1 Answer the following in brief:

(1) What are the limitations of Bohr's model of an atom?

(2) Which quantum numbers are associated with vector atom model?

(3) An electron is in the $n=3, l=2$ state of hydrogen. What is the length of electronic angular momentum vector?

(4) For a one electron atom or ion, spin-orbit coupling splits all states except s-states into doublets. Why are s-states exceptions to this rule?

(5) For beta-decay process show that the neutrino must have zero charge.

(6) How can one account for the fact that although electrons are not found inside the nucleus yet they are emitted by the nucleus during beta decay?

(7) What are strange particles?

(8) Name the quarks that combine to form a proton and a neutron.
2  (a) What is electron spin? How the concept of electron spin is useful in explaining anomalous Zeeman effect?

    OR

2  (a) Explain Stern Gerlach experiment.
2  (b) On the basis of vector atom model find the possible values of the total angular momentum of electron.

    OR

2  (b) Find the normal Zeeman splitting of the line 6438 A in a magnetic field of 0.5 T. Given: charge of electron $e = 1.6 \times 10^{-19}$ C, mass of electron $m_e = 9.1 \times 10^{-31}$ kg and speed of light $c = 3 \times 10^8$ m/s.

3  (a) Describe Bragg's apparatus to determine the range of alpha particles.

    OR

3  (a) Explain Kaufmann's experiment to determine e/m of beta particles.
3  (b) Explain origin of line and continous beta ray spectra.

    OR

3  (b) Explain origin of gamma rays.

4  Short Note : (Attempt any two)
(1) Paschen Back effect
(2) Spin orbit coupling
(3) Coloured quarks and gluons
(4) Conservation laws and symmetry