

EXERCISE**EXERCISE MULTIPLE CHOICE QUESTION ANSWERS**

- Which one of the following results in the discovery of proton
(a) cathode rays (b) canal rays (c) x-rays (d) alpha rays.
- Which one of the following is the most penetrating?
(a) protons (b) electrons (c) neutrons (d) alpha particles
- The concept of orbit was used by
(a) J. J. Thomson (b) Rutherford (c) Bohr (d) Planck
- Which one of the following shell consists of three subshells.
(a) O-shell (b) N shell (c) L shell (d) M shell
- Which radioisotope is used for the diagnosis of tumor in the body?
(a) cobalt-60 (b) iodine-131 (c) strontium-90 (d) phosphorus-32
- When U-235 breaks up, it produces:
(a) electrons (b) neutrons (c) protons (d) nothing
- The p subshell has:
(a) one orbital (b) two orbitals (c) three orbitals (d) four orbitals
- Deuterium is used to make:
(a) light water (b) heavy water (c) soft water (d) hard water
- The isotope C-12 is present in abundance of:
(a) 96.9 % (b) 97.6 % (c) 99.7 % (d) none of these
- Who discovered the proton:
(a) Goldstein (b) J. T. Thomson (c) Neil Bohr (d) Rutherford

ANSWER KEY

1	b	3	c	5	a	7	c	9	d
2	c	4	d	6	b	8	b	10	a

EXERCISE SHORT QUESTION ANSWERS

Q.1 What is the nature of charge on cathode rays?

Ans: Cathode rays are negatively charged particles. J.J. Thomson discovered the e/m (charge/mass) ratio of cathode rays and found it equal to electron.

Q.2 Give five characteristics of cathode rays.

Ans: The characteristics of cathode rays are as under:

- These rays travel in a straight line perpendicular to the cathode surface.
- They raise the temperature of the body on which they fall.
- Light is produced when these rays hit the sides of discharge tube.
- They can cast a sharp shadow of an opaque object if placed in their path.
- The nature of rays does not depend upon the nature of gas used in discharge tube.

Q.3 The atomic symbol of a phosphorus ion is given as ${}_{15}^{31}\text{P}^{3-}$

- How many protons, electrons and neutrons are there in the ion?
- What is name of the ion?
- Draw the electronic configuration of the ion.
- Name the noble gas which has the same electronic configuration as the phosphorus ion has.

Ans:

- a. In ${}_{15}^{31}\text{P}^{3-}$ ion:
- Number of protons = 15
 - Number of electron = $15+3=18$ (P^{3-} has three more electrons than neutral P-atom)
 - Number of neutrons = $31-15=16$
- b. The name of ion is Phosphide ion
- c. Electronic configuration of ${}_{15}^{31}\text{P}^{3-} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6$ (P^{3-} has three more electrons than neutral P-atom)
- d. Argon has same electronic configuration as the phosphorous ion has.

Q.4 Differentiate between shell and subshell with examples of each.

Ans:

Shell	Sub-shell
i. The circular path of an electron around the nucleus is called shell or principal energy level is called a shell.	i. Each shell consists of smaller paths called subshells.
ii. The shells are subdivided into subshells.	ii. The subshells are further composed of atomic orbitals.
iii. These are represented by K, L, M, N etc.	iii. Example: s, p, d and f are considered as the subshells of a shell. These are represented by s, p, d, f.

Q.5 An element has an atomic number 17. How many electrons are present in K, L and M shells of the atom?

Ans: Atomic number of element = number of electrons = 17

Therefore, its electronic configuration will be

K L M
2 8 7

OR

$1s^2, 2s^2, 2p^6, 3s^2, 3p^5$

Q.6 Write down the electronic configuration of Al^{3+} . How many electrons are present in its outermost shell?

Ans: Atomic number of Al = 13

Number of electrons of Al = 13

Number of electrons of $\text{Al}^{3+} = 13-3 = 10$ electrons.

Thus electronic configuration of Al^{3+} ion

K L
2 8

In terms of subshell: $1s^2, 2s^2, 2p^6$

Therefore,

Number of electrons present in outer most shell of $\text{Al}^{3+} = 8$ electrons

Q.7 Magnesium has electronic configuration 2, 8, 2,

(a) How many electrons are in the outermost shell?

(b) In which subshell of the outermost shell electrons are present?

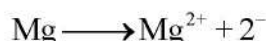
(c) Why magnesium tend to lose electrons?

Ans:

- a. Electronic configuration of Mg =
- | | | |
|---|---|---|
| K | L | M |
| 2 | 8 | 2 |
- [Mg] = $1s^2, 2s^2, 2p^6, 3s^2$

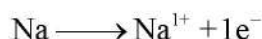
It has two electrons in the outermost shell.

- b. The outermost electrons are present in “s” subshell of the 3rd shell (M).
c. Magnesium is electropositive in character. It has the ability to lose its two electrons from its outermost shell.



Q.8 What will be the nature of charge on an atom when it loses an electron or when it gains an electron?

Ans: When an atom loses an electron, it acquires positive charge due to more number of protons in the nucleus e.g.



(2, 8, 1) (2, 8)

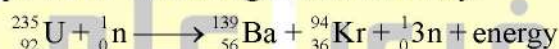
When an atom gains an electron, it possesses negative charge due to more electrons than protons in the atom e.g.



(2, 8, 7) (2, 8, 8)

Q.9 For what purpose is U-235 used?

Ans: Radioactive isotope U-235 is used to generate electricity.



Q.10 A patient has goiter, how will it be detected?

Ans: Isotopes of iodine-131 are used for diagnosis of goiter in thyroid gland. These radioactive isotopes are used as tracers in medicine to diagnose the presence of tumor in the human body.

Q.11 Give three properties of positive rays.

Ans: Positive rays are also called “canal rays”. Their properties are:

- These rays travel in straight line in a direction opposite to the cathode rays.
- These are positively charged rays.
- Mass of these particles was found equal to that of a proton or simple multiple of it.

Q.12 What are the defects of Rutherford's atomic model?

Ans: Rutherford's atomic model had following defects:

i. Stability of atom:

According to classical theory of radiations, electrons being charged particles should release or emit energy continuously. They should ultimately fall into the nucleus.

ii. Nature of spectrum:

If the electrons emit energy continuously they should form a continuous atomic spectrum but in fact, line atomic spectrum was observed.

Q.13 As long as electron remains in an orbit, it does not emit or absorb energy. When does it emit or absorb energy?

Ans: Electrons do not emit or absorb energy till they remain in their orbits. Electron emits energy when it jumps from high energy level to the lower energy level. An electron absorbs energy when it jumps from a lower energy orbit to a higher energy orbit. The change in energy is given by the following Planck's equation

$$\Delta E = E_2 - E_1 = h\nu \quad (\text{Energy absorb})$$

Where

E_1 = energy of lower energy orbit

E_2 = energy of higher energy orbit

“h” is Planck’s constant. Its value is 6.63×10^{-34} Js and frequency of light.

And

$$E_2 - E_1 = -h\nu \quad (\text{Energy emitted})$$

EXERCISE LONG QUESTION ANSWERS

Q.1 How are cathode rays produced? What are its five major characteristics?

Ans: See Q. No. 2 (Subjective Part, Long Questions Answers)

Q.2 How was it proved that electrons are fundamental particles of an atom?

Ans: See Q. No. 2 (Subjective Part, Long Questions Answers)

Q.3 Draw a labeled diagram to show the presence of protons in the discharge tube and explain how canal rays were produced.

Ans: See Q. No. 3 (Subjective Part, Long Questions Answers)

Q.4 How Rutherford discovered that atom has a nucleus located at the centre of the atom?

Ans: See Q. No. 5 (Subjective Part, Long Questions Answers)

Q.5 One of the postulates of Bohr’s atomic model is that angular momentum of a moving electron is quantized. Explain its meaning and calculate the angular momentum of third orbit (i.e. $n=3$)

Ans:

Q.6 How did Bohr prove that an atom must exist?

Ans: See Q. No. 6 (Subjective Part, Long Questions Answers)

Q.7 What do you mean by electronic configuration? What are basic requirements while writing electronic configuration of an element (atom)?

Ans: See Q. No. 9 (Subjective Part, Long Questions Answers)

Q.8 Describe the electronic configuration of Na^+ , Mg^{2+} and Al^{3+} ions. Do they have the same number of electrons in the outermost shell?

Ans:

(i) Na^+

Electronic configuration is shells = $\begin{matrix} \text{K} & \text{L} \\ 2 & 8 \end{matrix}$

In terms of subshell : $1s^2, 2s^2, sp^6$

(ii) Mg^{2+} :

Electronic configuration in shell: $\begin{matrix} \text{K} & \text{L} \\ 2 & 8 \end{matrix}$

In terms of subshell: $1s^2, 2s^2, sp^6$

(iii) Al^{3+}

Electronic configuration in shell: $\begin{matrix} \text{K} & \text{L} \\ 2 & 8 \end{matrix}$

In terms of subshell: $1s^2, 2s^2, sp^6$

Hence:

It is proved that all have 8 electrons in their outermost shells.

Q.9 Give the applications of isotopes in the field of radiotherapy and medicines.

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version now.

Ans: See Q. No. 13 (Subjective Part, Long Questions Answers)

Q.10 What is an isotope? Describe the isotopes of hydrogen with diagrams.

Ans: See Q. No. 11 (Subjective Part, Long Questions Answers)

