Exercise :5 A

What is the need for classification of elements?

Solution:

Classification is necessary to make comparative study easier. Following are the reasons for classification of elements

- Classification allows the study of elements in an organised manner.
- It helps in correlating the properties of elements concerning fundamental properties of all states of matter.
- It defines the realationship of one element with another.

2. What was the basis of the earliest attempts made for classification and grouping of elements ?

Solution:

Basis of earliest attempts made for classification and grouping of elements is based on malleability, ductility and density and also to consider whether they are metals and nonmetals.

3. (a) A, B and C are the elements of a Dobereiner's triad. if the atomic mass of A is 7 and that of C is 39, what should be the atomic mass of B? (b) Why was Dobereiner's triad discarded ?

Solution:

Atomic. wt. of A = 7, At. wt. of C = 39

$$\text{At wt. of B} = \frac{\text{At. wt. of A} + \text{At. wt. of C}}{2} = \frac{7 + 39}{2} = 23$$

At. wt. of B = 23

i.e. Average of weights of A and C.

b) Dobereiner's triad discarded because it failed to arrange all the known elements in the form of triads.

4. Explain 'Newland's law of Octaves.' Why was the law discarded ?

Solution:

Newland's law of Octaves explains when elements are arranged by increasing atomic mass, the properties of every eighth element starting from any element are a repetition of the properties of the starting element.

Newland's law of Octaves was discarded for the following reasons

- Classification did not work with heavier elements beyond Calcium.
- Newland classified two elements Cobalt and Nickel in the same slot, and these were placed in the same column as Fluorine, Chlorine and Bromine.

- Iron which resembles Cobalt and Nickel, was placed far away from these elements.

5. Did Dobereiners triads also exist in the columns of Newland's Octaves ? Compare and find out.

Solution:

Yes, Döbereiner's triads also exist in the columns of Newland's octaves. For example, the second column of Newlands classification has the elements Lithium (Li), Sodium (Na) and Potassium (K), which constitute a Döbereiner's triad.

6. (a) Lithium. sodium and potassium elements were put in one group on the basis of their similar properties. What are those similar properties
(b) The elements calcium, strontium and barium were put in one group or family on the basis of their similar properties. Whit were those similar properties ?

Solution:

a)

- They have one electron in the outermost shell.
- They form unipositive ions
- they are good reducing agents
- All these are soft metals.
- All these metals impart colour to the flame
- The common name of the group is alkali metals [Group 1A].

b)

- All are metals
- Their oxides are alkaline
- Each has valency 2.

7. (a) What was Mendeleev's basis for classification of elements ?
(b) Meendeleev's contributions to the concept of periodic table laid the foundation for the Modern Periodic Table. Give reasons.

Solution:

a) The basis for Mendeleev's are as follows

- Similarities in the chemical properties of elements.
- Increasing order of atomic weights of elements.
- Periodicity of properties of elements

b) Mendeleev laid the foundation for the Modern Periodic Table by classifying 63 elements in increasing order of their atomic masses. He arranged them in 8 groups by leaving gaps for undiscovered elements and predicting their properties. He made separate groups for metals and non-metals. He also created periods in which the element gradually changes from metallic to non-metallic character. He was also able to show that the element in the same sub-group had the same valency.

8. State Mendeleev's periodic law.

Solution:

Mendeleev's periodic law states that the physical and chemical properties of all the elements are a periodic function of their atomic masses.

9. Use Mendeleev's periodic law to predict the formula of
(a) hydrides of carbon and silicon
(b) Oxides of potassium, aluminium and barium.

Solution:

a)
C is in Group 4. So, the hydride will be CH_4 (Methane).
Si is in Group 4. So, the hydride will be SiH_4 (Silane).

b)
K is in Group 1. So, the oxide will be K2O (Potassium oxide).
Al is in Group 3. So, the oxide will be Al2O3 (Aluminium oxide).
Ba is in Group 2. So, the oxide will be BaO (Barium oxide).

10. Which group of elements was missing from Mendeleev's original periodic table ?

Solution:

Anomalous pairs of elements like Argon, Cobalt and Tellurium were missing from Mendeleev's periodic table.

11. State the merits of Mendeleev's classification of elements.

Solution:

Merits of Mendeleev's classification of elements are as follows

- It generalised the study of the elements.
- Mendeleev left some gaps in his periodic table for subsequent inclusion of elements not known at that time.
- He predicted the properties of then-unknown elements on the basis of the property of elements lying adjacent to the vacant slots.

12. Why did Mendeleev leave some gaps in his periodic table of elements ? Explain your answer with an example.

Solution:

Mendeleev left some gaps in his periodic table of elements for the undiscovered elements. For example Mendeleev discovered eka-silicon with atomic mass of 72, which was later named Germanium with atomic mass 72.6.

13. The atomic number of an element is more important to the chemist than its relative atomic mass. Why?

Solution:

Atomic number represents number of the electron in an element. Most of the chemical property of an element depends on electrons in their outermost shell which is called as valency shell. Hence, the atomic number is more important to a chemist than its relative atomic mass.

14. Consider the following elements : Be, Li, Na, Ca, K. Name the elements of (a) same group (b) same period.

Solution:

a) Same IA group (Li, Na, K) and IIA group (Be, Ca)
b) In the second period (Be, Li) and in the fourth period (K, Ca)

15. (a) Name an element whose properties were predicted on the basis of its position in Mendeleev's periodic table.
(b) Name two elements whose atomic weights were corrected on the basis of their positions in Mendeleev's periodic table.
(c) How many elements were known at the time of Mendeleev's classification of elements?

Solution:

a) Eka- Silicon
b) Gold and Platinum
c) 63