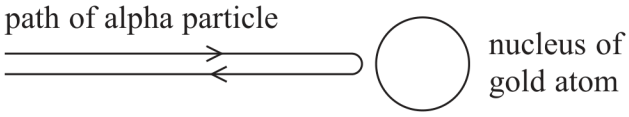
18 In the early part of the 20th century, experiments were carried out in which alpha particles were directed at thin sheets of metal.

A few alpha particles were deviated through small angles and a very small proportion were reflected back.

(a) The diagram represents an alpha particle reflected back through 180° as it approached the nucleus of a gold atom.



Calculate the maximum acceleration of the alpha particle as it reaches the point of minimum separation from the nucleus. Assume that the gold nucleus remains at rest.

speed of alpha particle = $1.74 \times 10^{7}\,\text{m s}^{-1}$

mass of alpha particle = $6.64 \times 10^{-27}\,\text{kg}$

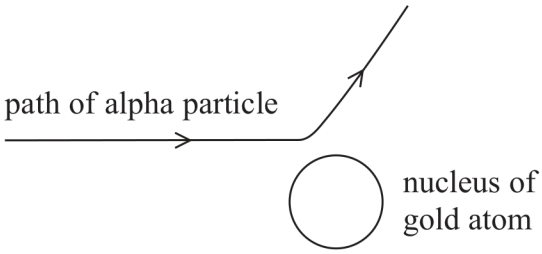
atomic number of gold = 79

(5)

Maximum acceleration = ...

DO NOT WRITE IN THIS AREA

(b) The diagram represents the path of an alpha particle with the same initial speed as in (a) that is deflected through a smaller angle.



Explain whether the maximum acceleration would be the same as for the alpha particle reflected back through 180°.

(4)

(Total for Question 18 = 9 marks)