Atomic Radius in Periodic Table Questions with Solutions

Q1: Why does the size of the elements increase on moving down the groups in a Periodic Table?

Answer: This is because there takes place an addition of energy levels as we move down in a group in the Periodic Table. As the number of energy levels increases, the size of the atoms also increases.

Q2. How can the Atomic Size be measured?

Answer: The Atomic Size of an element can be measured by measuring the distance between the nuclei of two atoms that are directly in contact with each other. This distance is noted and halved to determine the approximate size of an atom.

Q3. What is an Atomic Radius?

Answer: Atomic Radius is the distance between the nucleus of an atom to its outermost electronic energy level (outermost orbital). The Atomic Radius can also be defined as the mean distance from the nucleus of an atom to the boundary of subshells containing electrons.

Q4. What is the unit of measurement of the Atomic Radius?

Answer: The Atomic Radius of elements is so small that it is measured on an Angstrom (Å) scale.
$$1 \text{ Å} = 10^{-10} \text{ m} = 10^{-8} \text{ cm}$$

Q5. How does the Atomic Radius change within a group and in a period in a Periodic Table?

Answer: On moving to the right of a period, the Atomic Radius of elements decreases with an increase in the atomic number. And on moving down the group, the Atomic Radius increases due to the increase in the number of energy levels.

Q6. What is an Ionic Radius? How can it be measured?

Answer: Ionic Radius is the distance measured from the nucleus of an atom to the point where it has an influence on its electronic cloud. The Ionic Radius can be measured by measuring the distance between the two neighbouring ions in a crystal structure.

Q7. What is the range of the Atomic Radius of the Periodic Table Elements?

Answer: The Atomic Radius of the elements is too small and limited to some extent. The Atomic Radius of elements ranges from 30 PM to 300 PM.

Q8. _____ has the largest Atomic Radius.
  a. Francium
  b. Rubidium
  c. Chlorine
  d. Fluorine

Answer: (a)

Explanation: Francium has the largest Atomic Radius in the Periodic Table.

Q9. Pick the correct order of the Atomic Radius.
  a. K > Na
  b. F > Cl
  c. Fr < Cl
  d. Fe < C

Answer: (a)

Explanation: Potassium (K) lies in the fourth period, while Sodium (Na) lies in the third period. As the radius of elements increases on moving down in a group, the Atomic Radius of K is bigger than Na. So, option (a) is correct.

Q10. Comment on the sizes of metals and non-metals.

Answer: The non-metals exist in the right-most corner of the periodic table, and the metals exist in the left-most corner of the periodic table. As the Atomic Radius decreases on moving from left to right in a period, the size of non-metals is smaller than the size of the metals. The metals, in fact, have the largest size in a period.

Q11. Compare the sizes of Fluorine and Chlorine on the basis of their electronic configurations.

Answer: Fluorine exists in the second period, while Chlorine exists in the third period. The electronic configuration of Fluorine and Chlorine is given below.
F: $[He] 2s^2 2p^5$
Cl: $[Ne] 3s^2 3p^5 = [He] 2s^2 2p^6 3s^2 3p^5$
The above two electronic configurations show that Chlorine has 1 extra energy level than Fluorine. Due to this reason, Chlorine is larger in size than Fluorine.

Q12. The Atomic Radius increases due to an increase in the _____.
  a. Number of Electrons
  b. Number of Protons
  c. Number of Electronic Shells
  d. None of the above

Answer: (c)

Explanation: The Electronic Shells are the energy levels of an atom in which the electrons are present. As the number of electronic shells increases, the size of an atom also increases.

Q13. The decrease in Atomic Size is very prominent in _____.
   a. The First Period
   b. The Second Period
   c. The Third Period
   d. The Fourth Period

Answer: (b)

Explanation: The decrease in the Atomic Size on moving from left to right is most prominent in the Second Period. This is because of the following factors:
   1. The electronegativity of elements increases significantly towards the right.
   2. The Atomic Radius of the elements decreases.
   3. The Ionization Enthalpy increases.

Q14. The Ionic Species O^{2-}, F^-, Na^+, and Mg^{2+} are:
   a. Isoelectronic Species
   b. Isotopes
   c. Isomers
   d. None of the above

Answer: (a)

Explanation: All of the given species have 10 electrons. Thus, they are Isoelectronic Species.

Q15. The condition required for the chemical reaction: $X \rightarrow X^+ + e^-$ is_____.
   a. The use of a Catalyst
   b. Electron Affinity
   c. Ionization Energy
   d. None of the above

Answer: (c.)

Explanation: Ionization Energy is the energy given to isolate or remove an electron from the neutral gaseous atom.

Practice Questions on Atomic Radius in Periodic Table

Q1. Why does the Radius of atoms decreases on going from left to right in a period?

Answer: This is because, as we move from left to right in a period, the atomic number of elements increases in sequential order. With an increase in the atomic number, the number of protons inside the nucleus increases, and the number of electrons also increases within the same energy level. So, the nuclear pull on the electrons increases. Due to this gradual increase in the nuclear pull within the same energy level, the size of the atoms decreases on moving from left to right in a period.

Q2. State whether the following statement is true or false.
The value of Ionization Enthalpy is always positive for a reaction.
   a. True
   b. False

Answer: (a)

Explanation: For the removal of an electron from a neutral atom, the energy is always given to the atom. This is why the Ionization Enthalpy value is always positive for a chemical reaction.

Q3. The Oxidation State of Mn in $KMnO_4$ is _____.
   a. 4
   b. 5
   c. 6
   d. 7

Answer: (d)

Explanation: The given compound $KMnO_4$ is neutral. So, the sum of the charges of all the ions present in the compound is zero. This gives:
(Charge on one K ion) + (Charge on one Mn Ion) + (Charge on 4 oxygen ions) = 0
The charge on 1 K ion is +1, on 1 oxygen ion is -2 and let the charge on 1 Mn ion be x.
$$(+1) + (x) + 4(-2) = 0$$
$$x - 7 = 0$$
$$x = +7$$
Hence, the oxidation state on Mn in $KMnO_4$ is +7.

Q4. The compounds that can be tested with a litmus paper are:
   a. Only acids
   b. Only bases
   c. Both acids and bases
   d. None of the above

Answer: (c)

Explanation: The litmus paper turns red in an acidic solution and blue in a basic solution.

Q5. The elements Li, Mg, Be, and Al, are in a _____ relationship.
   a. Diagonal
   b. Triangular
   c. Periodical
   d. Group

Answer: (a)

Explanation: These elements form similar compounds in similar compositions. These elements also possess similar behaviour and properties. So, these elements are said to be in a diagonal relationship.