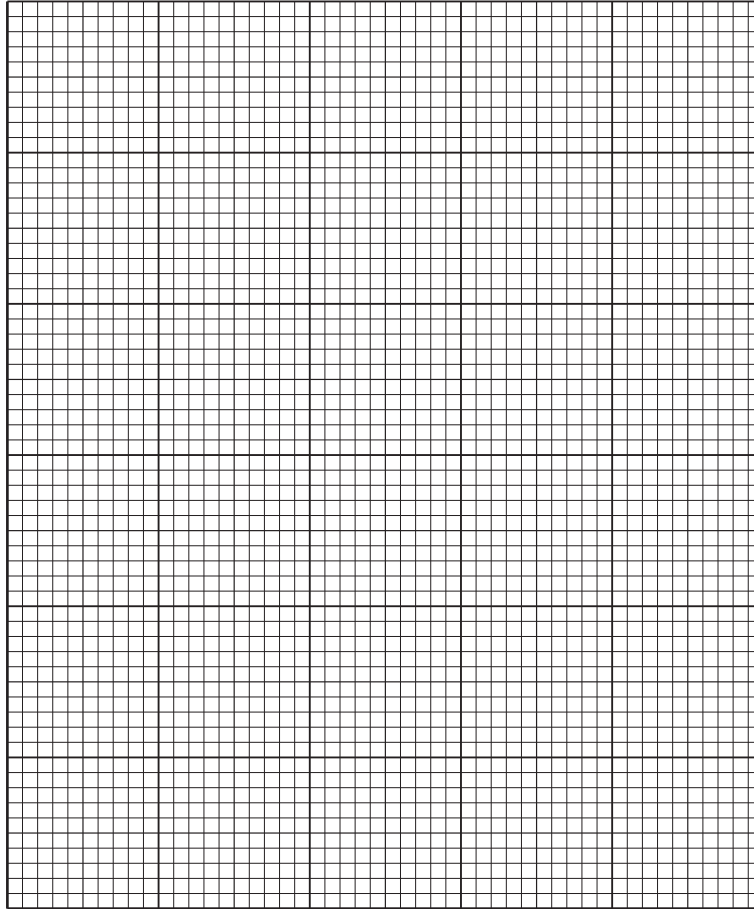
(ii) Calculate the temperature fall  $T_1$  during the first 30 s of cooling.

$T_1 = \dots\dots\dots$

(iii) Calculate the temperature fall  $T_2$  during the final 30 s of cooling.

$T_2 = \dots\dots\dots$  [3]

(c) Plot the graph of temperature ( $y$ -axis) against time ( $x$ -axis).



[5]

(d) (i) State how the rate of cooling in the first 30 s differs from that in the final 30 s.

.....  
.....

(ii) Explain how the graph line shows this difference.

.....  
.....

[2]

[Total: 11]

3 The IGCSE class is investigating the rate of cooling of water.

Fig. 2.1 shows the apparatus.

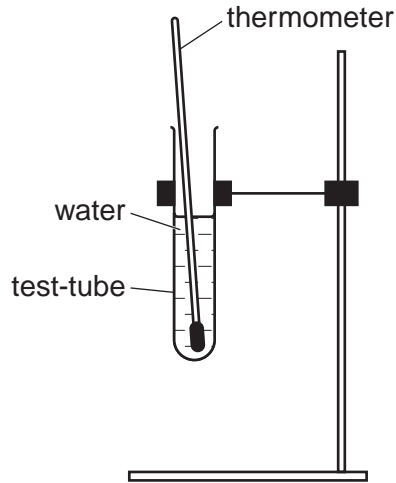


Fig. 2.1

(a) Record room temperature  $\theta_R$  as shown on the thermometer in Fig. 2.2.

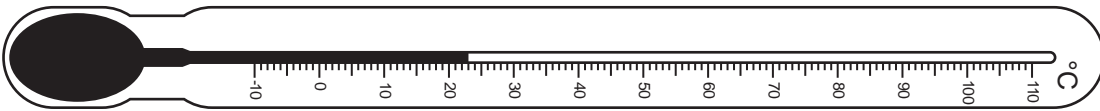


Fig. 2.2

$\theta_R = \dots\dots\dots$ [1]

(b) A student pours hot water into the test-tube until it is about two thirds full of water and places the thermometer in the water. When the thermometer reading stops rising, she measures the temperature  $\theta$  of the water and records  $\theta$  in Table 2.1 at time  $t = 0$ . She starts a stopclock and records in the table the time  $t$  and the temperature  $\theta$  of the water every 30s. She removes the thermometer and pours away the water from the test-tube. She then wraps cotton wool insulation round the test-tube and repeats the procedure.

- (i) Complete the time and temperature column headings in the table.
- (ii) Complete the time column in the table.

**Table 2.1**

$t/$	tube without cotton wool $\theta/$	tube with cotton wool $\theta/$
0	79	80
	65	67
	58	60
	55	57
	53	56
	52	55
	51	54

[2]

(c) State in which experiment the cooling is more rapid. Justify your answer by reference to the readings.

experiment .....

justification .....

.....[2]

(d) If these experiments were to be repeated in order to check the results, it would be important to control the conditions. Suggest two conditions that should be controlled.

1. ....

2. ....[2]

(e) Suggest two alternative insulating materials that could be used in place of cotton wool.

1. ....

2. ....[2]

[Total: 9]



4 The IGCSE class is investigating the cooling of water.

Fig. 2.1. shows the apparatus used.

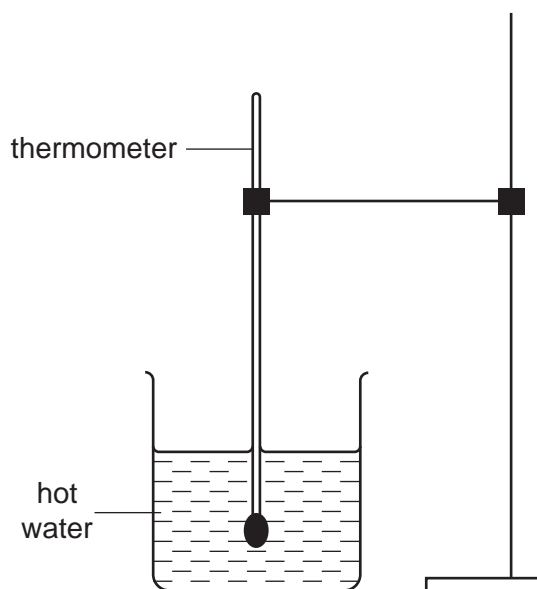


Fig. 2.1

Hot water is poured into the beaker and temperature readings are taken as the water cools.

Table 2.1 shows the readings taken by one student.

Table 2.1

$t/s$	$\theta/^\circ\text{C}$
0	85
30	78
60	74
90	71
120	69
150	67
300	63

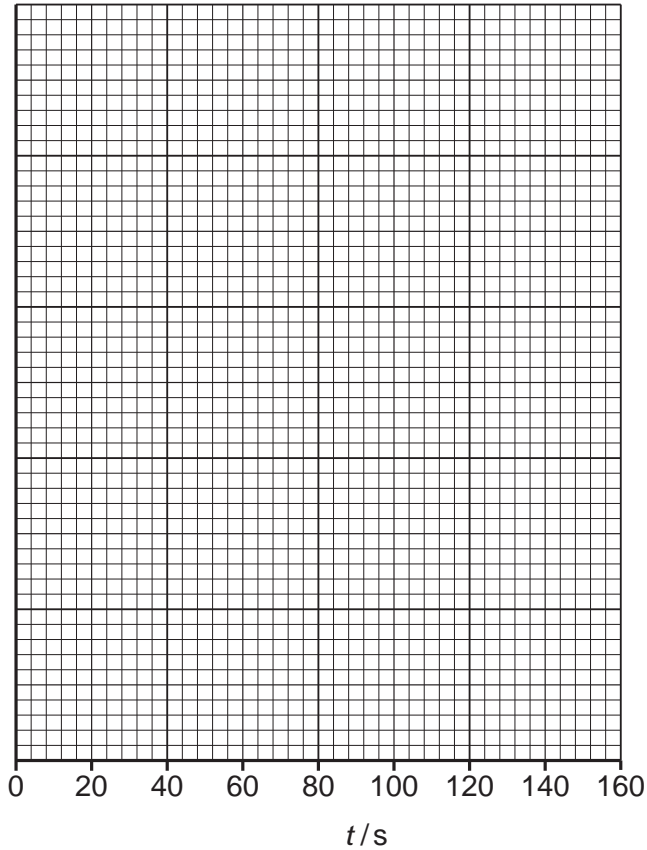
(a) (i) Using the information in the table, calculate the temperature change  $T_1$  of the water in the first 150 s.

$T_1 = \dots\dots\dots$

- (ii) Using the information in the table, calculate the temperature change  $T_2$  of the water in the final 150s.

$T_2 = \dots\dots\dots$  [3]

- (b) Plot a graph of  $\theta / ^\circ\text{C}$  ( $y$ -axis) against  $t/\text{s}$  ( $x$ -axis) for the first 150s. [5]



- (c) During the experiment the rate of temperature change decreases.
- (i) Describe briefly how the results that you have calculated in part (a) show this trend.

.....  
.....

- (ii) Describe briefly how the graph line shows this trend.
- .....  
.....

[2]

- 5 An IGCSE student is investigating the rate of cooling of water in different containers. Fig. 2.1 shows the two containers.

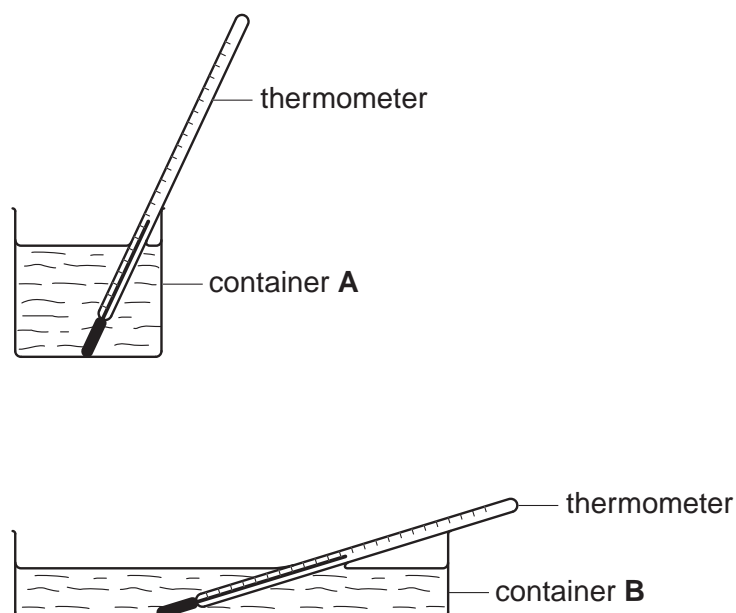


Fig. 2.1

Approximately  $200\text{ cm}^3$  of hot water is poured into container **A**. A stopclock is started and the temperature of the water is recorded at 30s intervals. Hot water is then poured into container **B** until there is sufficient to cover the thermometer bulb. The stopclock is started and the temperature of the water is recorded at 30s intervals. All the temperature readings are shown in Table 2.1.

Table 2.1

	container <b>A</b>	container <b>B</b>
$t/$	$\theta/$	$\theta/$
0	80	78
	71	66
	65	59
	59	55
	56	51
	55	49
	54	48

- (a) (i) Complete the column headings in the table.  
 (ii) Complete the time column in the table.

- (b) Calculate the temperature change of the water in each container over the period of 180s.

Container **A** temperature change = .....

Container **B** temperature change = ..... [1]

- (c) State which container, **A** or **B**, has the greater rate of cooling. Justify your answer by reference to the readings.

Statement .....

Justification .....

..... [2]

- (d) To make a fair comparison between the rates of cooling of the hot water in the two containers it is important to control other experimental conditions. Suggest two conditions that should be controlled in this experiment.

1. ....

2. .... [2]