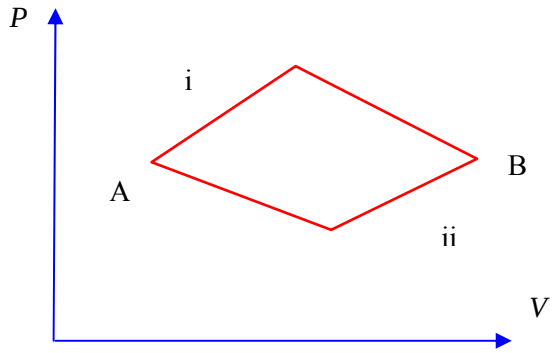
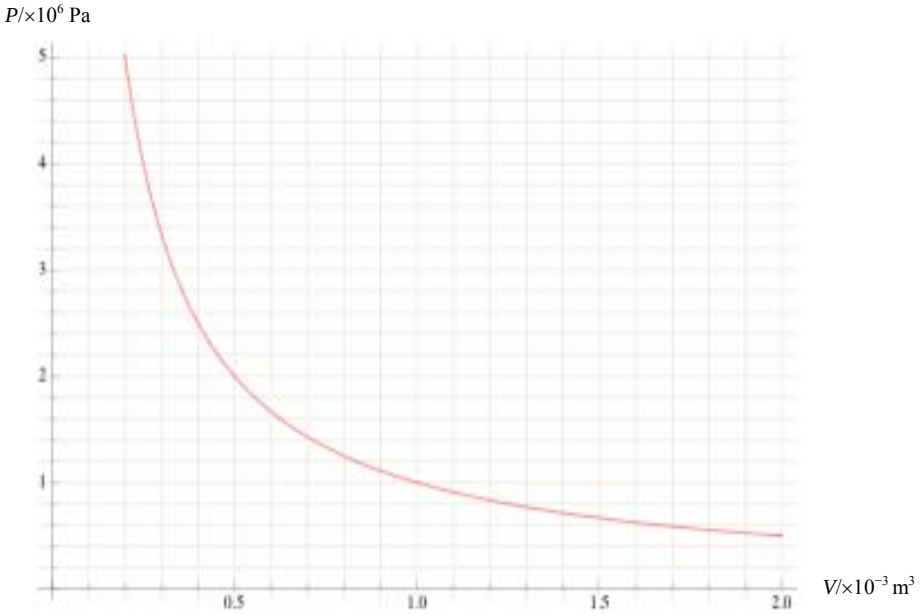
Extension Worksheet – Topic 3, Worksheet 3

1 The pressure–volume diagram below shows a fixed quantity of an ideal gas that undergoes two different changes from state A to state B, paths (i) and (ii).



State and explain along which path, (i) or (ii), the amount of thermal energy transferred is greatest. [2]

2 The graph shows an isothermal curve for 0.20 moles of an ideal gas.



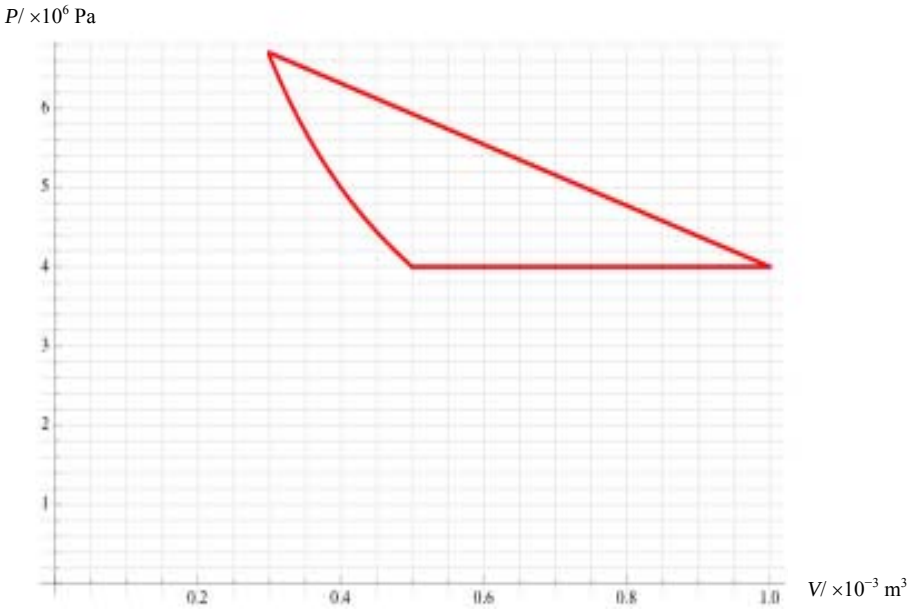
a Calculate the temperature this isothermal curve corresponds to. [2]

b Estimate the work done in expanding from a volume of 0.50×10^{-3} m^3 to a volume of 1.0×10^{-3} m^3. [2]

c Estimate the amount of thermal energy transferred during this expansion. [2]

d The gas is compressed adiabatically from the final to the initial volume in **c**. The temperature after the compression becomes 794 K. Calculate the pressure of the gas. [2]

3 The graph shows the isothermal expansion of a gas followed by an expansion at constant pressure up to a volume of 1.0×10^{-3} m^3. The gas is then returned to its original state along the straight line path shown.



The work done by the gas during the isothermal expansion is 1020 J and the change in internal energy of the gas during the expansion at constant pressure is 2990 J.

a Calculate the total thermal energy transferred to the gas during its expansion stage. [3]

b Calculate the total thermal energy transferred from the gas during its compression stage. [3]

c State and explain why the answers to **a** and **b** are different. [2]

4 A glass of cold water is placed in a warm room. It may be assumed that the room is well insulated so that no energy enters or leaves the room. Consider the process in which the cold water becomes colder and the room becomes warmer. State and explain, by reference to the first and second laws of thermodynamics, why this process would never be observed. [3]