**2** **(a)** State what is meant by the *internal energy* of a system.

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.....

.....

.....[2]

**(b)** An ideal gas undergoes a cycle of changes as shown in Fig. 2.1.

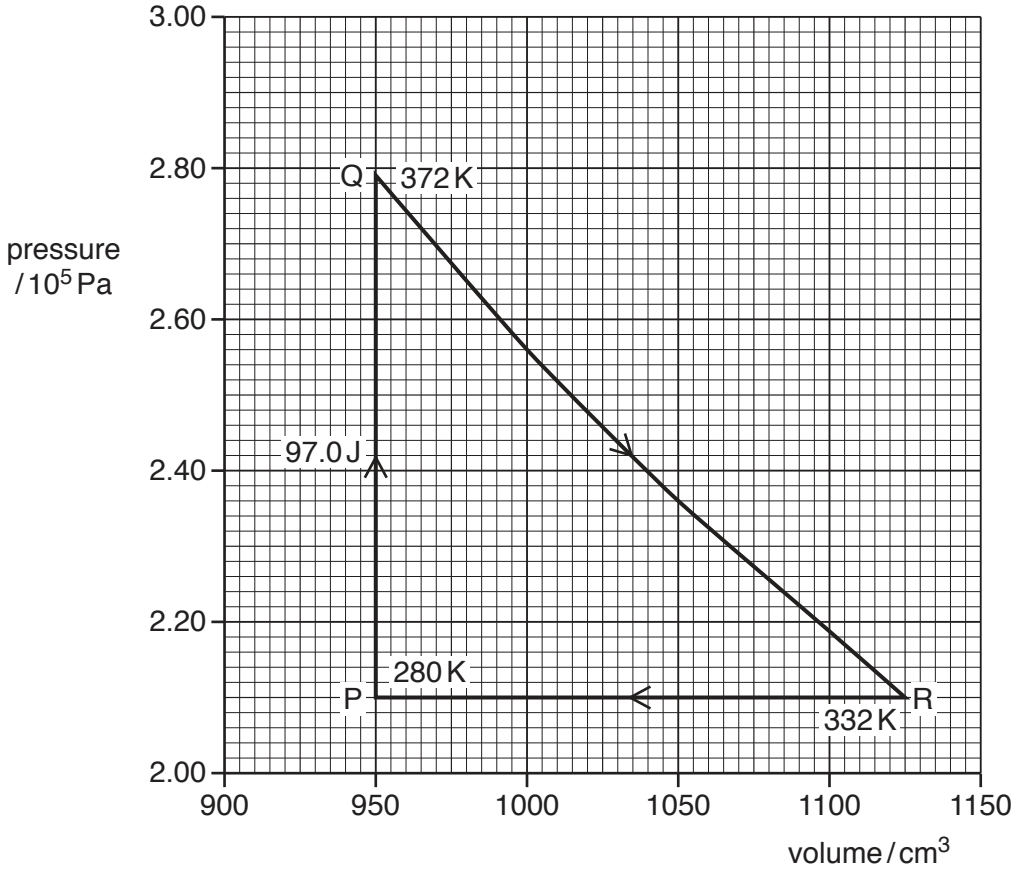


**Fig. 2.1**

At point P, the gas has volume 950 $cm^3$, pressure $2.10 \times 10^5$ Pa and temperature 280 K.

The gas is heated at constant volume and 97.0 J of thermal energy is transferred to the gas. Its pressure and temperature change so that the gas is at point Q on Fig. 2.1.

The gas then undergoes the change from point Q to point R and then from point R back to point P, as shown on Fig. 2.1.

Some energy changes that take place during the cycle PQRP are shown in Fig. 2.2.

| | change P → Q | change Q → R | change R → P |
|---|---|---|---|
| thermal energy transferred to gas / J | +97.0 | 0 | ..... |
| work done on gas / J | ..... | −42.5 | +37.0 |
| increase in internal energy of gas / J | ..... | ..... | ..... |

**Fig. 2.2**

**(i)** State the total change in internal energy of the gas during the complete cycle PQRP. Explain your answer.

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.....

.....[2]

**(ii)** On Fig. 2.2, complete the energy changes for the gas during

**1.** the change P → Q,

**2.** the change Q → R,

**3.** the change R → P.

[5]

[Total: 9]