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Class	9th	Chapter	08
Subject	Solved	Board	Punjab

CHAPTER 8: PERIODIC TABLE AND PERIODICITY

EXERCISE MULTIPLE CHOICE QUESTIONS (MCQs)

(i) In which period and group will you place the element which is an important part of the solar cell?

Answer: (a) Third period and 14th group.

(ii) Identify the electronic configuration of the outermost shell of a transition metal.

Answer: (b) $nd^x\ ns^2$

(iii) Which is the softest metal?

Answer: (a) Na

(iv) A yellow solid element exists in allotropic forms which is also present in fossil fuels. Indicate the name.

Answer: (d) Sulphur

(v) How many electrons can nitrogen accept in its outermost shell?

Answer: (b) 3

(vi) Which element is the most reactive element?

Answer: (c) Fluorine

(vii) Which element has the highest melting point?

Answer: (b) K

(viii) In what order does the metallic character change in the second group?

Answer: (d) Ba > Sr > Ca > Mg

(ix) Which of the following best describes the correct order of oxygen, fluorine, and nitrogen's atomic radii?

Answer: (c) F < O < N

(x) The element having less value of ionization energy and less value of electron affinity is likely to belong to:

Answer: (a) Group 1

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EXERCISE QUESTIONS FOR SHORT ANSWERS

(i) Why was atomic number chosen to arrange the elements in the periodic table?

Answer: Atomic number was chosen because it represents the fundamental property of an atom (number of protons or nuclear charge), which dictates electronic configuration and chemical periodicity more reliably than atomic mass.

(ii) What is the significance of the word periodic?

Answer: The word periodic signifies the regular, recurring pattern or repetition of similar chemical and physical properties of elements after fixed intervals when arranged in order of increasing atomic numbers.

(iii) Why does the size of a period increase as we move down the periodic table?

Answer: The size or length of a period increases down the periodic table because successive periods involve filling higher principal energy levels (shells), which can accommodate a larger number of electrons due to the availability of more subshells (s, p, d, f).

(iv) In a group, the elements have the same number of electrons in the outermost shell. Why is it so?

Answer: Elements are placed in the same group because they share similar valence-shell electronic configurations, which is the primary reason they exhibit similar chemical properties.

(v) Do you expect calcium to be more reactive than sodium? Give the reason for your answer.

Answer: No, sodium is more reactive than calcium because sodium belongs to Group 1 (alkali metals) with only one valence electron that is very easily lost, whereas calcium belongs to Group 2 with two valence electrons held more tightly by a higher effective nuclear charge.

(vi) Which element has the maximum atomic radius and which element has the minimum atomic radius in the third period?

Answer: Sodium (Na) has the maximum atomic radius, while chlorine (Cl) has a smaller atomic radius than sodium and is among the smallest atoms in the third period. This is because nuclear charge increases across the period, pulling electrons closer to the nucleus.

(vii) Why are the most electronegative elements present in the sixth and seventh groups?

Answer: The most electronegative elements are located on the upper-right side of the periodic table because they have small atomic radii and high nuclear attraction, enabling them to attract shared electron pairs strongly.

(viii) The first ionization energy value of magnesium is less than the second one. Give a reason.

Answer: Removing the first electron from a neutral magnesium atom requires less energy than removing the second electron from the positively charged magnesium ion (Mg^{+}). The second electron is removed from an ion with a greater positive charge, so more energy is required.

(ix) Is it possible for two metals or two non-metals to form an ionic bond?

Answer: Generally, an ionic bond forms between a metal and a non-metal because of a large electronegativity difference that favours electron transfer. Two metals typically form metallic bonds, while two non-metals usually form covalent bonds.

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EXERCISE CONSTRUCTED RESPONSE QUESTIONS

(i) Suppose a new element is discovered. Where would you like to accommodate this element in the periodic table?

Answer: A newly discovered element would be accommodated based on its atomic number and outer-shell electronic configuration, placing it in the group and period that match its chemical and physical properties.

(ii) What is the first element of the periodic table? Will it lose an electron or gain it?

Answer: The first element is hydrogen. It can gain an electron to achieve a stable noble-gas configuration by forming a hydride ion (H^-), or it can lose an electron to form H^+, depending on the reacting partner. Hydrogen also shares electrons in covalent bonds.

(iii) Atomic radii of boron and aluminium are 88 pm and 125 pm, respectively. Which element is expected to lose electron or electrons easily?

Answer: Aluminium is expected to lose electrons more easily because its larger atomic radius means its outer electrons are farther from the nucleus and experience weaker nuclear attraction, resulting in lower ionization energy.

(iv) How would you find the atomic radius of an atom?

Answer: The atomic radius can be found by measuring half the distance between the nuclei of two identical atoms bonded together in a molecule or crystal lattice. Depending on the type of bonding, this may be described as a covalent or metallic radius.

(v) Why is it not possible for an oxygen atom to accept three electrons to form an O^{3-} ion like nitrogen, which can accept electrons to form N^{3-}?

Answer: Oxygen already has six valence electrons and a relatively small atomic size. Adding three electrons would create excessive electron-electron repulsion in its compact valence shell, making an O^{3-} ion energetically unstable.

EXERCISE DESCRIPTIVE QUESTIONS

(i) Which information is needed to locate the elements in the periodic table if you do not know their atomic number? Is atomic mass helpful for this purpose?

Answer: If the atomic number is unknown, electronic configuration, valence electrons, and chemical behaviour can help locate an element. Atomic mass may be helpful in estimating the approximate position, but atomic number is the basis of the modern periodic table.

(ii) How many blocks of elements are present in the periodic table? Are these blocks helpful in studying the properties of elements?

Answer: There are four blocks of elements: s, p, d, and f. These blocks are helpful because elements within the same block have similar subshell-filling patterns and often show related chemical and physical properties.

(iii) Explain the variation in the following properties in the periods, giving reasons: (a) Atomic radius, (b) Ionization energy.

Answer:

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(a) Atomic radius: Atomic radius generally decreases across a period from left to right because increasing nuclear charge pulls the electron cloud closer to the nucleus.

(b) Ionization energy: Ionization energy generally increases across a period from left to right because increasing nuclear charge and decreasing atomic radius make it harder to remove valence electrons.

(iv) Which physical properties of elements may help us know what type of bond will form?

Answer: Properties such as electrical conductivity, melting point, physical state, and metallic lustre, along with electronegativity differences, help indicate whether elements will form ionic, covalent, or metallic bonds.

(v) Write down the names of four non-metals which exist in the solid state at normal temperature.

Answer:

1. Carbon (graphite or diamond)
2. Sulphur
3. Phosphorus
4. Iodine

(vi) Why do the second and third periods have an equal number of elements while all other periods contain different numbers of elements?

Answer: The second and third periods contain eight elements each because they involve filling the 2s and 2p subshells in the second period and the 3s and 3p subshells in the third period. These subshells can accommodate eight electrons in total. Other periods involve d and f subshells, which accommodate additional electrons and therefore contain more elements.

EXERCISE INVESTIGATIVE QUESTIONS

(i) Arrangement of the elements in the form of a periodic table is a remarkable achievement of chemists. Comment on this statement, citing the benefits of this table.

Answer: The periodic table systematically organizes all known elements, helps predict the properties of undiscovered elements, explains periodic trends in reactivity and bonding, and provides valuable information about atomic structure. It serves as a foundation for the study of chemistry.

(ii) Both lithium and beryllium show behaviour different from the rest of the alkali and alkaline earth metals, respectively. Can you think of the possible reasons for this difference?

Answer: Lithium and beryllium show unusual behaviour compared with other members of their respective groups because of their very small atomic sizes, high charge-to-radius ratios, strong polarizing power, and relatively high electronegativity. These characteristics contribute to their distinctive chemical properties.

(iii) The modern periodic table is the amended form of the earlier table developed by Mendeleev. Elaborate on how these tables are different from each other.

Answer: Mendeleev's periodic table arranged elements mainly in order of increasing atomic mass and left gaps for undiscovered elements. Some elements did not fit perfectly into the mass-based order. The modern periodic table

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arranges elements according to increasing atomic number, resolves these anomalies, organizes elements into s, p, d, and f blocks, and includes noble gases.

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