

2 (a) State the *first law of thermodynamics*.

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.....  
..... [1]

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

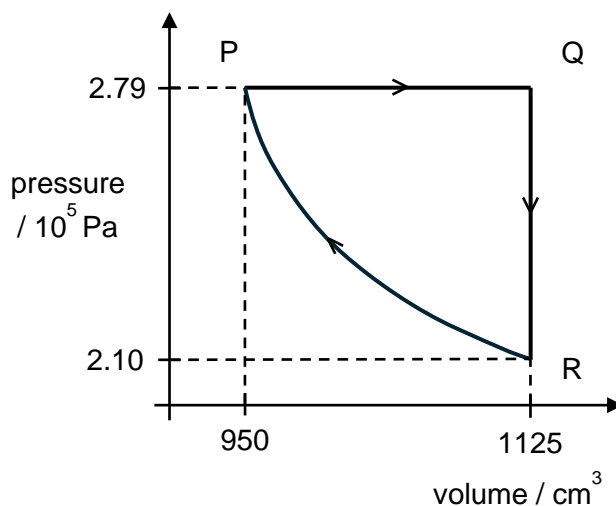


Fig. 2.1

The gas is initially at point P. It is heated, and its volume increases at constant pressure to point Q. The gas is allowed to cool at constant volume to R. It then undergoes a compression back to P.

(i) For the gas shown in Fig. 2.1, determine

1. the work done **on** the gas from P to Q.

work done = ..... J [2]

2. the heat loss to the surrounding from Q to R.

heat loss = ..... J [3]

- (ii) There is no heat exchange between the gas and the surrounding when the gas changes from point R to P.

Using the first law of thermodynamics, state and explain if the temperature increases, decreases or stays the same during the change from point R to P.

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 .....  
 .....  
 ..... [2]

- (iii) The molar heat capacity of the gas is the amount of heat supplied to 1 mol of gas to raise its temperature by 1 K.

For the transition from P to Q, the molar heat capacity of the gas is  $20.8 \text{ J mol}^{-1} \text{ K}^{-1}$  and its temperature at P and Q are 350 K and 414 K respectively.

Determine the heat supplied to the gas in this transition.

heat supplied = ..... J [3]