Multiple Choice Type Questions

1. **Which radiations were used in Rutherford's experiment?**

(a) alpha (b) beta

(c) gamma (d) x-rays

2. **Which is the smallest particle of matter?**

(a) Molecule (b) Atom

(c) Element (d) Compound

3. **The first periodic classification of elements was given by**

(a) Dobereiner (b) Moseley

(c) Newland (d) Mendeleev

4. **Modern Periodic table is based on which property of elements?**

(a) Atomic structure (b) Atomic mass

(c) Atomic number (d) Valency

5. **The number of periods and groups in modern periodic table are**

(a) 7 and 18 (b) 9 and 19

(c) 7 and 20 (d) 9 and 20

6. **The atomic size in periodic table on moving from top to bottom in a group**

(a) decreases (b) remains constant

(c) changes invariably

(d) increases

7. **Vander Waal radius is ..... than covalent radius**

(a) smaller (b) greater (c) same (d) none

8. **The number of elements in a short period is**

(a) 4 (b) 8 (c) 18 (d) 32

9. **The energy required to remove electron from a neutral atom is called**

(a) Electron gain enthalpy

(b) Electronegativity

(c) Ionisation enthalpy

(d) Excited energy

10. **Which of the following elements has maximum electronegativity?**

(a) H (b) Na

(c) Ca (d) F

11. **Which group has elements of maximum metallic properties?**

(a) 1 (b) 2 (c) 5 (d) 6

Answer

1. (a),	**2.** (b),	**3.** (d),	**4.** (c),	**5.** (a),
6. (d),	**7.** (b),	**8.** (b),	**9.** (c),	**10.** (d),
11. (a).				

✦ Very Short Answer Type Questions

Q.12. Name the model of Thomson.

Ans. Plum Pudding Model.

Q.13. What are the orbits of Bohr called?

Ans. Energy levels.

Q.14. What is modern periodic law?

Ans. The Modern Periodic Law states "The chemical and physical properties of elements are a periodic function of their atomic numbers."

Q.15. Write Mendeleef's Periodic law?

Ans. The chemical and physical properties of elements are a periodic function of their atomic masses.

Q.16. On the basis of which property did Mendeleev keep the elements in Periodic table?

Ans. On the basis of atomic masses.

Q.17. Which name was given to members of 18th group?

Ans. Noble gases.

Q.18. What is the other name for d-block and f-block elements?

Ans. d-block elements are known as Transition elements and f-block elements are known as inner transition elements.

✦ Short Answer Type Questions

Q.19. Give the positions of metals, non-metals and metalloids in modern periodic table.

Ans. The position of metals, non-metals and metalloids in the periodic table can be located by drawing a diagonal line joining the element boron (At. no. 5) with that of tellurium (At. no. 52) and passing through silicon and arsenic.

The elements above the diagonal line and to

shows slightly metallic character also). The non-metallic character is more marked when farther an element is from the diagonal line and up.

The elements below the diagonal line and to the left are metals. Hydrogen is a non-metal and is an exception. The metallic character is more marked when farther an element is from the diagonal line and down. All lanthanoids and actinoids are metals.

The elements along the diagonal line are metalloids and possess the characteristics of metals as well as of non-metals. In addition, germanium, antimony and selenium also show the characteristics of metalloids.

Q.20. Explain the periodicity of electron gain enthalpy in a group.

Ans. It is the energy change when an electron is accepted by an atom in the gaseous state.

$$X(g) + e^- \longrightarrow X^-_{(g)} + E$$

In a group, the electron affinity decreases on moving from top to bottom because on moving down the group, atomic size increases . The distance of electrons from the nucleus increases. Thus, there is less attraction for incoming electron.As a result, electron affinity decreases down the group.

For example. The values of electron gain enthalpy in seventh group.

F	Cl	Br	I	Ar
3.45	3.61	3.36	3.06	2.69

Q.21. What do you understand by vander Waal's radius and Covalent radius?

Ans. Covalent Radius: It is defined as one half the distance between the nuclei of two covalently bonded atoms of the same element in a molecule.

$$r_{\text{covalent}} = \frac{1}{2} \text{(internuclear distance between two bonded atoms)}$$

Since the inter nuclear distance between two bonded atoms is called the bondlength. Therefore

$$r_{\text{covalent}} = \frac{1}{2} \text{(bond length)}$$

vander Waal's radius : It is defined as one half the distance between the nuclei of two identical non-bonded isolated atoms or two adjacent identical atoms belonging to two neighbouring molecules of an element in the solid state. The magnitude of the vander Waal's radius depends upon the packing of the atoms when the element is in the solid state.

vander Waal's radius of an element is always larger than its covalent radius.

Q.22. Explain why is cation smaller than neutral atom and anion is larger than neutral atom?

Ans. A cation is formed by loss of one or more electrons from the neutral atom. Due to the removal of electrons from the parent atom, the number of electrons in the cation decreases but its nuclear charge remains the same as that of the atom. The force of attraction by the nucleus on the electron increases and hence the size of the atom decreases.

On the other hand, an anion is formed when a neutral gaseous atom gains one or more electrons. This increases the number of electrons in the anion while its nuclear charge remains the same as that on the neutral atom. Since the same nuclear charge now attracts greater number of electrons, therefore, the force of attraction by the nucleus on the electrons of all the shells decreases. Addition of one or more electrons, increases the repulsions among electrons and the electron cloud of the atom expands. Hence anion becomes larger than a neutral atom.

Q.23. What do you mean by effective nuclear charge? Explain its periodicity in a group.

Ans. Effective Nuclear Charge : It is the net force of attraction of nucleus acting on valence electrons. It can be approximated by $Z_{eff} = Z - S$, where Z = atomic number, S = number of inner shells' electrons. On moving down a group, number of inner shells's electrons increases and hence effective nuclear charge decreases.

Q.24. Explain the periodic properties of valency on moving left to right in a period.

Ans. The number of valence electrons increases in a period. In normal elements, it

increases from 1 to 8 in a period from left to right. It reaches 8 in group 18 elements (noble gases) which show practically no chemical activity under ordinary conditions and their valency is taken as zero. This valency is equal to the number of valence electrons or group number for groups 1 and 2, or (group number-10) for groups 13 to 17.

Q.25. Write the Atomic structure theory of Dalton.

Ans. John Dalton in 1808 gave a theory to explain the structure of atom. Main postulates of Dalton's atomic theory are as follows :

(i) Matter is composed of very tiny or microscopic particles called "Atom".

(ii) Atom is an indivisible particle.

(iii) Atom can neither be created nor destroyed.

(iv) Atoms of an element are identical in size, shape, mass and in other properties.

(v) Atoms of different elements are different in their properties.

(vi) Atoms combine with one another in small whole numbers.

(vii) All chemical reactions are due to combination or separation of atoms.

✦ Long Answer Type Questions

Q.26. List the merits and drawbacks of Mendeleev's periodic table.

Ans. Merits of Mendeleev's periodic table :

(i) At some places the order of atomic weight was changed in order to justify the chemical and physical nature.

(ii) Mendeleev left some gap for new elements which were not discovered at that time.

(iii) One of the strengths of Mendeleev's periodic table was that, when inert gases were discovered they could be placed in a new group without disturbing the existing order.

Drawbacks : The following were the main defects in it:

(1) Position of hydrogen : Hydrogen resembles alkali metals (forms H^+ ion just like Na^+ ions) as well as halogens (forms H^- ion

similar to Cl^- ion). Therefore, it could neither be placed with alkali metals (group I) nor with halogens (group VII).

2. Position of isotopes : Different isotopes of same elements have different atomic masses, therefore, each one of them should be given a different position in the periodic table. On the other hand, because they are chemically similar, they had to be given same position.

3. Anomalous pairs of elements : At certain places, an element of higher atomic mass has been placed before an element of lower atomic mass. For example, Argon (39.91) is placed before Potassium (39.1)

4. Some dissimilar elements are grouped together while some similar elements are placed in different groups. For example alkali metals such as Li, Na, K etc (group IA) are grouped together with coinage metals such as Cu, Ag and Au (group IB) though their properties are quite different. At the same time chemically similar elements like Cu (group IB) and Hg (group II B) have been placed in different groups.

5. Position of elements of group VIII : No proper place has been alotted to nine elements of group VIII which have been arranged in three triade without any justification.

6. Position of lanthanides and actinides : The 14 elements following lanthanum from atomic numbers 58-71 (commonly known as lanthanoids) and another group of 14 elements from atomic numbers 90-103 (commonly known as actinoids) have not been given proper positions in the main frame of periodic table but have been placed in two separate rows at the bottom of the periodic table.

Q.27. Explain the periodicity of following properties of elements

(a) Atomic radius

(b) Ionisation enthalpy

(c) Electronegativity

Ans. (a) Atomic radius : In a period, atomic radius generally decreases from left to right. In a period, there is a gradual increase in the nuclear charge. Since valence electrons are added in the same shell, they are more and more strongly

attracted towards nucleus. This gradually decreases atomic radii.

Atomic radii increase in a group from top to bottom. As we go down a group, the number of shells increases and valence electrons are present in higher shell and the distance of valence electrons from nucleus increases. Both the factors decrease the force of attraction between nucleus and valence electron. Therefore, atomic size increases on moving down a group.

(b) Ionisation enthalpy : Ionization energy decreases in a group from top to bottom. This is due to the fact that the force of attraction between valence electrons and nucleus decreases in a group from top to bottom. Thus, less energy is required to remove an electron from an atom.

On the other hand, the force of attraction between valence electron and nucleus increases in a period from left to right. As a consequence of this, the ionization energy increases in a period from left to right.

(c) Electronegativity : Electronegativity is the relative tendency of a bonded atom to attract the bond-electrons towards itself. Electronegativity decreases in group from top to bottom. In a period, electronegativity increases from left to right because atomic size decreases.

Q.28. Discuss the classification of elements on the basis of modern periodic table.

Ans. There are 18 vertical columns in the periodic table. Each column is called a group. The groups have been numbered from 1 to 18 (in Arabic numerals) from left to right.

(i) Elements present in groups 1 and 2 on left side and groups 13 to 17 on the right side of the periodic table are called normal elements or representative elements.

(ii) Elements present in groups 3 to 12 in the middle of the periodic table are called transition elements. Their two outermost shells are incomplete.

(iii) Group 18 on extreme right side of the periodic table contains noble gases. Their outermost shell contain 8 electrons.

(iv) Inner transition elements : 14 elements with atomic numbers 58 to 71 (Ce to Lu) are called lanthanides and they are placed alongwith the element lanthanum (La), atomic number 57 in the same position (group 3 in period 6) because of very close resemblance between them.

(v) 14 elements with atomic numbers 90 to 103 (Th to Lr) are called actinides, and they are placed along with the element actinium (Ac).

There are seven rows in the periodic table. Each row is called a period. The periods have been numbered from 1 to 7 (Arabic numerals).

(i) The first period is the shortest period of all and contains only 2 elements, H and He.

(ii) The second and third periods are called short periods and contain 8 elements each.

(iii) Fourth and fifth periods are long periods and contain 18 elements each.

(iv) Sixth and seventh periods are very long periods containing 32 element seach.

Q.29. Describe Rutherford's gold foil experiment. Explain also observations and conclusions of this experiment.

Ans. In 1911, Rutherford performed scattering experiment by bombardment of thin foils of metals like gold, silver, platinum, etc. with a beam of fast moving α particle. He selected gold foil because he wanted as thin layer as possible.

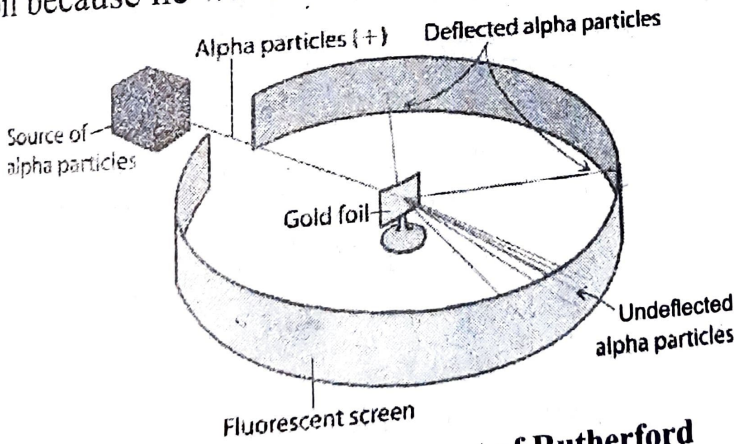

Fig. 7.12 Gold foil experiment of Rutherford

Following observations were made by rutherford :

1. Most of the alpha particles passed through the foil straight without any deflection from their original path.

2. A few alpha particles were deflected through small angles and a few were deflected through large angles.

3. A very few alpha particles completely rebounded on hitting the gold foil and turned back on their path.

On the basis of his observations, Rutherford gave the nuclear model as:

- The positive charge and most of the mass of atom was densely concentrated in extremely small region. This region was called as nucleus.
- The magnitude of positive charge on the nucleus was different for different atoms.
- The nucleus was surrounded by negatively charged electrons which balanced the positive charge on the nucleus.
- The electrons were not stationary but were revolving around the nucleus at a very high speed in circular paths known as orbits.
- Electrons and nucleus were held together by electrostatic force of attraction.
- Most of the space in an atom between the nucleus and revolving electrons was empty.