EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE - 2007/2008

FIRST SEMESTER (PROPER/REPEAT)

(DECEMBER 2008)

PH 303 NUCLEAR PHYSICS

Time: 01 hour.

Answer ALL Questions

You may find the following data useful:

$e = 1.6\times10^{-19}$C
$N = 6.023\times10^{23}$ per mole
1 MeV = 1.6×10^{-13}J
1 amu = 931.5 MeV/c^2
mass of the α particle = 4.002604 a.m.u
mass of the proton = 1.007825 a.m.u
mass of the oxygen = 15.990523 a.m.u

1. What do you mean by radioactive decay? Define the terms Decay constant, ha
mean life and radio activity of a radioactive sample and find a relation between th
life and the mean life.

The nuclide Th^{232} has a half life of 1.41×10^{10} years. Its radioactive decay
ultimately to the stable isotope Pb^{208}. A piece of rock contains $3.65\ g$ of Th^{23}
$0.75\ g$ of Pb^{208}. What is the age of this rock? If the rock is large and it emits α par
in the decay process that have been remained trapped, find the number of trapp
particles in the rock.

2. Define scattering process and elastic scattering. For a reaction of the type X(a, b)Y s
that

$$Q = \left(\frac{m_a}{m_y} - 1\right) T_a + \left(\frac{m_b}{m_y} + 1\right) T_b - \frac{2}{m_y}\sqrt{(m_a m_b T_a T_b)}\cos\theta$$

where the symbols have their usual meanings and θ is the angle of particle b with
direction of incidence.

Determine the Q value of the reaction $N^{14}(\alpha, p)O^{17}$ if the kinetic energy of the incom
alpha particle is $4.0\ MeV$ and the proton moving at an angle 60^0 to the direction
motion of the alpha particle and having a kinetic energy$2.09\ MeV$.