

CHAPTER 5

Periodic Classification of Elements

ONE MARK QUESTIONS

1. An element has atomic number 17. To which group and period does it belong to?

Ans : [CBSE 2016]

X(17): 2,8,7 is the electronic configuration. It has 7 valence electrons. It belongs to 17th group and 3rd period.

2. Out of Li and K, which will have stronger metallic character and why?

Ans : [CBSE 2016]

K will have more metallic character because it can lose electrons easily due to its bigger atomic size and less effective nuclear charge.

3. Find the atomic number of the element whose electronic configuration is 2, 8, 5.

Ans : [CBSE 2016]

Atomic number = $2 + 8 + 5 = 15$.

4. An element A has atomic number 16. To which group and period does it belong to?

Ans : [CBSE 2016]

A(16) has electronic configuration: 2, 8, 6. It has 6 valence electrons and three shells. It belongs to Group 16, 3rd period.

5. Write two reasons responsible for the late discovery of noble gases.

Ans : [CBSE 2015]

- They are inert i.e., least reactive.
- They are less abundant in nature except Argon.

6. How many vertical columns are there in the modern periodic table and what are they called?

Ans : [CBSE 2015, 2014]

There are 18 vertical columns in Modern Periodic Table. They are called groups.

7. List any two properties of elements belonging to the first group of modern periodic table.

Ans : [CBSE 2015, 2014]

- They have 1 valence electron.
- Their valency is equal to 1.

8. The atomic number of three elements A, B and C are 12, 18 and 20 respectively. State giving reason, which two elements will show similar properties.

Ans : [CBSE 2015, 2014]

A(12): 2, 8, 2, B(18): 2, 8, 8, C(20): 2, 8, 8, 2

A and C belong to the same group because they have same number of valence electrons.

9. Why are H, Li, Na and K placed in group-1?

Ans : [CBSE 2015]

It is because they have one valence electron.

10. Write the number of horizontal rows in the modern periodic table. What are these rows called?

Ans : [CBSE 2014]

There are 7 horizontal rows in the modern periodic Table. These rows are called periods.

11. Write one difference between Group 1 and Group 2 elements?

Ans : [CBSE 2014]

Group 1 elements has 1 valence electron whereas group 2 elements has 2 valence electrons.

12. Write the atomic numbers of two elements X and Y having electronic configurations 2, 8, 2 and 2, 8, 6, respectively.

Ans : [CBSE 2014]

$X = 2 + 8 + 2 = 12$

$Y = 2 + 8 + 6 = 16$

13. State the modern periodic law of classification of elements.

Ans : [CBSE 2014, 2013]

Modern Periodic Law: It states 'properties of elements are a periodic function of their atomic number'.

14. Out of the three elements P, Q and R having atomic numbers 11, 17 and 19 respectively, which two elements will show similar properties and why?

Ans : [CBSE 2014]

P(11): 2, 8, 1; Q(17): 2, 8, 7; R(19): 2, 8, 8, 1

P and R will show similar chemical properties because they have the same number of valence electrons.

15. Write the formula which is used to determine the maximum number of electrons that a shell can accommodate.

Ans : [CBSE 2014, 2013]

$2n^2$, where n is the shell number.

16. What would be the nature of oxides formed by the elements on the right side of periodic table?

Ans : [CBSE 2014]

On right hand side of the periodic table, most of them are non-metals, therefore they form acidic oxides.

17. Predict the maximum number of valence electrons possible for atoms in the first period of the periodic table.

Ans : [CBSE 2014]

Maximum number of valence electrons in 1st period is 2.

18. The electronic configuration of two elements X and Y are 2, 8, 7 and 2, 8, 8, 3 respectively. Write the atomic numbers of X and Y.

Ans : [CBSE 2013]

$X = 2 + 8 + 7 = 17$

$Y = 2 + 8 + 8 + 3 = 21$

19. The atomic numbers of three elements X, Y and Z are 3, 11 and 17 respectively. State giving reason which two elements will show similar properties.

Ans : [CBSE 2013]

$X = 2, 1$

$Y = 2, 8, 1; Z = 2, 8, 7$

X and Y will show similar properties due to same number of valence electrons.

20. Give reason why noble gases are placed in a separate group in the modern periodic table.

Ans : [CBSE 2013]

It is because they have their outermost shell completely filled and resemble with each other.

21. Name any two pairs of elements which were adjusted by Newlands in the same slot.

Ans : [CBSE 2013]

(i) Co and Ni, (ii) Ce and La

22. Define Newlands law of octaves.

Ans : [CBSE 2013]

Newlands Law of Octaves: When elements are arranged in increasing order of their atomic mass, every eighth element resembles with the first.

23. State Mendeleev's periodic law.

Ans : [CBSE 2012]

Mendeleev's Periodic Law: Properties of elements are a periodic function of their atomic mass.

24. Name any two elements which were discovered later

after the formation of Mendeleev's periodic table.

Ans : [CBSE 2011]

Gallium and Germanium.

25. What is a metalloid? Name any two of them.

Ans : [CBSE 2011]

Metalloids are those elements which resembles both with metals as well as non-metals e.g., Boron and Silicon.

26. Arrange the following metals in decreasing order of their atomic size:

Ca, Mg, Ba, Be

Ans : [CBSE 2011]

$Ba > Ca > Mg > Be$ is the decreasing order of atomic size.

27. Why does atomic size decreases as we move from left to right along a period in a periodic table?

Ans : [CBSE 2011]

It is because one proton and one electron is being added successively, therefore effective nuclear charge increases, atomic size decreases.

28. What is the valency of silicon with atomic number 14?

Ans : [CBSE 2010]

Si(2, 8, 4), the number of valence electrons in Si is 4. Therefore, its valency is 4.

29. What is the valency of phosphorus with atomic number 15?

Ans : [CBSE 2010]

P(2, 8, 5) has 5 valence electrons, therefore its valency is equal to 3.

30. What is the valency of an element with atomic number 35?

Ans : [CBSE 2010]

Atomic number is 35, it has electronic configuration of 2, 8, 18, 7. It has 7 valence electrons, therefore its valency is equal to 1.

31. What were the criteria used by Mendeleev in creating his periodic table?

Ans : [CBSE 2013]

Increasing order of atomic mass and same formula of oxides and hydrides.

32. Give the number of elements in 2nd and 5th period in the modern periodic table.

Ans : [CBSE 2013]

In 2nd period, there are 8 elements.

In 5th period, there are 18 elements.

33. Lithium, Sodium and potassium form a Dobereiner's triad. The atomic masses of lithium and potassium are 7 and 39 respectively. Predict the atomic mass of sodium.

Ans : [CBSE 2009C]

Atomic mass of Sodium

$$\begin{aligned} & \text{Atomic mass of lithium} \\ &= \frac{\text{Atomic mass of lithium} + \text{Atomic mass of potassium}}{2} \\ \text{Na} &= \frac{7 + 39}{2} = \frac{46}{2} = 23 \end{aligned}$$

34. Why was the system of classification of elements into triads not found suitable?

Ans : [CBSE 2009(C)]

It is because all the elements discovered at that time could not be classified as Dobereiner's triads.

35. The formula of magnesium oxide is MgO. State the formula of barium nitrate and barium sulphate, if barium belongs to same group as magnesium.

Ans : [CBSE 2012]

The valency of Mg is 2. The valency of Ba is also 2 as they belong to the same group. Formula of Barium nitrate is $\text{Ba}(\text{NO}_3)_2$, and that of Barium sulphate is BaSO_4 .

36. Which has larger atomic radius, K(19) or Ca(20)?

Ans : [CBSE 2016]

K has larger atomic radius than Ca.

37. Chlorine, Bromine and Iodine form Dobereiner's triads. The atomic mass of Cl and I are 35.5 and 126.9 respectively. Predict the atomic mass of Bromine.

Ans : [CBSE 2009]

Atomic Mass of Br

$$\begin{aligned} &= \frac{\text{Atomic mass of Cl} + \text{Atomic mass of I}}{2} \\ &= \frac{35.5 + 126.9}{2} = \frac{162.4}{2} = 81.2 \end{aligned}$$

Electronic configuration: $X = 2, 8, 7$

It has 7 valence electrons. It belongs to group 17.

It has 3 shells, therefore it belongs to 3rd period.

It can gain 1 electron to become stable, so its valency is equal to 1.

TWO MARKS QUESTIONS

38. An element X has mass number 35 and the number of its neutrons is 18. Identify the group number, period and valency of element X'.

Ans : [CBSE Sample Paper 2017-2018, CBSE 2016]

X has mass number 35, number of neutrons = 18

Atomic Number = $35 - 18 = 17$

- Electronic configuration: $X = 2, 8, 7$ It has 7 valence electrons. It belongs to group 17.
 - It has 3 shells, therefore it belongs to 3rd period.
 - It can gain 1 electron to become stable, so its valency is equal to 1.
39. Why is lithium with atomic number 3 and potassium with atomic number 19 are placed in group one? What will be atomic number of the first two elements in the second group?

Ans : [CBSE 2016]

Group 1

Li(3): 2,1

K(19):2,8,8,1

Group 2

Be(4): 2, 2

Mg (12): 2, 8, 2

Li and K are placed in group 1 due to same number of valence electrons. In second group the atomic number of first two elements will be 4 and 12 respectively.

40. Calcium is an element with atomic number 20.

- Will it be a metal/non-metal?
- What will be its valency?
- What would be the formula of its chloride?
- Will it be smaller / larger than K?

Ans : [CBSE 2016]

Ca(20): 2, 8, 8, 2

- It will be a metal.
- Its valency is equal to 2.
- CaCl_2 is the formula of its chloride.
- It will be smaller than K.

41. List the anomalies of Mendeleev's periodic table which were removed in Modern Periodic Table.

Ans : [CBSE 2016]

Co with higher atomic mass proceeds Ni with lower atomic mass. It was solved because Co has lower atomic number than Ni.

Isotopes should have been given different slots due to different atomic mass, but it is not possible due to same chemical properties. The problem was solved because isotopes have same atomic numbers.

42. Choose from the following:

${}_6\text{C}$, ${}_8\text{O}$, ${}_{10}\text{Ne}$, ${}_{11}\text{Na}$, ${}_{14}\text{Si}$

- Elements that should be in the same period.
 - Elements that should be in the same group.
- State the reason for your selection in each case.

Ans : [CBSE 2016,2012]

- ${}_6\text{C}(2, 4)$, ${}_8\text{O}(2, 6)$, ${}_{10}\text{Ne}(2, 8)$ belong to the same period i.e., 2nd period and ${}_{11}\text{Na}(2, 8, 1)$, ${}_{14}\text{Si}(2, 8, 4)$ belongs to the same period i.e., 3rd period.
- ${}_6\text{C}(2,4)$ and ${}_{14}\text{Si}(2,8,4)$ belongs to the same group -14 due to same number of valence electrons, which is equal to 4.

43. The elements X, Y and Z having atomic numbers 11, 7 and 6 respectively react with oxygen to form their

oxides.

- Arrange these oxides in increasing order of their basic nature.
- Give reason for your answer.

Ans : [CBSE 2015]

X(11) is sodium and it will form Na_2O , Y(7) is Nitrogen that will form N_2O_5 , Z(6) is carbon which will form CO_2 .

- $\text{N}_2\text{O}_5 < \text{CO}_2 < \text{Na}_2\text{O}$
- It is because non-metallic character increases along a period, therefore basic character of oxides decreases, and acidic nature increases from left to right across the period.

44. a. Name the element with atomic number 17.
b. To which period does it belong to?
c. To which group does it belong to?
d. Write its electronic configuration.

Ans : [CBSE 2015, 2014]

- Chlorine (17): 2, 8, 7
- It belongs to 3rd period.
- It belongs to group 17.
- 2, 8, 7 is the electronic configuration of chlorine.

45. a. Amongst the following elements identify the ones that would form anions:
K, O, Na, F, Ca, Cl, Mg
b. Write the electronic configuration of the anions identified above.

Ans : [CBSE 2015, 2014]

O, F, Cl will form anions.

O^{2-} (18): 2, 8

F^- (10): 2, 8

Cl^- (18): 2, 8, 8

46. An element belongs to third period and second group of the periodic table:
a. State the number of valence electrons in it.
b. Is it a metal or a non-metal?
c. Name the element.
d. Write the formula of its oxide.

Ans : [CBSE 2015, 2011]

- It has 2 valence electrons.
- It is a metal
- Magnesium.
- MgO is the formula of its oxide.

47. Write the trend of atomic size and metallic character along a group and a period in modern periodic table.

Ans : [CBSE 2013, 2012]

Atomic size increases down the group and decreases along a period from left to right in the periodic table. Metallic character increases down the group and it decreases along a period from left to right.

48. Elements in Periodic table show periodicity in properties. List any four such properties.

Ans : [CBSE 2013]

Valence electrons, Valency, Atomic size, Metallic character.

49. An element 'X' has atomic number 13.

- Write its electronic configuration.
- State the group to which 'X' belongs to.
- Is 'X' a metal or a non-metal?
- Write the formula of its bromide.

Ans : [CBSE 2012]

- X(13) : 2, 8, 3
- It belongs to group 13.
- It is a metal.
- XBr_3 is the formula of its bromide.

50. State the modern periodic law for the classification of elements. How many (a) groups, (b) periods are there in Modern Periodic Table?

Ans : [CBSE 2012]

Properties of elements are a periodic function of their atomic numbers. There are 18 groups and 7 periods in modern periodic table.

51. An element M has atomic number 11.

- Write its electronic configuration.
- State the group to which M belongs to.
- Is M a metal or a non-metal?
- Write the formula of its chloride.

Ans : [CBSE 2012]

- 2, 8, 1
- M belongs to group 1.
- It is a metal.
- MCl is the formula of its chloride.

52. An element M has atomic number 12.

- Write its electronic configuration.
- State the group to which M belongs to.
- Is M a metal or a non-metal?
- Write the formula of its oxide.

Ans : [CBSE 2012]

- 2, 8, 2,
- Group 2,
- Metal,
- MO is formula of its oxide.

53. How can the valency of an element be determined if its electronic configuration is known? What will be valency of an element with atomic number 9?

Ans : [CBSE 2012, 2011]

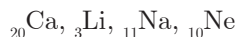
Valency = Number of valence electrons in case of metals and metalloids. It is also equal to 8 — Number of valence electrons in case of non-metals.
F(9) has electronic configuration of 2, 7. It is a non-metal. Its valency is equal to 1.

54. An element X belongs to 3rd period and group 17 of the periodic table. State its (a) electronic configuration, (b) valency. Justify your answer with a reason.

Ans : [CBSE 2012]

- 2, 8, 7; because it has 3 shells as it belongs to 3rd period. Group 17 means 7 valence electrons.
- Valency = 1
It can gain 1 electron to become stable i.e. to complete its octet.

55. Choose from the following:



- An element having two shells completely filled with electrons.
- Two elements belonging to same group of the periodic table.

Ans : [CBSE 2012]

- $_{10}\text{Ne}$ (2, 8)
- $_{3}\text{Li}$ (2, 1) and $_{11}\text{Na}$ (2, 9, 1) belong to the same group.

56. Why do all elements of the

- same group have similar properties?
- same period have different properties?

Ans : [CBSE 2012]

- It is due to same number of valence electrons which will decide the chemical properties.
- They differ in number of valence electrons, therefore they differ in chemical properties. They have the same number of shells.

57. An element 'E' has the following electronic configuration:

K	L	M
2	8	6

- To which group of the periodic table does element E belong to?
- To which period of the periodic table does element E belong to?
- State the number of valence electrons present in element E.
- State the valency of the element E.

Ans : [CBSE 2012]

- E (2, 8, 6) belongs to group 16,
- It belongs to 3rd period.
- It has 6 valence electrons.
- The valency of E is 2.

58. Choose from the following: $_{4}\text{Be}$, $_{9}\text{F}$, $_{19}\text{K}$, $_{20}\text{Ca}$

- The element having one electron in the outermost shell.
- Two elements of the same group.

Ans : [CBSE 2012]

- $_{19}\text{K}$ (2,8,8,1) has one valence electron,
- $_{4}\text{Be}$ (2, 2) and $_{20}\text{Ca}$ (2, 8, 8, 2) belongs to the same group.

59. An element has atomic number 13.

- What is the group and period number to which this element belongs to?
- Is the element a metal or a non-metal? Justify your answer.

Ans : [CBSE 2012]

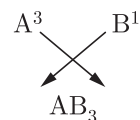
- It belongs to group 13, 3rd period because it has 3 valence electrons and 3 shells.
- It is a metal because it can lose 3 electrons to become stable.

60. The electronic configuration of two elements A and B

are 2, 8, 3 and 2, 8, 7 respectively. Find the atomic number of these elements. State the nature and formula of the compound formed by union of these elements.

Ans : [CBSE 2012]

A has $2 + 8 + 3 = 13$ as its atomic number B has $2 + 8 + 7 = 17$ as its atomic number



AB_3 is the formula of compound. It is an ionic compound.

61. The atomic number of three elements are given below:

Element (symbol)	A	B	C
Atomic number	5	7	10

Write the symbol of element which belongs to (a) group 13, (b) group 15 of the periodic table. State the period to which these elements belongs to. Give reason for your answer.

Ans : [CBSE 2012]

- A(2, 3) belongs to group 13 because it has 3 valence electrons.
- B(2, 5) belongs to group 15 because it has 5 valence electrons. It belongs to 2nd period because it has 2 shells.

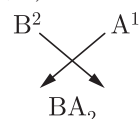
62. The electronic configuration of two elements A and B are 2, 8, 7 and 2, 8, 8, 2 respectively. Write the atomic number of these elements. What will be formula of the compound formed and the nature of bond between them when these two elements chemically combine together?

Ans : [CBSE 2012]

A - $2 + 8 + 7 = 17$ is its atomic number.

B - $2 + 8 + 8 + 2 = 20$ is its atomic number.

A(2, 8, 7) B(2, 8, 8, 2)



The nature of bond is ionic bond.

63. The atomic number of these elements are given below:

Element (symbol)	A	B	C
Atomic number	3	6	9

Write the symbol of element which belongs to

- group 1,
- group 14 of the periodic table.

State the period of the periodic table to which these elements belong to. State reason to support your answer.

Ans : [CBSE 2012]

- A(3) has electronic configuration 2, 1. It belongs to group 1. Hence the number of valence electrons is 1.
- B(6) has electronic configuration 2, 4. It belongs to group 14, valence electrons = 4.
They belong to second period because they have 2 shells.

64. How the electronic configuration of the atom of an element is related to its position in the modern periodic table? Explain with one example.

Ans : [CBSE 2011]

Period No. = Number of shells

Group No. = Number of valence electrons or valence electrons + 10.

Example

Na(11): 2, 8, 1. It has 1 valence electron, it belongs to group 1. Also Al (13): 2, 8, 3. It has 3 shells, therefore it belongs to 3rd period.

65. The atomic number of three elements, X, Y and Z are 9, 11 and 17 respectively. Which two of these elements will show similar chemical properties? Why?

Ans : [CBSE 2011]

X(9) : 2, 7

Y(11) : 2, 8, 1

Z(17) : 2, 8, 7

X and Z have similar chemical properties because they have the same number of valence electrons.

66. On the basis of electronic configuration, how will you identify the first and the last element of a period?

Ans : [CBSE 2011]

1st element will have 1 valence electron whereas last element will have 8 valence electrons except in first period in which last element has 2 electrons.

67. In the modern periodic table, the element Calcium (atomic number = 20) is surrounded by elements with atomic numbers 12, 19, 21 and 38. Which of these elements has physical and chemical properties resembling those of Calcium and why?

Ans : [CBSE 2011]

Ca(20): 2, 8, 8, 2

Mg(12): 2, 8, 2

Sr(38): 2, 8, 18, 8, 2

Mg and Sr has similar properties to Ca because each of them have 2 valence electrons.

68. How does metallic character of the elements change along a period in the periodic table from left to right

and why?

Ans : [CBSE 2011]

Metallic character of elements decreases along a period from left to right because atomic size decreases, tendency to lose electrons decreases.

69. How does valency of the elements vary

- in going down a group, and
- in going from left to right in a period of the periodic table?

Ans : [CBSE 2011]

- It remains the same.
- It first increases till middle, then decreases.

70. In the periodic table, how does the tendency of atoms to lose electrons change on going from

- left to right across a period?
- top to bottom in a group?

Ans : [CBSE 2011]

- Tendency to lose electron(s) decreases across the period from left to right.
- Tendency to lose electron(s) increases down in a group.

71. Give reasons:

- Elements in a group have similar chemical properties.
- Elements of Group 1 form ions with a charge of +1.

Ans : [CBSE 2011]

- It is due to the same number of valence electrons.
- Group-1 elements can lose one electron to form positive ions with charge equal to +1.

72. What is meant by periodicity of properties of elements? Why are the properties of elements placed on the same group of the periodic table similar?

Ans : [CBSE 2011]

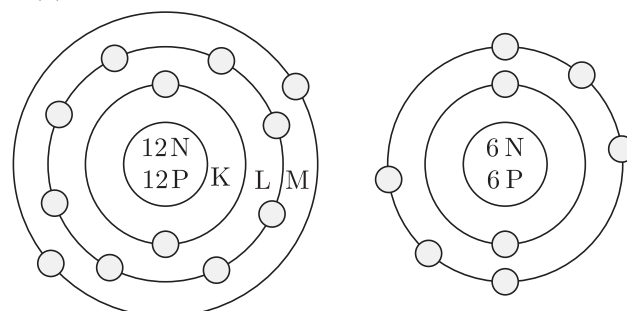
The repetition of similar properties after a definite interval is called periodicity of properties. It is due to the same number of valence electrons.

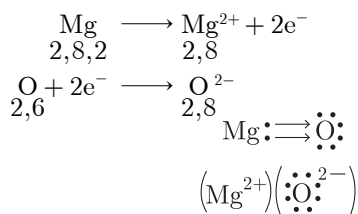
73. Elements Mg and O respectively belong to group 2 and group 16 of the modern periodic table. If the atomic number of Mg and O are 12 and 8 respectively, draw their electronic structures and show the process of formation of the compound by transfer of electrons between them.

Ans : [CBSE 2010]

Mg(12): 2, 8, 2

O(8): 2, 6





74. State Mendeleev's periodic law. Write two achievements of Mendeleev's periodic table.

Ans : [CBSE 2009]

Properties of elements are a periodic function of their atomic mass.

Achievements:

- It could arrange all the elements discovered at that time.
- It left some gaps for the elements to be discovered and helped in their discovery by predicting their properties.

75. The elements of the second period of the periodic table are given below:

Li, Be, B, C, N, O, F

- Give reason to explain why atomic radii decreases from Li to F.
- Identify the most (i) metallic and (ii) non-metallic element.

Ans : [CBSE 2008(C)]

- It is because effective nuclear increases due to increase in forces of attraction between more electrons with more protons, even though number of shells remain the same.
- (i) Li is the most metallic element, (ii) F is the most non-metallic element.

76. The elements of the third period of the Periodic Table are given below:

Group	I	II	III	IV	V	VI	VIII
Period 3	Na	Mg	Al	Si	P	S	Cl

- Which atom is bigger, Na or Mg? Why?
- Identify the most (i) metallic and (ii) non-metallic element in Period 3.

Ans : [CBSE 2008(C)]

- Na is bigger because it has 11p and 11e i.e., less forces of attraction than in Mg which has 12 protons and 12 electrons and has more forces of attraction, due to more effective nuclear charge.
- (i) Na is the most metallic element, (ii) Cl is the most non-metallic element.

77. Given below are four elements with their atomic numbers:

A(16), B(11), C(3), D(14)

- Identify the elements which belong to the same group of the Modern periodic table.
- Arrange the elements in decreasing order of the atomic size.
- Write the formula of oxide of B.
- Which of these elements is a metalloid?

Ans : [CBSE 2011]

- C(3) and B(11) belongs to the same group.

- A<D<B<C is the decreasing order of atomic size.
- B₂O is the formula of oxide.
- D is a metalloid.

78. Give reasons for the following:

- Lithium atom is smaller than sodium atom.
- Chlorine (Atomic number 17) is more electronegative than Sulphur (Atomic number 16)

Ans : [CBSE 2011]

- Li(3): 2, 1; Na(11): (2, 8, 1).
Li has two shells, therefore it is smaller than Na which has 3 shells.
- Chlorine (17) is smaller than sulphur (16), therefore it is more electronegative than sulphur.

79. a. State the main characteristic of elements on which modern periodic table is based.

- No fixed position is assigned to hydrogen in the periodic table, why?

Ans : [CBSE 2012]

- Modern periodic table is based on the trend of increasing order of atomic number. Elements of same group have same number of valence electrons.
- Hydrogen resembles with both group 1 and group 17 elements, therefore it does not have a fixed position.

80. Two elements M and N belong to group 1 and 2 respectively and are in the same period of the periodic table. How do the following properties of M and N vary?

- Sizes of their atoms.
- Their metallic character.
- Their valencies in forming oxides.
- Formulae of their chlorides.

Ans : [CBSE 2012, 2009]

- M has bigger size than N.
- M has more metallic character than N.
- M has valency equal to 1, N has valency equal to 2.
- MCl and MCl₂ are formula of their chlorides.

81. The following table shows the elements represented by the letters A, B, C, D, E, F, G and H.

Group	1	2	13	14	15	16	17	18
Element	A	B	C	D	E	F	G	H

- Which of the elements has the atomic size (i) biggest and (ii) smallest?
- Which element has valency equal to (i) 3 and (ii) zero?

Ans : [CBSE2012]

- (i) A has the biggest size. (ii) G has the smallest size.
- (i) C has valency equal to 3. (ii) H has valency equal to zero.

- 82.** a. State Modern Periodic Law
b. Elements A, B, C and D have atomic number 1, 8, 11, 19 respectively. Choose the odd element and give reason for your answer.

Ans : [CBSE 2012]

- Modern Periodic Law:** It states 'properties of elements are a periodic function of their atomic number'.
- B(8): 2, 6 is an odd element because it has 6 valence electrons whereas others have 1 valence electron.

- 83.** Arrange the following elements in descending order of their atomic size and give reason for your answer.
Mg(12), P(15), Cl(17), Ar(18)

Ans : [CBSE 2012]

Mg > P > Ar > Cl

As we move from left to right, atomic size decreases due to increase in effective nuclear charge. Ar is bigger than Cl due repulsion between 8 valence electrons.

- 84.** Na, Mg, Al are the elements having one, two and three valence electrons respectively. Which of these elements (a) has longest atomic radius, (b) is least reactive? Justify your answer stating reason for each.

Ans : [CBSE 2012, 2015]

- Na has the largest atomic radius due to least effective nuclear charge due to less forces of attraction between 11 protons and 11 electrons.
- Al is the least reactive element due to small its size and least tendency to lose electrons.

- 85.** The atomic number of these elements are given below:

Element	B	O	N	C
Atomic radius (in pm)	86	66	74	97

Arrange these elements in increasing order of their atomic numbers. Give reason for your answer.

Ans : [CBSE 2012]

B(5), C(6), N(7), O(8) is the increasing order of their atomic numbers.

It is because when we move along a period, atomic radii decreases due to increase in effective nuclear charge due to increase in number of protons and electrons continuously.

- 86.** Would you place the two isotopes Cl-35 and Cl-37 in different slots because of their different atomic masses or in the same slot because their chemical properties are same? Justify your answer.

Ans : [CBSE 2012, 2015]

They will be placed in the same slot because they have similar chemical properties due to same number of valence electrons.

- 87.** The electronic configuration of an element X is 2, 8, 2. To which period and group of periodic table does the element X belong to? State the valency and justify your answer in each case.

Ans : [CBSE 2012]

It belongs to 4th period because it has four shells.

It belongs to group 2 because it has 2 valence electrons. X has a valency equal to 2 because it can lose 2 electrons to become stable.

88.

- 89.** The atomic number of three elements are given below:
A(5), B(7), C(10)

Write the symbol of element which belongs to (a) group 13, (b) group 15 of the periodic table. State the period of periodic table to which these elements belong to. Give reason to your answer.

Ans : [CBSE 2012]

- A(5): 2, 3 belong to group 13 because it has 3 valence electrons.
- B(7): 2, 5 belong to group 15 because it has 5 valence electrons.

They i.e., A and B belong to second period because they have 2 shells.

- 90.** Arrange the following elements in increasing order of their atomic radii:

- Li, Be, F, N
- Cl, At, Br, I

Ans : [CBSE 2012]

- F < N < Be < Li
- Cl < Br < I < At

- 91.** Study the variation in atomic radii of first group elements given below and arrange them in an increasing order:

- Name the element which have the smallest and the largest atoms

Group	Na	Li	Rb	Cs	K
Radius in pm	161	152	244	262	231

- How does the atomic size vary as you go down the group?

Ans : [CBSE 2011]

Li < Na < K < Rb < Cs

- Li is the smallest, Cs is the largest atom.
- Atomic size increases down the group.

- 92.** Atomic radii of the elements of second period are given below:

Period II elements	B	Be	O	N	Li	C
Atomic radius (in pm)	88	111	66	74	152	77

- Arrange them in decreasing order of their atomic size.

- Are the elements now arranged in the pattern of a period in periodic table?
- Which elements have the largest and the smallest atoms?
- How does the atomic radius change as you go from left to right in a period.

Ans : [CBSE 2011]

- $\text{Li} > \text{Be} > \text{B} > \text{C} > \text{N} > \text{O}$
- Yes, They belong to the second period.
- Li is the largest, oxygen is the smallest.
- Atomic size decreases along a period from left to right.

- 93.** Li, Be, B, C are the elements of same period of Modern Periodic table.

- Arrange them in increasing order of their atomic size.
- In which shell (number) would last electron enter for all of them.
- Calculate the valence electrons in each.
- Which element amongst them is most electropositive?

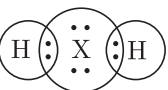
Ans : [CBSE 2016]

- $\text{C} < \text{B} < \text{Be} < \text{Li}$
- Second shell
- Li 2, 1
Be 2, 2
B 2, 3
C 2, 4
They have 1, 2, 3, 4 valence electrons respectively.
- Li is the most electropositive element.

THREE MARKS QUESTIONS

- 94.** An element X belongs to 3rd period and group 16 of the Modern Periodic table.
- Determine the number of valence electrons and the valency of X.
 - Molecular formula of the compound of X when it reacts with hydrogen and write its electron dot diagram.
 - Name the element X and state whether it is metallic or non-metallic.

Ans : [CBSE 2015]

- X has 6 valence electrons and its valency is equal to 2.
- H_2X is its formula, 
- X is sulphur. It is a non-metallic element.

- 95.** Two elements X and Y have atomic number 11 and 16 respectively.

- Write the electronic configuration of both.
- Write the formula of the compound formed by their combination (in terms of X and Y).

Ans : [CBSE 2014]

- $\text{X}(11): 2, 8, 1; \text{Y}(16): 2, 8, 6$
- X_2Y is the formula of compound formed.

- 96.** Differentiate between the arrangement of elements in Mendeleev's periodic table and Modern Periodic Table.

Ans : [CBSE Sample Paper 2017-2018]

Mendeleev's Periodic Table	Modern Periodic Table
It is based on increasing order of atomic mass.	It is based on increasing order of atomic number.
It has 8 groups and 6 periods.	It has 18 groups and 7 periods.
Increasing order of atomic mass could not be maintained.	Increasing order of atomic number can be maintained.

- 97.** Write the names given to the vertical columns and horizontal rows in the Modern Periodic Table. How does the metallic character of elements vary on moving down a vertical column? How does the size of atomic radius vary on moving from left to right in a horizontal row? Give reason in support of your answer in the above two cases.

Ans : [CBSE 2017]

Vertical columns are called groups. Horizontal rows are called periods. Metallic character of elements increases down the group because tendency to lose electrons increases down the group due to increase in atomic size. Atomic size goes on decreasing along the period due to increase in effective nuclear charge due to increase in number of protons and electrons.

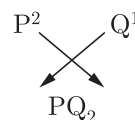
- 98.** An element 'P' (atomic number 20) reacts with an element 'Q' (atomic number 17) to form a compound. Answer the following questions giving reason: Write the position of 'P' and 'Q' in the Modern Periodic Table and the molecular formula of the compound formed when 'P' reacts with 'Q'.

Ans : [CBSE 2017]

$\text{P}(20): 2, 9, 9, 2; \text{Q}(17): 2, 8, 7$

'P' belongs to group 2 and 4th period.

'Q' belongs to group 17 and 3rd period.

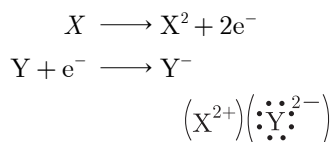
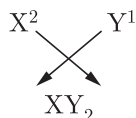


PQ_2 is the molecular formula of the compound formed.

99. Write the electronic configuration of two elements X' and 'Y' whose atomic numbers are 20 and 17 respectively. Write the molecular formula of the compound formed when element X' reacts with element 'Y'. Draw electron-dot structure of the product and also state the nature of the bond formed between both the elements.

Ans : [CBSE 2017, 2013]

X(20): 2, 8, 8, 2; Y(17): 2, 8, 7



This bond is ionic bond.

100. What is periodicity in properties of elements with reference to the Modern Periodic Table? Why do all the elements of the same group have similar properties? How does the tendency of elements to gain electrons change as we move from left in a period? State the reason of this change.

Ans : [CBSE 2017]

The repetition of similar properties after a definite interval is called periodicity of properties.

Tendency to gain electrons increases along a period from left to right because atomic size decreases.

101. The atomic number of an element is 19.
- Write the electronic configuration of this element and determine (i) the valency of this element, and (ii) whether this element is a metal or a non-metal?
 - Write the formula of the oxide of this element.
 - Is this element more reactive or less reactive than Na (atomic number 11)? Justify your answer, giving example.

Ans : [CBSE 2017]

- 2, 8, 8, 1
- Valency = 1
- It is a metal.
- X_2O
- It is more reactive than Na(11) because it is large in size and it can lose electrons easily due to less effective nuclear charge.
K reacts more vigorously with H_2O than Na.

102. Why is atomic number considered to be a more appropriate parameter than atomic mass for the classification of elements in a periodic table? How does the metallic character of elements vary as we move (a) from left to right in a period, and (b) top to bottom in a group of the modern periodic table? Give reasons to justify your answer.

Ans : [CBSE 2017]

It is because chemical properties depend upon the number of valence electrons which is determined with the help of atomic number.

- Metallic character decreases from left to right because atomic size decreases, tendency to lose electrons decreases,
- Metallic character increases from top to bottom in a group because atomic size increases due to which effective nuclear charge decreases.

103. a. Identify the elements among the following which will belong to the same group: H, He, Li, B, C.
b. State the group number of the recognised elements.
c. Name another one element belonging to the same group.

Ans : [CBSE 2017]

- H and Li belong to the same group.
- They belong to group 1.
- Na (sodium) also belong to this group.

104. Justify the following with suitable reasons:
- Cations are smaller than the corresponding atoms.
 - Size of atom increases as we move down the group.
 - Atomic size decreases as we move across a period.

Ans : [CBSE 2017, 2014]

- Cations are formed by loss of electrons, therefore effective nuclear charge increases, size of atom decreases.
- It is because number of shells goes on increasing down the group.
- It is because effective nuclear charge increases along a period.

105. Name the element with atomic number 19.

- In which group it is placed?
- To which period does it belong to?
- Write its electronic configuration.

Ans : [CBSE 2017]

The name of element is Potassium, K(19): 2, 8, 8, 1.

- It belongs to group 1.
- It belongs to 4th period.
- Its electronic configuration is 2,8 8,1.

106. The atomic number of an element is 20.

- Write its electronic configuration and determine its valency.
- Is it a metal or a non-metal?
- Write formula of its chloride.
- Is it more or less reactive than Mg(12)? Give reasons for your answer.

Ans : [CBSE 2017]

- Ca(20): 2, 8 8, 2. Its valency is equal to 2.
- It is a metal.
- $CaCl_2$.
- It is more reactive than Mg due to larger atomic size. It can lose electrons easily due to less effective nuclear charge.

107. The atomic number of an element is 12.

- Write its electronic configuration and determine its valency.
- Is it more reactive or less reactive than Ca(20)?
- Is it a metal or a non-metal?
- Write the formula of its oxide.

Ans : [CBSE 2017]

- Mg(12): 2, 8, 2. Its valency is equal to 2.
- It is less reactive than Ca.
- It is a metal.
- MgO

- 108.** Out of the elements H(1), Be(4), Na(11) and Mg(12).
- Write the pair of elements having similar chemical properties.
 - State the group number of each pair,
 - Name one another element belonging to each of these groups.

Ans : [CBSE 2017,2016]

- Be(4) and Mg(12) have similar chemical properties. H(1) and Na(11) have similar chemical properties.
- Be and Mg belong to group 2, H and Na belong to group 1.
- K belongs to group 1 and Ca belongs to group 2.

- 109.** Calcium is an element with atomic number 20. Stating the reason, answer each of the following questions:
- Is calcium a metal or a non-metal?
 - Will its atomic radius be larger or smaller than that of potassium with atomic number 19?
 - Write the formula of its oxide.

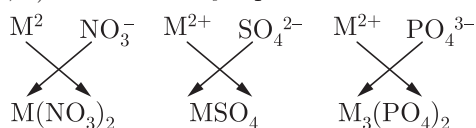
Ans : [CBSE 2016]

- Calcium is a metal because it can lose electrons to form cations.
- Its atomic radius will be smaller due to more number of protons and electrons, more forces of attraction.
- CaO

- 110.** An element M with electronic configuration (2,8,2) combines separately with $(\text{NO}_3)^-$, $(\text{SO}_4)^{2-}$ and $(\text{PO}_4)^{3-}$ radicals. Write the formula of the three compounds so formed. To which group and period of the Modern Periodic Table does the element M belong to? Will M form covalent or ionic compounds? Give reason to justify your answer.

Ans : [CBSE 2016]

M(2, 8, 2). It has valency equal to 2.



M belongs to group 2.

It belongs to 3rd period.

M will form ionic compound because M can easily lose electrons.

Bond will be formed by transfer of electrons.

- 111.** An element X'(Atomic number 20) burns in the presence of oxygen to form a basic oxide.
- Identify the element and write its electronic configuration.
 - State its group number and period number in the Modern Periodic Table.
 - Write a balanced chemical equation for the reaction when this oxide is dissolved in water.

Ans : [CBSE 2016]

- X is calcium because it forms CaO (basic oxide). Its electronic configuration is 2, 8, 8, 2.

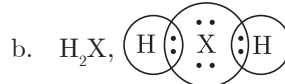
- It belongs to group 2 and 4th period.
- $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca}(\text{OH})_2$

- 112.** An element X belongs to 3rd period and group 16 of the Modern Periodic Table.

- Determine the number of valence electrons and the valency of X.
- Molecular formula of the compound when X reacts with hydrogen and write its electron dot structure.
- Name the element X and state whether it is metallic or non-metallic.

Ans : [CBSE 2016]

- X is sulphur, S(16): 2, 8, 6. It has 6 valence electrons. Its valency is equal to 2.



- X is a non-metal.

- 113.** How does tendency to lose electrons change in the Modern Periodic Table in (a) a group, (b) a period and why?

Ans : [CBSE 2016]

- In a group, tendency to lose electrons increases down the group because atomic size increases, forces of attraction between the valence electron and nucleus decreases.
- In a period, tendency to lose electrons decreases due to decrease in atomic size due to more effective nuclear charge.

- 114.** Three elements 'X', 'Y' and 'Z' have atomic numbers 7, 8 and 9 respectively.

- State their positions (Group number and period number both) in the Modern Periodic Table.
- Arrange these elements in decreasing order of their atomic radii.
- Write the formula of the compound formed when X' combines with 'Z'.

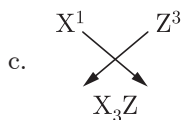
Ans : [CBSE 2016]

X(7): 2, 5,

Y(8): 2, 6

Z(9): 2, 7

- X belong to Group 15 and 2nd period.
Y belong to Group 16 and 2nd period.
Z belong to Group 17 and 2nd period.
- $\text{X} > \text{Y} > \text{Z}$



- 115.** The atomic number of Na and Mg are 11 and 12 respectively and they belong to the same period
- Which one should have smaller atomic size?
 - Which would be more electropositive?
 - To which group would each one belong?

Ans : [CBSE 2016]

Na(11): 2, 8, 1; Mg(12): 2, 8, 2

- Mg will have smaller size.
- Na is more electropositive.
- Na(11) belongs to group 1 whereas Mg(12) belongs to group 2.

- 116.** Explain the basic character of oxides of elements down the group and across the period.

Ans : [CBSE 2016]

Basic character of oxides increases down the group because metallic character increases.

Basic character of oxides decreases along the period from left to right because non-metallic character increases, metallic character decreases.

- 117.** Describe the basic character of oxides of third period elements across the period from left to right.

Ans : [CBSE 2016]

Na_2O , MgO are basic oxides.

SiO_2 , Al_2O_3 are amphoteric oxides.

P_2O_5 , SO_2 , Cl_2O_7 are acidic oxides.

Basic character of oxides decreases across the period.

- 118.** Write the number of periods in the modern periodic table. State the changes in valency and metallic character of elements as we move from left to right in a period. Also state the changes, if any, in the valency and atomic size of elements as we move down the group.

Ans : [CBSE 2015, 2013]

There are 7 periods in Modern Periodic Table.

Valency first increases and then decreases. Metallic character decreases along a period from left to right.

There is no change in valency down the group.

Atomic size increases down the group.

- 119.** How many groups and periods are there in the Modern Periodic Table? How do the atomic size and metallic character of elements vary as we move

- down a group and
- from left to right in a period?

Ans : [CBSE 2015]

There are 7 periods in Modern Periodic Table.

Valency first increases and then decreases. Metallic character decreases along a period from left to right.

There is no change in valency down the group.

Atomic size increases down the group.

- 120.** Two elements P and Q belong to the same period of the modern periodic table and are in Group-1 and Group-2 respectively. Compare their following

characteristics in tabular form:

- The number of electrons in their atoms.
- The size of their atoms.
- Their metallic character.
- Their tendency to lose electrons.
- The formula of their oxides.
- The formula of their chlorides.

Ans : [CBSE 2015, 2014]

- P has 1 valence electron, Q has 2 valence electrons.
- P is bigger than Q.
- P is more metallic than Q.
- P can lose electrons more easily than Q.
- P_2O and QO
- PCl and QCl_2

- 121.** Taking example of an element of atomic number 16, explain how the electronic configuration of the atom of an element relates to its position in the Modern Periodic Table and how valency of an element is calculated on the basis of its atomic number?

Ans : [CBSE 2015]

S(16) has electronic configuration of 2, 8, 6,

Group number = valence electrons + 10

$$= 6 + 10 = 16$$

Period number = Number of shells = 3

$$\text{Valency} = 8 - \text{valence electrons} = 8 - 6 = 2$$

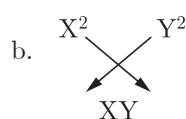
- 122.** The atomic number of an element X is 20.

- Determine the position of the element 'X' in the periodic table.
- Write the formula of the compound formed when 'X' reacts/combines with another element 'Y' (atomic number 8).
- What would be the nature (acidic or basic) of the compound formed? Justify your answer.

Ans : [CBSE 2015]

X(20): 2, 8, 8, 2; Y(8): 2, 6

- It belongs to group 2, 4th period because its valence electrons are 2 and no. of shells = 4



- Compound formed will be basic because 'X' is a metal.

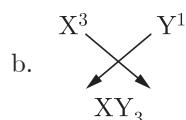
- 123.** An element X is placed in 13th group and 3rd period of Modern Periodic Table. Answer the following stating reason for your answer.

- Write the electronic configuration of the element X.
- Write the formula of the compound formed when element X reacts with another element 'Y', having atomic number 17.
- Will oxide of this element be acidic or basic?

Ans : [CBSE 2015]

X is Aluminium (13); Y(17) 2, 8, 7

- 2, 8, 3



- c. It will be amphoteric i.e., it is acidic as well as basic.

124. Given below are some elements of the Modern Periodic Table. Atomic number of the element is given in the parentheses:

A(4), B(9), C(14), D(19), E(20)

- Select the element that has only one electron in the outermost shell. Also write the electronic configuration of this element.
- Which two elements amongst these belong to the same group? Give reason for your answer.
- Which two elements amongst these belong to the same period? Which among the two has bigger atomic radius?

Ans : [CBSE 2015]

- D(19): 2,8,8,1 has 1 valence electron.
- A(4): 2, 2 and E(20): 2, 8, 8, 2 belong to same group because they have the same number of valence electrons.
- A(2, 2), B(2, 7) belong to the same period. A has bigger atomic radius than B.

125. Write the main aim of classifying elements. Name the basic property of elements which is used in the development of Modern Periodic Table. State the Modern Periodic Law. On which side (part) of the Modern Periodic Table do you find metals, metalloids and non- metals?

Ans : [CBSE 2015]

Classification is done so as to study the properties of 118 elements easily. Modern periodic table is based on atomic number of the atom an element. 'Properties of elements are a periodic function of their atomic numbers.' Metals are placed on the left and middle, non-metals are placed on the right and Metalloids are placed on the border line between metals and non-metals in a zig-zag manner.

126. The elements ${}_4\text{Be}$, ${}_{12}\text{Mg}$ and ${}_{20}\text{Ca}$ having two valence electrons in their valence shells are in periods 2, 3 and 4 respectively of the modern periodic table. Answer the following questions associated with these elements, giving reason in each case:

- In which group should they be placed?
- Which one of them is least reactive?
- Which one of them has the largest atomic size?

Ans : [CBSE 2015, 2014]

- They belong to group 2.
- Be is least reactive.
- Ca has largest atomic size.

127. In the following table, the position of six elements A, B, C, D, E and F are given as they are in the Modern Periodic Table:

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

On the basis of the above table, answer the following

questions:

- Name the element which forms only covalent compounds.
- Name the element which is a metal with valency of three.
- Name the element which is a non-metal with valency of three.
- Out of B and C, whose atomic radius is bigger and why?
- Write the common name of the family to which the elements D and F belongs to?

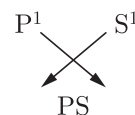
Ans : [CBSE 2015]

- E is an element which form covalent compounds.
- B is a metal with a valency of 3.
- C is a non-metal with a valency of 3.
- B has bigger size.
- D and F belong to Noble gases.

128. Four elements P, Q, R and S belong to third period of the Modern Periodic Table and have respectively 1, 3, 5 and 7 electrons in their outermost shell. Write the electronic configurations of Q and R and determine their valencies. Write the molecular formula of the compound formed when P and S combine.

Ans : [CBSE 2015]

P: 2, 8, 1 Valency = 1
Q: 2, 8, 3 Valency = 3
R: 2, 8, 5 Valency = 3
S: 2, 8, 7 Valency = 1



PS is the formula of compound.

129. Study the following table in which positions of six elements A, B, C, D, E and F are shown as they are in the modern periodic table:

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

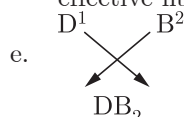
On the basis of the above table, answer the following questions:

- Name the element which forms only covalent compounds.

- Which element is a metal with a valency of one?
- Which element is a non-metal with a valency of two?
- Out of D and E, which has a bigger atomic radius and why?
- Write the formula of the compound formed when B combines with D.

Ans : [CBSE 2014]

- E forms only covalent compounds.
- D is a metal with valency of 1.
- B is a non-metal with valency of 2.
- D has bigger atomic size because it has less effective nuclear charge.



DB₂ is formula of the compound.

- 130.** The electrons in the atoms of four elements A, B, C and D are distributed in three shells having 1, 3, 5 and 7 electrons in the outermost shell respectively. State the period in which these elements can be placed in the modern periodic table. Write the electronic configuration of the atoms of A and D and the molecular formula of the compound formed when A and D combine.

Ans : [CBSE 2014]

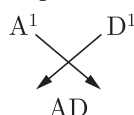
A: 2, 8, 1

B: 2, 8, 3

C: 2, 8, 5

D: 2, 8, 7

They belong to the 3rd period.



AD is the molecular formula.

- 131.** Based on the group valency of elements state the formula for the following giving justification for each:
- Oxides of 1st group elements,
 - Halides of the elements of group 13, and
 - Compounds formed when an element of group 2 combines with an element of group 16.

Ans : [CBSE 2014]

- M₂O
- MCl₃
- CaO

- 132.** a. Define the following terms (i) Valency, (ii) Atomic size
- How do the valency and the atomic size of the elements vary while going from left to right along a period in the modern periodic table?

Ans : [CBSE 2014]

- (i) Valency: It is the number of electrons lost or gained or shared by an atom.
(ii) Atomic size: It is the distance between centre of the nucleus and outermost shell of an atom.
- Valency first increases till middle and then decreases. Atomic size decreases from left to right

along a period.

- 133.** What is meant by 'group' in the modern periodic table? How do the following change on moving from top to bottom in a group?
- Number of valence electrons.
 - Number of occupied shells.
 - Size of atoms.
 - Metallic character of elements.
 - Effective nuclear charge experienced by valence electrons.

Ans : [CBSE 2014]

The vertical column of the periodic table is called group.

- Number of valence electrons remains the same in a group.
- Number of occupied shells goes on increasing down a group.
- Size of atom increases down the group.
- Metallic character of element increases down the group.
- Effective nuclear charge decreases down the group.

- 134.** The electronic configuration of 4 elements A, B, C and D are given as under:

A-2, 1; B-2, 2; C-2, 8, 2; D-2

- Which amongst them belongs to the same group? Name it.
- Which amongst them belong to the same period? Name it.
- Which amongst them is an inert element? Name it.

Ans : [CBSE 2014]

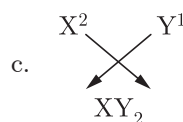
- B and C belong to the same group, 2nd group; Be and Mg.
- A and B belong to the same period, 2nd period; Li and Be.
- D is the inert; It is Helium (He).

- 135.** Two elements X and Y have atomic 12 and 17 respectively.

- Write the electronic configuration of both these elements.
- Which type of bond will they form?
- Write the formula of the compound formed by their combination (in terms of X and Y).

Ans : [CBSE 2014]

- X: 2, 8, 2; Y: 2, 8, 7
- They will form ionic bond.



XY₂ is the formula of the compound.

- 136.** An element X (atomic number 17) reacts with an element Y (atomic number 20) to form a compound.

- Write the position of these elements in the modern periodic table.
- Write the formula of the compound formed. Justify your answer in each case.

Ans : [CBSE 2013]

- X: 2, 8, 7 belongs to 3rd period, group 17, because

it has 3 shells and 7 valence electrons.

Y: 2, 8, 8, 2 belongs 4th period, group 2, because it has 4 shells and 2 valence electrons.

- b. YX_2 is the formula of the compound, because Y has valency 2, X has valency 1.

137. Given below are some elements of the modern periodic table:

${}_4\text{Be}$, ${}_9\text{F}$, ${}_{14}\text{Si}$, ${}_{19}\text{K}$, ${}_{20}\text{Ca}$

- a. Select the element that has one electron in the outermost shell and write its electronic configuration.
b. Select two elements that belong to the same group. Give reason for your answer.
c. Select two elements that belong to the same period. Which one of these two has bigger atomic size?

Ans : [CBSE 2013]

- a. ${}_{19}\text{K}$: 2, 8, 8, 1
b. ${}_4\text{Be}$, ${}_{20}\text{Ca}$ belong to the same group because both have same number of valence electrons.
Be: 2, 2; Ca: 2, 8, 8, 2
c. ${}_4\text{Be}$, ${}_9\text{F}$ belong to the same period. ${}_4\text{Be}$ has bigger atomic size than ${}_9\text{F}$.

138. The elements Li, Na and K each having one valence electron, are in period 2, 3 and 4 respectively of modern periodic table.

- a. In which group of the periodic table should they be placed?
b. Which one of them is least reactive?
c. Which one of them has the largest atomic radius?
d. Give reason to justify your answer in each case.

Ans : [CBSE 2013]

- a. They belong to group 1 because they have one only valence electron.
b. Lithium (Li) is the least reactive because it is smallest in size, has least tendency to lose electrons.
c. K has largest atomic radius because it has maximum number of shells.

139. Four elements P, Q, R and S have atomic numbers 12, 13, 14 and 15 respectively. Answer the following questions giving reasons:

- a. What is the valency of Q?
b. Classify these elements as metals and non-metals.
c. Which of these elements will form the most basic oxide?

Ans : [CBSE 2013]

- a. Q(2, 8, 3) has valency = 3
b. P, Q are metals, R and S are non-metals.
c. P will form the most basic oxide.

140. The atomic number an element is 17. Predict:

- a. its valency.
b. whether it is a metal or a non-metal?
c. its relative size with respect to other members of the group.

Justify your answer in each case.

Ans : [CBSE 2013]

2, 8, 7 is the electronic configuration.

- a. Its valency is equal to 1 because it can gain 1 electron to become stable.
b. Non-metals because it can gain an electron to form anion.
c. It is bigger in size than F (1st element) but smaller than all other members because it has 3 shells, F has 2 shells, others have more than 3 shells.

141. F, Cl and Br are the elements each having seven valence electrons. Which of these (a) has the largest atomic radius, (b) is most reactive? Justify your answer stating reason for each.

Ans : [CBSE 2012]

- a. Br has the largest atomic size because it has 4 shells.
b. F is the most reactive v it can give electrons most easily due to its smallest size.

142. Na/Mg and Al are the elements having one, two and three valence electrons respectively. Which of these elements (a) has the largest atomic radius, (b) is least reactive? Justify you answer stating reason for each.

Ans : [CBSE 2012]

Na has largest atomic radii due to 11 protons and 11 electrons and least effective nuclear charge. Na is most reactive because it can lose an electron easily due to its large size and least effective nuclear charge.

- 143.** a. How are the following related?
i. Number of valence electrons of different elements in the same group.
ii. Number of shells of elements in the same period.
b. How do the following change?
i. Number of shells of elements as we go down a group.
ii. Number of valence electrons of elements on moving from left to right in a period.
iii. Atomic radius in moving from left to right along a period.
iv. Atomic size as we go down a group.

Ans : [CBSE 2012]

- a. i. Same number of valence electrons.
ii. Number of shells remains the same in a period.
b. i. Number of shells goes on increasing down the group.
ii. Number of valence electrons goes on increasing in a period from left to right.
iii. Atomic radius decreases along a period from left to right.
iv. Atomic size increases down a group.

144. a. How many periods are there in the Modern Periodic Table of elements?
b. How do atomic radius, valency and metallic character vary down a group?
c. How do atomic size and metallic character of elements vary as we move from left to right in a period?

Ans : [CBSE 2012]

- a. There are 7 periods.

- b. Atomic radius and Metallic character increases down the group. Valency remains the same in a group.
- c. Atomic size and metallic character decrease along a period from left to right in a period.

145. Explain the variation in the following properties of the elements in periodic table:

- a. Atomic radius in the periodic table,
- b. Metallic character in a period,
- c. Valency in a group.

Ans : [CBSE 2012]

- a. Atomic radius and Metallic character increases down the group. Valency remains the same in a group.
- b. Atomic size and metallic character decrease along a period from left to right in a period.

146. The elements of group 18 of the periodic table are given:

He, Ne, Ar, Kr, Xe, Rn, Dg

- a. The elements of this group are unreactive, why?
- b. Which atom is bigger in size Ne or Ar and why?

Ans : [CBSE 2012]

- a. It is because they have their octet complete i.e., stable electronic configuration.
- b. Ar has bigger atomic size than Ne because Ar has 3 shells while Ne has 2 shells; Ar (2, 8, 8), Ne (2, 8)

147. (a) State modern periodic law.

- (b) How many groups and periods are present in the modern periodic table?
- (c) State how the problem of placing (a) hydrogen, (b) isotopes of an element has been solved in this periodic table.

Ans : [CBSE 2012]

- a. Properties of elements are a periodic function of their atomic numbers'.
- b. There are 18 groups and 7 periods.
- c. (i) Hydrogen is placed along with group 1 as well as halogens because it resembles with both of them.
(ii) Isotopes do not need a separate place as they have the same atomic number.

148. a. Predict which of the following will form anions and which will form cations.

(i) Na, (ii) Al, (iii) Cl, (iv) O

b. Name two elements that are inert.

Ans : [CBSE 2014]

- a. Cl and O will form anions i.e., Cl^- and O^{2-}
Na and Al will form cations i.e., Na^+ and Al^{3+} .
- b. He and Ne are inert elements.

149. a. How does electropositivity of elements gets affected as we move (i) down the group, (ii) across the period?

- b. Which atomic property increases both ways: as we move across the period or down the group?

Ans : [CBSE 2014]

- a. (i) Electropositivity increases down the group.

(ii) Electropositivity decreases across the period from left to right.

- b. Atomic number increases across the period as well as down the group.

150. (a) Identify the element that have two completely filled shells and the number of valence electrons in each case if atomic numbers are: (i) 1, (ii) 2, (iii) 7, (iv) 8

- (b) Analyse which amongst them is inert.

Ans : [CBSE 2014]

- a. (i) 2, 8, 1: Sodium
(ii) 2, 8, 2: Magnesium
(iii) 2, 8, 7: Chlorine
(iv) 2, 8, 8: Argon
- (b) Argon is inert.

151. The atomic number of K and Ca is 19 and 20 respectively and they belong to same period.

- a. Which amongst them would have smaller atomic size?
- b. Which one would be more electro-positive?
- c. To which group would each one belong to?

Ans : [CBSE 2014]

- a. Ca has smaller atomic size.
- b. K is more electropositive.
- c. K belongs to group 1, Ca belongs to group 2.

152. The position of three elements A, B and C in the periodic table are indicated below:

Ans :

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?

Ans : [CBSE 2011]

- a. O is a non-metal because it has 7 valence electrons. It can gain one electron to form an anion.
- b. A is more reactive than C because it is smaller in size, therefore it can gain electron(s) easily.

153. 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 combines with chlorine to form an acid and common salt respectively. The oxide of element A is liquid at room temperature and it is a neutral substance, while the oxides of the remaining six elements are basic in nature. Based on the above information, answer the following question:

- a. What could the element A be?
- b. Will elements A to G belong to the same period or same group of the periodic table?
- c. Write the formula of the compound formed by the reaction of the element A with oxygen.

- Show the formation of the compound by the combination of element C with chlorine with the help of electronic structure.
- What would be the ratio of number of combining atoms in a compound formed by the combination of element A with carbon?
- Which one of the given elements is likely to have the smallest atomic radius?

Ans : [CBSE 2010]

- A is hydrogen.
 - A and G will belong to the same group.
 - H₂O is the formula of the compound.
 - C is sodium.
- $$\text{Na} \longrightarrow \text{Na}^+ + \text{e}^- \quad \text{or} \quad \text{C} \longrightarrow \text{C}^+ + \text{e}^-$$
- $$\text{Cl} + \text{e}^- \longrightarrow \text{Cl}^- \quad \text{or} \quad \text{Cl} + \text{e}^- \longrightarrow \text{Cl}^-$$



- CA₄ i.e., 1:4
- A has smallest atomic radius.

154. 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 as follows:

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

- Which of these is (i) a noble gas, (ii) a halogen?
- If B combines with F, what would be the formula of the compound formed?
- Write the electronic configurations of 'C' and 'E'.

Ans : [CBSE 2010]

- (i) G is a noble gas, (ii) F is a halogen.
- BF is the formula of compound.
- C: 2, 8, 2 E: 2, 8, 6

155. 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)

- What is the electronic configuration of F?
- What is number of valence electrons in 'F'?
- What is number of shells in 'F'?
- Arrange E, F, G, H in decreasing order of atomic size.
- State whether F is a metal or a non-metal.
- Out of three elements B, E and F, which one has biggest atomic size.

Ans : [CBSE 2010]

- 2, 8, 2 is the electronic configuration of F.
- No. of valence electrons = 2.
- Three shells are present in F.
- H > G > F > E is the decreasing order of atomic size.
- F is a metal.
- B has biggest atomic size.

- 156.**
- Why did Mendeleev leave gaps in his periodic table?
 - State any three limitations of Mendeleev's periodic table.
 - How do the electronic configuration of atoms change in a period with increase in atomic number.

Ans : [CBSE 2009]

- He left gaps for the new elements which are to be discovered.
- (i) Increasing order of atomic mass could not be maintained.
(ii) Position of hydrogen was not justified.
(iii) Isotopes could not be placed in different slots due to different atomic mass but same properties.
- Number of valence electrons keep on increasing along a period from left to right in a period.

- 157.**
- What is meant by periodicity in properties of elements with reference to the periodic table?
 - Why do all the elements of the same group have similar properties?
 - How will the tendency to gain electrons change as we go from left to right across a period. Why?

Ans : [CBSE 2009]

- The repetition of similar properties after regular intervals is called periodicity in properties.
- It is because they have the same number of valence electrons.
- Tendency to gain electrons increases from left to right across the period due to decrease in atomic size.

158. The position of three elements A, B and C in the Periodic Table is shown below:

Group 16	Group 17
-	-
-	A
-	-
B	C

Giving reasons, explain the following:

- Element 'A' is a non-metal.
- Element 'B' has a larger atomic size than element 'C'.
- Element 'C' has a valency of 1.

Ans : [CBSE 2008C]

- A is a non-metal because it has 7 valence electrons, it can gain one electron to form anion.
- B has less electrons and protons, less forces of attraction between the nucleus and valence electrons, therefore it is bigger in size.
- C can gain 1 electron to become stable, therefore

its valency is equal to 1.

- 159.** The position of three elements A, B and C in the Periodic Table is shown below:

Group → Period ↓	1	2	13	14	15	16	17
1	B						
2							A
3						C	

Giving reasons, explain the following:

- Element A is a non-metal.
- Atoms of element C has a larger size than atoms of element A.
- Element B has a valency of 1.

Ans : [CBSE 2009C]

- A is a non-metal because it can gain one electrons to form anion.
- C has more number of shells i.e., it has 3 shells because it belongs to 3rd period whereas A has 2 shells as it belongs to 2nd period.
- B can lose 1 electron to become stable, therefore its valency is equal to 1.

- 160.** 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.

Ans : [CBSE 2009]

- Increasing order of atomic mass was the physical property.
- Formulae of oxides and hydrides was the chemical property.
- Increasing order of atomic mass could not be maintained.
- Position of isotopes posed a challenge for the classification of elements.

- 161.** Table given below shows a part of the modern periodic table.

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

Using this table, explain why

- Li and Na are considered as active metals.
- Atomic size of Mg is less than that of Na.
- Fluorine is more reactive than chlorine.

Ans : [CBSE 2009]

- Li and Na have largest atomic size in respective period, therefore they can lose an electron easily, hence they are active metals.
- Mg has 12 protons and 12 electrons which has more forces of attraction, therefore, it is smaller in size than Na which is having 11 protons and 11 electrons.
- F is smaller in size, it can gain electrons easily, therefore, it is more reactive than Cl.

- 162.** The element Be, Mg and Ca are placed in the second

group of the periodic table. Their atomic numbers are 4, 12, 20 respectively

- Write the electronic configuration of these elements.
- Write the valency exhibited by them,
- Which three elements will be the most reactive?

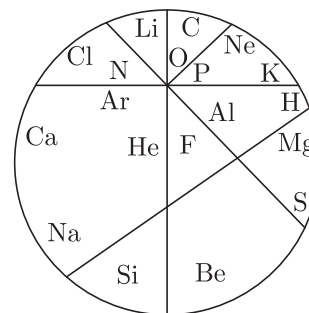
Ans : [CBSE 2013]

a.

Shell	K	L	M	N
Be(4) :	2	2		
Mg(12) :	2	8	2	
Ca(20):	2	8	8	2

- Valency is 2.
- Ca is the most reactive metal.

- 163.** In the figure given below the first 20 elements are jumbled up. Carefully observe the figure and answer the following questions:



- Pick out the two elements which are known as alkali metals.
- Pick out the two elements which have valency of 4.
- Pick out two elements which belong to group 16 of the periodic table.

Ans : [CBSE 2013]

- Na, K are alkali metals.
- C, Si have valency equal to 4
- O and S belongs to group 16.

- 164.** Examine elements of the third period: Na, Mg, Al, Si, P, S, Cl and Ar Answer the following:

- Choose (i) Metals, (ii) Non-metals out of these elements.
- On which side of periodic table we find (i) metals (ii) non-metals.
- Name metalloids out of the elements given above.

Where are they located in the periodic table?

Ans : [CBSE 2011]

- (i) Na, Mg, Al are metals.
(ii) P, S, Cl, Ar are non-metals.
- (i) Metals are placed on the left hand side and middle part of the periodic table.
(ii) Non-metals are placed on the right hand side of periodic table.
- Silicon is a metalloid. They are located between metals and non-metals at the border line in a zig-zag manner.

165. As we move across a period in the periodic table, what is gradation in the following properties: (a) Atomic size, (b) Atomic number, (c) Electronegativity?

Ans : [CBSE 2015]

- Atomic size goes on decreasing across the period from left to right.
- Atomic number goes on increasing along the period from left to right.
- Electronegativity goes on increasing along a period from left to right.

166. (a) Name metals among the first five elements of the Modern Periodic Table.
(b) Write their symbols.
(c) Write the formula of their oxides.

Ans : [CBSE 2016, 2015]

- Lithium and Beryllium are metals among first five elements.
- Lithium (Li), Beryllium (Be).
- Li_2O and BeO are the formulae of their oxides.

167. Lithium, Sodium, Potassium are placed in the same group on the basis of their similar properties. List three such similar properties.

Ans : [CBSE 2015]

- All of them are reactive metals.
- They have 1 valence electron and form positive ions with +1 charge.
- They are largest in size in their respective periods.

168. The position of elements A, B, C, D, E, F and G in the Modern Periodic Table is given as under:

Group →	16	17	18
Period ↓			
1			A
2	B	C	D
3	E	F	G

- In which group are inert elements placed?
- What type of ions would 'B', 'C', 'E' and 'F' will form?
- Which element would have chemical properties similar to 'C'?
- How many shells do 'A' have?
- What is the similarity between 'A' and 'D'?
- Identify the most abundant element in the earth crust.

Ans : [CBSE 2015]

- Group 18
- They will form anions.
- F will have similar properties to 'C'.
- A has only one shell.
- A and D both are inert elements.
- C is the most abundant element in the Earth crust.

FIVE MARKS QUESTIONS

- 169.** a. The modern periodic table has been evolved through the early attempts of Dobereiner, Newlands and Mendeleev. List one advantage and one limitation of all the three attempts.
b. Name the scientists who first of all stated that atomic number of an element is a more fundamental than its atomic mass.
c. State modern periodic law.

Ans : [CBSE 2018]

(a)

Dobereiner Periodic Table

Advantage: It could predict the atomic mass of middle elements quite correctly. **Limitations:** He could identify only three triads of elements.

Newlands Periodic Table

Advantage: Every eight element had properties similar to the first if elements are arranged in increasing order of atomic mass.

Limitations: It was applicable only upto calcium only. No future elements could fit into it.

Mendeleev's Periodic Table

Advantage: He could classify all the elements discovered at that time into groups and periods. He also predicted the existence of new elements which were not discovered at time.

Limitations: No fixed position of hydrogen. Position of isotopes could not be sorted out.

(b) Moseley:

Properties of elements are a periodic function of their atomic numbers.

- 170.** Name the element which has
- the electronic configuration 2, 8, 1.
 - a total of two shells, with 4 electrons in the valence shell.
 - a total of three shells, with 3 electrons in the valence shell.
 - one shell which is completely filled with electrons.
 - twice as many electrons in the second shell as in the first shell.

Ans : [CBSE 2016]

- Sodium (2, 8, -1)
- Carbon (2, 4)
- Aluminium (2, 8, 3)
- Helium (2)
- Carbon (2, 4)

- 171.** a. Why do we classify elements?
b. What were the two criteria used by Mendeleev in creating his periodic table.
c. Why did Mendeleev leave some gaps in his periodic

table?

- d. In Mendeleev's periodic table, why was there no mention of noble gases like He, Ne and Ar?
- e. Would you place two isotopes of Cl-35 and Cl-37 in different slots because of their different atomic mass or in the same slot because their chemical properties are same? Justify your answer.

Ans : [CBSE 2015, 2013, 2012]

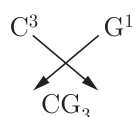
- a. It makes their study easier.
- b. (i) Increasing order of atomic mass, (ii) Formula of oxides and hydrides.
- c. The gaps were left for the elements to be discovered.
- d. Noble gases were not invented at that time.
- e. They will be placed at the same slot as they have the same atomic number and same chemical properties.

- 172.** Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells but different number of electrons in their outermost shell. It was found that elements A and G combine to form an ionic compound. This compound is added in a small amount to almost all vegetable dishes during cooking. Oxides of elements A and B are basic in nature while those of E and F are acidic. The oxide of D is almost neutral. Based on the above information answer the following questions:

- a. To which group or period of the Periodic Table do the listed elements belong to?
- b. What would be the nature of the compound formed by the combination of elements 'B' and 'F'?
- c. Which two of these elements could definitely be metals?
- d. Which one of the eight elements is most likely to be found in gaseous state at room temperature?
- e. If the number of electrons in the outermost shell of elements 'C' and 'G' be 3 and 7 respectively, write the formula of the compound formed by the combination of 'C' and 'G'.

Ans : [CBSE 2010]

- a. A and B belongs to group-1 and group-2 respectively because they form basic oxides. 'C' belongs to group-13, 'D' belongs to group-14 which forms almost neutral oxide (actually amphoteric oxide), E and F belong to group-15, 16 forming acidic oxides. 'G' belongs to group-17 because NaCl is used in cooking. 'H' belongs to group 18. they belong to third period of the periodic table.
- b. B and F will form ionic compound because 'B' is a metal and 'F' is a non-metal.
- c. A and B are definitely metals.
- d. H is most likely to be found in gaseous state at room temperature.

- e.  is the formula of compound.

ionic compound which can also be extracted from sea water. Oxides of the elements A and B are basic in nature while those of E and F are acidic. The oxide of element D is almost neutral. Answer the following questions based on the information given herein:

- a. To which group or period of the periodic table do the listed elements belong?
- b. Which one of the eight elements is likely to be a noble gas?
- c. Which of the eight elements would have the largest atomic radius?
- d. Which two elements amongst these are likely to be non-metals?
- e. Which one of these eight elements is likely to be a semi-metal or a metalloid?

Ans : [CBSE 2010]

- a. A and B belongs to group-1 and group-2 respectively because they form basic oxides. 'C' belongs to group-13, 'D' belongs to group-14 which forms almost neutral oxide (actually amphoteric oxide), E and F belong to group-15, 16 forming acidic oxides. 'G' belongs to group-17 because NaCl is used in cooking. 'H' belongs to group 18. they belong to third period of the periodic table.
- b. H belongs to noble gas elements.
- c. A will have largest atomic radius.
- d. E and F are likely to be non-metals,
- e. D is likely to be a metalloid or semi metal.

- 173.** Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells but different number of electrons in their outermost shell. It was found that elements A and G combine to form an