

102246

No. of Printed Pages : 3



GS-299

VI Semester B.Sc. Examination, May/June 2019

PHYSICS-VII

ATOMIC, MOLECULAR AND NUCLEAR PHYSICS

(CBCS) (FRESH) (2018-19 & Onwards)

Time : 3 Hours

Max. Marks : 70

Instructions : Answer **any five** questions from all the parts.

PART - A

Answer **any five** of the following questions. Each question carries **eight** marks. **5x8=40**

1. (a) State and explain Pauli's exclusion principle. **4+4**
(b) Obtain an expression for the maximum number of electrons in a shell.
2. (a) What is Zeeman effect ? **1+2+5**
(b) Distinguish between normal and anomalous Zeeman effect.
(c) Give the Quantum theory of Normal Zeeman effect.
3. (a) What is Raman effect ? Give the Quantum mechanical explanation of Raman effect. **2+4+2**
(b) Distinguish between Stoke's and Antistoke's lines.
4. (a) State the assumptions of Rutherford's theory of α -ray scattering. **2+6**
(b) Obtain an expression for Rutherford's scattering formula.
5. (a) What is α -decay ? **2+4+2**
(b) Outline Gamow's theory of α -decay.
(c) What are the factors on which the range of α -particle depends ?

P.T.O.



6. (a) What is β -decay ? 1+2+5
(b) Mention the types of β -decay.
(c) Give the important features of β -ray spectrum.
7. (a) Explain endoergic and exoergic types of reactions. 4+4
(b) What is threshold energy ? Derive an expression for the same.
8. (a) What are elementary particles ? 2+6
(b) What are the broad categories into which the elementary particles are classified ?

PART - B

Answer **any five** of the following questions. Each question carries **four** marks.

5x4=20

9. Find the wavelength of light emitted when the hydrogen atom undergoes transition from the 5th orbit to the 2nd orbit. Assume ionization potential for hydrogen atom to be 13.6 eV.
10. In a normal Zeeman effect, the sodium 422.6 nm line splits into three components separated by 0.025 nm in a magnetic field of 3T. Calculate the specific charge of the electron.
11. The force constant of CO bond is 187 Nm^{-1} . Find the frequency of vibration of CO molecule given mass of $\text{C}^{12} = 1.99 \times 10^{-26} \text{ kg}$, and $\text{O}^{16} = 2.66 \times 10^{-26} \text{ kg}$. Also find the spacing between vibrational levels.
12. 1 g of a radioactive substance takes 50 s to lose one centigram. Find its half life period.
13. Calculate the α -particle potential barrier in case of ${}_{86}\text{Rn}^{222}$.



14. C^{14} undergoes β -decay transition to N^{14} . If the end point energy of the transition is 0.156 MeV and the mass of the initial atom is 14.00768 amu, find the mass of the final atom.
15. Calculate the Q value of the reaction ${}_1H^2(d, n){}_2He^3$. Given ${}_1H^2 = 2.0141$ amu, ${}_2He^3 = 3.0160$ amu, ${}_0n^1 = 1.00866$ amu. Is it exoergic or endoergic ?
16. When target Lithium (${}_3Li^7$) of thickness 0.025 mm is bombarded with a beam of intensity 10^{15} protons per second, 10^9 neutrons are produced. Calculate the cross-section of the reaction.
- Given density of Lithium = 500 kg/m³.

PART - C

Answer **any five** of the following questions. Each question carries **two** marks.

17. (a) The Alkali metals have hydrogen - like spectra. Explain. **5x2=10**
- (b) Why is normal Zeeman effect observed in a strong magnetic field ?
- (c) Why is red light used in danger signals ?
- (d) Electrons of target atoms are not effective in scattering alpha particles. Explain.
- (e) Electrons do not exist in the nucleus. How is it emitted during β -decay ?
- (f) Alpha ray spectrum is characteristic of the nucleus while β -ray spectrum is not. Explain.
- (g) What is the significance of positive and negative sign of Q values in nuclear reaction ?
- (h) Is kinetic energy conserved in inelastic scattering. Explain.