Dhanamanjuri University

B.Sc. 4th Semester Examination 2021 (June)

PHYSICS : PHY 204

Atomic and Nuclear Physics

Answer all the questions.

1. Describe the principle, construction and working of Bainbridge's mass spectrograph and explain how a linear mass scale is obtained on the photographic plate ?

   2+3+3+2= 10

2. State Bohr's postulates of the atomic model of Hydrogen atom. Derive the expression for the radius, velocity and energy of the electron in the n^{th} orbit.

   2+2+3+3 = 10

3. Describe the principle, construction and working of a cyclotron. State the limitations of a cyclotron and explain how it can be rectified ?

   2+2+4+2 = 10

4. (a) Explain the terms (i) nuclear size and (ii) nuclear quadrapole moment. What are the characteristics of nuclear forces ? 2+2+3

   (b) Explain how nuclear stability is related to the binding energy on basis of the B.E. per nucleon and mass number curve. 3

5. Explain what is meant by Nuclear mass. Deduce Von Weizsacker's semi-empirical mass formula of the mass of a nucleus. 3+7 = 10

6. (a) What is breeding reaction ? What are fissile and fertile materials ? Give one example of each. Explain how a fertile material can be converted into a fissile material by the breeding reaction. 1+2+3 = 6

   (b) Define the threshold energy of a nuclear reaction. Calculate the threshold energy of the nuclear reaction: Na^{23} [n,α] F^{23} . Given that Q-value, Q = – 5.4 eV, mass of neutron(n) =1.00866 a.m.u. and mass of Na^{23} = 22.99097 a.m.u. 1+3 = 4

———————