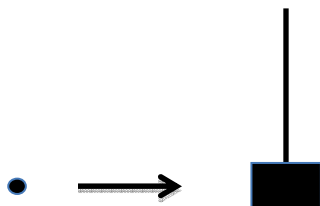# PHYS 172 Recitation 11 (Spring 2012)

<u>Problem 1</u>: **The Ballistic Pendulum**

A simple device called a "ballistic pendulum" consisting of a wooden block suspended from thin strings can be used to measure the speed of a bullet. The wooden block has a mass of 3 kg. The strings are 0.8 m long and have negligible mass.



a)  A bullet is fired into the block and becomes embedded in it. Is the collision elastic or inelastic?

b)  The bullet weighs 4 grams and travels at 650 m/s before striking the block. What is the speed of the block immediately after the bullet becomes embedded in the block?

c)  How much kinetic energy is converted into thermal energy during the collision?

d)  After the collision the block swings upward. What is the maximum height (relative to its original position) reached by the block?

e)  *[Checkpoint 1]*
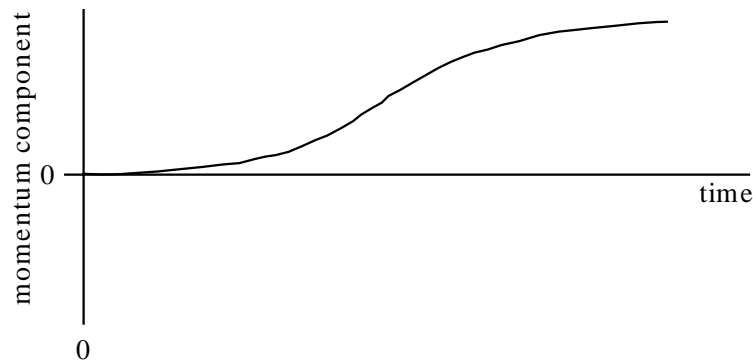

<u>Problem 2</u>: **Rutherford Scattering**

An alpha particle (a helium nucleus: two protons and two neutrons) passes near the nucleus of a gold atom, which is initially at rest. The alpha particle travels from location A to location B to location C along the path shown in the diagram below.
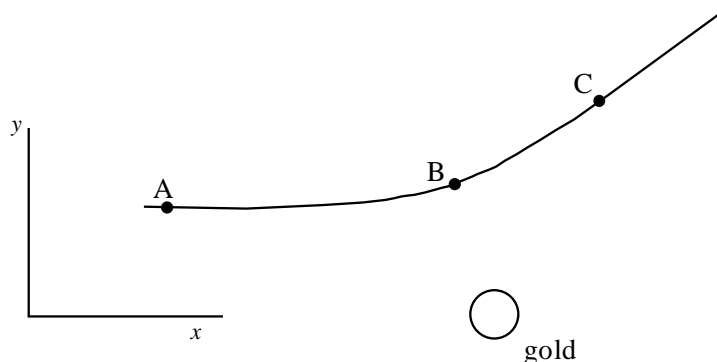
**a)** Reproduce the above diagram on your white board. At each location marked by a letter, draw and label an arrow representing the momentum of the alpha particle. Make certain that the direction and relative lengths of the arrows are correct.

**b)** At each location marked by a letter, draw and label an arrow representing the electric force exerted on the alpha particle by the gold nucleus. Make certain that the direction and relative magnitude are clear, and that your arrow are labeled

*[Checkpoint 2]*

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**c)** The graph below shows one component of the alpha particle's momentum as a function of time during this encounter. Is this the x-component or the y-component of the alpha particle's momentum? Explain briefly how you can tell.

**d)** On your white board, draw a graph showing the same component (x or y) of the momentum of the **gold** nucleus as a function of time. Be certain to label your graph.



*[Checkpoint 3]*