Cambridge Assessment International Education

Cambridge IGCSE™

7: Thermal physics – Topic questions

Paper 6

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2016	June	63
4	2016	March	62
2	2016	November	61

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

1 Some students are comparing the rates of cooling of two thermometer bulbs under wet and dry conditions.

They are using the apparatus shown in Fig. 1.1.

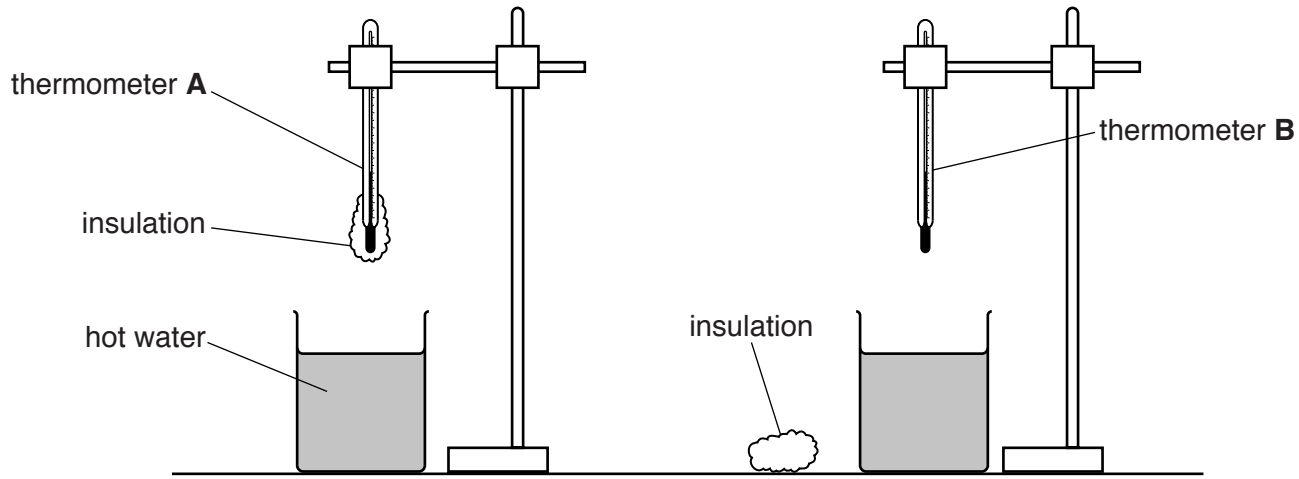

Fig. 1.1

Thermometer **A** has a layer of cotton wool insulation fixed around the bulb.

(a) Record the room temperature θ_R, as shown on the thermometer in Fig. 1.2.

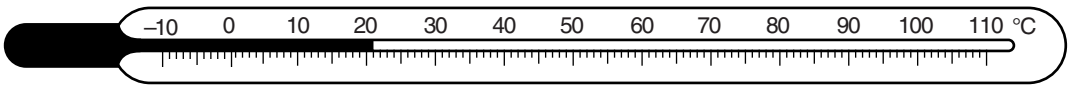

Fig. 1.2

θ_R = ...[1]

(b)
- Thermometer **A** is placed into hot water, at 81.0 °C, for two minutes and then removed.
- A student records, in Table 1.1, the temperature θ of the thermometer bulb every 30 s.
- Thermometer **B** is placed into hot water, also at 81.0 °C, for two minutes.
- The student removes thermometer **B** from the water and quickly wraps a layer of dry cotton wool insulation around the bulb.
- He then records the temperature θ of the thermometer bulb every 30 s.

Complete the column headings and time column in Table 1.1.

Table 1.1

	thermometer **A** with wet insulation	thermometer **B** with dry insulation
time /	θ /	θ /
0	80.0	77.5
	75.0	70.5
	67.0	64.0
	59.5	59.0
	53.5	54.5
	48.0	50.5
	43.0	47.5

[2]

(c) (i) Write a conclusion to this experiment, stating for which thermometer the cooling is faster. Explain your answer by reference to the results.

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.....[2]

(ii) Describe what is unusual about the pattern of cooling for thermometer **A**.

.....

.....

.....[1]

(d) The student first wrapped dry insulation around the bulb of thermometer **B** before starting the timing.

(i) Suggest why he did this.

.....

.....

.....[1]

(ii) Suggest what problem this delay in starting the timing might have caused with the procedure.

.....

.....

.....[1]

(e) Suggest two factors which should be kept constant to ensure that the comparison is fair.

1. .....

.....

2. .....

.....

[2]

[Total: 10]

4 A student suggests that the area of the water surface will affect the rate of cooling of hot water in a container.

Plan an experiment to investigate the relationship between surface area and rate of cooling.

Write a plan for the experiment, including:

- the apparatus needed
- how you will obtain a range of surface areas
- instructions for carrying out the experiment
- the measurements you will take
- the precautions you will take to ensure that the results are as reliable as possible
- the graph you will plot from your results – you should sketch the axes, with appropriate labels.

A diagram is not required but you may draw one if it helps to explain your plan.

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[7]

[Total: 7]

2 A student is investigating the cooling of water.

(a) She pours 100 cm^3 of hot water into a beaker.

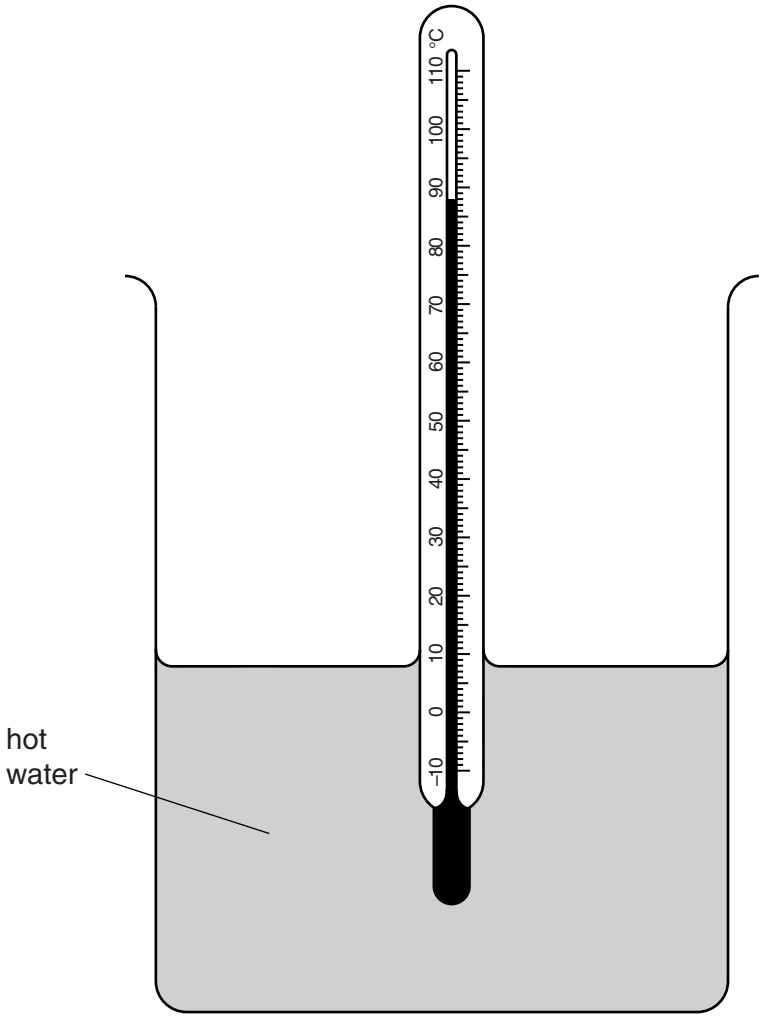

Fig. 2.1

(i) Record the temperature θ_H of the hot water, as shown in Fig. 2.1.

θ_H = ...[1]

(ii) The student measures the temperature θ_C of an equal volume of cold water.

θ_C = 19 °C

Calculate the average temperature θ_{AV} using the equation $\theta_{AV} = \frac{\theta_H + \theta_C}{2}$.

θ_{AV} = ...[1]

(b) The student adds the cold water to the hot water. She records the temperature of the mixture.

θ_M = 46 °C

State **one** precaution that you would take to ensure that the temperature readings are as reliable as possible.

.....

.....[1]

(c) The student is provided with:

- a lid, with a hole for the thermometer
- some insulating material
- two elastic bands.

In the space below, draw a labelled diagram to show how you would use these items to reduce the loss of thermal energy when the procedure is repeated.

[2]

Question	Answer	Mark
1 (a)	θ_R = 21(°C)	1
1 (b)	s, °C, °C time values correct 30, 60, 90, 120, 150, 180	1 1
1 (c) (i)	'A cools more rapidly' and 'greater overall temperature change' reference to 'in the same time'	1 1
1 (c) (ii)	rate increases then decreases **OR** cooling is less in first 30s than in subsequent 30s periods	1
1 (d) (i)	makes comparison fair/only one factor changed	1
1 (d) (ii)	causes start temperature to be lower	1
1 (e)	any two appropriate factors, e.g. • start temperature, • room temperature, • draughts, • humidity, • amount of insulation, • type of thermometer	2
		Total: 10
4	**apparatus:** (set of) different sized beakers / containers, thermometer and stop clock / watch **method:** pour hot water into container (and allow to cool) and measure temperature and time repeat for a second container with a different surface area **precautions:** any two from: • 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, temperature against time, time to cool between fixed temperatures against surface area **additional point, any one from:** • 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	1 1 1 2 1 1
		Total: 7

Question	Answer	Mark
2 (a) (i)	88(°C)	1
2 (a) (ii)	53.5(°C)	1
2 (b)	perpendicular viewing of scale OR stirring **OR** wait until temperature stops rising **OR** avoid delay (between adding water and taking temperature) allow thermometer not touching beaker owtte	1
2 (c)	correct diagram with lid drawn insulation placed round beaker	1 1
2 (d)	statement and justification to match results. A number or numbers must be seen comment must include yes or no or too close to call owtte	1
2 (e)	two from: • room temperature (or other environmental condition) • temperature of cold water • temperature of hot water • volumes of water • size/shape/material/surface area of beaker	2
		Total: 8

Notes about the mark scheme are available separately.