3 **(a)** State 3 assumptions of the kinetic theory of gases. [3]

1. ……..……..

……..……..

2. ……..……..

……..……..

3. ……..……..

……..……..

(b) A cylinder fitted with a frictionless piston contains a fixed mass of Argon, assumed to be ideal. Initially, the gas has a volume of 6.0×10^{-4} m^3, at a temperature of 300 K and a pressure of 1.0×10^5 Pa.

Calculate the number of Argon molecules in the cylinder.

number of Argon molecules = …….. [3]

(c) The p-V cycle within a heat engine is a cyclic process characterised by rapid compression of the fuel-air mixture to a higher pressure for greater engine efficiencies.

The cycle uses the following processes

A → B **Compression stroke**, an adiabatic compression of air in the cylinder with no fuel added.

B → C **Ignition,** heat addition at constant pressure through the introduction of fuel into the compressed air when the fuel-air mixture is ignited.

C → D **Expansion (Power) stroke**, isothermal expansion of the hot gases in the cylinder.

D → A **Exhaust & Induction strokes**, the ejection of spent, hot gases and the intake of the next air change into the cylinder. The net volume change in this process is zero.

On the Pressure-Volume (p-V) axes below, sketch the graph that represents the heat cycle of the heat engine. The graph should include the labels **A**, **B**, **C** and **D**. [4]

Pressure (p)