14 In the 1930s, scientists investigated collisions of alpha particles with protons to determine whether the collisions were elastic.

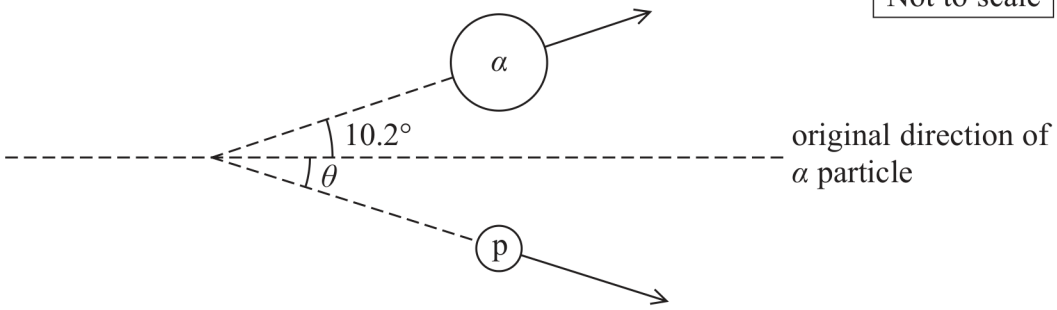
The diagrams show an alpha particle before and after a collision with a stationary proton.
The proton moves off at an angle θ to the original direction of the alpha particle.

Before collision

momentum of alpha particle = 1.26×10^{-19} N s

After collision

Not to scale



momentum of alpha particle = 8.06×10^{-20} N s

(a) Show that the momentum of the proton after the collision is about 5×10^{-20} N s at an angle θ, where θ is about 20°.

(6)

(b) Deduce whether the collision was elastic.

mass of alpha particle = 6.64×10^{-27} kg

(4)

(Total for Question 14 = 10 marks)