TEST YOUR SELF

TEST YOURSELF 3.1 (HISTORY OF PERIODIC TABLE)

i. What was the contribution of Dobereiner towards classification of elements?

Ans. "A German chemist Dobereiner observed relationship between atomic masses of several groups of three elements called triads.

Law of triad:

"The central or middle element had atomic mass average of the other two elements."

Drawback: Only a few elements could be arranged in this way. This classification did not get wide acceptance.

Example: An example of triads is that of calcium (40) strontium (88) and barium (137). The atomic mass of strontium is the average of the atomic masses of calcium and barium

Ca = 40
Sr = 88
Ba = 137

$$\frac{40+137}{2} = 88.5 = 88$$

ii. How Newlands arranged the elements?

Ans. In 1864 British chemist Newlands arranged the elements in increasing order of their atomic masses. He gave law of octaves.

According to this law,

"There was a repetition in chemical properties of every eighth element if they were arranged in the increasing order of their atomic masses."

iii. Who introduced the name of Periodic Table?

Ans. A Russian chemist, Mendeleev (1869) introduced the name of periodic table. He arranged then known elements (63) in increasing order of their atomic masses.

iv. Why the improvement in Mendeleev's periodic table was made?

Ans: The improvement in the Mendeleev periodic table was made due to two reasons.

a. Position of isotopes could not be explained

b. Wrong order of the atomic masses of some elements suggested that atomic mass of an element could not serve as the basis for arrangement of elements.

It was based upon atomic masses instead of atomic number which is more fundamental property of elements.

v. State Mendeleev's periodic law.

Ans: Mendeleev's periodic law is stated as:

"Properties of the elements are periodic function of their atomic mass."

vi. Why and how elements are arranged in a period?

Ans. Elements are arranged in a period according to their increasing atomic numbers because it can determine the position of an element more accurately due to the following reasoning.

i. Atomic number is fixed for each element.

ii. It increases regularly by one from element to element.

TEST YOURSELF 3.2 MODERN PERIODIC TABLE

i. How the properties of elements repeat after regular intervals?

Ans. Properties of elements repeat after regular intervals because of increasing atomic number from left to right, the elements with similar electronic configuration repeat after regular interval in successive periods.

ii. In which pattern modem periodic table was arranged?

Ans. Modern periodic table was arranged in increasing order of atomic number of elements. The arrangement of elements on the basis of their electronic configuration gave a long form of periodic table. The elements were arranged in vertical columns (groups) and horizontal rows (periods) in the modern periods table.

iii. How many elements are in first period and what are their names and symbols?

Ans. There are two elements in first period of the modern periodic table. These are hydrogen (H) and helium (He).

iv. How many elements are placed in 4th period?

Ans. There are eighteen elements placed in fourth period of modern period table. It starts from potassium (K) and ends at krypton (Kr).

v. From which element lanthanide series starts?

Ans. Lanthanide series starts from Lanthanum-57. That is why it is called lanthanide series.

vi. From which period actinides series starts?

Ans. Actinides series starts from 7^{th} period and element actinium (Ac).

vii. How many elements are in 3rd period, write their names and symbols?

Ans. There are eight elements in 3rd period of modern period table. Their names and symbols are: Sodium (Na), Magnesium (Mg), Aluminum (Al), Silicon (Si), Phosphorus (P), Sulphur (S), Chlorine(Cl) and Argon (Ar).

viii. How many periods are considered normal periods?

Ans. There are two periods considered as normal periods. These periods are second and third.

ix. What do you mean by a group in a periodic table?

Ans. *"The vertical columns of elements in the periodic table are called groups. The groups are studied from top to bottom."*

x. What is the reason of arranging elements in a group?

Ans. Elements are arranged in groups because of having similar electronic configuration of elements in the periodic table. Elements of a group have similar properties due to which they are called family.

xi. What do you mean by periodic function?

Ans. **Periodic function:**

"*A function which repeats its value after regular intervals is called periodic function.*"

In modern periodic table periodic function means properties of elements repeat after regular intervals such that elements with similar properties and similar configuration are placed in the same groups.

xii. Why the elements are called s or p block elements?

Ans. The elements are called s or p block elements because they have their valance electrons in their s or p sub shells respectively.

Examples:

a. Elements of group 1 and 2 have valence electrons in 's' subshell. Therefore, they are called s- block elements.

b. Elements of group 13 to 18 have valence electrons in 'p' subshell. Therefore they are called p-block elements.

xiii. Write down the names of elements of group 1 with their symbols?

Ans. Group 1 consist of seven elements which are given below:

Hydrogen (H), Lithium (Li), Sodium (Na), Potassium (K), Rubidium (Rb), Cesium (Cs)

and Francium (Fr)

xiv. How many members are in group 17, is there any liquid, what is its name?

Ans. There are six elements (F, Cl, Br, I, At, Uus) in group 17 of the periodic table. There is one liquid element. Its name is bromine (Br)

TEST YOURSELF 3.3 (PERIODICITY OF PROPERTIES)

i. How can you define atomic radius?

Ans: *The half of the distance between the nuclei of the two bonded atoms is referred as the atomic radius of the atom."*

Example:

The distance between the nuclei of two carbon atoms in its elemental form is 154 picometer (pm). It means atomic size of carbon atom is 154 pm and its radius is 77 pm.

ii. What are SI units of atomic radius?

Ans. Although SI unit of length is meter but atom is too small to measure its radius in meters. Therefore, atomic radius is measured in picometer (pm) $= 10^{-12}$ m

iii. Why the size of atoms decreases in a period?

Ans: The size of atoms decreases in a period gradually from left to right. Because of increase of atomic number (one more proton in the nuclei of the atom) the effective nuclear charge increases gradually. This increase in effective nuclear charge pulls down or contracts the outermost shell towards the nucleus.

iv. Define ionization energy.

Ans. "*The ionization energy is the amount of energy required to remove the most loosely bound electron from the valence shell of an isolated gaseous atom.*"

Example:

$$Na \longrightarrow Na^{+} + 1e^{-}$$
$$\Delta H = +496 \text{ KJ mol}^{-1}$$

Its unit is KJ mol^{-1}

v. Why the 2nd ionization energy of an elements is higher than first one?

Ans. "*The energy required to remove an electron from an isolated monopositive gaseous ion (M^{+}) is called second ionization energy.*"

A monopositive gaseous ion has more protons than electrons. The effective nuclear charge increases and it attracts the remaining electrons more strongly. Thus removal of 2^{nd} electron becomes difficult. That is why 2^{nd} I.E is higher than first one.

vi. What is trend of ionization energy in a group?

Ans. Ionization energy decreases in a group from top to bottom, as we move down the group more and more shells lie between the valence shell and the nucleus of the atom. These additional shells reduce the electrostatic force felt by the electrons present in the outermost shell. Resultantly the valence shell electrons can be taken away easily.

vii. Why the ionization energy of sodium is less than that of magnesium?

Ans. The ionization energy of sodium is less than the magnesium because both sodium and magnesium belong to same period. When we move from left to right in a period atomic size decreases and ionization energy increases that is why the ionization energy of sodium is less than that of magnesium.

viii. Why is it difficult to remove an electron from halogens?

Ans. It is difficult to remove an electron from halogens because of following reasons:

a. Smaller atomic size
b. More effective nuclear charge (increase in proton number)
c. High electron affinity
d. High electronegative values etc.

ix. What is shielding effect?

Ans: **"***The decrease in attractive force exerted by the nucleus on the valence shall electrons due to presence of electrons lying between the nucleus and valence shall is called shielding effect."*

Trends in periodic table: Shielding effect increases from top to bottom in groups and remains same from left to right in periods of the periodic table.

x. How does shielding effect decrease the forces of electrostatic attractions between nucleus and outermost electrons?

Ans. The electrons present between the nucleus and the outermost shell of an atom, reduce the nuclear charge felt by the electrons present in the outermost shell. The attraction of outer electrons towards nucleus is partially reduced because of inner electrons. As a result an atom experiences less nuclear charge than that of the actual charge, which is called effective nuclear charge (Z_{eff}).

xi. Why do the bigger size atoms have more shielding effect?

Ans. The bigger size atoms have more shielding effect because in bigger size atoms the number of inner shells and inner shell electrons increases which increases shielding effect.

xii. Why is the trend of electron affinity and electronegativity same in a period?

Ans. we the The trend of electron affinity and electro negativity is same in a period because when move from left to right in a period the size of an atom decreases and the attraction of nucleus for electrons increases. Therefore electron affinity as well as electro negativity increase from left to right in a period.

xiii. Which element has the highest electronegativity?

Ans. Fluorine (F) atom has the highest electronegativity value among all the elements. Its electronegativity value is 4.00.