Periodic Classification Of Elements

Assess Yourself

Q. 1. How does non-metallic character vary from left to right in a period?

Answer: Non- metallic character increases from left to right in a period because effective nuclear charge increases from left to right in a period. Due to this effective nuclear charge, the electronegativity increases and the tendency of gaining electrons also increases. So non- metallic character increases from left to right in a period.

Note-

(i) Effective nuclear charge is defined as the charge per unit volume.

(ii) From left to right in a period, the effective nuclear charge increases because charge increases from left to right due to increment of proton. But the size remains same because number of shells remains same from left to right in a period.

(iii) From top to bottom in a group, the effective nuclear charge decreases because charge increases down a group due to increment of proton and the size of elements also increases due to increment in shells.

Q. 2. How does electropositive character of elements in a period vary from left to right?

Answer: Electropositive character of elements decreases in a period because effective nuclear charge increases from left to right in a period. Due to this effective nuclear charge, the electronegativity increases and the attraction of nucleus on valence shell electrons also increases. So the tendency of losing electrons decreases. Hence the electropositive character of elements decreases in a period.

Note- Non-metals always gain electrons and metals lose their electrons.

Q. 3. How does metallic character vary down a group?

Answer: Metallic character increases down a group because the size of elements increases down a group due to increment in the shells. So the effective nuclear charge decreases down a group. Due to this effective nuclear charge, the electronegativity decreases and the attraction of nucleus on valence shell electrons also decreases. So the tendency of losing electrons increases. Hence metallic character increases down a group.

Q. 4. How does the elements having similar properties are placed in the same group or period?

Answer: Elements are placed in groups have same number of valence electrons.

Ex- Elements Na and K of first group have 1 valence electron.

Elements are placed in period have same number of shells.

Ex- Elements C, N and O of second period have K and L shells.

Q. 5. Which has smaller size; Na or Na^+?

Answer: Na^+ is smaller than Na because Na^+ has less number of electrons and its last electrons are in L shell as compared to Na which has last electron in M shell but both have same number of protons. So the attraction of nucleus on valence electrons become strong in Na^+ than Na. Hence the size of Na^+ become smaller than Na.

Q. 6. Which has bigger size; Cl or Cl^-?

Answer: Cl^- has bigger size as compared to Cl because Cl- has more number of electrons than Cl and nucleus can hold less electrons tightly than more electrons. So the attraction on Cl^- become less. Hence, the Size of Cl^- become bigger than Cl.

Q. 7. An element 'X' belongs to the second group of periodic table. What is the formula of its chloride?

Answer: Since element X belongs to second group so element X has 2 valence electrons. Hence the formula of its chloride will be XCl_2.

Q. 8. An element 'B' belongs to the second period and Group 13. Give the formula of its oxide.

Answer: Since element B belongs to 13 group and second period so element B has 3 valence electrons and 2 shells. Hence the oxide of B will be B_2O_3.

Q. 9. Give two examples of elements of Groups 1, 2, 16 and 17.

Answer: The examples of elements are:

Group 1- Sodium (Na)

Potassium (K)

Group 2- Beryllium (Be)

Magnesium (Mg)

Group 16- Oxygen (O)

Sulphur (S)

Group 17- Fluorine (F)

Chlorine (Cl)

Q. 10. What is the number of valence electrons in the last element of the 3rd size?

Answer: The last element of third size means last element of third period and the last element of third period is Argon (Ar) which has 8 valence electrons.

Q. 11. Which one has the bigger size?

Na (11) or Cl (17); Cl (17) or F (9)

Answer: (i) Na has bigger size than Cl because effective nuclear charge increases from left to right in a period. Due to this effective nuclear charge, the electronegativity increases and the attraction of nucleus on valence shell electrons also increases. So the size of atom reduces.

(ii) Cl has bigger size than F because number of shells increases down a group. So the size of atom also increases down a group.

Q. 12. Which one has the smaller size?

K (19) or Na (1); B (5) or C (6)

Answer: (i) Na has the smaller size than K because number of shells increases down a group. So the size of atom increases down a group. Hence K is bigger and Na is smaller.

(ii) C has smaller size than B because effective nuclear charge increases from left to right in a period. Due to this effective nuclear charge, the electronegativity increases and the attraction of nucleus on valence shell electrons also increases. So the size of atom reduces. Hence C has smaller size.

Q. 13. Calcium is an element with atomic number 20.

(i) Is it a metal or non-metal?

(ii) Is it more reactive than Mg or less?

(iii) What will be its valency?

(iv) What will be the formula of its Chloride?

(v) Will it be larger than K or smaller?

Answer: (i) Ca is a metal because it contains 2 valence electrons. So it will lose these electrons to acquire stable noble gas electronic configuration.

Ca20- 2, 8, 8, 2

(ii) Yes, Ca is more reactive than Mg because the size of Ca is bigger than Mg. Due to this bigger size, the effective nuclear charge decreases so the attraction of nucleus on valence electrons decreases. So Ca will lose its valence electrons more easily than Mg.

(iii) Ca has two valence electrons so its valency will be 2.

(iv) Ca has two valence electrons and it will lose these two electrons so the formula of its chloride will be $CaCl_2$.

(v) Ca is smaller than K because effective nuclear charge increases from left to right in a period. Due to this effective nuclear charge, the electronegativity increases and the attraction of the nucleus on valence shell electrons also increases. So the size decreases.

Q. 14. For the main groups of periodic table given as follows:

1	2	13	14	15	16	17	18
H							He
A						B	
C						D	

(a) Which element is the most metallic?
(b) Which atom is the largest?

Answer: (a) We know that metallic character decreases from left to right in a period and metallic character increases down a group. So element C is the most metallic.

(b) We know that the size of atom decreases from left to right in a period and size of atom increases down a group. So atom C is the largest.

Q. 15.

1	2	13	14	15	16	17	18
			Carbon		Oxygen	L	Neon
X			S		G	Q	
Y						R	
Z						T	

(a) Which is the most reactive metal?

(b) Which is the most reactive non-metal?

(c) Name the family of L, Q, R, T

(d) Name one element from each of groups 2, 13 and 15.

Answer: (a) Most reactive metal is Z because size of atom increases down a group and effective nuclear charge decreases. The attraction of nucleus on valence electrons also decreases. So, the tendency of losing electrons increases. Hence reactivity increases.

(b) We know that electronegativity of non-metals increases from left to right in a period due to the increment of effective nuclear charge and decreases down a group due to the increment of size of atom. So, the most reactive non-metal is L.

(c) L, Q, R, T are the elements of the halogen family.

(d) Group 2- Magnesium (Mg)

Group 13- Boron (B)

Group 15- Nitrogen (N)

Q. 16. This question refers to the elements of the periodic table with atomic numbers 3 to 18.

(a) (i) Which of them are noble gases?

(ii) Which of them are halogens?

(iii) Which of them are akali metals?

(iv) Which are the elements with valency 4?

(b) An element with atomic no. 3 combines with another element with atomic number 17; what would be the formula of the compound?

(c) What is the electronic configuration of an element with atomic number 10?

Answer: (a) (i) Elements of 18 groups are noble gases. So Neon (Ne) with atomic number 10 and Argon (Ar) with atomic number 18 are the noble gases because these have complete octet.

(ii) Elements of 17 group are halogens. So Fluorine (F) with atomic number 9 and Chlorine (Cl) with atomic number 17 are halogens.

(iii) Elements of 1 group are alkali metals except hydrogen (H). So Lithium (Li) with atomic number 3 and Sodium (Na) with atomic number 11 are alkali metals.

(iv) Elements with valency 4 are elements of group 14. So Carbon (C) with atomic number 6 and Silicon (Si) with atomic number 14 are elements with valency 4.

(b) Element with atomic number 3 is Li which has 1 valence electron and element with atomic number 17 is Cl has 7 valence electrons. Element with atomic number 17 wants one electron to complete its octet. So the formula will be LiCl.

(c) The electronic configuration of element with atomic number 10 is

10^{Ne-} 2, 8

Q. 17. Give the symbols for:

(i) A metal of group 2

(ii) A metal of group 13

(iii) Two non-metals of group 16

(iv) Most reactive non-metal group 17.

Answer: (i) Mg.

(ii) Al.

(iii) O and S.

(iv) Most reactive non-metal of group 17 is fluorine because its electronegativity is more. Its symbol is F.

Q. 18. Why is K more reactive than Li?

Answer: K is more reactive than Li because the size of K is bigger than Li and due to this bigger size, the effective nuclear charge decreases so the attraction of nucleus on valence electrons also decreases. So K loses its valence electrons more easily than Li.

Q. 19. Why He, Ne and Ar called inert gas?

Answer: He, Ne and Ar are called inert gases because they have complete octet and due to this complete octet they do not react to any other.

Q. 20. Which one has larger atomic size– Cl or Br? Why?

Answer: Br has larger atomic size than Cl because the atomic size increases from top to bottom in a group. From top to bottom in a group, the number of shells increases. So, the atomic size increases.

Q. 21. Where in period 3 of the modern periodic table do we find:

(a) Non-metals?

(b) Elements forming negative ions?

(c) Elements with high melting points?

(d) Elements forming positive ions?

(e) Metals?

(f) Elements with low boiling points?

Mention their atomic numbers only.

Answer: (a) The elements with atomic number 15, 16, 17 and 18 are non-metals in 3 period because silicon with atomic number 14 is metalloid and rest of the elements are metals in 3 period.

(b) We know that non-metals form negative ions. So, the elements with atomic number 15, 16, 17 and 18 are the elements in 3 period which form negative ions.

(c) We know that metals have highest melting point due to strong metallic bond. So, the elements with atomic number 11, 12 and 13 have highest melting point in 3 period.

(d) We know that metals form positive ions. So, the elements with atomic number 11, 12 and 13 are the elements in 3 period which form positive ions.

(e) The elements with atomic number 11, 12 and 13 are the metals in 3 period.

(f) We know that non-metals have low boiling point. So, the elements with atomic number 15, 16, 17 and 18 are the elements which have low boiling point.

Q. 22. An element belongs to 4th period and group 17 of the periodic table. Find out:

(a) The number of valence electrons.

(b) Is it a metal or non-metal.

(c) The name of the element.

(d) Formula of its compound with hydrogen.

(e) Electron dot structure of this element with calcium.

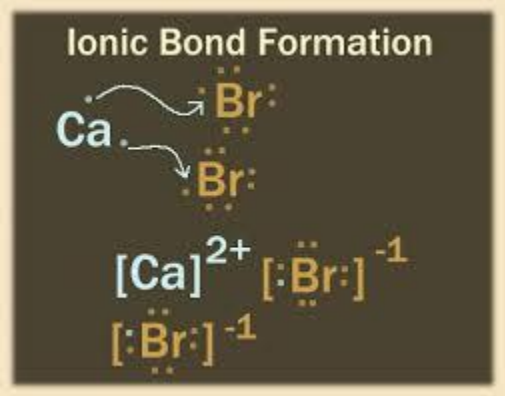
Answer: (a) We know that every element of group 17 has 7 valence electrons. So this element also has 7 valence electrons.

(b) It is non-metal because it can only gain electron.

(c) Its name is Bromine (Br).

(d) The formula of its compound with hydrogen is HBr.

(e)



Q. 23. The position of certain elements in the Periodic Table are shown below.

Group → Period ↓	1	2	3 to 12	13	14	15	16	17	18
1	G								H
2	A			I			B		C
3		D			E				F

Using the above table answer the following questions:

(a) Which element will form only covalent compounds?
(b) Which element is a non-metal with valency 2?
(c) Which element is a metal with valency 2?
(d) Out of H, C, F, which has largest atomic size?
(e) Give name of family to which H, C and F belong?

Answer: (a) Element E will form only covalent bond because it has 4 valence electrons.

(b) Element B is a non-metal with valency 2 because element B has 6 valence electrons so it can take only two electrons to complete its octet.

(c) Element D is a metal with valency 2 because it has 2 valence electrons.

(d) We know that atomic size increases from up to down in a group due to increment in number of shells. So F has largest atomic size.

(e) Noble gases is the name of family to which H, C and F belong.

Q. 24. An element has electronic configuration 2, 8, 7.

(a) To which group and period of the long form of Periodic Table does it belong?

(b) What is atomic number of this element?

(c) Is it metallic or non-metallic and why?

(d) Identify the element.

(e) Name an element chemically similar to this element.

Answer: (a) Element belongs to 17 group and 3 period.

(b) Atomic number of this element is 17 because atomic number is equal to total electrons present in it.

(c) It is non-metallic because it has 7 electrons in its valence shell so it can gain only one electron to complete its octet.

(d) This element is Chlorine.

(e) Bromine is chemically similar to this element because bromine and chlorine are the elements of same group.

Q. 25. The positions of three elements A, B and C in the periodic table are indicated below:

Group 16	Group 17	
-	-	(First Period)
-	A	(Second Period)
-	-	(Third Period)
B	C	(Fourth Period)

(a) State whether element C would be a metal or a non-metal. Why?

(b) Which is the more active element, A or C? Why?

(c) Which type of ion (cation or anion) will be formed by the element C? Why?

Answer: (a) Element C is non-metal because it belongs to 17 group and it contains 7 valence electrons so it can gain only one electron. So it is non-metal.

(b) In non-metals, electronegativity increases from left to right in a period due to increase in effective nuclear charge and decreases from top to bottom in a group due to increment in size. So A is the most active element.

(c) Since C is non-metal and it has 7 valence electrons. So it can gain only one electron and anion will be formed.

Q. 26. Atoms of seven elements A, B, C, D, E, F and g have a different number of electronic shells but have the same number of electrons in their outermost shells. The elements A and C combine with chlorine to form and acid and common salt respectively. The oxide of element A is liquid at room temperature and is a neutral substance, while the oxide of the remaining six elements are basic in nature. Based on the above information, answer the following question:

(i) What could the element A be?

(ii) Will element A to G belong to the same period or same group of the periodic table?

(iii) Write the formula of the compound formed by the reaction of the element A with oxygen.

(iv) Show the formation of the compound by a combination of element C with chlorine with the help of electronic structure.

(v) What would be the ratio of number of combining atoms in a compound formed by the combination of element A with carbon?

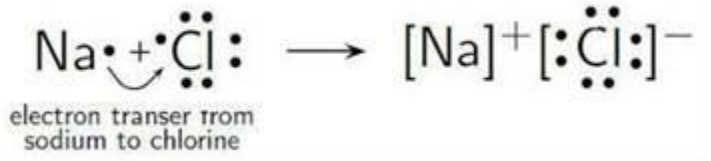
(vi) Which one of the given elements is likely to have the smallest atomic radius?

Answer: (i) A will be hydrogen (H) because A, B, C, D, E, F and G all have same number of valence electrons so this means these elements belong to same group. Since element C combine to Cl and forms NaCl so these elements belong to 1 group. Only H form an acid on reaction with Cl in 1 group and its oxide is also neutral substance.

(ii) Elements A to G will belong to same group but periods will different because number of shells are different in all elements.

(iii) A is hydrogen (H) then the formula of the compound formed by the reaction of the element A with oxygen is H_2O.

(iv) Element C is Na because C combine with chlorine and forms common salt (NaCl).



(v) A is H so the compound formed by the combination of element A with carbon will be CH_4 and the ratio of combining atoms will be 4:1.

(vi) The element which has the smallest atomic radius is A.

Q. 27. In the following table, six elements A, B, C, D, E and F (here letters are not the usual symbols of the elements) of the modern Periodic Table with atomic numbers 3 to 18 are given:

3	4	5	6	7	8	9	10
A					E		G
11	12	13	14	15	16	17	18
B	C		D			F	

(a) Which of these is (i) a noble gas, (ii) a halogen?

(b) If B combines with F, what would be the formula of the compound formed?

(c) Write the electronic configurations of C and E.

Answer: (a) (i) G with atomic number 10 is a noble gas because it has complete octet.

(ii) F with atomic number 17 is a halogen.

(b) B with atomic number 11 has 1 valence electron and F with atomic number 17 has 7 valence electrons so the formula of the compound formed would be BF.

(c) Electronic configuration of C and E are

E_{8-} 2, 6

C_{12-} 2, 8, 2

Q. 28. In the following table, are given eight elements A, B, C, D, E, F, G and H (here letters are not the usual symbols of the elements) of the Modern Periodic Table with the atomic numbers of the elements in parenthesis.

Period	Group 1	Group 2
2	A (3)	E (4)
3	B (11)	F (12)
4	C (19)	G (20)
5	D (37)	H (38)

(i) What is the electronic configuration of F?

(ii) What is the number of valence electrons in the atom of F?

(iii) What is the number of shells in the atom of F?

(iv) Write the size of the atoms of E, F, G and H in decreasing order.

(v) State whether F is a metal or a non-metal.

(vi) Out of the three elements B, E and F, which one has the biggest atomic size?

Answer: (i) Electronic configuration of F is

F12- 2, 8, 2

(ii) There are 2 valence electrons in the atom of F.

Explanation- Valence electrons are those electrons which present in the last shell.

(iii) There are 3 shells in the atom of F.

(iv) We know that atomic size increases from top to bottom in a group due to increment in shells. So the order will be H>G>F>E.

(v) Since F has 2 valence electrons so it will donate these two electrons to acquire noble gas electronic configuration. Hence it is a metal.

(vi) We know that atomic size increases from top to bottom in a group and decreases from left to right in a period. So B has the bigger atomic size.

Q. 29. (a) How does the atomic radius changes as you go.

(i) From left to right in a period?
(ii) Down a group in the periodic table?

(b) Two elements X and Y have atomic numbers 12 and 16 respectively. Write the electronic configuration for these elements. To which period of the Modern Periodic Table do these two elements belong? What type of bond will be formed between them and why?

Answer: (a) (i) Atomic radius decreases from left to right in a period because effective nuclear charge increases from left to right in a period. Due to this effective nuclear charge, the electronegativity increases and the attraction of nucleus on valence shell electrons also increases. So the size decreases.

(ii) Atomic radius increases down a group because number of shells increases.

(b) X_{12}- 2, 8, 2

Y_{16}- 2, 8, 6

These two elements belong to 3 period because period of an atom in periodic table is equal to the number of shells present in that atom.

These two elements will form ionic bond because X has two valence electrons so it will completely lose these two electrons to acquire noble gas electronic configuration and Y has six valence electrons and it has more electronegativity so it will gain two electrons to complete its octet. So X will completely give its two electrons to Y and ionic bond will form.

Q. 30. “The atomic number of Lithium is 3.” On the basis of this information answer the question that follows:

(a) Write the electronic configuration of Li
(b) To which group Li belong?
(c) Find valency of Li.
(d) Identify type of ion it will form.
(e) Write down the formula of the compound formed by it.

Answer: (a) Li_3- 2, 1

(b) Li belongs to 1 group.

(c) The valency of Li is 1 because it contains one valence electron.

(d) It will form positive ion because it has one valence electron so it will lose this one electron to acquire stable noble gas electronic configuration and it will form positive ion.

(e) The formula of the compound formed by it is LiX.