NPL

Measurement At Home

Hot mug challenge

#MeasurementAtHome
npl.co.uk/measurement-at-home

How fast do drinks cool in mugs?

- how much variation is there in how long containers keep drinks warm for?
- how much effect does a lid have?
- do drinks take the same time to cool from 60 to 50 °C as from 50 to 40 °C?
- what does this experiment have to do with reducing the impact of heating houses upon climate change?

estimated time: depends on drinks containers – Mostly 30 minutes though some can take hours. ***no prior knowledge needed.***

Instructions

watch the video **(** YouTube: VEsoNS8eYx8**)**

1. List your drinks containers in a results table (as in video). Download table here.
2. Very carefully use the measuring jug to put 100 ml of boiled water into each container. If the water temperature in the container is less than 60 °C, empty and refill with new hot water. Put on any lids.
3. Measure room temperature.
4. Measure water temperature for each container about once a minute. Record the time when the temperature is 60 °C. **Replace lids each time and don't leave the thermometer in the container.**
5. Continue measuring water temperature about once a minute. Write down the time when the temperature is 50 °C.
6. Continue measure water temperature and write down the time when the temperature is 40 °C. Give the thermometer time to settle outside the water, then measuring the room temperature.
7. Calculate times each drinks container takes to cool from 60 °C to 50 °C and from 50 °C to 40 °C, and record values below or into NPL webpage:

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Equipment required

- hot drinks containers. Ideally including an identical pair – one with a lid
- measuring jug
- thermometer that works up to 100 °C
- a clock or timer
- paper to record results in a table

Risks

- hot water can scald, take extreme care
- take care if handling a glass thermometer
- mop up spilt water immediately

SI measurement units

- second (s) for time (and minute = 60 seconds)
- kelvin (K) for temperature
- metre (m) as litre for volume m^3

Challenge topics

climate measurement, measurement science, thermal properties, insulation, maths

Thoughts, tips and information

- which material keeps drinks hot best?
- how do lids affect the result?
- what is the coldest temperature the drink will ever reach?

describe material container is made from	
room temperature at start of experiment (in °C)	
room temperature at end of experiment (in °C)	
time taken for water to drop from 60 °C to 50 °C (in minutes)	
time taken for water to drop from 50 °C to 40 °C (in minutes)	