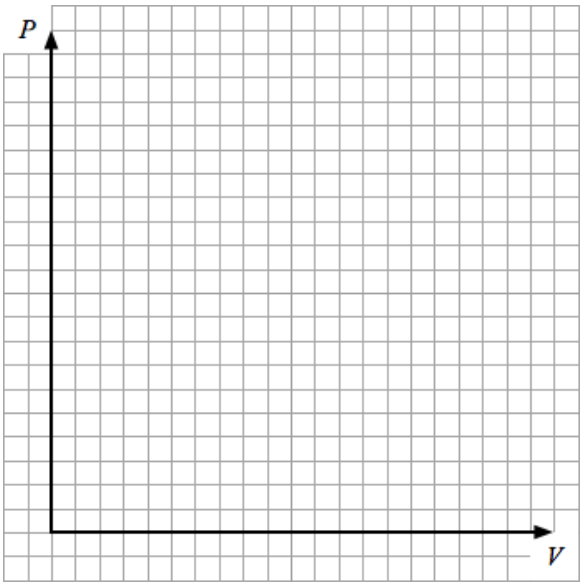
4. A cylinder fitted with a piston contains 0.1 mol of a monatomic gas at a pressure of 1×10^5 Pa and a temperature of 300 K. The gas is

   (i) first heated at constant pressure to 400 K, and then
   (ii) compressed isothermally to its initial volume, and finally
   (iii) cooled at constant volume to its initial temperature.

   (a) Find the initial volume of the gas and determine its volume after process (i) is completed. (2 marks)

   (b) Hence sketch the above changes on the following $P - V$ diagram, inserting all the initial and final pressure and volume values for each of the processes (i), (ii) and (iii). (4 marks)



   (c) What is the change in internal energy of the gas in process (i)? (3 marks)

   (d) Hence determine the heat input to the cylinder in process (i). (3 marks)

   (e) What does the area bounded by the curves sketched in part (b) represent? (1 mark)