CIE A-Level Physics

12 - Thermal Properties of Materials

Flashcards

Describe the arrangement and energy of particles in a solid, a liquid and a gas.

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- Solid - regular arrangement, vibrate about fixed positions.
- Liquid - close together, constantly moving past each other.
- Gas - spaced very far apart, free to move in all directions.

Why can melting and boiling take place without a change in temperature?

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When a change of state occurs the energy changes the intermolecular bonding. For melting, the energy breaks these bonds, but there is no change in kinetic energy as the molecules have the same speed both before and after the transition. Changing state alters potential energy rather than kinetic energy.

Why is the specific latent heat of vaporisation higher than specific latent heat of fusion for the same substance?

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The energy required to completely separate the molecules is greater than that required to go from solid to liquid as, from solid to liquid forces of attraction still exist between the molecules whereas from liquid to gas they are almost 0.

Why does a cooling effect accompany evaporation?

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Evaporation requires heat energy which is removed when molecules transition from a liquid into a gas and this leaves behind a lower temperature than when it left.

What is internal energy?

What is internal energy?

The sum of the potential and kinetic energies of a system.

True or false? At a given temperature, all particles in a material have the same kinetic energy.

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False. The kinetic energies will be randomly distributed around a central ‘most likely’ value.

How can you increase the thermal energy of a system?

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We can increase it by heating it up or doing work on the system.

Explain the energy changes that occur during a change of state.

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During changes of state the potential energy of the particles change but the kinetic energies don’t.

What equation can be used to determine the energy required to change the temperature of a substance?

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$$Q = mc\Delta T$$

Where Q = energy, m = mass, c = specific heat capacity, ΔT = temperature change

What is the specific heat capacity of substance?

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The energy required to raise the temperature of 1kg of a substance by 1K.

State the equation used to calculate the energy required for a change of state?

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$$Q = ml$$

Where Q = energy, m = mass, l = specific latent heat (‘of fusion’ if melting/freezing, ‘of vaporisation’ if condensing/evaporating)

What is the specific latent heat of a substance?

What is the specific latent heat of a substance?

The energy required to change the state of a unit mass of a substance, whilst keeping the temperature constant.

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An overestimate.

Specific heat capacity is calculated as: $c = Q / m\Delta T$

The energy input will be used, but the temperature change of the water will be lower than it should be due to the escaped energy - therefore c will be too high.

What is the first law of thermodynamics?

What is the first law of thermodynamics?

$$\Delta U = Q + W$$

Where Q is the heat added to a system

And W is the work done by the system