

**B Sc DEGREE END SEMESTER EXAMINATION MARCH 2018****SEMESTER – 6: PHYSICS (CORE COURSE)****COURSE: 15U6CRPHY10 –: NUCLEAR AND PARTICLE PHYSICS***Common for Regular (2015 Admission) & Supplementary (2014 Admission)*

Time: Three Hours

Max. Marks: 60

**PART A** (Very short answer questions)Answer **all** questions. Each question carries **1** Mark

1. Distinguish between isotopes and isobars
2. Explain the term packing fraction
3. What is proton electron hypothesis?
4. Mention the application of GM counter.
5. What is the significance of Geiger – Nuttall law?
6. What should be the minimum energy of a  $\gamma$  ray for pair production?
7. Differentiate between mean life and half-life.
8. What is controlled chain reaction?
9. What is Tokamak confinement?
10. What are strange particles? (1 x 10 = 10)

**PART B** (Short answer questions)Answer **any seven** questions. Each question carries **2** Marks

11. Explain the properties of nuclear forces.
12. Discuss about the magnetic dipole moment and electric quadrupole moment of the nucleus.
13. Distinguish between natural and artificial radioactivity.
14. Discuss the nature of alpha particle energy spectrum.
15. What is K – electron capture? Give an example.
16. Write a note on electron positron pair production by gamma rays.
17. Briefly explain the energy production in stars.
18. Give a brief description of nuclear radiation hazards.
19. Briefly explain the quark model of elementary particles. (2 x 7 = 14)

**PART C (Problem/Derivations)**

Answer **any four** question. Each question carries **4** Marks

20. The binding energy of  $^{24}\text{Mg}_{12}$  is 198.25 MeV. Calculate its atomic mass.
21. The radius of  $\text{Ho}^{165}$  is 7.731 fermi. Deduce the radius of  $\text{He}^4$ .
22. Alpha particles of energy 5 MeV pass through an ionization chamber at the rate of 10 per second. Assuming no energy loss, calculate the current produced. (35 eV is required for the production of each ion pair)
23. 2g of a radioactive substance has an activity of  $7.4 \times 10^{10}$  disintegrations per second. Calculate its mean life if its mass no. is 228.
24. Calculate the velocity and mass of a beta particle with a kinetic energy of 0.5 MeV. Find the magnetic flux density required to cause them to traverse a circular arc of radius 0.1 m (assuming uniform magnetic field).
25. Estimate the energy released in kWh by the fission of 1 mg of  $^{92}\text{U}_{235}$ , if fission of  $^{92}\text{U}_{235}$  yields 200eV. (4 x 4 = 16)

**PART D (Long answer questions)**

Answer **any two** question. Each question carries **10** Marks

26. Describe, with necessary theory, how Bainbridge identified the ten isotopes of tin.
27. Deduce the Gamow theory of alpha decay.
28. Discuss nuclear fission on the basis of liquid drop model. Also explain the major components of a nuclear reactor.
29. Discuss the classification of elementary particles. Also explain the conservation laws followed in particle interactions. (10 x 2 = 20)

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