Periodic Classification of Elements

CHAPTER 5

TRY YOURSELF

ANSWERS

1. (i) Increasing atomic masses and (ii) Grouping of similar elements together, *i.e.,* similarity in the formulae of hydrides and oxides of elements.

2. (a) Newland's law of octaves

(b) Because in this classification, the repetition in the properties of elements is just like the repetition of eight notes in an octave of music.

(c) This could be applied only up to the element calcium and not beyond that.

3. Mendeleev observed relationship between the atomic masses of the elements and their physical and chemical properties. He formulated the periodic law on the basis of atomic masses of the elements.

Limitations (i) The position of hydrogen was uncertain in the periodic table.

(ii) The isotopes of elements were not given proper position.

4. K_2O, CO_2, Al_2O_3, SiO_2, BaO

5. This is because every 8^{th} element in 2^{nd} and 3^{rd} period have similar valence shell electronic configurations and lie in the same group of the periodic table. That is why, every 8^{th} element in 2^{nd} and 3^{rd} period of the periodic table has similar properties.

6. Halogens – Group 17, Alkali metals – Group 1.

Inert gases - Group 18

7. Third period – 8 Elements

Fourth period – 18 Elements

Sixth period – 32 Elements

8. Yes, valency is a periodic property. On moving across a period, the valency of the elements first increases from 1 to 4 and then decreases to 0.

9. Magnesium is a group 2 element.

Valency of magnesium = No. of valence electrons = 2

Nitrogen is a group 15 element

Valency of nitrogen = 8 – no. of valence electrons

= 8 – 5 = 3

10. Fluorine, chlorine and bromine belong to group 17. The valency of all the group 17 elements is 1.

11. On moving from left to right along a period, atomic radius decreases because effective nuclear charge increases. On moving down a group, the number of shells increases, hence, atomic radius increases.

12. As we move from left to right in a period, the atomic number of each succeeding element increases by 1. This means that number of protons in the nucleus and the number of electrons in the extra-nuclear part increases by 1. The addition of this extra electron takes place in the same shell. But the addition of an extra proton to the nucleus increases the nuclear charge by 1 in each succeeding element. Due to this increased nuclear charge, the electrons are attracted closer to the nucleus and hence the atomic size decreases.

13. Fluorine, chlorine, bromine (all are group 17 elements) have seven electrons in their outermost shell. The non-metallic character decreases down the group hence the non-metallic character decreases as : F > Cl > Br

Atomic size increases down the group, hence the atomic size increases as : F < Cl < Br

14. Generally metals possess 1, 2 or 3 electrons in their respective valence shells and thus, to acquire stable electronic configuration they have a strong tendency to lose electrons to form positive ions. Therefore, metals are electropositive in nature. Non-metals on the other hand, generally have 4 to 8 electrons in their respective outermost shells and thus, to acquire stable electronic configuration they have a tendency to gain electrons to form negative ions. Hence, non-metals are electronegative in nature.

15. As we move down a group in the periodic table, atomic size gradually increases. As a result, the force of attraction between the nucleus and the valence electrons decreases. Therefore, the tendency of the element to lose electrons to form positive ions increases and hence the metallic or the electropositive character increases as we move down the group.

16. Elements of third period,

Na, Mg, Al	Si	P, S, Cl
Metals	Metalloid	Non-metals

Nature of Elements

Metallic character decreases →

Non-metallic character increases

In the third period, sodium, magnesium and aluminium are metals. The properties of silicon are in between those of

metals and non-metals. Therefore, silicon is a metalloid or a semi-metal. The next elements, phosphorus, sulphur and chlorine are non-metals.

17. The chemical reactivity of non-metals depends upon their tendency to gain or accept electrons to acquire the stable electronic configuration of the nearest noble gas. As we move down the group, their tendency to gain electrons decreases due to an increase in their atomic size. As a result, their tendency to accept electrons decreases and hence the reactivity of non-metals decreases as we move down the group.

18. The chemical reactivity of alkali metals increases from top to bottom in a group. The reason being that the chemical reactivity of metals depends upon their tendency to lose electrons. As we move down the group, their tendency to lose electrons increases due to increase in atomic size and hence, the reactivity increases.

19. Since the oxides of metals are basic and those of non-metals are acidic, therefore, as we move from left to right across a period, the acidic character increases and on moving down the group acidic character decreases.

20. (i) As the oxide A_2O is basic in nature, hence A is a metal. Formula of the oxide (A_2O) indicates valency of A is 1. Hence, number of electrons in the outermost shell of the element A is 1.

(ii) A belongs to group 1 of the periodic table.

(iii) It is a metal.

21. (i) $\text{Electronegativity} \propto \frac{1}{\text{Atomic radius}}$

As the atomic radius decreases, the value of electronegativity increases.

(ii) Electronegativity $\propto$ Effective nuclear charge.

As the effective nuclear charge increases, the value of electronegativity increases.

22. Electronegativity increases along a period from left to right and decreases down a group. Hence, among the given elements, F is most electronegative and Na is least electronegative.

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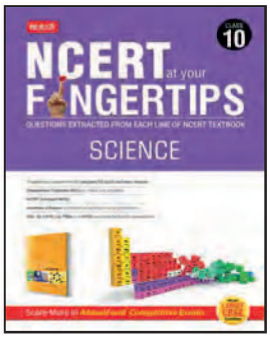

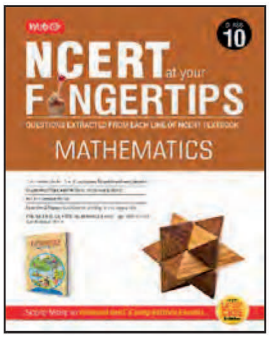

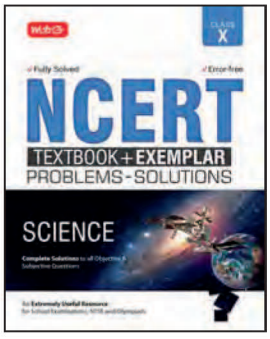

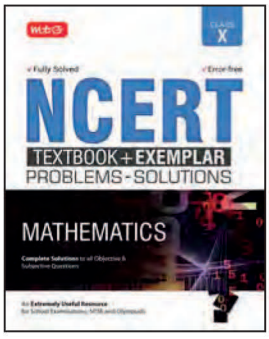

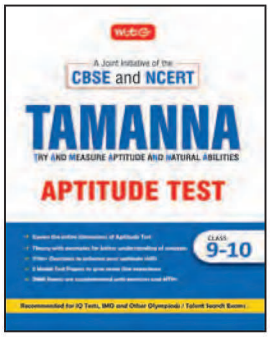

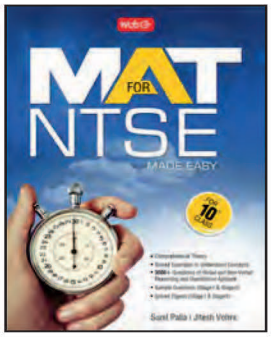

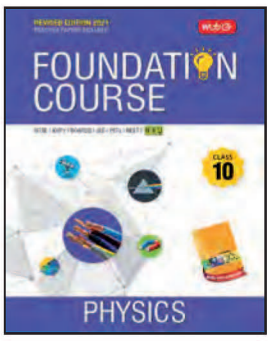

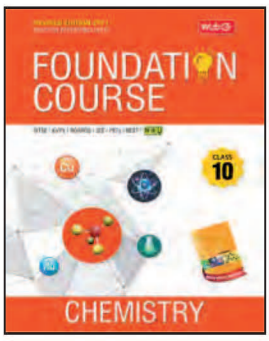

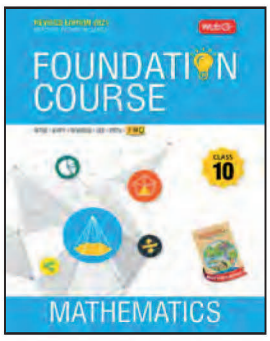

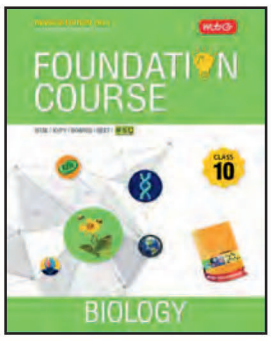

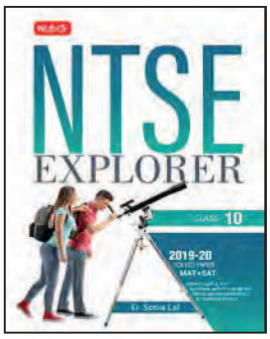

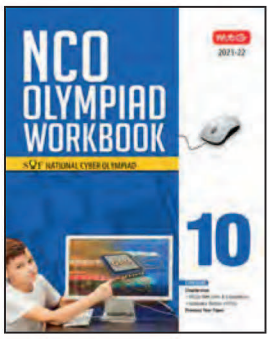

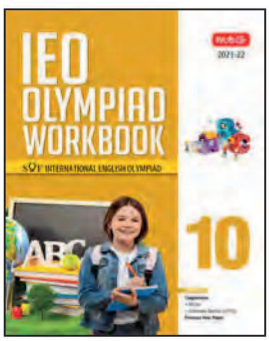

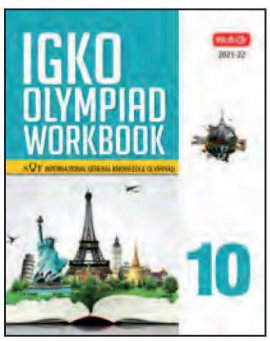

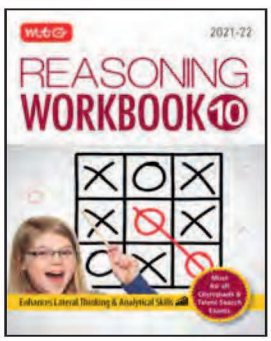

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