3 (a) State how the temperature of an ideal gas is related to the energy of its molecules.

....

[1]

....

(b) An oven with volume 0.029 m³ contains air at a pressure and temperature of 1.0×10^5 Pa and 27°C respectively. The mass of one mole of air is 0.030 kg. Assume that the air behaves as an ideal gas.

(i) Determine the root-mean-square speed of the air molecules in the oven.

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

(ii) Calculate the number of moles of air molecules in the oven.

number of moles   = ... [2]

(iii) The oven is heated to a temperature of 220°C.

Use your answer in **(a)** and the kinetic theory of gases to explain why the pressure of the air in the oven increases.

....

....

....

[2]

....

(iv) The oven door is opened.

Calculate the mass of air that must escape from the oven for the pressure in the oven to return to 1.0×10^5 Pa.

mass of air   = ... kg   [2]