

17 Over one hundred years ago, Rutherford supervised a series of experiments using a source of alpha particles and thin gold foil.

- (a) Describe the model of the atom that Rutherford proposed as a result of this series of experiments.

(3)

- (b) The initial kinetic energy of an alpha (${}^4_2\alpha$) particle is $7.3 \times 10^{-13} \text{ J}$.

- (i) In a textbook, it states that an alpha particle with this energy would be brought to rest when it reached a distance of $5.0 \times 10^{-14} \text{ m}$ from the centre of the gold nucleus (${}^{197}_{79}\text{Au}$).

Deduce whether this statement is correct.

(4)

- (ii) Determine the initial momentum of the alpha particle.

(3)

Initial momentum =

- (c) An alpha particle moves along a path directly towards a gold nucleus, as shown.

alpha particle ● →



gold nucleus

- (i) An elastic interaction occurs and the alpha particle recoils.

State what is meant by an elastic interaction.

(1)

- (ii) State what happens to the atoms in the gold foil as a result of these interactions.

(1)

(Total for Question 17 = 12 marks)