

4th Semester Examination, 2022

Time : 3 hours

Full Marks : 60

Answer from all the Groups as per direction

The figures in the right-hand margin indicate marks

*Candidates are required to answer in their own words
as far as practicable*

(ELEMENTS OF MODERN PHYSICS)

GROUP – A

1. Answer all questions : 1 × 8

(a) The dimension of Rydberg Const. _____.

(b) Compton effect can not be observed for
_____ light.

(Turn Over)

- (c) In terms of Rydberg const. the wave number of 1st Balmer line is _____.
- (d) A proton and an alpha particle are accelerated through the same potential difference. The ratio of their de-Broglie wavelength is _____.
- (e) The half life of a sample in terms of decay const. is given by _____.
- (f) The empirical formula for nuclear radius is _____.
- (g) Half life period of lead is _____.
- (h) For a non-relativistic free particle the phase velocity is _____ of group velocity.

GROUP – B

2. Answer any *eight* questions :

$$1\frac{1}{2} \times 8$$

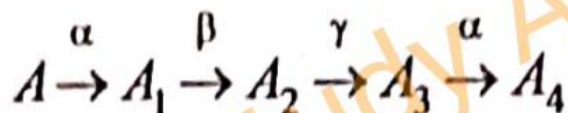
- (a) Give the difference between photoelectric effect and Compton effect.

(3)

- (b) First member of Balmer series of hydrogen has a wavelength 6563 Å. Calculate the wavelength of second member.
- (c) State Bohr's correspondance principle.
- (d) Calculate the de-Broglie wavelength of neutron of energy 12.8 Mev.
- (e) If the uncertainty in the angular momentum of object is ΔL then what other quantity will be uncertain and by what extent ?
- (f) Define packing fraction and show the variation of packing traction with mass number.
- (g) What are Magic number ?
- (h) Give the laws of radioactive decay.
- (i) Give the difference between nuclear fusion and fission.

(4)

- (j) A radioactive nucleus undergoes a series of decay according to the scheme.



Mass no. of A is 180 and atomic no. is 72.
What are these numbers for A₄?

GROUP – C

3. Answer any *eight* questions: 2 × 8

(a) Draw the intensity ~ wavelength curve for Blackbody and give the salient features of the curve.

(b) What do you mean by Stopping Potential and discuss the importance of stopping potential in measuring maximum velocity of photo-electrons ?

(c) A hydrogen atom is in the ground state. What is the quantum number to which it will be excited absorbing a photon of energy 12.75 eV ?

(5)

(d) Define phase velocity and group velocity.
Write down a relation between them.

(e) Find out the minimum energy of a harmonic oscillator using Heisenberg's uncertainty principle.

(f) What are nuclear forces? Give the properties of nuclear forces.

(g) Give the assumptions of shell model.

(h) Define mean life and half life and give the relation between them.

(i) Explain Pair Production.

(j) Explain Carbon dating.

GROUP - D

Answer all the following questions : 6×4

4. Describe Frank-Hertz experiment as a direct evidence for discrete energy states of an atom. State its limitations.

Or

What is Compton effect ? Obtain an expression for the shift in the wavelength of x-ray beam.

5. What is a wave packet ? Discuss in detail the Time-development of wave packet.

Or

State and explain Heisenberg's uncertainty principle. Illustrate the validity of uncertainty principle by gamma ray microscope experiment.

6. What is semiempirical mass formula ? Explain the significance of each term of the formula.

Or

What is meant by Binding energy ? Draw the B.E curve and discuss in detail the features of B.E curve.

(7)

7. Explain the neutrino hypothesis of β decay.

Or

Explain the principle and working of a nuclear reactor.
