November 19, 2012

Graded Group Problem #3

Neutron Radiation Treatment

You have been able to get a part time job with a medical physics group investigating ways to treat inoperable brain cancer. One form of cancer therapy being studied uses slow neutrons to knock a particle (either a neutron or a proton) out of the nucleus of the atoms that make up cancer cells. The neutron knocks out the particle it collides with in an inelastic collision. The heavy nucleus essentially does not move in the collision. After a single proton or neutron is knocked out of the nucleus, the nucleus decays, killing the cancer cell. To test this idea, your research group decides to measure the change of internal energy of a nitrogen nucleus after a neutron collides with one of the neutrons in its nucleus and knocks it out. In the experiment, one neutron goes into the nucleus with a speed of 2.0×10^{7} m/s and you detect two neutrons coming out at angles of 30° and -15°. You can now calculate the change of internal energy of the nucleus.

$m_n = 1.674 \times 10^{-27}$ kg
$m_p = 1.673 \times 10^{-27}$ kg
$m_e = 9.109 \times 10^{-31}$ kg
$1 \text{ eV} = 1.602 \times 10^{-19}$ J

NOTE:

Use a *Group Problem Solving Guide* to answer this problem. Clearly indicate your names as well as your lab time.