100197

No. of Printed Pages : 3

GS-303

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

PHYSICS-VII

ATOMIC PHYSICS, NUCLEAR PHYSICS AND MATERIAL SCIENCE

(CBCS 2016-17 & Onwards/NS-Repeaters 2013-14 & Onwards)

Time : 3 Hours Max. Marks : 70

Instructions : *Answer* ***five*** *questions from each part.*

PART - A

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

1. (a) What is fine structure ? Explain. **2+6**
   (b) Describe Stern-Gerlach experiment with relevant theory.

2. (a) State Paulis exclusion principle. **2+3+3**
   (b) Obtain an expression for the frequency of larmar's precession with respect to Vector atom model.
   (c) Obtain an expression for the maximum number of electrons that can be filled in a shell.

3. (a) Explain vibrational rotational spectra of diatomic molecule. Prove that spacing between the spectral lines $\Delta\gamma = \frac{h}{2\pi I}$. **6+2**
   (b) Distinguish between Rayleigh Scattering and Raman Scattering.

4. Assuming the relation between impact parameter and angle of scattering derive Rutherford's scattering formula. **8**

5. Describe the construction and working of a Geiger-Muller Counter and explain the features of its characteristic curve. **8**

6. (a) Distinguish between endoergic and exoergic nuclear reactions. **2+6**
   (b) Describe with theory working of a cyclotron and mention its limitations.

P.T.O.

7. (a) What are nano-materials ? Write a note on quantum structures of nanotechnology. 6+2

(b) Mention any two applications of nano-materials.

8. (a) Describe the various kinds of polarization when a dielectric material is placed in an electric field. 6+2

(b) Write expression for electronic and orientational polarizabilities.

PART - B

Answer **any five** problems. Each problem carries **four** marks : 5x4=20

9. Calculate the value of Bohr Magneton using $h = 6.625 \times 10^{-34}$ Js $e = 1.6 \times 10^{-19}$ C and $m_e = 9.1 \times 10^{-31}$ kg.

10. The Zeeman components of a 500 nm spectral lines are 0.0116 nm apart. When magnetic field is 1 T, find the specific charge of an electron.

11. With an exciting radiation of wavelength 602.24 nm a substance gave a Raman line of wavelength 620.2 nm. Calculate the frequency and the wavelength of the corresponding antistokes line.

12. Calculate the kinetic energy of the α -particles emitted by the decay of $_{86}Rn^{222}$Given mass of $_{86}Rn^{223} = 222.017531$ amu, mass of polonium nucleus $= 218.008930$ amu and mass of α particle $= 4.002603$ amu.

13. Calculate the Q value of reaction

$_{29}Cu^{63}$ (P.n) $_{30}Zn^{63}$

Given mass of Cu = 62.93 amu

mass of Proton = 1.0078, amu

mass of Neutron = 1.0087 amu

and mass of Zn = 63.93 amu.

Whether it is endothermic or exothermic reaction ?

14. Thorium - 228 emits alpha particle of energy 5.42 MeV. Calculate alpha disintegration energy.

15. A solid elemental dielectric with density 3×10^{28} atoms/m^3 shows an electric polorizability of 10^{-10} Fm^2. Assuming the internal electric field to be a Lorentz field, calculate the dielectric constant of the material.

16. Calculate the radius of the atom. If its electric polorizability is 1.85×10^{-41} Fm^2. Given $\epsilon_0 = 8.85 \times 10^{-12}$ Fm^{-1}.

PART - C

Answer **any five** of the following questions. Each question carries **two** marks : **5x2=10**

17. (a) Can the principal quantum number take zero in the hydrogen atom ? Explain.

(b) Write the possible values of quantum number ml for l=3.

(c) Why are IR photographs more clear than photographs taken using visible light.

(d) The Rutheford's Scattering formula fails to agree with the data at very small scattering angles. Give reasons.

(e) What is the significance of negative sign of Q ?

(f) Can a nuclear reaction take place for any energy of the projectile ? Explain.

(g) What is meant by dielectric breakdown ? Explain.

(h) Can Nematic liquid crystals be made conductors ? Explain.

- o 0 o -