Periodic Classification of Elements

Periodic Test

Q.1. Name a group of elements which was not known when Mendeleev formulated his periodic table.

Answer: Noble gases were not known when Mendeleev formulated his periodic table. This is because the noble gases such as He, are etc. where not discovered at that time.

Q.2. Element M is in the first group of the periodic table. Write the formula of its oxide.

Answer: First group of the periodic table is mainly known as alkali metals and they have valency = 1 and oxide with the valency = 2 so the formula of oxide would be M_2O.

Q.3. Why do you think the noble gases are placed in a separate group?

Answer: The noble gases are placed in a separate group because these are unreactive and present in a very low concentration in the atmosphere and their properties do not resemble with any other group so they are placed in a separate group.

Q.4. An element belongs to the 3rd period and 2nd group of the periodic table. Find out the valence electrons and valency of this element.

Answer: The valency of an atom refers to the number of electrons present in the outermost shell.

The element in the 3rd period and 2nd group is Magnesium (Mg). Its configuration is 2, 8, 2 which shows that its outermost shell has 2 valence electrons and its valency is 2.

Q.5. Name two elements which will be chemically similar to aluminum. What is the basis of your choice?

Answer: In periodic table elements of the same group have the same chemical properties so aluminium will have same chemical properties are Gallium (Ga) and Indium (In).

These all elements belong to the same group so they have similar chemical properties.

Q.6. Amongst elements with atomic number 11 and 14, which has a bigger atomic size?

Answer: Both the elements with atomic number 11 and 14 lie in the same group so when we move from right to left in a period atomic size decreases. So, an element with atomic number 11 will be in bigger in size.

Q.7. Element X with atomic number 12 and Y atomic number 17 reacts with hydrogen to form hydrides. Which of them is expected to have a high melting point?

Answer: The element with atomic number 12 is Magnesium (Mg) and element with atomic number 17 is Chlorine (Cl).

When Mg reacts with hydrogen it forms MgH2 and chlorine forms HCl. MgH2 is solid and HCl is liquid so MgH2 has a higher melting point.

Q.8. An element X has E.C. = 2, 8, 8, 1 while Y has 2, 8, 7. Which of these is a metal?

Answer: 'X' has 1 valence electron and it belongs to a 4^{th} period so it is Potassium (K) and the 'Y' is of the 3^{rd} period and it has 7 electrons in an outermost cell with atomic number 17 so it is Chlorine (Cl). We know that poopt5assium is a metal.

Q.9. Name the most reactive element present in group 17.

Answer: Fluorine is a most reactive element in group 17 because of its small size and high electronegativity by which it accepts electron easily and forms a bond with another element.

Q.10. Give the formula of oxide formed by a metal if it belongs to the 3^{rd} period and 13^{th} group.

Answer: 13^{th} group consists of the following elements:

Boron (B), Aluminium (Al), Gallium (Ga), Indium (In), Thallium (Ti).

'Al' lies in the 3^{rd} period so; the formula of oxide of Aluminium is 'Al_2O_3'.

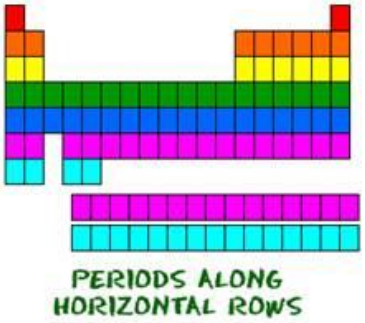
Q.11. What similarity do you observe in:

(i) Elements belonging to the same period.

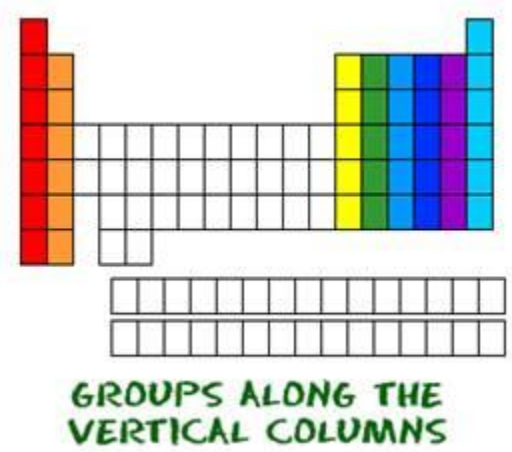
(ii) Elements belonging to the same group.

Answer: Elements belonging to the same period have the same number of shells.

Example: Every element in the first period (top row) has one orbital for its electrons. All the elements in the second period (the second row) have two orbitals for their electrons.



(ii) Elements belonging to the same group have same number of valence electrons.



Q.12. How is the valency of an element related to its electronic configuration? Explain giving suitable example.

Answer: The valency of an atom refers to the number of electrons present in the outermost shell. The number of valence electrons in the atom will determine the last number of the atom's electron configuration.

For example, Sodium has an electron configuration of 2,8,1, so it has 2 valence electrons.

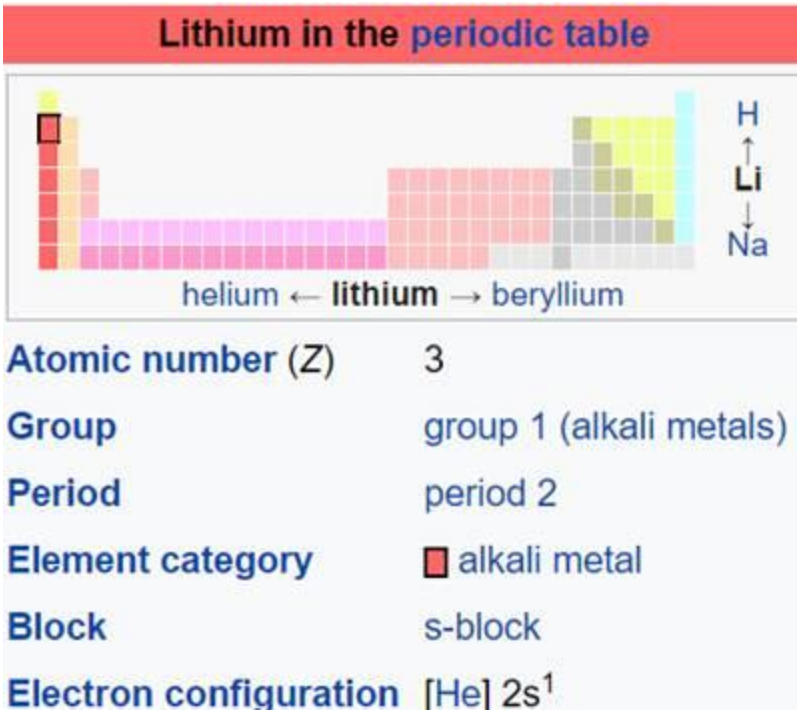
Q.13. Why is the atomic number of the element more important to a chemist than its atomic mass?

Answer: Atomic number represents the number of electrons in the element and also in electronic configuration and physical and chemical properties.

Q.14. What is the similarity between elements Li, Be, B, C, N, O, F and Ne belonging to the second period?

Answer: These all elements (Li, Be, B, C, N, O) belong to the same period i.e. Period 2

One similarity between them is they have the same number of shells.



Q.15. Chlorine and bromine are kept in the same group in the periodic table. Why?

Answer: As Chlorine and Bromine consists of the same number of valence electrons in the outermost shell so they are kept in the same group of the periodic table.

Q.16. Which amongst the following elements whose atomic number is given below belong to the same period?

Give reason. 17, 10, 20, 12, 19, 15.

Answer: We will first write the electronic configuration of all the elements mentioned:

17: - 2,8,7

10: - 2,8

20: - 2,8,8,2

12: - 2,8,2

19: - 2,8,8,1

15: - 2,8,5

So, the elements with atomic number

17, 12, 15 belong to the same period as they have the same number of the shell.

20, 19 belong to the same period as they have the same number of the shell.

Q.17. What were the achievements of Mendeleev's periodic table? What was the basis of the classification of elements in it?

Answer: The achievements by Mendeleev were:

•Mendeleev kept some blank spaces in the periodic table for the elements that were yet to be discovered.

E.g.: - Eka-aluminium, Eka-boron, Eka-silicon.

•He also predicted properties of some elements which were yet to be discovered.

E.g.: - The properties of Eka-aluminium predicted by Mendeleev and those of element gallium were almost the same.

Property	Eka-aluminium	Gallium
Atomic Mass	68	69.7
Formula of oxide	E_2O_3	Ga_2O_3
Formula of chloride	ECl_3	$GaCl_3$

•When noble gases were discovered, they could be placed in a new group without disturbing the order.

The formula of the hydrides and oxides formed by an element were treated as one of the basic the properties of an element for its classification.

Q.18. How does the electronic configuration of an atom relate to its position in the modern periodic table?

Answer: The modern periodic table contains of groups and periods.

The atoms with identical outer shell electronic cell electronic configuration are in the same groups.

The atoms with same number of shells are in same period.

Q.19. The elements of the second period of the periodic table are given along:

Li Be B C N O F

(a) Give a reason to explain why atomic radii decrease from Li to F.

(b) Identify the most:

(i) Metallic

(ii) Non-metallic elements.

Answer: (a) The atomic radii decreases from Li to F because of increase in nuclear charge which tends to pull electrons closer to nucleus and reduces the size of an atom.

b. (i) As we go down the group metallic character increases and decreases along the period.

So, the most metallic element is Li (Lithium)

(ii) As the metallic character decreases along the period, the non-metallic character increases.

The most non-metallic element is F (fluorine).

Q.20. The elements of the 3rd period of the periodic table are given along:

Na Mg Al Si P S Cl

(a) Which is more non-metallic S or Cl?

Na Mg Al Si P S Cl

(b) Which has a higher atomic mass: Al or Cl?

Answer: (a) Along the group non-metallic character increases so; Cl (Chlorine) is more non-metallic.

(b) As we see the trend as the atomic no. increases atomic mass also increases (other than few exceptions). So, Cl has a higher atomic mass than Al.

Q.21. What physical and chemical properties of elements were used by Mendeleev in creating his Periodic Table? List two observations which posed a challenge to Mendeleev's Periodic Law.

Answer: "The physical and chemical properties of the elements are the periodic functions of their atomic weights".

According to Mendeleev periodic law, the characteristic property of the elements is based on their atomic weights. In this periodic table, elements are arranged in increasing order of their atomic weight.

Two observations which posed a challenge to Mendeleev's periodic Law are:

•Isotopes of all elements posed a challenge to Mendeleev's periodic law.

•The atomic masses do not increase in a regular manner in going from element to another so, it was not possible to predict how many elements could be discovered between 2 elements.

Q.22. Study the Periodic Table and answer the following questions:

(i) Na has physical and chemical properties similar to which element(s) and why?

(ii) Write the electronic configuration of N and P. Which one of these will be more electronegative and why?

Group→ / Period↓	I	II	III	IV	V	VI	VII	zero
1.	H							He
2.	Li	Be	B	C	N	O	F	Ne
3.	Na	Mg	Al	Si	P	S	Cl	Ar
4.	K	Ca						

Answer: (i) Na has similar properties as of the same group members as K, Rb, Cs. They contain 1 valence in the outermost shell so all of them are reactive.

(ii) Nitrogen:- 2,5

Phosphorus:- 2,8,5

Electronegativity is a measure of how strongly atoms attract bonding electrons to themselves.

Nitrogen is more electronegative because in nitrogen outermost shell is nearer to nucleus and nucleus will attract electrons easily.

Q.23. Using the above periodic table Explain why:

(i) Li and Na are considered as active metals.

(ii) Atomic size of Mg is less than that of the Na.

(iii) F is more reactive than Cl.

Answer: (i) Li and Na have a single electron in the outermost shell. They can easily lose 1 electron and produce cation which causes chemical reactions which are explosive in nature.

(ii) Na and Mg both lie in the same period so along the period atomic size decreases. So, the size of Mg is smaller than Na.

(iii) Electronegativity of F is more than Cl i.e. F has more affinity to attract electrons because of its small size due to this F is more reactive than Cl.

Q.24. Explain giving a reason, why:

(i) Metallic character decreases in a period.

(ii) Atomic size increases in a group.

(iii) Chemical reactivity first decreases and then increases in a period.

Answer: (i) As the effective nuclear charge acting on the valence shell increases across the period, the tendency to lose electrons decreases due to this metallic character decreases.

(ii) Atomic size increases in a group because new shells are being added as we go down the group. This increases the distance between the outermost shell and nucleus.

(iii) The reactivity of element depend upon their tendency to lose or gain electrons to complete their outermost shell, greater is the tendency to lose/gain electron greater is the reactivity

So, in a period first tendency to lose electron decreases so reactivity decreases and the tendency to gain electron increases so the reactivity increases.

Q.25. The position of three elements A, B and C in the Periodic table is given above. Giving a reason, explain the following:

(i) Element A is a non-metal.

(ii) An atom of element C has a larger size than an atom of element A.

(iii) Element B has a valency of 1.

Group → / Period ↓	I	II	III	IV	V	VI	VII	VIII
1.	B							He
2.							A	
3.						C		

Answer: (i) Element A is closer to noble gas and is on the right side of the period and in the periodic table, non-metals are on the right side.

(ii) As we go down in periodic table atomic size increases, so the size of element C is greater than element A.

(iii) Element B is in the first group and it consists of elements having 1 electron in the outermost shell so it has valency 1.

Q.26. Define the following:

(i) Ionisation energy (ii) Electron affinity (iii) Atomic radii (iv) Modern periodic law

Answer: (i) Ionisation energy:- It is the amount of energy required to remove an electron from an isolated gaseous atom.

(ii) Electron affinity:- Electron affinity is the energy which is released when an extra electron is added to an isolated gaseous atom in its outermost shell.

(iii) Atomic radii:- The distance from the center of the nucleus to the outermost shell is defined as atomic radii.

(iv) Modern periodic law:- Properties of the element are a periodic function of their atomic number.

Comprehensive Exercises (MCQ)

Q.1. Which of the following statement is not a correct statement about the trends when going from left to right across the periods of Periodic Table?

A. The elements become less metallic in nature

B. The number of valence electrons increases

C. The atoms lose their electrons more easily

D. The oxides become more acidic.

Answer: If we check all options in option (a) it is true that elements become less metallic decreases because tendency to lose e- decreases, in option (b) this statement is also true that valence electrons increases in option (c) it is not true because tendency to lose electrons is difficult across the period and (d) option is also correct as the oxides become more acidic.

So, the correct answer is an option (c).

Q.2. The order of decreasing atomic size is:

A.I < Br < Cl < F

B. I > Br > Cl > F

C. Br > I > Cl > F

D. Cl > Br > F > I

Answer: If we see all the orders in option (b) is only the correct order in others the sequence is not correct and in option (a) the arrows are wrong.

Q.3. The order of decreasing atomic size is:

A. Na < Mg < Al < Si

B. Na > Mg > Al > Si

C. Mg < Na < Al < Si

D. Mg > Na > Al > Si

Answer: We know that across the period atomic size decreases. Na has the greatest size in all these elements so it should come first this makes the option (c) and (d) invalid and in option (a) the arrows are wrong.

Q.4. The element with atomic number 18 belongs to which group:

A. Halogens

B. Alkali metals

C. Alkaline earth metals

D. Noble gases.

Answer: If we break this configuration the we see that it is 2,8,8 which completely fills the atom do it belongs to the Noble Gases.

Q.5. The scientist who showed that the atomic number of an element is a more fundamental property than its atomic mass is:

A. Henry Moseley

B. Johann Wolfgang Dobereiner

C. John Newlands

D. Dmitri Ivanovich Mendeleev

Answer: Moseley only proposed atomic number of an element is a more fundamental property than it's atomic mass by doing this prediction of properties of elements could be done with more precision.

Q.6. When Mendeleev started his work, the number of known elements was:

A.68

B. 53

C. 57

D. 63

Answer: When Mendeleev started the work, many elements were not even discovered. Example – noble gases.

Q.7. It was assumed by Newlands that only:

A.56 elements existed in nature

B. 57 elements existed in nature.

C. 59 elements existed in nature.

D. 63 elements existed in nature.

Answer: It was assumed that only 63 elements existed in nature and no new elements would be discovered in the future. But later on several new elements were discovered whose properties did not fit into the law of octaves.

Q.8. Doberiener's system of classification into triads was not found to be useful as he could identify only:

A. Two triads

B. Three triads

C. Four triads

D. Five triads

Answer: He could only find 3 triads in elements due to this his concept was discarded.

Q.9. It was found that the law of octaves was applicable only to:

A. Chlorine

B. Potassium

C. Calcium

D. Argon

Answer: After calcium, every 8th do not possess properties similar to that of the first.

Q.10. The element X has the following electron configuration 2, 8, 8, 2. It means that it belongs to:

A. Second period and a second group

B. Fourth period and the fourth group

C. Fourth period and the second group.

D. Second period and fourth group.

Answer: The element which is mentioned is Calcium (Ca) it is located in the fourth period and second group.

Q.11. Arrange the following elements in the order of their decreasing metallic character: Na, Si, Cl, Mg, Al

A. Cl > Si > Al > Mg > Na

B. Na > Mg > Al > Si > Cl

C. Na > Al > Mg > Cl > Si

D. Al > Na > Si > Ca > Mg

Answer: In the above options we know that among the elements that Na has highest metallic character Cl has lowest. So, only (b) option matches.

Q.12. Arrange the following elements in the order of their increasing non-metallic character: Li, O, C, Be, F.

A.F < O < C < Be < Li

B. Li < Be < C < O < F

C. F < O < C < Be < Li

D. F < O < Be < C < Li

Answer: In the above-mentioned elements we know that F has highest non- metallic character so it should come in the last and across the period non- metallic character increases so (b) option matches with this.

Q.13. What type of oxide would Eka-aluminium form?

A.EO3

B. E3O2

C. E2O3

D. EO

Answer: Eka-aluminium has the properties similar to the aluminium so it forms the same type of oxide as that of aluminium i.e. E_2O_3.

Q.14. Three elements B, Si and Ge are:

A. metals

B. non-metals

C. metalloids

D. metal, non-metal and metalloid respectively.

Answer: Silicon and Germanium are metalloids but boron is a non-metal but there is no such option mentioned so we will go with option (c).

Q.15. Which of the following elements will form an acidic oxide?

A. An element with atomic number 7

B. An element with atomic number 3

C. An element with atomic number 12

D. An element with atomic number 19

Answer: if we see the options in (a) at. No 7 is nitrogen which forms 5 types of oxides in which some of them are neutral so we can't say it forms acidic oxide and option (b) is at. no 3 which is lithium, it is a metal it forms basic oxide and same goes with option (c) it is magnesium which forms basic oxide too. In option (d) at. no 19 which is chlorine which forms all acidic oxides.

Q.16. The element with atomic number 14 is hard and forms acidic oxide and a covalent halide. To which of the following categories does the element belong?

A. Metal

B. Metalloid

C. Non-metal

D. Left-hand side element

Answer: It is written that it forms acidic oxide so it is confirmed that the element is non-metal and atomic number 14 element is carbon (C).

Q.17. Which of the following statements about the Modern Periodic Table is correct?

A. It has 18 horizontal rows known as Periods

B. It has 7 vertical columns known as Periods

C. It has 18 vertical columns known as Groups.

D. It has 7 horizontal rows known as Groups.

Answer: In the modern periodic table it consists of 18 vertical columns known as Groups and 7 horizontal rows known as periods. According to this definition, only option (c) matches.

Q.18. Which of the given elements A, B, C, D and E with atomic numbers 2, 3, 7, 10 and 30 respectively belong to the same period?

A. A, B, C

B. B, C, D

C. A, D, E

D. B, D, E

Answer: The elements B(Lithium), C(Nitrogen), D(Neon) all lie in the same 2nd period.

Q.19. The elements A, B, C, D, and E have atomic numbers 9, 11, 17, 12 and 13 respectively. Which pair of elements belongs to the same group?

A. A and B

B. B and D

C. A and C

D. D and E

Answer: The all the above-mentioned atomic numbers belong to 2^{nd} and 3^{rd} groups which have a difference of 8 between them so the numbers which have a difference of 8 is ‘9’ and ‘17’. So, the correct option is (c).

Q.20. Where would you locate the element with electronic configuration 2, 8 in the Modern Periodic Table?

A. Group 8

B. Group 2

C. Group 18

D. Group 10

Answer: 2,8 is completely filled electric configuration so it must be noble gas which lies in group 18.

Q.21. An element which is an essential constituent of all organic compounds belongs to:

A. Group 1

B. Group 14

C. Group 15

D. Group 16

Answer: Carbon is the element which is essential constituent of all organic compounds and lies in group 14.

Q.22. Which of the following is the outermost shell for elements of period 2?

A. K shell

B. L shell

C. M shell

D. N shell

Answer: Highest atomic number in period 2 is 10 which has an electronic configuration of 2,8. So, L shell is the outermost shell in period 2.

Q.23. Which of the following set of elements is written in order of their increasing metallic character?

A. Be Mg Ca

B. Na Li K

C. Mg Al Si

D. C O N

Answer: Down the group metallic character increases and across the period metallic character decreases. Only option (a) follows the right order.

Q.24. In Mendeleev's Periodic Table, gaps were left for the elements to be discovered later. Which of the following elements found a place in the periodic table later?

A. Germanium

B. Chlorine

C. Oxygen

D. Silicon

Answer: Germanium was the element which found the place later in periodic table but Mendeleev predicted germanium to as eka-silicon.

Comprehensive Exercises (T/F)

Q.1. Write true or false for the following statements:

It was assumed by Newlands that only 63 elements existed in nature and no more elements would be discovered in the future.

Answer: False

The assumption in the statement is wrong he assumed to be having 56 elements existed in nature.

Q.2. Write true or false for the following statements:

In order to fit elements into his table, Newlands adjusted three elements in the same slot, but also put some unlike elements in the same slot.

Answer: True

Q.3. Write true or false for the following statements:

In Mendeleev's periodic table, elements were arranged in the order of their increasing atomic masses and it was also observed that there occurs a periodic recurrence of elements with similar physical and chemical properties.

Answer: True

Q.4. Write true or false for the following statements:

Electronic configuration of hydrogen resembles that of alkaline earth metals.

Answer: True

Q.5. Write true or false for the following statements:

In 1913, Dmitri Ivanovich Mendeleev showed that the atomic number of an element is a more fundamental property than its atomic mass.

Answer: False

It was Henry Moseley who proposed that the atomic number of an element is a more fundamental property than its atomic mass.

Q.6. Write true or false for the following statements:

Na, Mg, Li, Al, Si, F, P and Cl belong to the third period of the Modern periodic table.

Answer: False

Na, Mg, Al, Si, P and Cl belong to 3^{rd} period but Li and F belong to the 2^{nd} period of the modern periodic table.

Q.7. Write true or false for the following statements:

The term atomic size refers to the distance between the centre of the nucleus and the penultimate shell of an isolated atom.

Answer: False

The shell just inner to the outermost shell is called pen ultimate shell. So, the above definition gets wrong for atomic size.

Q.8. Write true or false for the following statements:

In the Modern periodic table, a zig-zag line separates metals from non-metals. The borderline elements-boron, silicon, germanium, arsenic, antimony, tellurium and polonium are intermediate in properties and are called metalloids or semimetals.

Answer: True

Q.9. Write true or false for the following statements:

Metallic character decreases across a period and increases down a group because the effective nuclear charge acting on the valence shell electrons increase across a period and decreases down the group.

Answer: True

Q.10. Write true or false for the following statements:

Non-metals are electronegative. They tend to form bonds by gaining electrons. As the trends in the electronegativity show, non-metals are found on the right-hand side of the periodic table towards the top.

Answer: True