Practice Challenge - Subjective

Subject: Chemistry

Topic : Periodic Table revision session_3

Class: X

Time: 00:20 hrs

1. What is Newland’s law of octaves? Explain with an example.

   According to Newlands' law of octaves, when elements are arranged in increasing order of their atomic masses, the properties of the eighth element are a repetition of the properties of the first element. Newlands divided the elements into horizontal rows. Each horizontal row had 7 elements.

   For example, let us take a row from Newlands' classification of elements. If we take the elements Li, Be, B, C, N, O, F and Na, lithium (Li) is the first element, and sodium, the eighth. It has been found that the properties of sodium are a repetition of the properties of lithium. In short, both lithium and sodium have similar chemical properties.

2. What is Debereiner’s law of triads? Explain with the help of one example of a Dobereiner’s triad.

   According to Dobereiner's law of triads, when elements are arranged in increasing order of their atomic masses, a group of three elements with similar chemical properties is obtained. This group is called a triad. The atomic mass of the middle element is equal to the arithmetic mean of the atomic masses of the other two elements.

   For example, the set of elements: calcium (Ca), strontium (Sr) and barium (Ba), with atomic masses 40, 88 and 137 respectively form a triad because they have similar chemical properties, and the atomic mass of strontium is approximately equal to the average of the atomic masses of calcium and barium.

   Arithmetic mean of atomic masses of calcium and barium = $\frac{40+137}{2} = 88.5$

Copyright © Think and Learn Pvt. Ltd.

3. Can the following groups of elements be classified as Dobereiner's triads?

(a) Na, Si, Cl (b) Be, Mg, Ca

Give the reason for your answer.

(Atomic masses : Be = 9; Na = 23; Mg = 24 ; Si = 28 ; Cl = 35.5; Ca = 40)

(a) The atomic masses of Na, Si and Cl are 23, 28 and 35.5 respectively. According to Dobereiner's law of triads, when elements are arranged in the increasing order of their atomic masses, a three element group with similar chemical properties is obtained. The atomic mass of the middle element is equal to the arithmetic mean of the atomic masses of the other two.

The above set of elements does not form a triad because arithmetic mean of the atomic masses of Na and Cl = $\frac{(23+35.5)}{2} = 29.25$
This value is approximately equal to the atomic mass of silicon, but they do not form a triad because the elements do not exhibit similar chemical properties.

(b) The set of elements Be, Mg and Ca with atomic masses 9, 24 and 40 respectively, form a triad because they have similar chemical properties and the atomic mass of magnesium (Mg) is approximately equal to the average of the atomic masses of beryllium (Be) and calcium (Ca).
The arithmetic mean of the atomic masses of Be and Ca = $\frac{(9+40)}{2} = 24.5$ which is approximately equal to 24.

4. How could the modern periodic table remove various anomalies of Mendleev's periodic table?

Various anomalies are removed in the following ways:

(1) The position for all isotopes of an element justified since they have same atomic number.

(2) The position of certain elements which were earlier misfit like Co- 58.9 was placed before Ni- 58.7, are now justified because Co has lower atomic number than Ni.

(3) Cause of periodicity explained due to repeatition of same electronic configuration and valence electrons after certain gap.

Copyright © Think and Learn Pvt. Ltd.

Practice Challenge - Subjective

5. A metal X is in the first group of the periodic table. What will be the formula of its oxide?

The elements in the first group of the periodic table have a valency of 1. As the metal X is in the first group, its valency is 1. We know that the valency of oxygen is 2 because it needs two electrons to complete its outer shell of 8. From this, we can conclude that two atoms of metal X will combine with one atom of oxygen to form an oxide X_2O. Therefore, the formula of the oxide of metal X is X_2O.

6. Element X forms a chloride with the formula XCl_2, which is a solid with a high melting point. X would most likely be in the same group of the Periodic Table as

(a) Na
(b) Mg
(c) Al
(d) Si

Valency of X in the given compound is 2. Among the given elements, only Mg is present in the group 2 of periodic table. So the element X is Mg and it form the compound $MgCl_2$.

7. Elements with configuration 2, 8, 2 and 2, 7 are placed in modern periodic table. Find out:

1. the valency of the elements mentioned above.
2. the period and group of the above elements.

1. Element with electronic configuration 2, 8, 2 is magnesium and it has a valency of 2, as it is easy for Mg to lose 2 electrons and attain the nearest noble gas configuration.
Element with electronic configuration 2, 7 is fluorine and it has a valency of 1, as it can accept one electron and attain the nearest noble gas configuration.
2. Element with electronic configuration 2, 8, 2 belongs to 3rd period and 2nd group.
Element with electronic configuration 2, 7 belongs to 2nd period and 17th group.

Copyright © Think and Learn Pvt. Ltd.

8. (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?

(a) As per Dobereiner's triads, when element are arranged in the order of increasing atomic masses, groups of three elements, having similar chemical properties are obtained. The atomic mass of the middle element of the triad being equal to the arithmetic mean of the atomic masses of the other two elements. Thus,
(atomic mass of A + atomic mass of C)/2 = atomic mass of B

(7+39)/2

46/2=23

Atomic mass of B is 23.

(b) Dobereiner's law of triads failed for the following reasons :

- All the then known elements could not be arranged in the form of triads.
- For very low mass or for very high mass elements, the law was not holding good.
  Example: F, Cl, Br. Atomic mass of Cl is not an arithmetic mean of atomic masses of F and Br.

Copyright © Think and Learn Pvt. Ltd.