

EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE 2005/2006 (AUG-SEP. 2007)

FIRST SEMESTER

PH 303 – NUCLEAR PHYSICS

Time: 01 hour.

Answer ALL Questions.



1. Define the decay constant λ , half-life $T_{1/2}$, mean-life \bar{T} and the activity of a radioactive element.

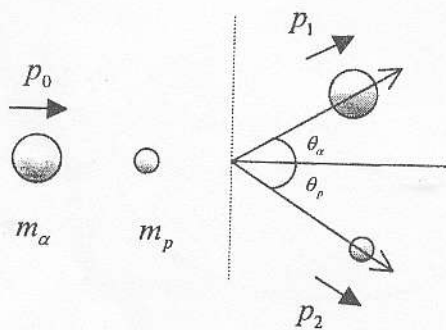
Establish the relationships

$$\lambda^{-1} = T_{1/2} (\ln 2)^{-1} = \bar{T}$$

- (a) A radioactive source contains $1 \mu\text{g}$ of uranium (mass number 235). The source is estimated to emit a total of 2000 α particles per second in all directions. Calculate the half-life of uranium.
- (b) The numbers of disintegrations per minute of a certain radioactive substance are 6050 and 4465 at the 2nd and 3rd hour. Calculate the decay constant and half-life of the substance.

2. What do you mean by scattering process and elastic scattering?

An α particle is elastically scattered by a proton which is initially at rest.



Before scattering After scattering

Where p_0, p_1 and p_2 are momentum of the particles.

Show that

$$\left(1 - \frac{m_p}{m_\alpha}\right) p_0^2 - 2p_0 p_1 \cos \theta_\alpha + \left(1 + \frac{m_p}{m_\alpha}\right) p_1^2 = 0$$

and hence deduce that the maximum possible scattering angle for the α particle is $14^\circ 30'$.