Learning outcomes
By the end of today you will:

- **Bronze:** Will be able to state the relationship between energy and mass in temperature change (E)

- **Silver:** Will be able to explain how different materials affect energy required in temperature change (D)

- **Gold:** Will be able to calculate energy required to raise temperature of a mass (C)

Starter – 5 minutes

Scenario 1

- 2 beakers of water
- 250ml & 500ml
- Which one boils first?
- Why?

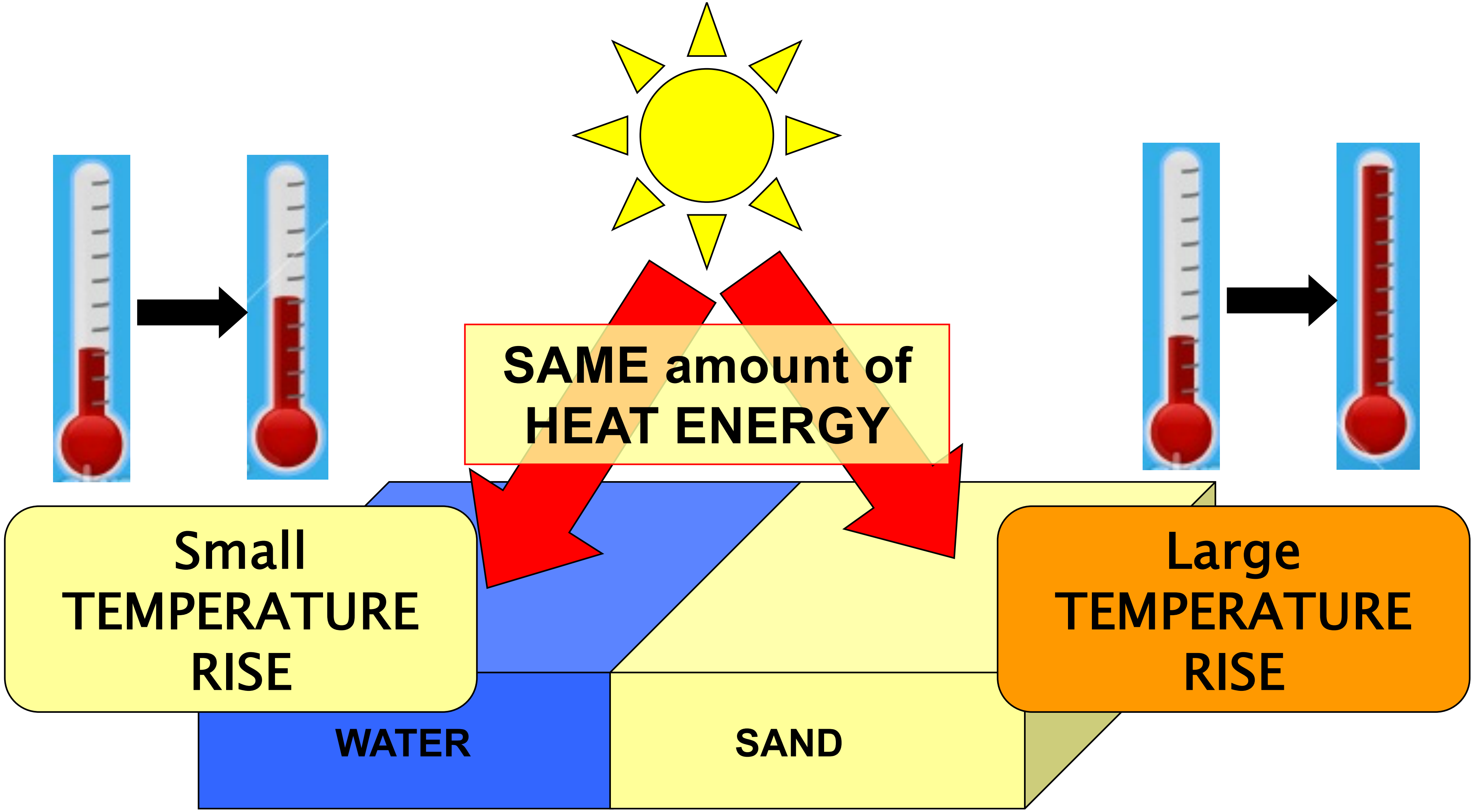
Scenario 2

- A mass of metal
- Heated to 150 degrees
- Then put in to beaker of water
- Why does the water not boil?

https://www.youtube.com/watch?v=D3CwpfBzF94

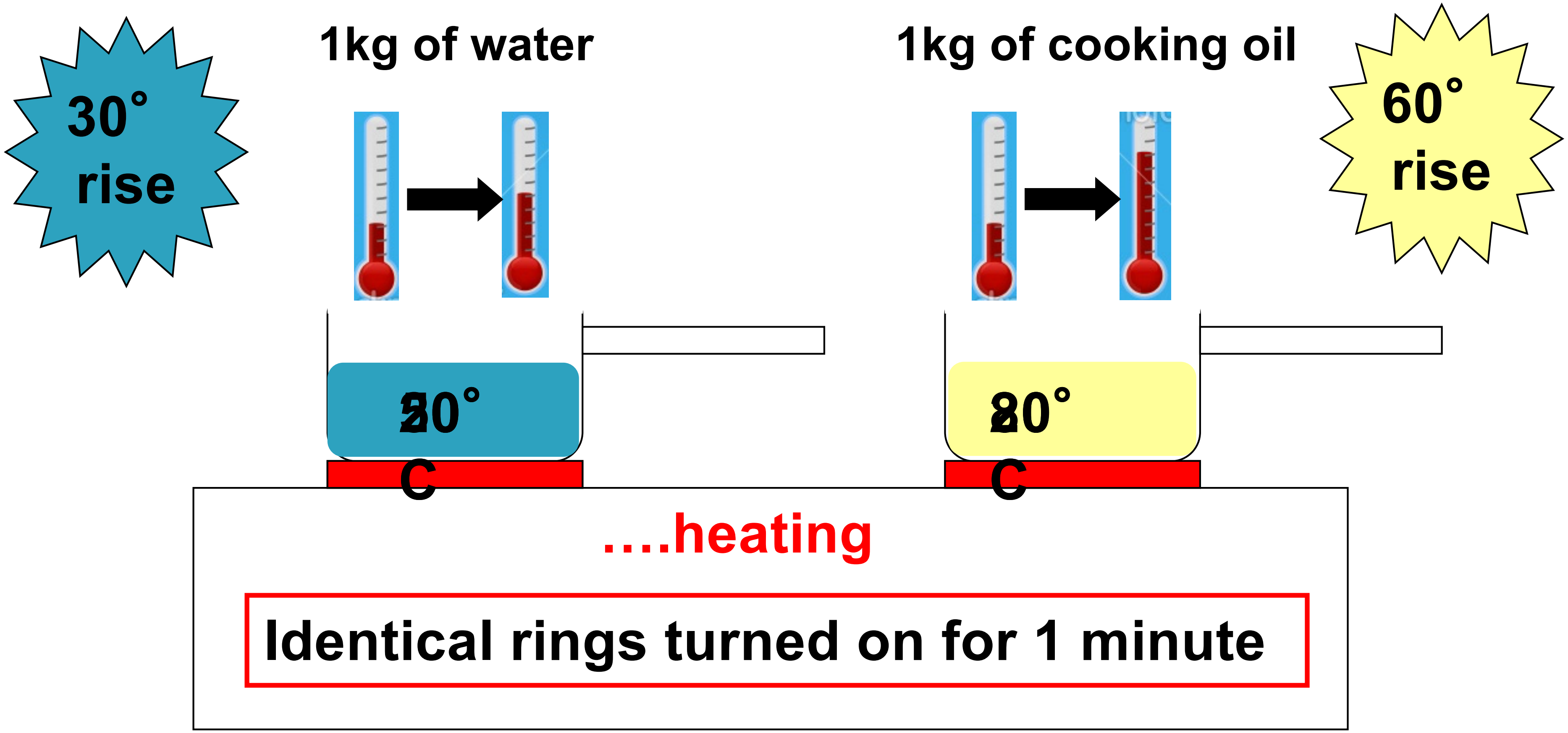
SPECIFIC HEAT CAPACITY

At the end of a sunny day at the beach, you often notice that while the sand has become quite hot, the water has stayed cool.



Putting the SAME AMOUNT OF HEAT into some materials gives a BIGGER TEMPERATURE RISE than in other materials

Comparing water and cooking oil

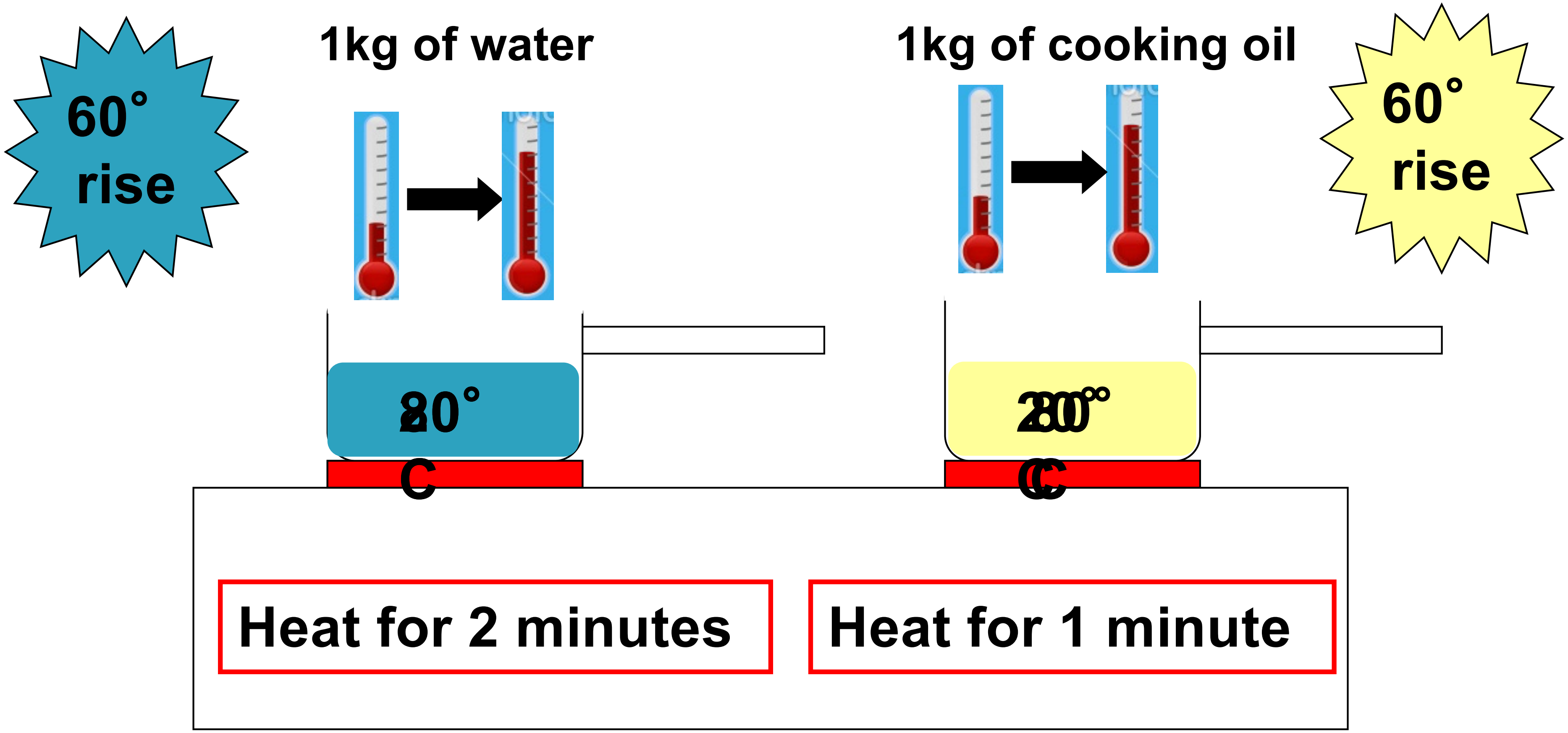


The water heats up less than the oil.

The SAME AMOUNT OF HEAT produces HALF the TEMPERATURE RISE in the water as in the oil

Comparing water and cooking oil 2

What would we need to do to make the SAME TEMPERATURE RISE in the water as in the oil?

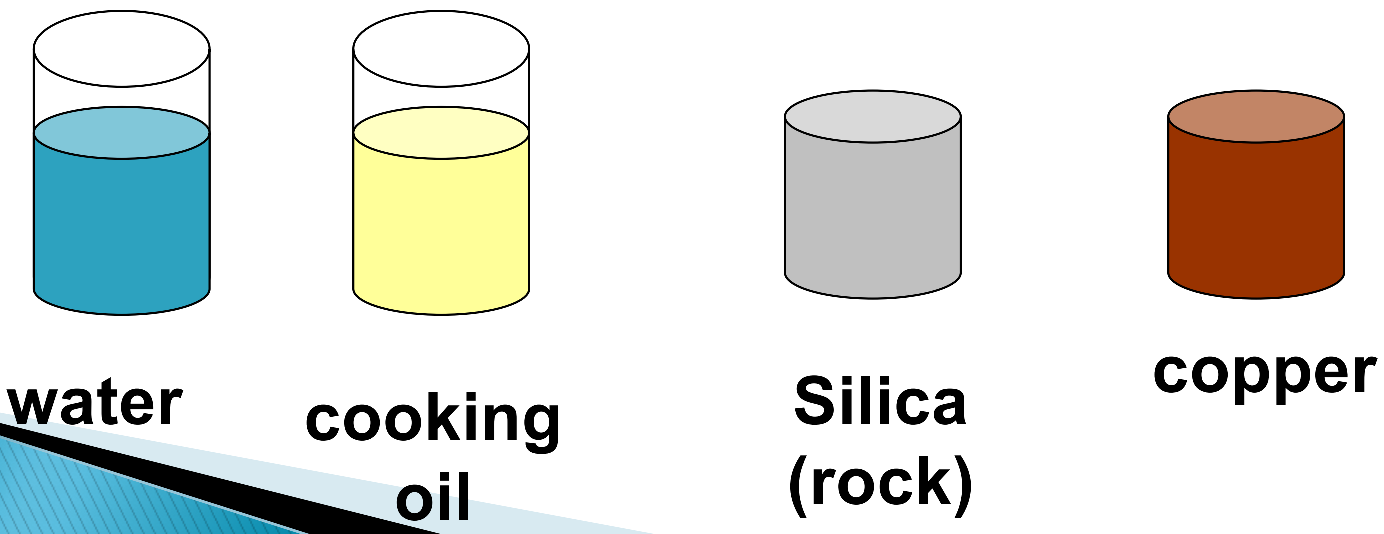


To make the SAME TEMP RISE we need to put TWICE AS MUCH HEAT into the water as the oil

To make the SAME TEMP RISE we need to put TWICE AS MUCH HEAT into the water as the oil

This means water has twice the CAPACITY to absorb and store heat energy as oil.

Materials vary quite widely as to the amount of heat they can absorb for the same temperature rise. There are no simple patterns in this although metals tend to have low capacities.



SAME AMOUNT OF HEAT PUT IN

We only get ¼ the TEMP RISE with **water** than with **rock** for the SAME AMOUNT of HEAT

Two ways to look at heat capacity…

We need to put in 4x the AMOUNT OF HEAT into water than rock to get the SAME TEMP RISE

So we say water has a HIGHER HEAT CAPACITY than rock

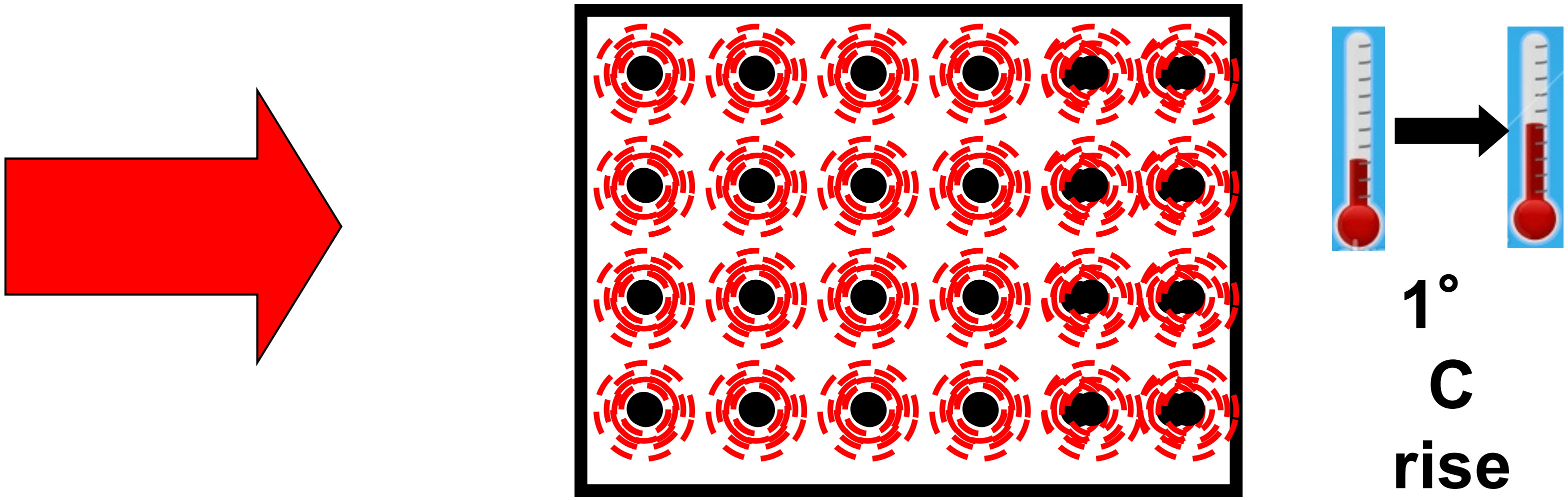
See those results again..

How to MEASURE HEAT CAPACITY?

To compare the heat capacity of materials, we need to measure:

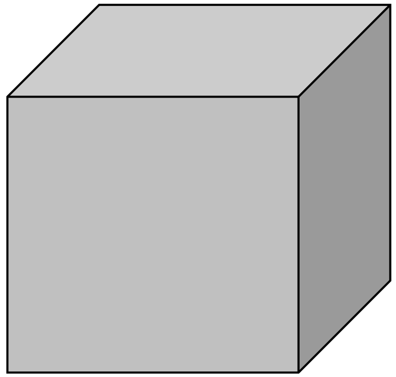
How many **JOULES of heat energy**

are needed to make each degree temperature rise

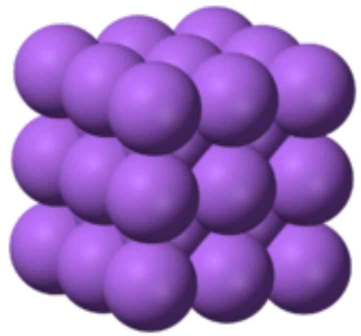


To make a FAIR comparison between materials we also need to compare the same amount of…..

mass (kg)?



volume (m^3)?



particles (moles)?

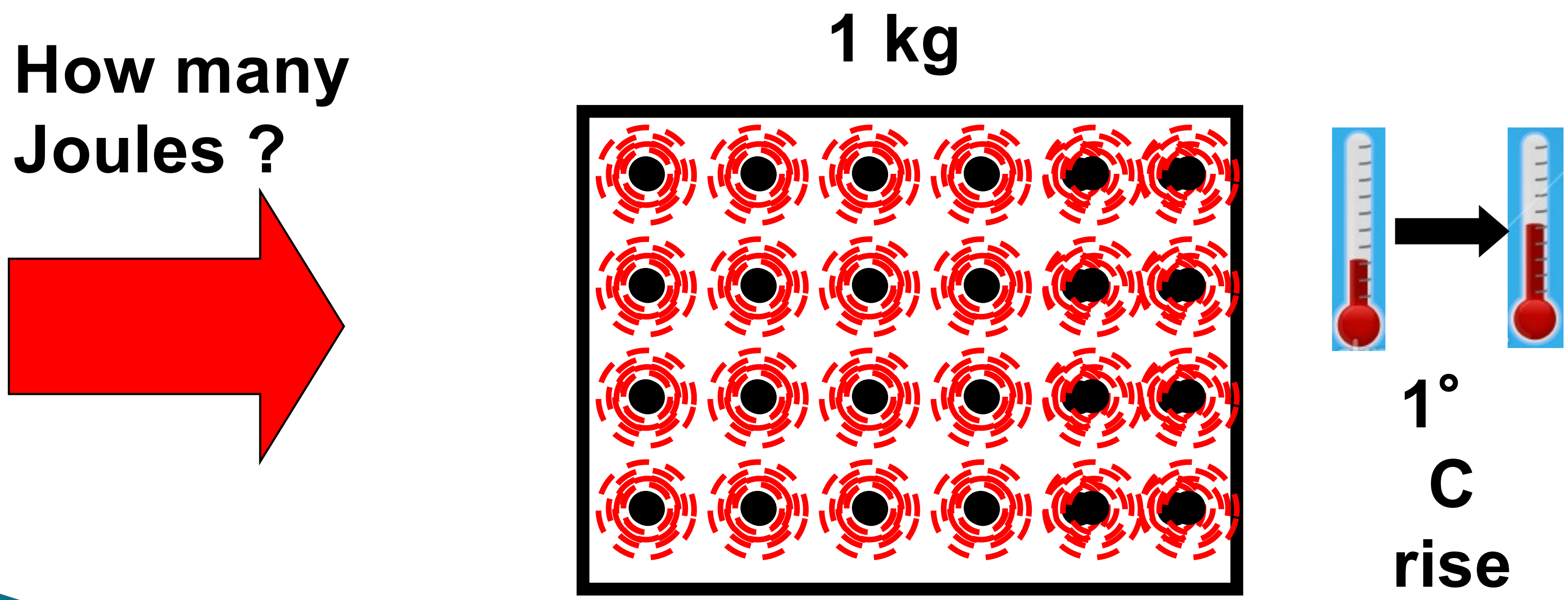
All of these are used to compare heat capacities, but for GCSE we use SPECIFIC Heat Capacity which compares the same amount of MASS.

SPECIFIC HEAT CAPACITY (c) is….

How many **JOULES of heat energy**

are needed to raise the temperature of:

each kg by each ° C



Working it out…

Specific heat capacity = $\dfrac{\text{Number of } \textbf{Joules} \text{ of } \textbf{HEAT (Q)}}{\text{Number of } \textbf{kg} \text{ of } \textbf{MASS (m)} \quad \text{Number of } ^\circ\textbf{C} \text{ of } \textbf{TEMPERATURE CHANGE } (\Delta T)}$

$$c = \frac{Q}{m \quad \Delta T} \qquad c = \frac{Q}{m \quad \Delta T}$$

Given in the exam as:

Heat = mass x SHC x temp change

SPECIFIC HEAT CAPACITIES			
Air (typical room conditions)	1012	Lead	129
Aluminium	897	Mercury	139.5
Carbon dioxide	839	Methane	2191
Chromium	449	Nitrogen	1040
Copper	385	Neon	1030.1
Diamond	509.1	Oxygen	918
Ethanol	2440	Paraffin wax	2500
Gasoline	2220	Polyethylene	2302.7
Glass	840		
Gold	129	Silica	703
Granite	790	Water at 100 °C (steam)	2080
Graphite	710	Water at 25 °C	4181.3
Helium	5193.2	Water at −10 °C (ice)	2050
Hydrogen	14300	Zinc	387
Iron	450		

Puzzle Card Sort – 20 mins

- Groups of 4.
- Use clues on sheets to answer questions.
- Make the calculations.
- Group check after.

Plenary - 10 minutes

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