

- 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.

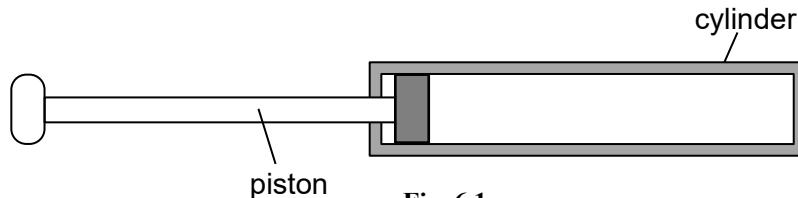


Fig. 6.1

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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[2]

- (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  $1.1 \times 10^5$  Pa and a temperature of 28 °C. The volume of the gas in the cylinder is  $6.2 \times 10^{-4}$  m<sup>3</sup>.

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,  $\Delta U$ , of the gas in the cylinder.

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

3. Calculate the change in average kinetic energy,  $\Delta E_K$ , of a gas molecule due to the compression.

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

- (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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