

Physics - Key stage 4 - Energy

Insulating material required practical part 2 (Physics only) - worksheet

Dr Fishwick

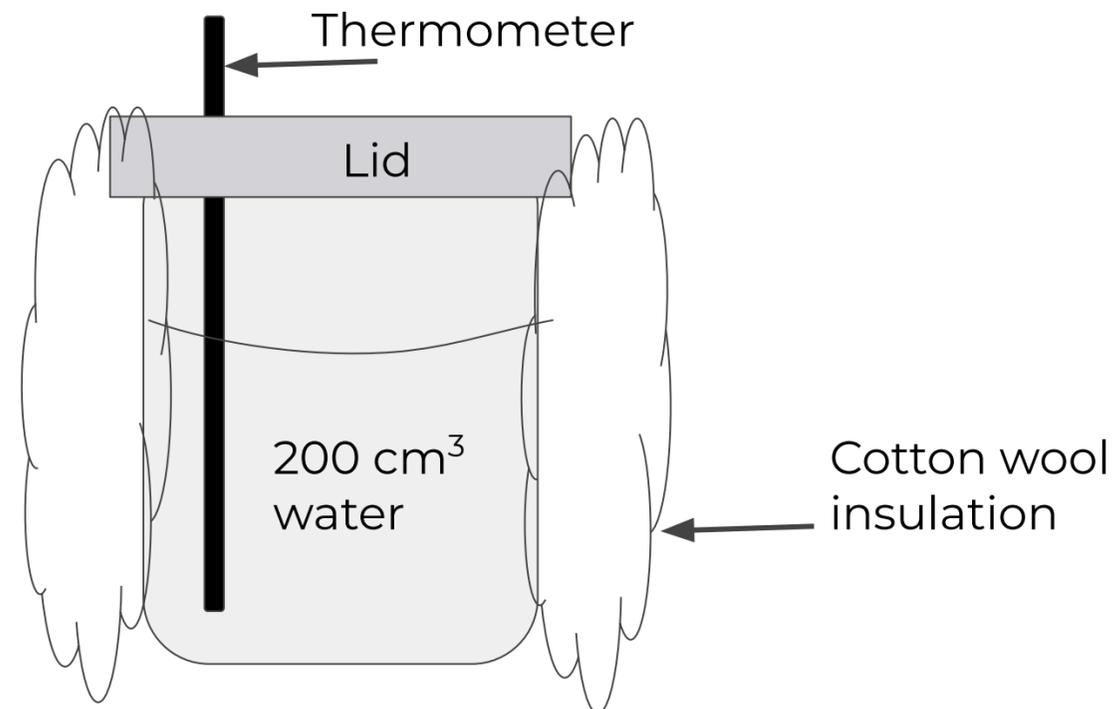


Exam style question

A student investigates how the thickness of insulation affects the rate of cooling of water.

- a) Calculate the temperature difference for 6 mm of cotton wool. **(2)**
- b) The reading for 2 mm cotton wool is anomalous. Explain how it can be seen that this is anomalous. **(1)**

Thickness of cotton wool / mm	Start temperature / °C	End temperature / °C	Temperature change / °C
0	90	65	25
2	90	45	45
4	90	69	21
6	88	69	
8	88	71	17
10	90	74	16

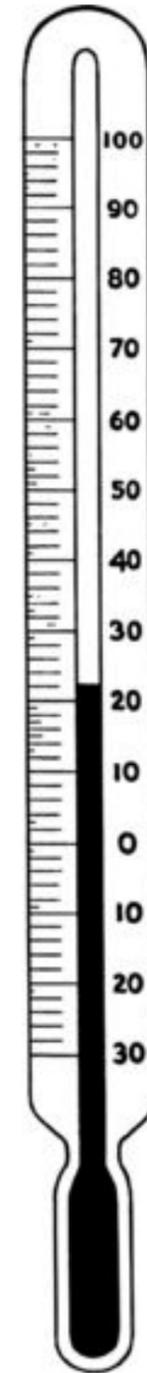


Exam style question

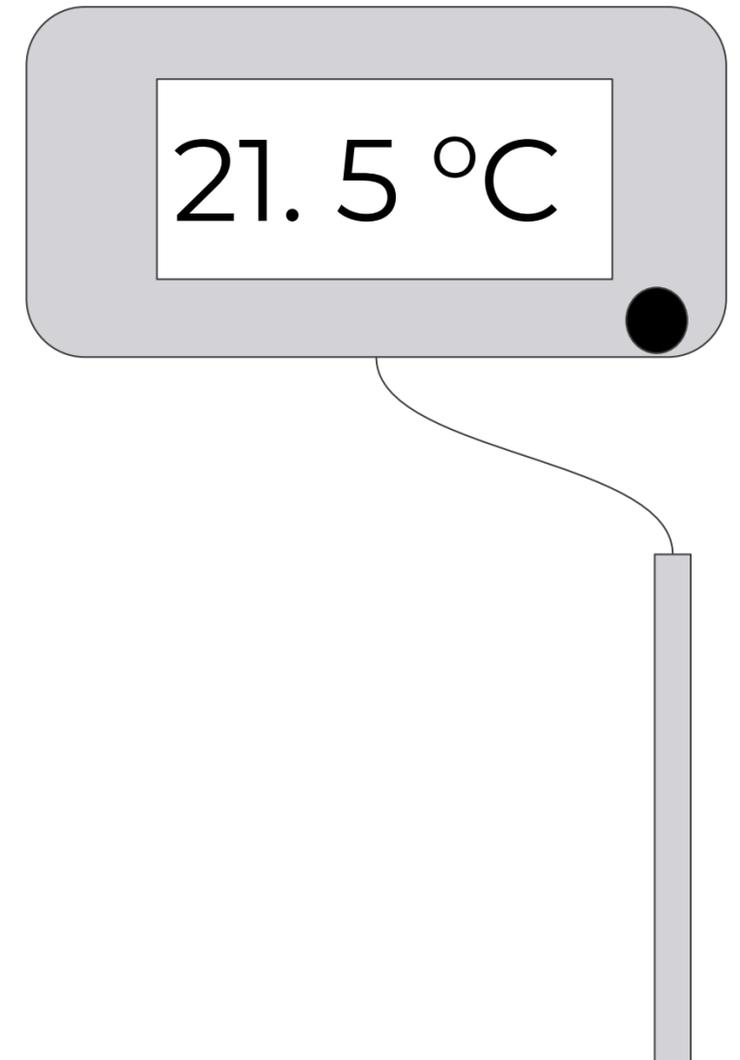
c) The student had access to a datalogger capable of taking 5 readings every second and a temperature probe able to read to 1 decimal place. The thermometer was an analogue thermometer as shown to the right.

Explain why the student chose just to use the thermometer for this experiment. (1)

Thermometer

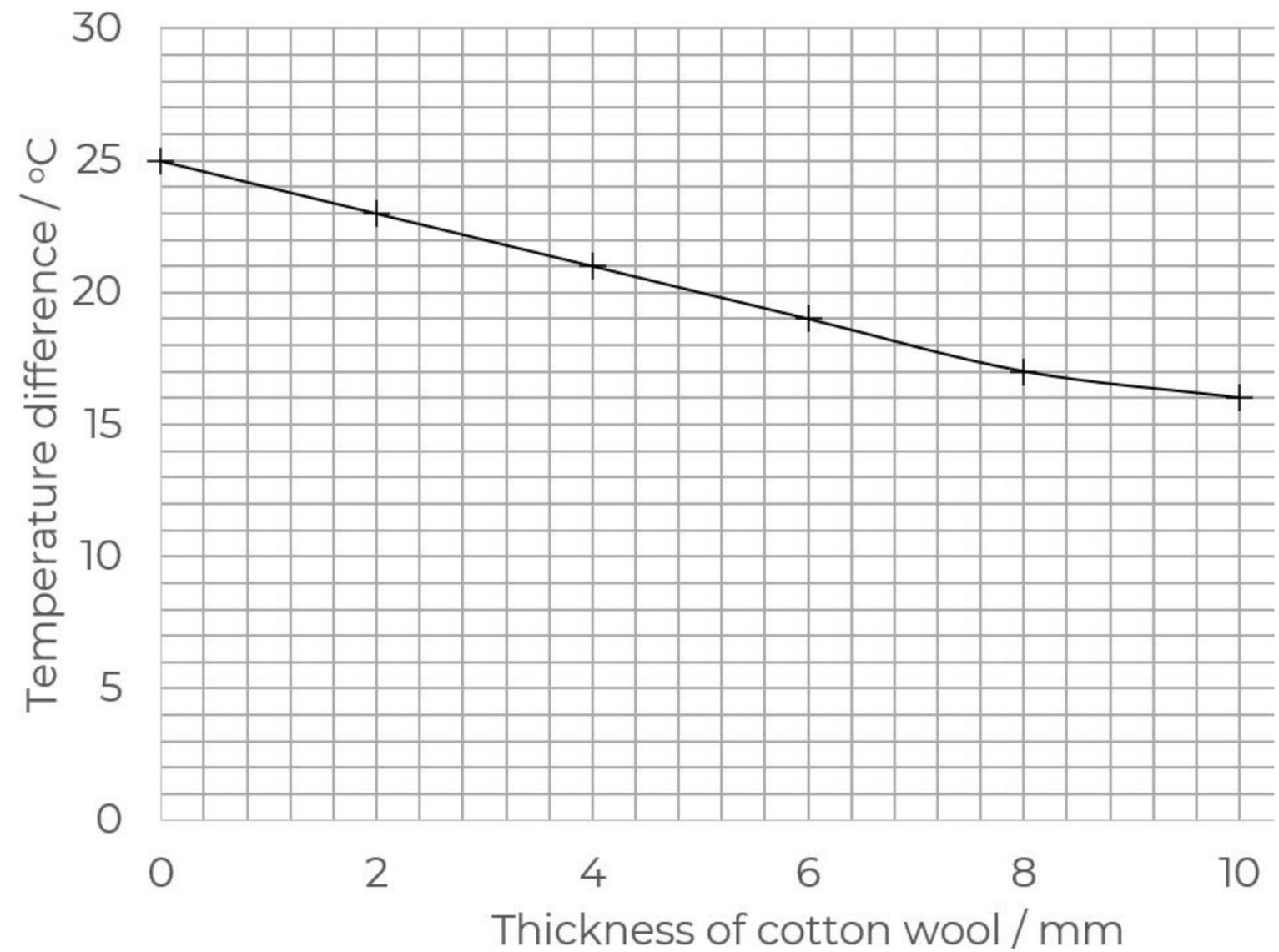


Datalogger



Exam style question

d) Describe the relationship between thickness of insulation and temperature change and the effect of thickness on rate of cooling. **(2)**



Exam style question

The student followed this method:

Wrap insulation around beaker

Measure temperature at the start

Measure temperature at end, calculate difference

Repeat with different thicknesses of cotton wool

e) Suggest two improvements to the method that the student could perform. **(2)**



Answers



- a) $88 - 69 = 19\text{ }^{\circ}\text{C}$ **1**
- b) The temperature difference for 2 mm is larger than for no insulation. **1**
- Or, the result does not fit the pattern of decreasing temperature difference.
- c) The readings do not need to be taken as often as every second as only need start and end readings of temperature. **1**
- d) As the thickness increases, the temperature change decreases. **1**
- The rate of cooling decreases with increasing thickness **1**
- e) Any two from
- Stir the water, use a more precise instrument, have the same starting temperature of water, take repeats and calculate a mean **2**



In lesson questions



Independent practice

1. What is the biggest source of error in this practical?
 - The biggest error is due to
2. Explain why it is the biggest error.
3. What can be done to improve this method? **(4)**



Review

1. What is the biggest source of error in this practical?
 - The biggest error is due to **not filling the space between the beakers the same.**
2. Explain why it is the biggest error. **Because with different air gaps, we will have different insulating properties than each material actually has.**
3. What can be done to improve this method? **(4)**
 - **Ensure all space is filled with insulation completely**
 - **Ensure exact same covering sizes are used for each beaker**
 - **Choose a larger range of materials**
 - **Compare the thickness of the material against its insulating properties**

