6 **(a)** Compare an α-particle with a β^+ particle in terms of their masses and charges.

.....

.....

.....

.....

..... [3]

(b) Nucleus P undergoes α-decay to form nucleus Q. Nucleus Q then undergoes a further decay to form nucleus R. The proton and nucleon numbers of P and R are shown in Fig. 6.1.

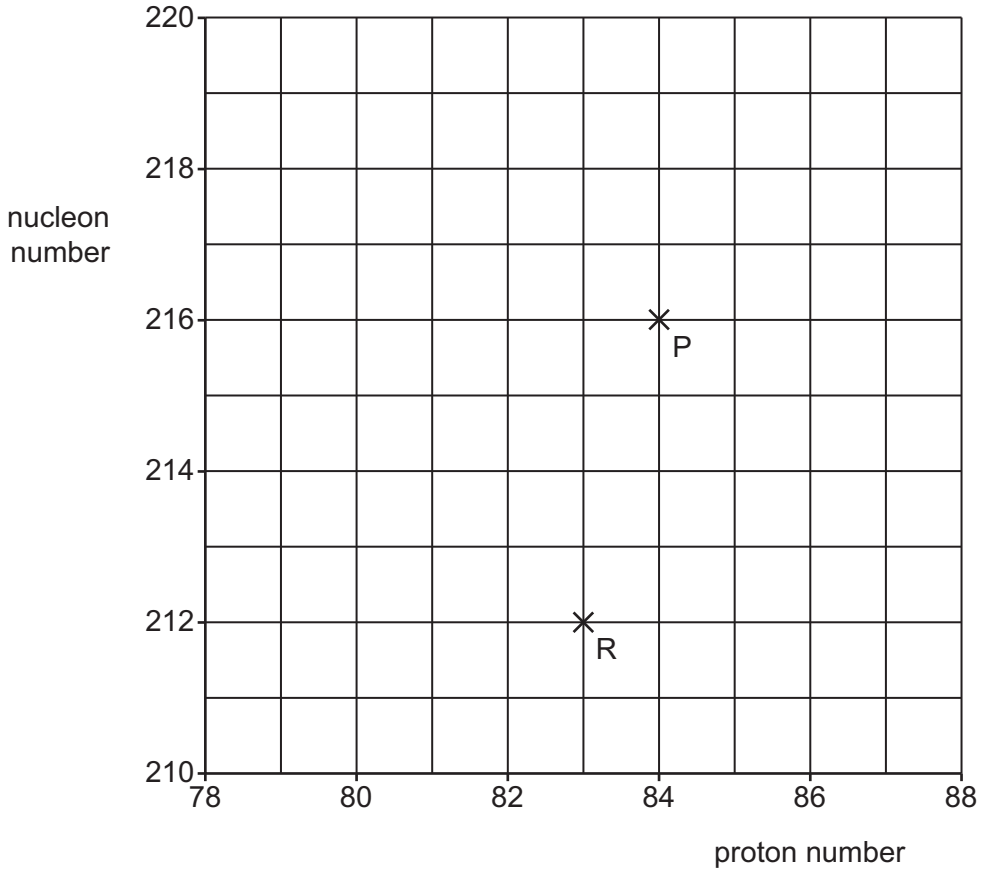

Fig. 6.1

(i) On Fig. 6.1, draw a cross (×) to show the proton number and nucleon number of Q. Label your cross Q. [1]

(ii) State the names of the particles emitted as Q decays to form R.

.....

..... [2]

(c) Before the α-decay, P is travelling at a constant velocity. After the decay, Q has a velocity of $1.3 \times 10^5\,m\,s^{-1}$ at an angle of 68° to the original path of P.
The α-particle has a velocity of $150 \times 10^5\,m\,s^{-1}$ at an angle of θ to the original path of P, as shown in Fig. 6.2.

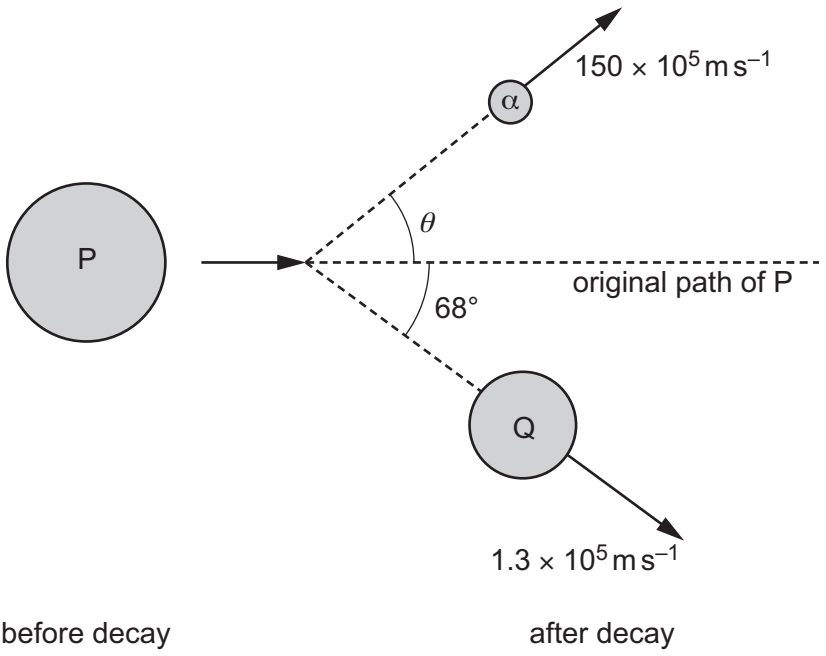

Fig. 6.2 (not to scale)

(i) Use the principle of conservation of momentum to determine θ.

θ = ...° [3]

(ii) Calculate the kinetic energy of the α-particle.

kinetic energy = ... J [2]

[Total: 11]