1 **(a)** Fig. 1.1 shows an insulated cylinder fitted with a perfectly fitting piston and a heater. There is negligible friction between the cylinder and the piston. The cylinder contains a fixed mass of ideal neon gas.

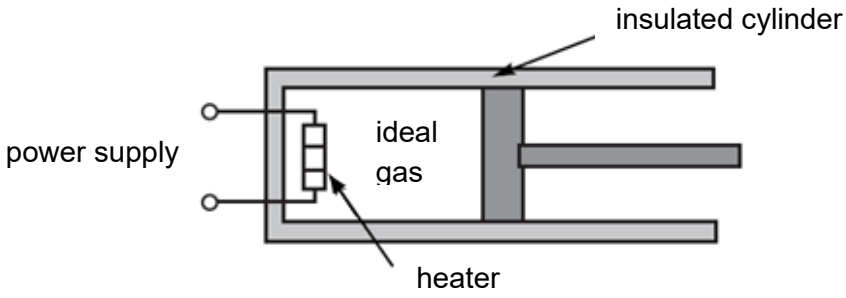

Fig. 1.1

The following two experiments are performed.

Experiment 1 The heater provides 150 J of energy with the piston fixed in position. The temperature rise of the gas is found to be 29 K.

Experiment 2 The heater supplies 150 J of energy with the piston free to move so that the gas expands at constant pressure. The temperature rise of the gas is now 18 K.

(i) Explain why the temperature rise is different in the two experiments.

.....

.....

.....

..... [2]

(ii) Complete Fig. 1.2 to show the values of each of the quantities for experiments 1 and 2. You may present your working using the space provided below.

	thermal energy supplied to gas/J	work done on gas /J	increase in internal energy of gas/J
Experiment 1			
Experiment 2			

Fig. 1.2 [4]

(b) Some argon gas is now introduced into the cylinder and the gas mixture is heated to a temperature of 100°C. The gases are assumed to be ideal.

(i) Calculate the average kinetic energy of each gas molecule.

average kinetic energy = ... J [2]

(ii) The mass of a neon atom is 3.35×10^{-26} kg.

Calculate the root-mean-square speed of argon atom, given that an argon atom is 1.8 times more massive than a neon atom.

root-mean-square speed = ... m s^{-1} [2]