EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2008/2009

SECOND SEMESTER (PROPER/REPEAT)

(Sep/Oct 2010)

PH 204 MECHANICS II

Time: 01 hour.

Answer ALL Questions

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1. What do you mean by *Elastic collision?* What are the differences between the elastic and inelastic collision?

   An electron of mass m collides head-on with an atom of mass M, which is initially at rest. As a result of the collision a characteristic amount of energy E is stored in the atom. Show that the minimum initial velocity V_o as:

$$\left[2E\left(\frac{M+m}{Mm}\right)\right]^{\frac{1}{2}}$$

   Consider a head-on collision between an electron and an atom. If the stored energy E in the atom is $2 \times 10^3\ J$, what would be the minimum initial velocity of the electron?

   You may assume that the mass of an electron is $9.11 \times 10^{-31}\ kg$ and the mass of the atom is twice the mass of an electron.

2. Explain the principle of conservation of linear momentum.

A rocket of total mass $(M + m_o)$ contains fuel of mass εM where $\varepsilon < 1$. The mass of the payload is m_o and the mass of the rocket casing is $(1 - \varepsilon)$M. Suppose if it is technically possible to discard the casing continuously at a constant rate whilst the fuel is burning so that no casing remains when the fuel is burnt, show that the casing must be discarded at the rate $\left(\frac{1-\varepsilon}{\varepsilon}\right) k$ if the fuel is burnt at constant rate k.

Verify that, if $\varepsilon = \frac{5}{6}$ and $m_o = \frac{M}{100}$, the rocket's final velocity will be approximately 3.8 c where c is the exhaust velocity. All external forces on the rocket may be neglected.