2 **(a)** Define *linear momentum*.

.....

..... [1]

(b) Two particles A and B with masses $2m$ and m respectively, move at the same speed u towards each other along a horizontal line and collide elastically. Particle B moves vertically down after the collision and particle A is deflected through an angle θ as illustrated in Fig. 2.1.

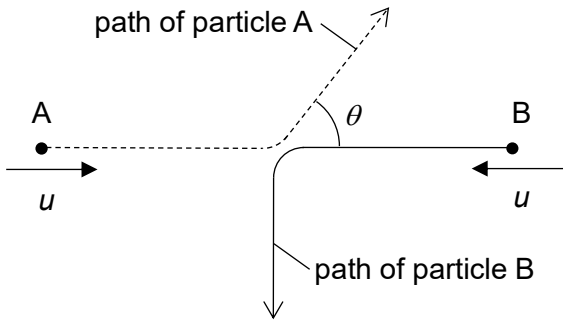

Fig. 2.1

(i) By considering the kinetic energies of both particles, show that:

$$3u^2 = 2v_A^2 + v_B^2$$

where v_A and v_B are the speeds after collision of particles A and B respectively.

[1]

(ii) The value of m is 1.7×10^{-27} kg and the value of u is 3.5×10^{5} m s^{-1}.

1. By considering the momenta of both particles in the vertical and horizontal directions and using the equation in **(b)(i)**, determine v_B.

v_B = ... m s^{-1} [3]

2. Hence, calculate the change in momentum of particle B due to the collision.

magnitude of change = ... kg m s^{-1}

direction of change = ... [3]

(iii) The two particles are in contact for a time of 1.2 μs during collision.

Determine the average force exerted by particle B on particle A.

magnitude of average force = ... N

direction of average force = ... [2]