Extension Worksheet – Topic 3, Worksheet 2

1 The pressure of an ideal gas is 3.2×10^6 Pa and its volume is 6.1×10^{-3} m^3. The temperature of the gas is 310 K. Calculate the number of molecules in the gas. [2]

2 The volume of an ideal gas is doubled at constant pressure. The pressure is then reduced to half its value at constant volume. The initial temperature of the gas was 22 °C. Calculate the new temperature of the gas. [2]

3 Equal masses of hydrogen and helium gas are kept (in separate containers) at the same volume and pressure. State and explain which gas has the greater temperature. [2]

4 A gas is to be compressed from a volume V_1 to a volume V_2. In one experiment the compression is done isothermally and in another it is done adiabatically. State and explain in which case the work done on the gas is greater. [2]

5 Two ideal gases X and Y are kept at the same temperature.
The molecules of gas X have mass m and those of gas Y have mass $2m$. The ratio $\frac{\text{average speed of molecules of gas X}}{\text{average speed of molecules of gas Y}}$ is

A 1

B $\frac{1}{\sqrt{2}}$

C $\sqrt{2}$

D 2 [1]

6 A fixed quantity of an ideal gas is allowed to expand isothermally doing 180 J of work in the process. The gas is then compressed at constant pressure down to its original volume by doing 100 J of work on the gas. The gas is then heated to its original temperature at constant volume. Calculate the net amount of thermal energy transferred to or from the gas. [3]

7 A fixed quantity of an ideal gas is allowed to expand adiabatically doing 120 J of work in the process. The gas is then heated at constant volume, by adding 80 J of thermal energy to the gas. Determine whether the final temperature of the gas will be less than, equal to or greater than the initial temperature of the gas. [3]

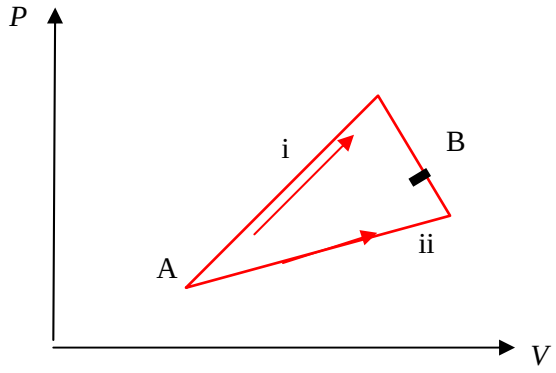
8 Explain, why the temperature of the gas will decrease in an adiabatic expansion using

a the molecular model of an ideal gas. [2]

b the first law of thermodynamics. [2]

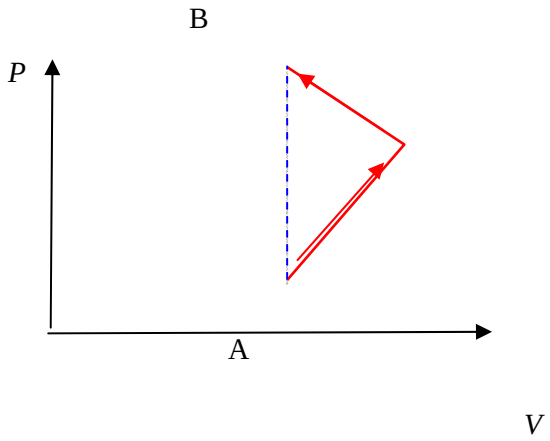
9 The temperature of a fixed quantity of an ideal gas is to be increased by 50 K. In order to use the least amount of thermal energy should the thermal energy provided at constant volume or at constant pressure? [3]

10 A fixed quantity of an ideal gas undergoes a change from state A to state B along path (i). The same quantity of another ideal gas undergoes the same change along path (ii) and (ii) as shown in the p–V diagram below.



State and explain how the changes in **a** temperature and **b** thermal energy transferred compare along paths (i) and (ii). [3]

11 An ideal gas undergoes the change from state A to state B as shown in the pressure–volume diagram below.



What may be concluded about the net work done and the temperature change during the change A to B?

	Work done	**Temperature change**
A	zero	zero
B	positive	negative
C	negative	positive
D	zero	positive

[2]