

PHYH-C IX: ELEMENTS OF MODERN PHYSICS

Assignment -III

Due date: On or before 19 April, 2019

Answer all the questions

1. Write down the semi-empirical mass formula for mass of the nucleus. Show that this formula can be written as

$$M(A, Z) = F_A + pZ + qZ^2$$

Where F_A , q and p depends on Mass number only. Write their expressions. Neglect the pairing energy term from the Binding energy formula.

Marks: (2+8)

2. Plot $M(A, Z)$ as a function of Z .

Marks: 5

3. What is atomic mass unit? Write mass of neutron in amu format.

Marks: 5

4. Compute the binding energy of the last proton in a nucleus of ^{12}C in the mass of ^{12}C -nucleus is 12.00052 amu and the mass of the ^{11}B -nucleus is 11.01006 amu. The mass of the proton is 1.00759 amu.

Marks: 10

5. Using the semi-empirical binding energy formula, calculate the binding energy of $^{40}_{20}\text{Ca}$

Marks: 10

6. Using the semi-empirical binding energy formula, find the atomic number of the most stable nucleus for a given mass number A.

Hence explain

(i) Which is the most stable among ^6_2He , ^6_2Be and ^6_3Li

(ii) Which nuclei you expect to be most stable ^7_3Li or ^8_3Li ; ^9_4Be or $^{10}_4\text{Be}$

Marks: 10+5+5