

C.U.SHAH UNIVERSITY

Summer Examination-2018

Subject Name: Elements of Modern Physics

Subject Code: 4SC03EMP1

Branch: B.Sc.(All)

Semester: 3

Date: 06/04/2018

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
 - (2) Instructions written on main answer book are strictly to be obeyed.
 - (3) Draw neat diagrams and figures (if necessary) at right places.
 - (4) Assume suitable data if needed.
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- Q-1 Attempt the following questions: (14)**
- a) Give the relation between energy (E) and frequency (f) of light. 01
 - b) According to Planck's quantum theory, light is said to be a collection of ----- 01
 - c) The experimental proof of De-Broglies hypothesis was given by 01
 - i) Davisson and Germer ii) Rutherford iii) Bohr
 - d) State the Heisenberg's uncertainty principle. 01
 - e) Nuclear forces are charge ----- 01
 - i) Dependent ii) independent
 - f) Explain the term 'wave-particle duality'. 01
 - g) Give the operator form of momentum(p) and energy (E) used in quantum mechanics. 01
 - h) State the De-Broglie's hypothesis. 01
 - i) Define Compton Shift. 01
 - j) Define threshold frequency. 01
 - k) Define Binding energy. 01
 - l) Give the general formula for the radius of a nucleus. 01
 - m) What are the constituent particles of an atom? 01
 - n) Define normalization (of a wave function). 01

Attempt any four questions from Q-2 to Q-8

- Q-2 Attempt all questions (14)**
- a) Explain the principle, construction and working of photoelectric effect; also (08)



define the terms “Work Function” and “Stopping Potential”.

- b) An atom has energy levels (E) of 1eV, 2eV, 3eV. What are the frequencies (f) and wavelengths (λ) of the line spectra emitted by the atom? (06)

Q-3 Attempt all questions (14)

- a) Explain the Bohr’s model of atom. (07)
b) Explain the Davisson-Germer experiment with proper diagram. (07)

Q-4 Attempt all questions (14)

- a) Derive the formula for Heisenberg’s uncertainty principle. (03)
b) Explain the characteristics of nuclear force. (07)
c) Give two differences between proton-neutron hypothesis and proton-electron hypothesis of a nucleus. (04)

Q-5 Attempt all questions (14)

- a) Derive the time dependent Schrodinger equation. (07)
b) Give the physical interpretation of wave function (ψ). (07)

Determine the normalization constant (A) of a wave function $\psi = A \cdot e^{im\phi}$.

Q-6 Attempt all questions (14)

- a) Determine the energy (E) and wave function (ψ) for a particle confined in a rigid box. (12)
b) Define Tunneling (02)

Q-7 Attempt all questions (14)

- a) Explain the Rutherford’s experiment to understand the model of an atom. (07)
b) Explain the Heisenberg’s gamma ray microscope. (07)

Q-8 Attempt all questions (14)

- a) Explain the concept of tunneling through a rectangular barrier. (07)
b) Explain the Compton effect. (07)

