

## VI Semester B.Sc. Examination, September/October 2021 (CBCS – Fresh + Repeaters – 2018 – 19 and Onwards) PHYSICS – VII

## Atomic, Molecular and Nuclear Physics

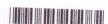
Time: 3 Hours

Max. Marks: 70

Instructions: 1) Answer any five questions from each Part.

2) Use of non-programmable scientific calculator are allowed.

		PART – A	
A e	nsv <b>igh</b>	ver <b>any five</b> of the following questions. <b>Each</b> question carries t marks. (5:	×8=40)
1	. a)	State and explain Pauli's exclusion principle.	
	b)	Obtain an expression for the maximum number of electrons in a shell.	(3+5)
2	a)	What are the two main features of the vector atom model?	
	b)	하면 역 전역적 MP 하면 보고 하면 되다 수밖에서 없는데 이번 전다. 이번 그는데 그런 그런 그런 그렇게 모습니다.	(2+6)
3.	a)	What is anomalous Zeeman effect ?	
	b)	Explain the phenomenon of anomalous Zeeman effect on the basis of quantum theory and derive an expression for change in energy.	(2+6)
4.	a)	State any two assumptions of Rutherford's alpha particle scattering experiment.	
	b)	Derive the relation between the impact parameter and angle of scattering in Rutherford's alpha particle scattering experiment.	g <b>(2+6)</b>
5.	a)	What is beta decay?	15.
		Explain the different types of beta decay with an example for each type.	(2+6)
6.	De	scribe the construction and working of a Geiger-Muller counter and expla features of its characteristic curves.	
7.	De Mo	rive an expression for the Q value of a nuclear reaction using Energy- mentum conservation.	.01 8



- 8. a) State any two properties of Quarks.
  - b) Describe the four types of fundamental reactions.

(2+6)

## PART - B

Solve any five of the following problems. Each problem carries four marks.

- 9. Find the wavelength of light emitted when a hydrogen atom undergoes transition from 5th orbit to 2nd orbit. Assume the ionisation potential for Hydrogen to be 13.6eV. Given  $e = 1.6 \times 10^{-19}$  C and  $c = 3 \times 10^{8}$  m/s.
- 10. Determine the value of rotational constant for HF molecule. Given the moment of inertia of the molecule is  $1.38 \times 10^{-47}$  Kgm<sup>2</sup>.

Assume  $h = 6.625 \times 10^{-34} \text{ Js and}$ 

 $c = 3 \times 10^8 \text{ m/s}.$ 

- 11. With an exciting radiation of wavelength 435.8 nm, a substance should Raman line of a wavelength of 462.4 nm. Calculate the frequency of the corresponding anti stokes line.
- 12. One gram of a radioactive substance takes 50 seconds to lose one centigram. Find the half-life period of the substance.
- 13. Neptunium <sub>93</sub>Np<sup>237</sup> emits alpha particles of energy 4.19 MeV. Calculate the alpha disintegration energy.
- 14. Deutrons in a cyclotron describe a circle of radius 0.6 m before emerging from "dees". The oscillator frequency is 15MHz. Find the flux density of the magnetic field and the energy acquired by the deutrons. Given  $m_d = 3.349 \times 10^{-27} \text{ Kg}$

 $e = 1.6 \times 10^{-19} C$ 

15. Calculate the threshold energy required to initiate the reaction P31 (n.p)Si31.

Mass of proton = 1.00814 u

Mass of neutron = 1.00898 u

Mass of phosphorus = 30.93856 u

Mass of Silicon = 30.98515 u

16. When target Lithium  $(_3Li^7)$  of thickness 0.028 mm is bombarded with a beam of intensity 1015 protons/sec, 109 neutrons are produced. Calculate the cross-section of the reaction. Given density of Lithium = 500kg/m³.



## PART - C

Answer any five of the following questions. Each question carries two marks. (5×2=10)

- 17. a) Alkali metals have Hydrogen like spectra. Justify.
  - b) Can principal quantum number be zero? Explain.
  - c) Are energy levels in pure rotational spectra equally spaced? Explain.
  - d) Why is that only  $\alpha$  particles are emitted by radioactive nuclei while protons and neutrons are not ? Explain.
  - e) In Betatron, do electrons move in a fixed orbit of constant radius ? Explain.
  - f) What is the significance of the negative sign of Q value of a nuclear reaction ? Explain.
  - g) Does conservation of parity hold good in (i) strong interactions and (ii) weak interactions?
  - h) Is photon an elementary particle? Explain.