Edexcel IAL Physics A-Level

Topic 5.1 - Thermodynamics

Flashcards

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

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

$$E = mc\Delta T$$

E, energy - J

M, mass - kg

C, specific heat capacity - JK^{-1}

T, temperature - K

Give the equation to work out the energy to change the state of a substance?

Give the equation to work out the energy to change the state of a substance ?

$$E = mL$$

E, energy - J

M, mass - kg

L, specific latent heat - Jkg^{-1}

What is internal energy?

PMT
•resources•tuition•courses

What is internal energy?

It is the sum of the kinetic and potential energy of the molecules within a system.

What is kinetic and potential energy?

What is kinetic and potential energy?

Kinetic energy depends on the mass and speed of a molecule and is proportional to temperature; the higher the temperature, the more kinetic energy.

Potential energy is caused by the interactions between molecules based on their positions relative to each other. It depends on the state of the object.

What is the difference between absolute scale temperature and celsius temperature?

What is the difference between absolute scale temperature and celsius scale temperature?

Absolute scale is measured in Kelvins and measures the total internal energy, which starts at 0K / -273°C.

Celsius scale is measured in celsius and is used for easier day to day activities.

What is specific heat capacity?

What is specific heat capacity?

It is the amount of energy needed to raise the temperature of 1kg of a substance by 1K (or 1°C).

Describe the arrangement of molecules for solids, liquids and gases.

Describe the arrangement of molecules for solids, liquids and gases.

SOLID - molecules are in a regular lattice and held in position by strong forces of attraction.

LIQUID - molecules are constantly moving around and are free to move, however are attracted to each other.

GAS - molecules are free to move around with constant random motion.

What does a change of phase mean?

What does a change of phase mean?

It means a change of internal energy. When it is heated, the kinetic energy increases and when it changes state, the potential energy increases.

What is specific latent heat?

What is specific latent heat?

It is the quantity of thermal energy required to change the state of 1kg of a substance. It can either be fusion or vaporisation.

Energy change = SLH x mass of substance

Describe Boyle's Law.

Describe Boyle's Law.

When there is constant temperature, the pressure and volume of a gas are inversely proportional.

E.g. if you increase the volume, the molecules will collide less with the container, therefore the pressure will decrease.

$$pV = constant$$

Describe Charles' Law.

Describe Charles' Law.

At constant pressure, the volume of a gas is directly proportional to its absolute temperature.

E.g. when the temperature increases, it gains kinetic energy, meaning the molecules move more quickly and further apart.

$$V / T = constant$$

Describe Guy-Lussac's law.

Describe Guy-Lussac's law.

At constant volume, the pressure of a gas is directly proportional to the absolute temperature.

E.g. if you heat a gas, it has more kinetic energy, therefore the molecules collide more with each other and the container, increasing the pressure.

What is the equation for an Ideal Gas?

What is the equation for an Ideal Gas?

$$pV = NkT$$

p = pressure / Pa, V = volume / m^3

N = number of molecules, k = boltzmann constant,

T = temperature / k

What equation can be used to calculate the kinetic energy of a molecule from its temperature?

What equation can be used to calculate the kinetic energy of a molecule from its temperature?

$KE = 3/2kT$

K is the boltzmann constant and T is the temperature (K).

Derive the following equation

$$\frac{3}{2}kt = \frac{1}{2}m\overline{c^2}$$

Derive the following equation

$$\frac{3}{2}kt = \frac{1}{2}m\overline{c^2}$$

We can relate the two pressure equations, $pV = NkT$ and $pV = ⅓Nm\overline{c^2}$ to produce the equation

$$kt = \frac{1}{3}m\overline{c^2}$$

The equation for kinetic energy is 1/2mv2, so by adjusting the equation, we can produce

$$\frac{3}{2}kt = \frac{1}{2}m\overline{c^2}$$

This shows that $E_k = \frac{3}{2}kt$, where E_k is the mean kinetic energy of the gas molecules