Assignment – 4

Course Instructor: Prof. Rajeev Gupta

M.Sc. Chemistry (Semester – IV)

Paper: 4104 Section: B (Nuclear & Radiation Chemistry)

Time: 1 Hour

Attempt any five questions. All questions carry equal marks.

1. Explain how the potential energy of a neutron and a proton approaching the nucleus changes. Why does the extent of potential energy vary for two cases ?

2. Find out the Coulombic Barrier for the approach of a proton towards $^{232}Th_{90}$ nucleus. How much this value would change if the approaching particle is an alpha particle ?

3. Calculate the electric quadrupole moment for $^{75}As_{33}$ nucleus if its deformation index (β) is 0.15. Also find out the ratio of major and minor axes.

4. Spins of fluorine (Z = 9) nuclei having mass number 17, 19, and 20 are 5/2, 1/2 and 2, respectively. Explain these observations and calculate the possible deformation, if any, for these nuclei.

5. Calculate the number of ^{24}Na atoms formed when a 50 mg piece of ^{23}Na metal was bombarded for 5 minutes in a thermal neutron flux of 5×10^8 neutron $cm^{-2}s^{-1}$? The cross section for the $^{23}Na(n, \gamma)^{24}Na$ nuclear reaction is 0.25 barn.

6. What is the origin of delayed neutrons and how do they differ from prompt neutrons? Discuss the importance of delayed neutrons in controlled nuclear fission reactions.

Values of some of the physical constants:

$N = 6.023 \times 10^{23}$

$1/4\pi\varepsilon_o = 9 \times 10^9$

1 amu = 931.478 MeV

$e = 1.6 \times 10^{-19}$ C

$1eV = 1.6 \times 10^{-19}$ J

$k = 1.3805 \times 10^{-23}$ J deg^{-1}

$R_o = 1.5 \times 10^{-15}$ m