

specific heat, latent heat, and why a substance can take in energy without getting hotter

Heat and temperature are not the same

- **heat** is energy in transit from a hotter body to a cooler one, measured in **joules**
- **temperature** measures how hot a body is, in **degrees Celsius or kelvin**, and it decides which way heat will flow
- a bucket of warm water holds **more heat** than a cup of boiling water, though the cup is at the higher temperature
- the **specific heat capacity c** is the heat needed to raise one kilogram by one kelvin, in $\text{J kg}^{-1} \text{K}^{-1}$
- **water has an unusually high specific heat**, about 4200, which is why it heats and cools slowly
- that high value is why water is used as a **coolant**, why coastal places have mild climates, and why a hot water bottle stays warm

The relations of this chapter

heat to change temperature $Q = mc\Delta T$

heat to change state, no temperature change $Q = mL$

principle of heat exchange $Q_{\text{lost}} = Q_{\text{gained}}$

converting Celsius to kelvin $T(\text{K}) = t(^{\circ}\text{C}) + 273$

relative humidity as a percentage

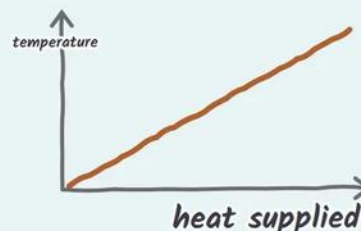
$$RH = \frac{\text{actual vapour}}{\text{saturated vapour}} \times 100$$

a change of one degree Celsius is exactly a change of one kelvin, so a temperature **DIFFERENCE** has the same number in both scales. Only a single temperature reading needs the 273 added

Latent heat, and the flat part of the graph

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- **latent heat** is the energy needed to change the state of one kilogram of a substance **with no change in temperature**
- **latent heat of fusion** is for melting or freezing, and for ice it is about $3.34 \times 10^5 \text{ J per kg}$
- **latent heat of vaporisation** is for boiling or condensing, and for water it is about $22.6 \times 10^5 \text{ J per kg}$, far larger
- during a change of state the energy goes into **breaking the forces between particles**, not into speeding them up, so the thermometer does not move
- that is why a heating curve has **flat portions** at the melting and boiling points
- **steam at 100°C burns worse than water at 100°C** , because it gives up all that latent heat as it condenses on the skin



temperature plotted against heat supplied for ice warmed right through to steam: the line rises through each single state and goes flat at the melting and boiling points, where energy is being taken in but the temperature holds still

