Your notes

KS3 Science: revision notes

P3.2 Heating

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Internal energy and heat transfer

- **Internal energy** is the total kinetic and potential energy of all the particles in a system.
- Heating increases the **internal energy**: it either raises the temperature (the particles move faster) or changes the state (the forces between the particles are overcome).
- **Conduction**: particles vibrate and pass energy to their neighbours. It is fastest in solids, especially metals.
- **Convection**: in liquids and gases, the warmer part expands, becomes less dense and rises, and cooler fluid sinks, making a **convection** current.
- **Radiation**: **infrared** waves transfer energy without particles, even through a vacuum. Dark, matt surfaces are the best emitters and absorbers; shiny, light surfaces are the worst, and reflect **infrared**.

Reducing heat loss

- Homes lose less energy with loft **insulation**, cavity wall **insulation**, double glazing and draught excluders. Insulating materials trap air, which reduces **conduction** and convection.
- A vacuum flask keeps drinks hot because the vacuum stops **conduction** and **convection**, and the shiny walls reduce **radiation**.

Specific heat capacity

- **Specific heat capacity** is the energy needed to raise the temperature of 1 kg of a substance by 1 °C.
- Energy = mass × **specific heat capacity** × temperature change ($E = m \times c \times \Delta\theta$).

- Water has a high **specific heat capacity** (4200 J/kg°C), so it takes a lot of energy to heat up. Heating 2 kg of water by 10 °C needs 2 × 4200 × 10 = 84 000 J.
- To measure it, heat a metal block of known mass with an electric heater, measure the energy supplied and the temperature rise, then calculate c = E ÷ (m × Δθ). Insulate the block to reduce energy losses.

Specific latent heat

- **Specific latent heat** is the energy needed to change the state of 1 kg of a substance without changing its temperature: energy = mass × **specific latent heat** (E = m × L).
- **Latent heat of fusion** is for melting; **latent heat of vaporisation** is for boiling.
- While a substance changes state, its temperature stays the same, which shows as a flat section on a **heating curve**.

Key terms

Internal energy	The total kinetic and potential energy of the particles in a system.
Conduction	Energy transfer through a material by particles passing on vibrations.
Convection	Energy transfer by the movement of a warm liquid or gas.
Radiation	Energy transfer by infrared waves, which can cross a vacuum.
Infrared	Invisible radiation given out by warm objects.
Insulation	A material that reduces energy transfer by heating.
Specific heat capacity	The energy needed to raise the temperature of 1 kg of a substance by 1 °C.
Specific latent heat	The energy needed to change the state of 1 kg of a substance.
Latent heat of fusion	The energy needed to melt 1 kg of a substance.
Latent heat of vaporisation	The energy needed to boil 1 kg of a substance.
Heating curve	A graph of temperature against time as a substance is heated.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is internal energy?
2. How is energy transferred along a metal spoon?
3. Why does hot air rise?

Your notes

4. Which type of energy transfer can happen through a vacuum?
5. Which surface is the best emitter of infrared radiation?
6. What does specific heat capacity measure?
7. How much energy is needed to heat 2 kg of water by 10 °C? (c = 4200 J/kg°C)
8. Why does water take a long time to heat up?

Answers

1. The total kinetic and potential energy of the particles in a system
2. By conduction
3. It expands and becomes less dense
4. Radiation
5. Dull black
6. The energy needed to raise the temperature of 1 kg of a substance by 1 °C
7. 84 000 J
8. It has a high specific heat capacity

What to do next

Practise 14 questions on this topic

Try 4 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

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