Chapter 02
(ATOMIC STRUCTURE)

SECTION – A

Time allowed: 20 minutes **Marks: 17**

Note: Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

(i) Which of the following is not true for cathode rays?:
(a) cathode rays or negatively charged
(b) they can produce X rays when they strike on an anode
(c) They cast a shadow when an opaque medium is placed in their path
(d) there e/m value depends upon the nature of gas in discharge tube

(ii) When fast neutrons are bombarded on nitrogen atoms what radiations are emitted?
(a) Beta rays (b) gamma Rays
(c) x-rays (d) alpha rays

(iii) The radius of 1^{st} orbit of Li^{+2} ion is:
(a) 0.176 A◦ (b) 0.2645 A◦
(c) 0.529 A◦ (d) 2.116A◦

(iv) The wavelength of green light is 500 nm. Its frequency is equals to:
(a) 6×10^{14} Hz (b) 6Hz
(c) 1.5 Hz (d) 1.5×10^{14} Hz

(v) The maximum number of electrons in a subshell for which l =3 is?
(a) 14 (b) 10
(c) 8 (d) 4

(vi) Which set of quantum numbers is not valid for an electron?
(a) **n= 3, l=2, m=-2** (b) **n= 1, l=1, m=0**
(c) **n= 2, l=0, m=0** (d) **n= 3, l=1, m=-1**

(vii) Which one of the following statement is not correct?
(a) Rydberg's constant and wave number have same unit.
(b) Lyman series of hydrogen spectrum occurs in the ultraviolet region.
(c) The angular momentum of the electron in the ground state of hydrogen atom is equal to $h/2\pi$
(d) the radius of first Bohr orbit of hydrogen atom is 2.116×10^{-8}

(viii) For which species Bohr's theory does not apply?_____
(a) H (b) He^{+}
(c) Li^{2+} (d) Be

(ix) Which of following quantum numbers is not obtained from Schrodinger wave equation?
(a) principal quantum number, n (b) azimuthal quantum number, l
(c) magnetic quantum number, m (d) spin quantum number, s

(x) From the discharge tube experiment, it is concluded that:
(a) mass of a proton is in fraction (b) matter contained electrons
(c) nucleus contains positive charge (d) positive rays are heavier than protons

(xi) According to (n+l) rule. Which one of the following has the highest energy?
(a) 2s (b) 3s (c) 3p (d) 2p

(xii) The neutron particle has:
(a) a mass of one gram (b) a mass approx equal to proton
(c) a charge equal but opposite to that of electron (d) same e/m as electron

(xiii) Total number of degenerate orbitals in d subshell are
(a) 3 (b) 5 (c) 7 (d) 9

(xiv) Which gas has highest e/m ratio?
(a) Li^{+} (b) H^{+}
(c) He^{+} (d) Be^{+}

(xv) Which of the following deviates Aufbau principle in electron configuration
(a) B (b) Cu
(c) Na (d) K

(xvi) As we move away from nucleus the distance between the adjacent orbits goes on:

(a) increasing (b) decreasing

(c) remains the same (d) may increase or decrease

(xvii) The value of azimuthal quantum number when the value of north is equals to 3 is:

(a) 0,1,3 (b) 1

(c) 0,1 (d) 0,1,2

For Examiner's use only:_____

Total Marks: **17**

Marks Obtained:

Time allowed: 2.40 hours **Total Marks: 68**

Note: Answer any eleven parts from Section 'B' and Attempt any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q.2 Attempt any **Fourteen** parts from the following. All parts carry equal marks.

(i) How mass of electron can be calculated from e/m ratio and charge?

(ii) Differentiate b/w Fast and Slow Neutron

(iii) What are X, Y and Z in the following reactions?

(a) $${}_{7}N^{14} + {}_{0}n^{1} \longrightarrow {}_{5}X^{11} + {}_{2}Y^{4}$$

(b) $${}_{5}B^{11} + {}_{2}He^{4} \longrightarrow {}_{7}Z^{14} + {}_{0}n^{1}$$

(iv) What species are formed as a result of decay of neutron? Write necessary chemical reaction to support your answer.

(v) Bohr's equation for the radius of n^{th} of electron in the Hydrogen atom is

(i) $r_n = \dfrac{\varepsilon_0 h^2 n^2}{\pi e^2 m}$

(a) When the electron moves from $n=1$ to $n=2$, how much does the radius change?

(b) What is the distance travelled by the electron when it goes from $n=8$ to $n=3$?

(vi) Calculate how much energy is required in order to remove electron of hydrogen atom.

(vii) Why is it necessary to decrease the pressure in the discharge tube to get the Cathode rays?

(viii) Why the properties of positive rays depend upon the nature of gas?

(ix) Positive rays are also called Canal rays. Give reasons.

(x) What is H_∞ - line in hydrogen spectrum? which effect explain these lines?

(xi) Describe the following relationships:-
(a) Energy and wavelength
(b) Frequency and wavelength
on the basis of Plank's theory.

(xii) Why is it necessary to decrease the pressure in the discharge tube to get the Cathode rays?

(xiii) Differentiate b/w Zeeman and Stark effect.

(xiv) State and Breifly explain Pauli Exclusion principle with the help of examples.

(xv) What is meant by Moseley's law? Breifly explain the necassary terms in its formula.

(xvi) What is N+l rule? Briefly explain that which orbital has lower energy value in 4S and 3d?

(xvii) Write the electronic configuration of $_{30}Zn$, $_{64}Gd$, $_{31}Sc$, $_{29}Cu^{+2}$, $_{13}Al^{3+}$

(xviii) Calculate energies of n_1 for

(a) $_{2}He^{+}$

(b) $_{3}Li^{+2}$

(xix) State and Briefly explain Hund's rule with the help of examples.

(xx) How is the wavelength of moving Particles are related to the momentum of electron.

SECTION – C (Marks 26)

Attempt any **Two** Questions from the following. All parts carry equal marks.

(3) Q(a) :- Derive an expression for total energy of electron present in the n^{th} orbit of H-atom.

(b) Calculate the radius of first orbit of Hydrogen atom and Helium ion (He^+). which one has smaller radius and why?

(4) Q(a) :- Explain the origin of spectrum of Hydrogen atom on the basis of Bohr's atomic model. Also explain in detail that what are the different series of spectral lines present in the infrared region of this spectrum and how they are formed?

(5) Q(a) What do you know about Quantum numbers also explain that how they help us to understand atomic structure.

Sheet No: _____

(b) Write three important postulates of Plank's quantum theory with the help of necessary mathematical derivations

BEST OF LUCK!