

25I203

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Name :

Reg. No :

SECOND SEMESTER INTEGRATED M.Sc. GEOLOGY DEGREE EXAMINATION, APRIL 2026

(FYIP)

CC25PHY2MNIC02 - MODERN PHYSICS AND NUCLEAR PHYSICS

(Physics - Minor Course)

(2025 Admission - Regular)

Time: 2.0 Hours

Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

Answer *all* questions. Each question carries 3 marks.

1. How does Compton effect provide a conclusive evidence of the particle properties of radiation? [Level:2] [CO1]
2. Describe the relationship between photoelectric effect and work function of metal. [Level:2] [CO1]
3. Why does carbon cycle require higher temperature than proton-proton cycle? [Level:2] [CO6]
4. What are matter waves? [Level:2] [CO1]
5. In the Bohr model, the electron is in constant motion. How can such an electron have negative amount of energy. [Level:2] [CO3]
6. In Rutherford planetary model of the atom, what keeps the electron from flying off into space? [Level:2] [CO3]
7. Explain the Planck's quantum hypothesis. [Level:2] [CO2]
8. Define the activity of a radioactive sample. What are its units? [Level:2] [CO6]
9. Define mass unit and state its relation to the mass of a ^{12}C atom. [Level:2] [CO4]
10. What is a compound nucleus in nuclear reaction? [Level:2] [CO6]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer *all* questions. Each question carries 6 marks.

11. The radionuclide ^{232}U alpha-decays into ^{228}Th . (a) Find the energy released in the decay. (b) Is it possible for ^{232}U to decay into ^{231}U by emitting a neutron? (c) Is it possible for ^{232}U to decay into ^{231}Pa by emitting a proton? The atomic masses of ^{231}U and ^{231}Pa are respectively 231.036270 u and 231.035880 u. [Level:3] [CO5]

12. Explain the nuclear shell model. [Level:2] [CO4]
13. The radionuclide ^{24}Na beta-decays with a half-life of 15.0 h. A solution that contains 0.0500 Ci of ^{24}Na is injected into a person's bloodstream. After 4.50 h the activity of a sample of the person's blood is found to be 8.00 pCi. How many liters of blood does the person's body contain? [Level:3] [CO5]
14. Determine the wavelength of the first three lines of the Balmer series limit. [Level:2] [CO3]
15. Determine the wavelength of first line in the Lyman series. In what region of the electromagnetic spectrum does it lie. [Level:3] [CO3]
16. State the values of spin quantum number and magnetic quantum number of a neutron. [Level:2] [CO4]
If spin quantum number of a particle is $1/2$, Calculate the spin angular momenta.
17. A photon of frequency 7.3×10^{14} falls through the height of 30m. Compute the change in frequency. [Level:3] [CO1]
18. Explain Beta decay with examples. [Level:2] [CO4]

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any **one** question. The question carries 10 marks.

19. Explain briefly the liquid drop model and deduce the semi-empirical binding energy formula without the correction energy terms. [Level:2] [CO4]
20. Show that the total energy of an hydrogen atom is inversely proportional to the orbital radius. [Level:2] [CO3]

(1 × 10 = 10 Marks)
