

A-0593

Total Pages : 3

Roll No.

MSCPH-511

M.Sc. PHYSICS (MSCPH)

(Nuclear Physics)

3rd Semester Examination, Session December 2024

Time : 2:00 Hrs.

Max. Marks : 70

Note :- This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.***

Section-A

Long Answer Type Questions **2×19=38**

Note :- Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any two (02) questions only.

1. What are the basic differences between liquid drop model and shell model of the nucleus ? What is the evidence of shell structure in the nuclei ? Explain the main assumptions of the shell model of the nucleus. Discuss its achievements, failures and limitations.
2. Give an account of Gamow's theory of α -decay. How far this explains Geiger-Nuttall law ?
3. Explain phenomenon of resonance in nuclear reactions. Derive Breit-Weigner one level formula for scattering cross-section.
4. Give an account of the principle of working of a cyclotron. Discuss its limits of the energy that can be obtained and possible improvement.
5. Write short notes on following :
 - (i) Binding energy and binding fraction
 - (ii) Magnetic dipole moment
 - (iii) Isotopic spin
 - (iv) Parity

Section-B

Short Answer Type Questions 4×8=32

Note :- Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Find the energy release, if two ${}^2_1\text{H}$ nuclei can fuse together to form ${}^4_2\text{He}$ nucleus. The binding energy per nucleon of ${}^2\text{H}$ and ${}^4\text{He}$ is 1.1 MeV and 7.0 MeV respectively.
2. Discuss the main feature of collective model for atomic nucleus.
3. Calculate the activity of ${}^{40}\text{K}$ in 100 kg man assuming the 0.35% of the body weight is potassium. The abundance of ${}^{40}\text{K}$ is 0.012%, its half life is 1.31×10^9 years.
4. Explain the Dirac's theory of pair production.
5. Find an expression for Q-value of the nuclear reaction,
6. Discuss the p - p scattering at 0-10 MeV.
7. What is electric quadrupole moment of a nucleus ? Discuss the shapes of the nucleus on its basis.
8. Discuss in brief working of scintillation detectors.
