A Level H2 Physics Tutorial 9: First Law of Thermodynamics

Syllabus :
(a) define and use the concepts of specific heat capacity and specific latent heat .

1.

(i) The latent heat of fusion of water is 3348 J/kg. Find the heat needed to melt 10 g of ice at 0 ºC.
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(ii) The specific heat capacity of water is 4200 J/kg/ºC. Find the heat needed to heat 10 g of water from 0 to 100 ºC.

(iii) The latest heat of vaporisation of water at 100 ºC is 2260 kJ/kg. Find the heat needed to boil 10 g of water at 100 ºC.

(b) show an understanding that internal energy is determined by the state of the system and that it can be expressed as the sum of a random distribution of kinetic and potential energies associated with the molecules of a system

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2. The internal energy of an ideal gas is the sum of the kinetic energies of all the molecules in a container.

(i) Why are the potential energies not included?

(ii) How is the internal energy of a real gas different?

(iii) As a result, explain what is likely to happen to a real gas if temperature is sufficiently low.

(c) relate a rise in temperature of a body to an increase in its internal energy

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(d) recall and use the first law of thermodynamics expressed in terms of the increase in internal energy, the heat supplied to the system and the work done on the system.

3.

(a) State the first law of thermodynamics.

(b) The total kinetic energy of 1 mole of ideal gas is $^3/_2RT$.

(i) Explain why $^3/_2RT$ is the internal energy of the ideal gas, but not the internal energy of a real gas.

(ii) Some heat Q is given to the ideal gas at constant volume. The temperature increases by 10 °C. Find Q.

(iii) Find the change in internal energy, ΔU, and work done W.

(c) The gas is then allowed to expand. It pushes a piston and does 10 J of work. The temperature does not change as the container is well insulated. Find the heat Q given to the gas, and the change in internal energy ΔU.