

- 6 (a) (i) Energy is supplied to water that is boiling.

State and explain, in terms of molecular behaviour, the change (if any) in its internal energy.

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[3]

- (ii) Steam at 100 °C is used to warm 200 g of water in a 100 g closed insulated glass container from 20 °C to 50 °C.

The specific heat capacity of glass is $8.4 \times 10^2 \text{ J kg}^{-1} \text{ K}^{-1}$.

The specific heat capacity of water is $4.2 \times 10^3 \text{ J kg}^{-1} \text{ K}^{-1}$.

The specific latent heat of vaporisation of steam is $2.3 \times 10^6 \text{ J kg}^{-1}$.

Calculate the mass of steam required.

mass of steam = kg [3]

- (iii) Referring to data in (a)(ii), state and explain which is more likely to cause a more serious burn, 1 kg of 100 °C liquid water or 1 kg of 100 °C steam.

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[2]

- (b) Fig. 6.1 shows a cylinder with a piston connected to it.

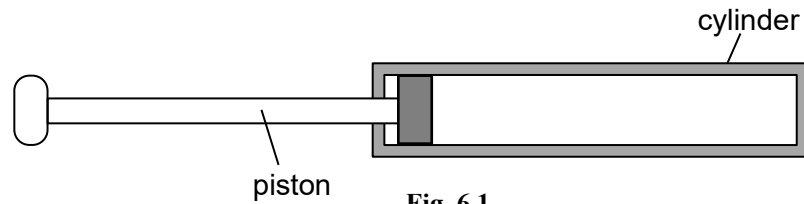


Fig. 6.1

The gas in the cylinder is compressed quickly by a piston resulting in an increase in temperature. The gas in the cylinder can be assumed to be ideal.

- (i) Explain what is meant by an *ideal gas*.

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- (ii) Use the kinetic theory of gases to explain why the temperature of the gas increases.

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[2]

- (iii) Before compression, the gas in the cylinder is at a pressure of 1.1×10^5 Pa and a temperature of 28 °C. The volume of the gas in the cylinder is 6.2×10^{-4} m³.

1. Calculate the number of moles of gas in the cylinder.

number of moles = mol [2]

2. The work done to *quickly* compress the gas is 15 J.

Calculate the increase in the internal energy, ΔU , of the gas in the cylinder.

$$\Delta U = \dots\dots\dots \text{ J} \quad [2]$$

3. Calculate the change in average kinetic energy, ΔE_K , of a gas molecule due to the compression.

$$\Delta E_K = \dots\dots\dots \text{ J} \quad [2]$$

- (c) The gas is now *slowly* being compressed by the same amount. This is to ensure that the process took place at a constant temperature.

State and explain how the final pressure of the gas compares to final pressure of the gas in (b).

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[2]