



Q.1. Give short answers of the following: (10x3=30)

- (i)-Give the following properties of nucleus: charge, mass and radius.
- (ii)-All matter is nothing but atoms and molecules. Why do we have substances with density very low as compared to nuclear density?
- (iii)-A cyclotron is a so-called resonance device. Explain.
- (iv)-What is the basic difference between the interaction of charged particles and radiation with matter?
- (v)-Name the detectors which depend upon the fluorescence property and photographic effect of particles to be detected.
- (vi)-What is evidence for the existence of neutrinos? Why was their existence postulated?
- (vii)-The alpha particle has twice the electric charge of the beta particle but, for the same velocity, accelerates less than the beta in a magnetic field. Why?
- (viii)-If the nuclear force is charge independent and a neutron and a proton form a bound state, then why is there no bound state for two neutrons? What information does this provide on the nucleon-nucleon force?
- (ix)-Why number of neutrons tends to exceed number of protons in stable nuclei?
- (x)-Show that the energy associated with the Coulomb force between protons in a nucleus is proportional to  $Z(Z - 1)$ .

Answer the following questions.

Q. 2: (a)-Discuss the variation of binding energy per nucleon with mass number and state the results obtained from graph. 05 + 05

(b)-What are semiconductor detectors? State its types. Explain any one semiconductor detector in detail.

Q. 3: In  $\beta$ -decay process, in the allowed approximation, the partial decay rate for electrons and neutrinos with proper momenta is, 10

$$d\lambda = Ap^2q^2dp$$

where  $p$  and  $q$  are momenta of emitted electron (positron) and anti-neutrino (neutrino) respectively and  $A$  is constant including all factors independent of  $p$  and  $q$ . Use this expression to calculate momentum,  $N(p)$  and  $N(T_c)$ , the distribution of emitted electrons. Draw the expected shapes these distributions and also draw Fermi-Kurie plot.

Q. 4:- (a)-Discuss neutron-proton scattering at low energies and hence derive relations for differential cross-section and total cross-section. What informations are obtained from this scattering? 05 + 05

(b)-What are magic number nuclei? How does the shell model explain the existence of magic numbers? Give experimental evidence of nuclear magic numbers.