7 One property of α-particles is that they produce a high density of ionisation of air at atmospheric pressure. In this ionisation process, a neutral atom becomes an ion pair. The ion pair is a positively-charged particle and an electron.

(a) State

    (i) what is meant by an α-particle,

    ....

    ....[1]

    (ii) an approximate value for the range of α-particles in air at atmospheric pressure.

                                        range = ... cm [1]

(b) The energy required to produce an ion pair in air at atmospheric pressure is 31 eV. An α-particle has an initial kinetic energy of 8.5×10^{-13} J.

    (i) Show that 8.5×10^{-13} J is equivalent to 5.3 MeV.

                                                                                       [1]

    (ii) Calculate, to two significant figures, the number of ion pairs produced as the α-particle is stopped in air at atmospheric pressure.

                                           number = ...[2]

(iii) Using your answer in **(a)(ii)**, estimate the average number of ion pairs produced per unit length of the track of the α-particle as it is brought to rest in air.

number per unit length = ...[2]