13DD 44 – V (41)

B.Sc. V Sem. Degree Examination Nov./Dec. 2013
PHYSICS
(Paper – 5.1) : Atomic, Molecular Physics and Special Theory of Relativity

Time : 3 Hours Max. Marks : 80

Instructions : 1) *Section* ***I*** *is* ***compulsory.***
2) *Answer* ***any four*** *questions from Section* ***II*** *and* ***any four*** *questions from Section* ***III.***

SECTION – I

1. Answer **any twelve** of the following : **(12×1=12)**

A) Choose the correct answer :

i) If an electron has initial velocity perpendicular to the direction of magnetic field, the path of the electron is
a) a straightline b) a parabola c) a circle d) an ellipse

ii) If λ is the wavelength of emitted spectral line when an electron jumps from an orbit where its energy is E_2 to E_1 then
a) $\lambda = \frac{h}{c}^{(E_2-E_1)}$ b) $\lambda = hc\,(E_2 - E_1)$
c) $\lambda = \frac{hc}{(E_2 - E_1)}$ d) $\lambda = \frac{c}{h(E_2 - E_1)}$

iii) According to Duane Hunt law
a) $ev = h\gamma_{max}$ b) $ev = h\gamma_{min}$
c) $ev = h\lambda_{min}$ d) none of these

iv) According to the selection rule, Δm_J can take _____ values.
a) 0 b) +1 c) –1 d) All the above

B) Fill in the blanks :

i) Cathode rays are stream of _____ charged particle.

ii) Orbital angular momentum is an integral multiple of

iii) The _____ quantum number explains Zeeman effect and Stark effect.

iv) Length of moving train is measured by an observer from a plot form is _____ than the length of train as measured by an observer with in the train.

P.T.O.

C) State **true** or **false** :

i) Cathode rays travel with velocity of light.

ii) The shortest and longest wave length in the Lyman series have their wave lengths 911 A° and 1215 A°.

iii) Pure vibrational spectra is observed only in liquids.

D) Answer the following in **one** or **two** sentences :

i) Define ionisation potential.

ii) What is stark effect ?

iii) Define coherent scattering.

iv) Define proper length.

SECTION – II

(4×4=16)

2. Write the properties of cathode rays.
3. Derive an expression for velocity of electron in n^{th} orbit of Bohr's.
4. Explain normal Zeeman effect with experimental arrangement.
5. Explain Pauli's exclusion principle.
6. Write a note on characteristic X-ray spectra.
7. On the basis of Lorentz transformation obtain the relation $\Delta t = \frac{\Delta t_0}{\sqrt{1 - v^2/c^2}}$.

SECTION – III

8. a) Describe with necessary theory of J.J.Thomson method to determine e/m of an electron.

   b) A monoenergetic electron beam with electron speed of 5.20×10^{-6} ms^{-1} is subjected to a magnetic field of 1.30×10^{-4} T normal to the beam velocity. What is the radius of the circle traced by the beam, given e/m for electron equals 1.76×10^{11} Ckg^{-1}. **(9+4=13)**

9. a) Assuming Bohr's postulates, derive an expression for energy of an electron moving in n^{th} orbit of Bohr's.

   b) Explain Rutherford experiment on α -ray scattering.

   c) Wave length of $H\alpha$ line of Balmer series is 6563 Å. Calculate the wave length of the first member of Lyman series. **(6+3+4=13)**

10. a) Describe Stern-Gelach experiment, with necessary theory. Discuss the results.

    b) In the Stern-Gerlach experiment, silver atoms traverses a distance of 0.1 m in a non-homogeneous magnetic field of field gradient 55 Tm^{-1}. If the velocity of silver atoms is 450 ms^{-1}, calculate the displacement of atom. Given $\mu B^1 = 9.2 \times 10^{-24}$ JT^{-1} ; mass of silver atom = 1.79×10^{-25} Kg. **(9+4=13)**

11. a) Give the theory of origin of vibration-rotation spectra.

    b) Explain the phenomenon of fluorescence. **(9+4=13)**

12. a) What is Raman effect ? Explain the experimental study of Raman effect.

    b) Write a note on Rayleigh-Scattering of light.

13. Describe Michelson and Morley experiment with necessary theory and explain the negative result. **13**

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B.Sc. V Semester Degree Examination, Nov./Dec. 2013
PHYSICS
Paper – 5.2 : Quantum Mechanics, Nuclear Physics and Energy Physics

Time : 3 Hours Max. Marks : 80

Instructions : 1) *Section* ***I*** *is* ***compulsory***.
2) *Answer* ***any four*** *questions from Section* ***II*** *and* ***any four*** *questions from Section* ***III***.

SECTION – I **(12×1=12)**

1. Answer **any twelve** of the following.

A) Choose the correct answer.

i) The uncertainty relation does not hold good for the following pairs.

a) Position and momentum b) Energy and time
c) Linear momentum and angle d) None of these

ii) The Zero point energy of harmonic oscillator is

a) $\hbar\omega$ b) $\frac{1}{2}\hbar\omega$ c) $2\hbar\omega$ d) $\frac{1}{4}\hbar\omega$

iii) Nuclear radius given by the relation

a) $R = R_0 A^{1/3}$ b) $R = R_0 A^{1/2}$ c) $R = R_0 A^{5/2}$ d) $R = R_0 A^{3/2}$

iv) What is the source of stellar energy ?

a) Fission b) Fusion
c) Chemical energy d) Electric energy

B) Fill in the blank.

i) Wave length of the matter wave is given by _____

ii) Electrons cannot remain inside nucleus according to _____ hypothesis.

iii) Nuclear charge is _____

iv) Uncontrolled chain reaction results in _____

P.T.O.

C) State **True** or **False**.

i) In Compton scattering the change in wave length (D) depends on the angle of scattering.

ii) Nuclear force is ineffective outside the nucleus.

iii) Anti particle of electron in Proton.

D) Answer the following in **one** or **two** sentences.

i) Name the experiment which shows the wave nature of material particle.

ii) Define binding energy.

iii) Define half life and mean life of radio active element.

iv) What is Q-value of nuclear reaction ?

SECTION – II

Answer **any four** of the following. **(4×4=16)**

2. Explain with experimental illustration of uncertainty principle by diffraction at a single slit.

3. Obtain Schrodinger's time independent wave equation.

4. Write characteristic properties of nuclear forces.

5. Write a note on P-P cycle of thermo-nuclear reactions.

6. Give a brief account of classification of elementary particles.

7. Write a note on Bio-energy.

SECTION – III

Answer **any four** of the following : **(13×4=52)**

8. a) Describe Davision and Germer experiment to study of electron diffraction. Explain the results.

b) What is de-Broglie wavelength of an electron which has been accelerated from rest through a Potential difference of 100V. **(9+4=13)**

9. a) Derive an expression for energy and wave function of a particle moving in a infinite deep Potential well in one dimension.

   b) A microscope using photons is employed to located an electron in an atom within a distance of 0.1Å. What is the uncertainty in momentum of the electron located ? **(9+4=13)**

10. a) Write a note on Proton-electron and Proton-neutron hypothesis.

    b) A nucleus of mass number 125 has radius 6 fermi. Find the radius of a nucleus having mass number 64. **(9+4=13)**

11. a) Define radio activity. Give the theory of successive radioactive disintegration and obtain the condition for secular equilibrium.

    b) The activity of a radio active sample drops to $\frac{1}{16}^{th}$ of its initial value in one hour, 20 minutes. What is its half life ? **(2+7+4=13)**

12. a) Describe the construction and theory of cyclotron.

    b) Electrons are accelerated to maximum Kinetic energy in a cyclotron under the influence of a magnetic field of 3.2 Weber/m^2. Calculate the frequency of revolution of emerging electron.

    Given $e = 1.6\times10^{-19}$ c $m = 9.1\times10^{-31}$Kg. **(9+4=13)**

13. a) Derive an expression for Q-value of nuclear reaction.

    b) Find the Q-value of the following reaction

    $${}_7N^{14} + {}_2He^4 \rightarrow {}_8O^{17} + {}_1H^1 + Q.$$

    Given atomic mass of reactant and products are ${}_7N^{14} = 14.00755$ amu.
    ${}_2He^4 = 4.0038$ amu ${}_8O^{17} = 17.0045$ amu ${}_1H^1 = 1.00815$ amu. **(9+4=13)**
