USDSEPHT13 - Physics (Paper-I) : Nuclear and Particle Physics

P. Pages : 2

Time : Three Hours

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GUG/W/22/13365

Max. Marks : 50

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Notes : 1. All questions are compulsory.
2. Draw neat labelled diagram wherever necessary.

Either:

1. a) i) Explain basic properties of nucleus in terms of Nuclear size, mass and charge density. **5**

   ii) What is Nuclear Binding energy? Draw the curve for Binding energy per nucleon versus mass number and write its main features. **3**

   iii) Taking the mass of proton as 1.007276 amu and that of neutron 1.008665 amu. **2**

   Calculate the mass defect and binding energy for $8O^{16}$ having nuclear mass is 15.990523 amu.

<div align="center">OR</div>

   b) 1) Explain packing fraction and its variation with mass number. **2½**

   2) Explain Angular momentum and Nuclear magnetic momentum. **2½**

   3) States electric moments and magnetic moment of an atom. **2½**

   4) Find the binding energy of deuteron. Given : $m_p = 1.007276$ u ; $m_n = 1.008665$ u **2½**

   and $Z M^A = 2.013553$ u.

Either:

2. a) i) Explain nuclear Fission on the basis of liquid drop model. Writes its merits and limitations. **5**

   ii) States the main assumptions of shell model of the nucleus. Write its merits and Failures. **5**

<div align="center">OR</div>

   B) 1) Write the general concept of Nuclear forces. **2½**

   2) Describe semi Empirical mass formula. **2½**

   3) Describe origin of Magic Number. **2½**

   4) Calculate the energy released in MeV. When deuteron fuses with a tritium to form heavy nucleus and one neutron (Given: 1 amu = 931.5MeV) **2½**
   Mass of deuterium = 2.01474 amu
   Mass of tritium = 3.01700 amu
   Mass of helium = 4.00387 amu
   Mass of neutron = 1.00898 amu

Either:

3. a) i) Explain Gamma ray interaction through matter. Describe methods of measurement of Gamma rays energies by pair production and Absorption of Gamma rays by matter. **5**

   ii) Describe the discovery of Neutron and Estimation of mass of Neutron. **5**

<div align="center">OR</div>

b) 1) Define the term Nuclear reaction. What is meant by 'Q' value of a nuclear reaction. **2½**

2) Write the difference between Exo-ergic and Endo-ergic nuclear reaction. **2½**

3) Explain any two Laws of Nuclear reactions. **2½**

4) Write briefly Cerenkov radiation. **2½**

Either:

4. a) i) Explain the construction and working of linear accelerator. Show that the length of cylindrical electrode in a linear accelerator is proportional to square root of the number of that electrode **5**

ii) Describe construction & working of Geiger-Mueller counter. What are the main features of G. M. tube. Discuss the importance of quenching in G. M. tube. **5**

OR

b) 1) Describe the construction and working if cyclotron. Obtain an expression for the accelerated particles. **2½**

2) Explain Van-de Graaff generator. **2½**

3) Describe principle, construction and working of Wilson Cloud Chamber. **2½**

4) If the frequency of oscillator potential applied to the dee's of the cyclotron is 9MHz. What must be magnetic flux density B to accelerate the alpha particles. **2½**

(Given : Mass of alpha particle $= 6.643 \times 10^{-27}$ kg; Charge of $\alpha = 3.204 \times 10^{-19}$ C)

5. Solve **any ten** questions of the followings.

a) Define Mass defect. **1**

b) What is Bohr Magneton? **1**

c) Write constituents of nucleus. **1**

d) What are the conditions of nuclear stability? **1**

e) Write on Fermi gas Model. **1**

f) Give the main assumptions of liquid drop model of nucleus. **1**

g) What is Cerenkov radiation. **1**

h) What is meant by reaction cross section. **1**

i) Write Neil-Bohrs formula. **1**

j) Define Dead time. **1**

k) Write limitation of cyclotron. **1**

l) Write principle of scintillation counter. **1**

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