

Chapter 5: Periodic Classification of Elements

1) Dobereiner's triads do not exist in Newland's Octaves. Is the above statement true? If true, Justify.

Ans.

False. Dobereiner's triads do exist in Newland's Octaves. For example, the elements

Lithium(Li), Potassium(K) and Sodium(Na) constitute a Dobereiner's Triad but are also found in the second column of Newland's Octaves.

2) What were the anomalies of Dobereiner's classification?

Ans.

- i. They were not applicable for very low mass or very high mass elements.
- ii. All the elements couldn't fit into Dobereiner's triads.
- iii. As the methods to calculate atomic mass improved, Dobereiner's triads validity began to decrease. For example, in the triad of F, Cl and Br, the arithmetic mean of atomic masses of F and Br is not equal to the atomic mass of Cl.

3) Why did Newland's Law of Octaves fail to completely answer all the questions of atomic mysteries?

Ans.

- (i) Elements discovered later like the noble gases couldn't fit into his table.
- (ii) The law was not valid for atomic masses higher than Ca.

4) Predict the formulae for the oxides of the following elements: Si, K, Ba, Al, Ca using Mendeleev's periodic table.

Ans.

Si- SiO_2

K – K_2O

Ba-BaO

Al-Al₂O₃

Ca -CaO

5) Which are the other elements other than Gallium that Mendeleev left in his periodic table,

Ans.

since the time they were discovered?

Germanium and Scandium

6) What were the characteristics of the atoms that Mendeleev concentrated upon while creating his periodic table?

Ans.

He concentrated on the various compounds formed by the elements with Hydrogen and

Oxygen. Among physical properties, he observed the relationship between the atomic masses of various elements.

7) Justify the placement of noble gases in a separate group.

Ans.

They had to be placed in a separate group due to their inert nature and low concentration in our atmosphere so that they don't disturb the existing order.

8) What were the limitations of Mendeleev's table and how did the modern periodic table solve them?

Ans.

The various anomalies of Mendeleev include the position of hydrogen, anomalous pair of isotopes, position of lanthanides and actinides etc. These limitations were overcome in the modern periodic table by adopting Atomic number as the main criteria instead of atomic mass.

9) Suggest two elements whose reactions are similar to that of Magnesium.

What is the basis of your choice?

Ans.

Calcium and Beryllium

This is because all the three elements belong to the same group and have 2 valence electrons in their outer shell.

10) Mention:

a) Two elements that have filled outermost shells

b) Two elements with a single electron in their outermost shells

c) Two elements with two electrons in the outermost shell

Ans.

a) Helium, Neon

b) Sodium, lithium

c) Magnesium, Calcium

11) a) What is the similarity in the manner in which Lithium, Sodium and Potassium react with water to liberate Hydrogen gas?

Ans.

They've one valence electron in their outermost shells and as a result of this, they are very unstable. So, they readily react with water to liberate hydrogen. They are also called alkali metals.

b) What is that common characteristic of Helium and Neon that is responsible for them having almost zero reactivity?

Ans.

Their outermost shells are full leading to high stability. They react only in extreme circumstances and hence are called as noble gases.

12) In the first ten elements, which are those that are metals?

Ans.

Lithium and Beryllium

13) Which of the following elements exhibits the maximum metallic character?

Al, Si, P, S, Cl

Ans.

Cl(chlorine) shows the maximum metallic character

14) Which of the following statements that show the trends while moving from left to right in a periodic table are wrong?

Ans.

(a) The acidity of oxides increase

(b) No of valence electrons in the outermost shell increases

(c) Metallic character of elements decrease

(d) Atoms lose their electrons readily

The incorrect statement is (d).

15) An element A forms a chloride which has formula ACl_2 . ACl_2 is a solid having a high melting point. Which of the following elements A most likely represents?

Mg, Na, Si, Al

Ans.

'A' most likely represents Mg.

16) Name the element which has

a) Two completely filled shells

b) Three shells and four electrons in its outermost(valence) shell

c) Twice the number of electrons in its second shell than it has in the first shell

d) Two shells and three electrons in its outermost(valence) shell

e) An electronic configuration of 2,8,2

Ans.

a) Neon

b) Silicon

c) Carbon

d) Boron

e) Magnesium

17) What is the common characteristic that all the elements in the column where fluoride is, exhibit?

Ans.

They all have seven electrons in their outermost shell or the valence shell and they mostly form salts in combination with the alkali metals.

18) Name the element which has an electronic configuration of 2,8,7.

Ans.

Chlorine

19) Which of the following duo- Nitrogen and Phosphorous is more electronegative? Why?

Ans.

Nitrogen will be more electronegative since its atom has a smaller size and thus has a larger attractive force from the nucleus towards the incoming electron.

20) How does an atom's electronic configuration affect its position in the periodic table?

Ans.

The number of valence electrons decides an atom's position in the periodic table while the electronic configuration decides the number of valence electrons.

21) Why do you think Hydrogen should be placed with the alkali metals?

Ans.

Hydrogen should be placed above alkali metals because its electronic configuration resembles that of alkali metals.

22) Calcium with atomic number 20 is surrounded by elements in the modern periodic table with atomic numbers 12, 19, 21 and 38. Which of these elements resemble calcium?

Ans.

Calcium has an atomic number of 20, and thus has an electronic configuration of 2, 8, 8, 2. Thus, calcium has 2 valence electrons. The electronic configuration of the element having atomic number 12 is 2, 8, 2. Thus, this element with 2 valence electrons will resemble calcium the most.