CAIE Physics A-level

16 - Thermodynamics

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 (bonds).
- Liquid - particles in close proximity, constantly moving past each other, forming transient bonds.
- Gas - particles spaced very far apart, free to move in all directions, negligible bonding.

What is internal energy of a system?

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

Does every particle in the system have to possess the same ratio of potential and kinetic energy?

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No,

the ratio of the respective potential/kinetic energy components may be randomly distributed within a system.

What is the general relationship between the temperature of a system and its internal energy?

What is the general relationship between the average temperature of a system and its internal energy?

There is a positive correlation between the average temperature of a system and the sum of its internal energy.

Why is there a pause in the temperature increase as a substance is being heated at the temperatures at which phase changes take place?

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When melting or evaporation occurs, intermolecular bonds are broken. Energy is required to break bonds (latent heat of fusion/vaporisation), and is therefore absorbed in this process, rather than being invested in raising the substance's temperature.

What is the specific latent heat of a substance?

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

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.

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.

Describe the distinction between work being done by a gas and work being done on a gas?

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Work is done on a gas when it is compressed i.e. the temperature of a constant volume of gas is increased or if the volume itself is decreased.

Work is done by the gas if it expands due to a temperature increase (while sustaining a constant pressure).

Give an equation that describes the work done by a gas, at constant pressure, when it changes volume?

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$$W = p\Delta V$$

The work done by the gas is equal to the pressure multiplied by the change in volume.

What is the first law of thermodynamics?

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$$\Delta U = Q + W$$

Where Q is the heat added to a system

And W is the work done by the system