

Section B

Answer **one** question from this Section in the spaces provided.

- 8 (a) The first law of thermodynamics may be expressed in the form

$$\text{increase in internal energy} = (+q) + (+w).$$

- (I) State what is meant by *internal energy*.

.....

.....

.....

.....[2]

- (II) State what is meant by the symbols $+q$ and $+w$.

$+q$

$+w$ [2]

- (b) A fixed mass of an ideal gas has volume $1.2 \times 10^4 \text{ cm}^3$ at pressure $5.4 \times 10^5 \text{ Pa}$ and temperature 57°C .

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

.....

.....

.....[2]





(II) Determine, for the gas at 57 °C,

1. the number of molecules

number = [3]

2. the mean kinetic energy of one molecule

energy = J [2]

3. the total internal energy of the gas. Explain your working.

total internal energy = J [2]





(c) The gas in (b) is now heated to a temperature of 155°C .

(i) Calculate the total increase in internal energy of the gas.

increase = J [3]

(ii) The answer in (c)(i) is equal to the thermal energy supplied to the constant mass of gas during the heating process.

1. State and explain what other quantity must be constant during the heating process.

.....

 [2]

2. The molar heat capacity of a gas heated as in (c) is numerically equal to the quantity of thermal energy required to raise the temperature of 1.0 mol of the gas by 1.0 K .

Determine, for the heating process in (c), the molar heat capacity C , in $\text{J mol}^{-1}\text{ K}^{-1}$, of the gas.

$C = \dots\dots\dots \text{J mol}^{-1}\text{ K}^{-1}$ [2]

[Total: 20]

