

- 6 (a) In the  $\alpha$ -particle scattering experiment,  $\alpha$ -particles travelling in a vacuum are incident on a gold foil. The  $\alpha$ -particles are shot at the gold foil one at a time.

On Fig 6.1, complete the path of each  $\alpha$ -particle as it passes the gold nucleus.

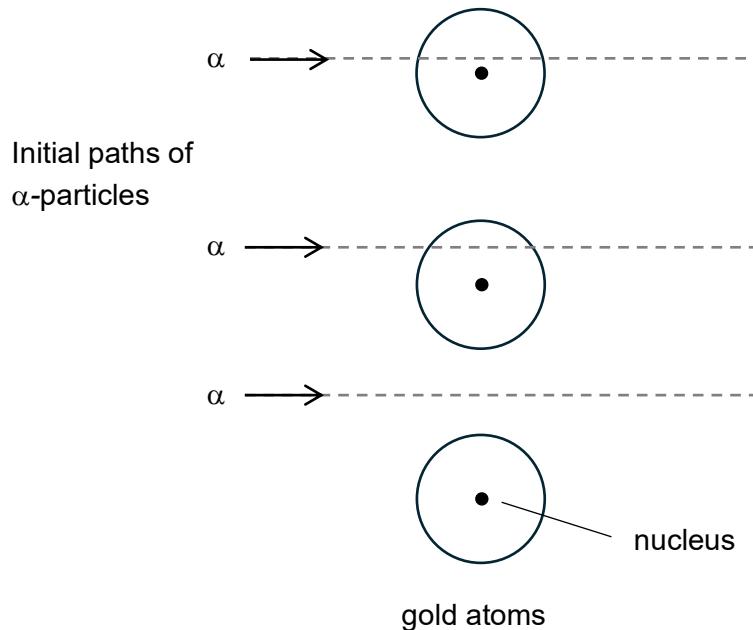


Fig. 6.1

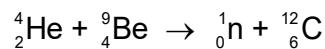
[3]

- (b) Describe and explain how the  $\alpha$ -particle scattering experiment which you have illustrated in part (a) gives evidence for the existence and small size of the nucleus.

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..... [4]

- (c) The structure of the nucleus was clarified further by an experiment in which  $\alpha$ -particles were fired at a piece of beryllium. A nuclear reaction took place in the beryllium and the reaction is now known to be



- (i) What information does the symbol,  ${}_{2}^{4}\text{He}$  give about the  $\alpha$ -particle?

..... [1]

- (ii) Data for the particles in the reaction in part (c) are given as follows.

particle	mass / u
${}_{2}^{4}\text{He}$	4.00260
${}_{4}^{9}\text{Be}$	9.01212
${}_{0}^{1}\text{n}$	1.00867
${}_{6}^{12}\text{C}$	12.00000

Calculate the energy associated with the change in mass in the reaction.

energy = ..... J [3]

- (iii) Explain whether the products in the reaction have a higher or lower total binding energy than the reactants.

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..... [1]

[Total :12]