2 A proton is projected with a velocity of 2.4×10^5 m s^{-1} directly towards a distant stationary helium nucleus as shown in Fig. 2.1. The mass of helium nucleus is four times that of proton. The interaction can be taken to be an elastic head-on collision.

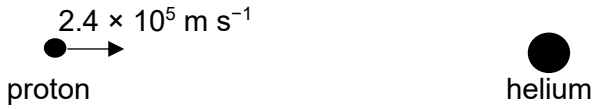

Fig. 2.1

(a) Explain what is meant by an *elastic collision*.

……..…….....

……..……. [1]

(b) Calculate the velocity of each particle after collision.

velocity of proton = …….. m s^{-1}

velocity of helium = …….. m s^{-1} [4]

At one instant during the collision, the two particles have a common velocity v_o.

(c) Show that the value of v_o is 4.8×10^4 m s^{-1}.

[1]

(d) State the energy change that has occurred up to this instant.

…….

…….. [1]

(e) Using energy considerations, calculate the separation between the two particles at this instant.

separation = …….. m [3]