2 Periodic Table

The students in the picture are trying to make a model of the periodic table as part of group activity. You have learned that the periodic table, in which elements are scientifically classified, is helpful in the study of chemistry.

Moreover, you are familiar with the early attempts at the classification of elements, and the periodic law proposed by Dmitri Ivanovich Mendeleev.

In 1869, when Mendeleev prepared the periodic table, there was no clarity regarding the structure of atom or subatomic particles. However, Mendeleev's periodic table had many merits.

List the merits of Mendeleev's periodic table.

•

•

•

•

You are also aware of certain demerits of Mendeleev's periodic table. What are they?

•

•

You have also learned about isotopes.

- How do isotopes of the same element differ from one another?

.....

You know that elements are arranged on the basis of atomic mass in Mendeleev's periodic table.

Since isotopes have different atomic masses, it is necessary to assign different positions for them in the periodic table.

For e.g. ${}_{1}^{1}H$, ${}_{1}^{2}H$ and ${}_{1}^{3}H$ are the isotopes of hydrogen. As per Mendeleev's periodic table, it is not possible to assign a specific position to each of them on the basis of atomic mass.

Henry Moseley
(1887 - 1915)

Through his X-ray diffraction experiments, Henry Moseley proved that properties of elements depend mainly on atomic number rather than atomic mass. He then revised Mendeleev's periodic law. This is known as modern periodic law.

Modern Periodic Law

The chemical and physical properties of elements are periodic functions of their atomic numbers.

On the basis of modern periodic law, Moseley arranged elements in the increasing order of atomic number and designed the modern periodic table.

Let us have a look at the merits of the modern periodic table.

- As you know, one of the demerits of Mendeleev's periodic table is that elements having different properties are included in the same group. For e.g. hard metals like copper (Cu) and silver (Ag) were included along with soft metals like sodium (Na) and potassium (K). But, in the modern periodic table, Moseley was particular about including elements with similar properties in the same group. Hence, if we know the properties of an element, we get an idea of the properties of other elements belonging to the same group.
- In Mendeleev's periodic table, there is no specific position for isotopes of the same element. But, in the modern periodic table, the elements are arranged in the ascending order (increasing order) of their atomic numbers. Thus, this limitation of Mendeleev's periodic table was overcome.
- Another limitation of Mendeleev's periodic table is that the ascending order of atomic mass is not strictly followed. For e.g. the element potassium (K, atomic mass-39) is placed after argon (Ar, atomic mass-40). Since elements are arranged on the basis of atomic number, this kind of irregularity in atomic mass is irrelevant in modern periodic table.

Periodic tables of various forms have been developed from time to time.

The periodic table which includes 118 elements is widely used now.

In the periodic table, the horizontal rows are called periods and the vertical columns are called groups. The elements belonging to the same group exhibit similarity in chemical and physical properties.

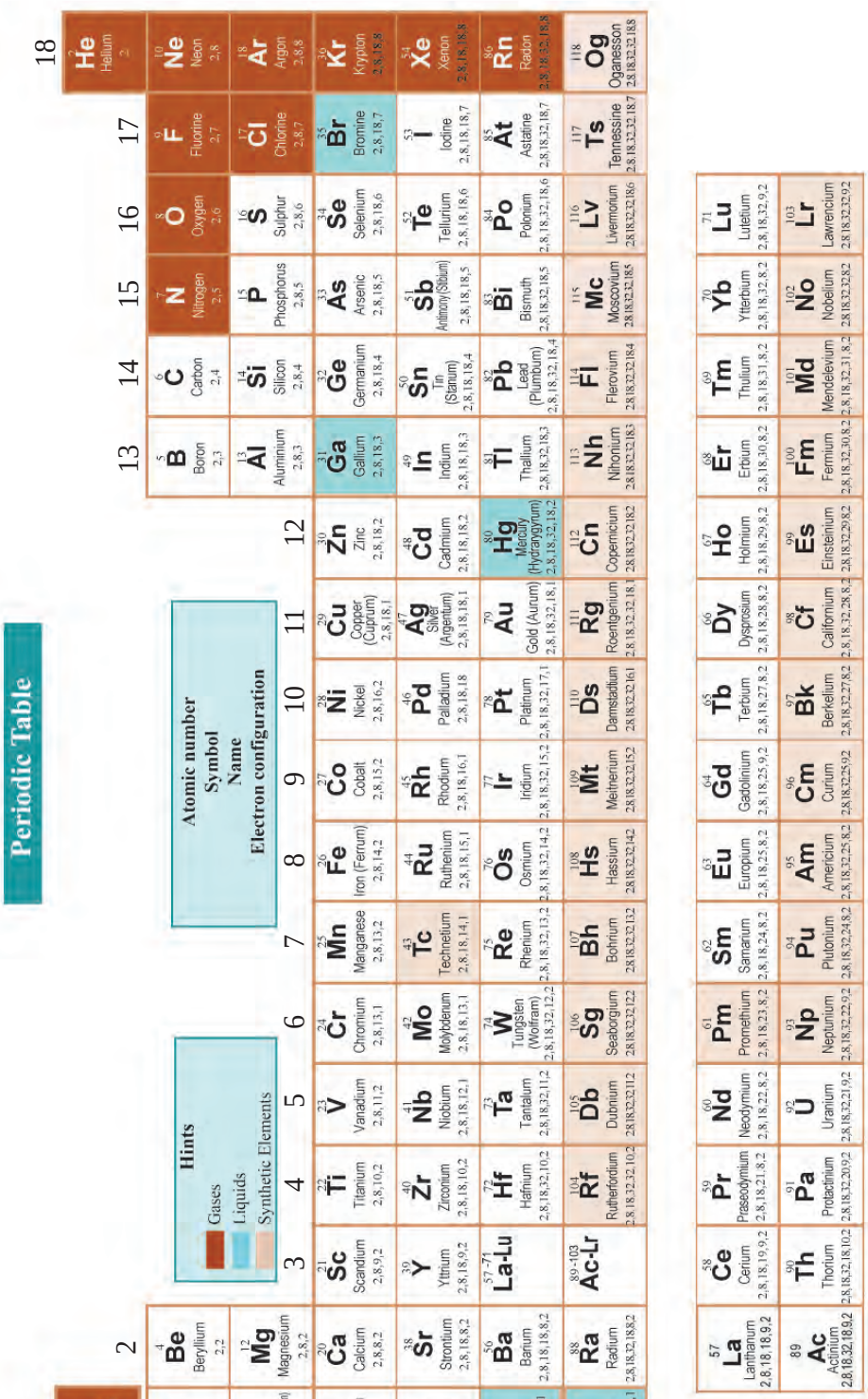

Periodic Table
Hints
Gases
Liquids
Synthetic Elements
Atomic number
Symbol
Name
Electron configuration
1 H Hydrogen 1
2 He Helium 2
3 Li Lithium 2,1
4 Be Beryllium 2,2
5 B Boron 2,3
6 C Carbon 2,4
7 N Nitrogen 2,5
8 O Oxygen 2,6
9 F Fluorine 2,7
10 Ne Neon 2,8
11 Na Sodium (Natrium) 2,8,1
12 Mg Magnesium 2,8,2
13 Al Aluminium 2,8,3
14 Si Silicon 2,8,4
15 P Phosphorus 2,8,5
16 S Sulphur 2,8,6
17 Cl Chlorine 2,8,7
18 Ar Argon 2,8,8
19 K Potassium (Kalium) 2,8,8,1
20 Ca Calcium 2,8,8,2
21 Sc Scandium 2,8,9,2
22 Ti Titanium 2,8,10,2
23 V Vanadium 2,8,11,2
24 Cr Chromium 2,8,13,1
25 Mn Manganese 2,8,13,2
26 Fe Iron (Ferrum) 2,8,14,2
27 Co Cobalt 2,8,15,2
28 Ni Nickel 2,8,16,2
29 Cu Copper (Cuprum) 2,8,18,1
30 Zn Zinc 2,8,18,2
31 Ga Gallium 2,8,18,3
32 Ge Germanium 2,8,18,4
33 As Arsenic 2,8,18,5
34 Se Selenium 2,8,18,6
35 Br Bromine 2,8,18,7
36 Kr Krypton 2,8,18,8
37 Rb Rubidium 2,8,18,8,1
38 Sr Strontium 2,8,18,8,2
39 Y Yttrium 2,8,18,9,2
40 Zr Zirconium 2,8,18,10,2
41 Nb Niobium 2,8,18,12,1
42 Mo Molybdenum 2,8,18,13,1
43 Tc Technetium 2,8,18,14,1
44 Ru Ruthenium 2,8,18,15,1
45 Rh Rhodium 2,8,18,16,1
46 Pd Palladium 2,8,18,18
47 Ag Silver (Argentum) 2,8,18,18,1
48 Cd Cadmium 2,8,18,18,2
49 In Indium 2,8,18,18,3
50 Sn Tin (Stanum) 2,8,18,18,4
51 Sb Antimony (Stibium) 2,8,18,18,5
52 Te Tellurium 2,8,18,18,6
53 I Iodine 2,8,18,18,7
54 Xe Xenon 2,8,18,18,8
55 Cs Caesium 2,8,18,18,8,1
56 Ba Barium 2,8,18,18,8,2
57-71 La-Lu
72 Hf Hafnium 2,8,18,32,10,2
73 Ta Tantalum 2,8,18,32,11,2
74 W Tungsten (Wolfram) 2,8,18,32,12,2
75 Re Rhenium 2,8,18,32,13,2
76 Os Osmium 2,8,18,32,14,2
77 Ir Iridium 2,8,18,32,15,2
78 Pt Platinum 2,8,18,32,17,1
79 Au Gold (Aurum) 2,8,18,32,18,1
80 Hg Mercury (Hydrargyrum) 2,8,18,32,18,2
81 Tl Thallium 2,8,18,32,18,3
82 Pb Lead (Plumbum) 2,8,18,32,18,4
83 Bi Bismuth 2,8,18,32,18,5
84 Po Polonium 2,8,18,32,18,6
85 At Astatine 2,8,18,32,18,7
86 Rn Radon 2,8,18,32,18,8
87 Fr Francium 2,8,18,32,18,8,1
88 Ra Radium 2,8,18,32,18,8,2
89-103 Ac-Lr
104 Rf Rutherfordium 2,8,18,32,32,10,2
105 Db Dubnium 2,8,18,32,32,11,2
106 Sg Seaborgium 2,8,18,32,32,12,2
107 Bh Bohrium 2,8,18,32,32,13,2
108 Hs Hassium 2,8,18,32,32,14,2
109 Mt Meitnerium 2,8,18,32,32,15,2
110 Ds Darmstadium 2,8,18,32,32,16,1
111 Rg Roentgenium 2,8,18,32,32,18,1
112 Cn Copernicium 2,8,18,32,32,18,2
113 Nh Nihonium 2,8,18,32,32,18,3
114 Fl Flerovium 2,8,18,32,32,18,4
115 Mc Moscovium 2,8,18,32,32,18,5
116 Lv Livermorium 2,8,18,32,32,18,6
117 Ts Tennessine 2,8,18,32,32,18,7
118 Og Oganesson 2,8,18,32,32,18,8
57 La Lanthanum 2,8,18,18,9,2
58 Ce Cerium 2,8,18,19,9,2
59 Pr Praseodymium 2,8,18,21,8,2
60 Nd Neodymium 2,8,18,22,8,2
61 Pm Promethium 2,8,18,23,8,2
62 Sm Samarium 2,8,18,24,8,2
63 Eu Europium 2,8,18,25,8,2
64 Gd Gadolinium 2,8,18,25,9,2
65 Tb Terbium 2,8,18,27,8,2
66 Dy Dysprosium 2,8,18,28,8,2
67 Ho Holmium 2,8,18,29,8,2
68 Er Erbium 2,8,18,30,8,2
69 Tm Thulium 2,8,18,31,8,2
70 Yb Ytterbium 2,8,18,32,8,2
71 Lu Lutetium 2,8,18,32,9,2
89 Ac Actinium 2,8,18,32,18,9,2
90 Th Thorium 2,8,18,32,18,10,2
91 Pa Protactinium 2,8,18,32,20,9,2
92 U Uranium 2,8,18,32,21,9,2
93 Np Neptunium 2,8,18,32,22,9,2
94 Pu Plutonium 2,8,18,32,24,8,2
95 Am Americium 2,8,18,32,25,8,2
96 Cm Curium 2,8,18,32,25,9,2
97 Bk Berkelium 2,8,18,32,27,8,2
98 Cf Californium 2,8,18,32,28,8,2
99 Es Einsteinium 2,8,18,32,29,8,2
100 Fm Fermium 2,8,18,32,30,8,2
101 Md Mendelevium 2,8,18,32,31,8,2
102 No Nobelium 2,8,18,32,32,8,2
103 Lr Lawrencium 2,8,18,32,32,9,2
I
II
III
IV
V
VI
VII

Fig. 2.1

Newly Discovered Elements

In 2016, four new elements were added in the periodic table. They were placed in the 7th period.

Atomic number	Symbol	IUPAC name
113	Nh	Nihonium
115	Mc	Moscovium
117	Ts	Tennessine
118	Og	Oganesson

The element nihonium got its name from the Japanese word 'Nihon'. This word is used to represent 'Japan' in Japanese Language. It also means 'the land of the rising sun'. Experiments related to the discovery of the element moscovium were carried out mainly in the laboratories in Moscow. The element tennessine derived its name on the basis of experiments conducted in Tennessee State. The three elements mentioned above got their names from places associated with their discoveries. But the element oganesson was named in honour of Prof. Yuri Oganesson, a nuclear scientist. This is the second instance where an element was named after a living scientist. Previously, seaborgium, the element with atomic number 106 was named after a scientist in this way. It was in honour of Glenn Seaborg, an American chemist.

Let us study more about the properties of elements and the merits of their scientific classification in detail.

Electron Configuration of Elements and their Positions in the Periodic Table

Analyse the modern periodic table (Figure 2.1) and answer the following questions.

- How many periods are there?

  .....

- Write the total number of groups.

  .....

- Which period has the least number of elements?

  .....

- Are the number of elements in period 2 and 3 the same?

.....

- How many elements are included in the 4th period?

.....

- What all information about an element can be obtained from the periodic table? Note down in the science diary.

  - Name
  - Symbol
  -
  -
  -

Elements of group 1 are given in the table. Complete Table 2.1.

Complete Table 2.1 and verify using Kalzium software.

Name of the element	Symbol	Atomic number	Electron configuration
Lithium	Li	3	-
Sodium	Na	11	-
Potassium	-	-	2,8,8,1
Rubedium	Rb	-	2,8,18,8,1
Caesium	-	55	2,8,18,18,8,1
Francium	Fr	-	2,8,18,32,18,8,1

Table 2.1

- Have you noticed any peculiarity regarding the number of outermost electrons in the elements of group 1?

.....

- With the help of periodic table, write the electron configuration of the elements in group 2.

.....

It is clear that the number of outermost electrons of the elements in a given group are the same.

Chemical properties of elements are based on the number of outermost electrons in them. Usually, these electrons take part in chemical reactions.

Based on the common characteristics of elements in each group,

they can be considered as families. A table enlisting the various families of elements is given below.

Group number	Name of family
1	Alkali metals
2	Alkaline earth metals
From 3 to 12	Transition elements
13	Boron family
14	Carbon family
15	Nitrogen family
16	Oxygen family
17	Halogens
18	Noble gases

Table 2.2

Main Group Elements

Examine the elements belonging to group 1, group 2 and groups 13 to 18 in the periodic table (Figure 2.1).

- Which of these elements are familiar to you?

  .....

- Write the examples of metals among these elements.

  .....

- Do these elements include non-metals? .....

  e.g. .....

Do these groups include elements belonging to the solid state, liquid state and gaseous state?

.....

In solid state .....

In liquid state .....

In gaseous state .....

Complete this activity using Kalzium software

Metalloids are also present in these groups. Elements exhibiting the properties of both metals and non-metals are known as metalloids. e.g. silicon (Si), germanium (Ge), arsenic (As), antimony (Sb) etc.

The elements in group 1 and group 2 and groups 13 to 18 are known as main group elements.

Let us examine another characteristic of the main group elements.

Main group elements in periods 2 and 3 in the periodic table are given below.

	1	2	13	14	15	16	17	18
Period 2	3 Li 2, 1	4 Be 2, 2	5 B 2, 3	6 C 2, 4	7 N 2, 5	8 O 2, 6	9 F 2, 7	10 Ne 2, 8
Period 3	11 Na 2, 8, 1	12 Mg 2, 8, 2	13 Al 2, 8, 3	14 Si 2, 8, 4	15 P 2, 8, 5	16 S 2, 8, 6	17 Cl 2, 8, 7	18 Ar 2, 8, 8

Table 2.3

- How does electron filling take place in the outermost shell of these elements?
- What change do you observe in the number of outer electrons on moving from left to right along a period?

On moving along a period from left to right, there is an increase of one electron in the outermost shell of main group elements until eight electrons are gained.

Characteristics of main group elements

- They show similarity in properties in a group.
- They include different types of elements such as metals, non-metals and metalloids.
- They represent elements belonging to different physical states.

- Which are the families included in main group elements?
- In which groups are metalloids present?

How to find the group number of main group elements.

A few elements of group 1 and 2 are given in Table 2.4. Complete the table and record it in your science diary.

Name of element	Symbol	Atomic number	Electron configuration	Number of electrons in the outermost shell	Group number
Lithium	Li	3	2, 1	1	1
Sodium	Na	-	-		
Potassium	-	19	2, 8, 8, 1		
Beryllium	Be	4	-	-	2
Magnesium	-	12	-		
Calcium	Ca	-	2, 8, 8, 2		

Table 2.4

- What is the relation between the number of outermost electrons and group number here?

.....

In the elements of group 1 and 2, the number of outermost electrons represent the group number.

Let us examine whether groups 13 to 18 follow the same relation. Complete Table 2.5 on the basis of the periodic table.

Name of element	Symbol	Atomic number	Electron configuration	No. of the outermost electrons	Group number
Boron	B	5	2, 3	3	13
Carbon	C	6	-	-	-
Nitrogen	N	7	-	-	-
Oxygen	O	8	-	-	-
Fluorine	F	9	-	-	-

Table 2.5

- Find the number which is added to the number of outermost electrons to get the group number of elements in group 13 to 18?

- Have you ever thought why the number 10 is added to the number of outermost electrons?

You know that transition elements are present in groups 3 to 12.

- In how many groups are they distributed?

.....

The position of transition elements is after the second group elements in the periodic table. The elements from group 13 to 18 are placed after these 10 groups of transition elements.

It is clear why the number 10 is added to the number of outermost electrons to get the group number of groups 13 to 18.

Name of element	Symbol	Atomic number	Electron configuration	Group number
Boron	B	5	2, 3	3 + 10 = 13
Carbon	C	6	2, 4	4 + 10 = 14
Nitrogen	N	7	2, 5	5 + 10 = 15
Oxygen	O	8	2, 6	6 + 10 = 16
Fluorine	F	9	2, 7	7 + 10 = 17
Neon	Ne	10	2, 8	8 + 10 = 18

Table 2.6

How to find the period number of elements

Complete Table 2.7 with the help of the periodic table.

Name of element	Symbol	Atomic number	Electron configuration	No. of shells	Period number
Hydrogen	H	1	1	1	1
Helium	He	2	-	1	-
Lithium	Li	-	-	2	-
Beryllium	Be	4	2, 2	-	2
Sodium	Na	11	-	-	-
Magnesium	Mg	-	-	-	-
Potassium	K	-	2, 8, 8, 1	-	4
Calcium	Ca	20	2, 8, 8, 2	-	-

Table 2.7

Can you find any relation between the period number and the number of shells of the given elements?

.....

The number of shells in the atoms of elements is their period number.

Noble Gases

Certain data regarding the main group elements are given in the following table. Complete Table 2.8 and record it in your science diary.

Name of element	Symbol	Atomic number	Electron configuration	Group number
Helium	He	2	2	18
Neon	Ne	-	-	-
Argon	Ar	18	-	-
Krypton	Kr	-	2, 8, 18, 8	-

Table 2.8

- You know that the elements given in the table are noble gases. To which group do they belong?

  .....

- What peculiarity do you notice in the number of the outermost electrons of elements except helium?

  .....

If elements other than hydrogen and helium have 8 electrons in their outermost shell, they attain stability. It is to attain this stability that atoms of all elements undergo chemical reactions. (You can learn more about this in the next unit.)

Usually, 18th group elements do not take part in chemical reactions because of the stable arrangement of electrons.

Elements $_{8}P$, $_{10}Q$, $_{12}R$, $_{18}S$ are given. (symbols are not real)

a. Write down the electron configuration of these elements.

b. Which among these are noble gases?

Transition Elements

The elements present in the ten groups from group 3 to group 12 in the periodic table are called transition elements.

- Which transition elements are familiar to you? List them with the help of the periodic table.

.....

- Are all of them metals?

.....

- From which period onwards can you locate transition elements in the periodic table?

.....

12th Group Elements

Though elements of group 12 are considered as transition elements, they are not transition elements in the strict sense. You will learn about this in higher classes.

The elements of group 1 and 2 are generally more metallic in nature and are placed on the left side of the periodic table. Meanwhile, the elements from group 13 to 18 are placed on the right side of the periodic table and are generally less metallic in nature. Based on this, how will you indicate the position of the transition elements?

The transition elements lie in between the more metallic elements and the comparatively less metallic ones.

The elements from group 3 upto group 12 are known as the transition elements because they indicate a regular change or transition from more metallic elements of group 2 to less metallic elements of group 13.

Let us consider another peculiarity of the transition elements.

The electron configuration of a few elements in the 4th period is given in Table 2.9.

Group number	1	2	3	4	5
Electron configuration	19 K 2, 8, 8, 1	20 Ca 2, 8, 8, 2	21 Sc 2, 8, 9, 2	22 Ti 2, 8, 10, 2	23 V 2, 8, 11, 2

Table 2.9

It is evident from the table that in the elements of group 1 and 2, the electron is being added to the last shell.

- However, in groups 3, 4 and 5, electrons are being added to the penultimate shell.

- With the help of the periodic table, examine whether the same pattern is followed in groups 6 to 12.

Complete this activity using Kalzium software

In ten groups from group 3 to 12 (transition elements) electron filling takes place in the penultimate shell.

You have learnt that elements in the same group show similarity in properties.

Generally, transition metals also show such similarity in groups.

Let us examine whether they exhibit any peculiarity along a period.

Analyse the transition elements of 4th period given in Table 2.9.

- Do they have any peculiarity in the number of outermost electrons?

.....

Usually, transition elements in the same period have the same number of outermost electrons. Hence, they show similarity in properties along a period too.

You have seen coloured chemicals in your lab. Examine the chemicals given in Table 2.10. Find their molecular formulae and identify their colours with the help of your teacher. Complete the table and record it in your science diary.

Name of chemical	Molecular formula	Colour
Nickel sulphate	.....	-
Copper sulphate	.....	-
Calcium carbonate	.....	-
Potassium permanganate	.....	-
Cobalt nitrate	.....	-
Potassium dichromate	.....	-
Ferrous sulphate	.....	-

Table 2.10

It is clear that transition elements are present in the coloured compounds given in the table.

Usually, transition elements form coloured compounds.

- Elements included in groups 3 to 12 are transition elements.
- Filling of electron takes place in the penultimate shell.
- Generally, they exhibit similarity in chemical properties in groups as well as periods.
- They are metals.
- They generally form coloured compounds.

You will learn about transition metals in detail in higher classes.

Lanthanoids and Actinoids

Have you noticed the number of elements included in the 6th period of the periodic table?

- Identify the position of lanthanum (atomic number -57) and the 14 elements following it.

.....

- Similarly, find the position of actinium (atomic number-89) and the 14 elements following it in the 7th period.

.....

In the 6th period, lanthanum and the 14 elements following it, have been arranged separately at the bottom of the periodic table. The elements from lanthanum, (La, atomic number-57) to lutetium (Lu, atomic number-71) are known as lanthanoids.

In the 7th period, actinium and the 14 elements following it have been given a separate position below lanthanoids. The elements from actinium (Ac, atomic number-89) to lawrencium (Lr, atomic number-103) are called actinoids.

Lanthanoids and actinoids are known as inner transition elements. Lanthanoids are also called rare earths. Actinoids coming after uranium (U) are man-made elements.

You are familiar with situations in which transition elements and their compounds are used in our daily life. Write an assignment based on this topic.

Periodic Trend in the Periodic Table

Depending on the position in groups and periods, the chemical and physical properties of elements show a regular change.

You are aware that electron configuration of elements and number of shells vary with atomic number.

Transuranium Elements

All the 118 elements discovered till now are included in the modern periodic table. Among elements from atomic number 1 to 92, the elements except technitium (atomic number 43) and promethium (atomic number 61) are naturally occurring. Elements coming after atomic number 92 are made artificially. Artificial elements are less stable and exhibit radio activity. The elements coming after uranium (atomic number-92) are known as transuranium elements.

Size of atom - In group and period

Though atoms are extremely minute particles, properties of an element are closely related to the size of its atom. The size of an atom can be expressed in terms of atomic radius. It is the distance from the centre of the nucleus to the outermost shell containing electrons. The size of an atom depends mainly on two factors.

- Nuclear charge
- Number of shells

A few elements of group 1 are given in Table 2.11.

Name of element	Symbol	Atomic number	Electron configuration	Number of shells
Lithium	Li	3	2, 1	2
Sodium	Na	11	2, 8, 1	3
Potassium	K	19	2, 8, 8, 1	4
Rubidium	Rb	37	2, 8, 18, 8, 1	5

Table 2.11

- What change do you observe in the number of shells, on moving down the group?

  .....

- How does the increase in the number of shells influence the size of an atom?

  .....

Nuclear charge depends on the number of protons present in the nucleus.

- What change do you observe in the number of protons with the increase in the atomic number?

  .....

- If so, what happens to the nuclear charge with the increase in the atomic number?

  .....

With an increase in nuclear charge, the force of attraction between the nucleus and the outermost electron increases.

- If so, what happens to the size of the atom?

  .....

Though nuclear charge increases down a group, its effect is overcome by the increase in the number of shells and hence, the size of the atom increases.

The electron configuration of the elements belonging to the 2nd period of the periodic table is given below.

Group	1	2	13	14	15	16	17
Period 2	Li 2, 1	Be 2, 2	B 2, 3	C 2, 4	N 2, 5	O 2, 6	F 2, 7

Table 2.12

- Do you observe any change in the number of shells on moving along a period from left to right?

.....

- Does the nuclear charge increase?

.....

Nuclear charge increases on moving along a period from left to right, but there is no change in the number of shells.

- What happens to the attractive force of nucleus towards the outermost electrons (increases/ decreases)?

.....

- What change takes place in the size of the atom?

.....

Moving along a period from left to right, there is no change in the number of shells. But nuclear charge increases gradually. The attractive force of nucleus on the outermost electron increases. Hence, the size of the atom gradually decreases.

You have seen the change in the size of the atom in group and period.

- If so, where can you locate the comparatively bigger atoms in the periodic table?

.....

- Where are the smaller atoms located?

.....

Moving down the group, the size of an atom increases. The size of an atom decreases on moving from left to right along a period.

You will learn about periodic trends such as ionisation energy, electronegativity etc., in the next unit.

Screening Effect (Shielding Effect)

The number of shells increases down a group. As a result, the outermost electrons move away from the nucleus. As the number of electrons in the inner shells increases, the attractive force of the nucleus on the outermost electrons decreases gradually. This is known as screening effect.

Let's Assess

1. The symbols of a few elements are given. Write the electron configurations of these elements and find the period and group to which they belong.

   a) $^{23}_{11}Na$ b) $^{27}_{13}Al$ c) $^{35}_{17}Cl$ d) $^{16}_{8}O$ e) $^{20}_{10}Ne$ f) $^{12}_{6}C$

2. The electron configuration of element X is 2, 8, 8, 1. (Symbol is not real.)
   a. Find the atomic number of X.
   b. To which group does it belong?
   c. What is its period number?
   d. To which family does it belong?
   e. Write the electron configuration of the noble gas which comes just before X.

3. There are 3 shells in an atom of element P. There are 7 electrons in its outermost shell. (Symbol is not real.)
   a. Write the electron configuration of element P.
   b. What is its atomic number?
   c. To which period does it belong?
   d. To which group does it belong?
   e. Draw the model of this atom.

4. The element M belongs to the 3rd period and group 1. (Symbol is not real)
   a. Write the electron configuration of this element.
   b. Write its name and symbol.
   c. To which family does this element belong?
   d. Write the electron configuration of the element belonging to the same period and group 13.

5. Electron configurations of elements P, Q, R and S are given. (Symbols are not real)

   P – 2, 7 Q – 2, 8

   R – 2, 8, 1 S – 2, 8, 7

   a. Which of these elements belong to the same period?
   b. Which of these elements belong to the same group?
   c. Identify the noble gas among these.
   d. Find the group number and period number of element S.

6. Electron configurations of a few elements are given.

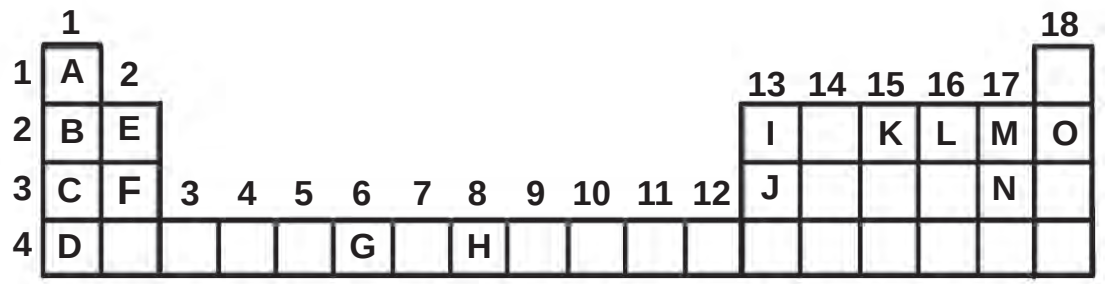
   A – 2, 1 B – 2, 8, 1 C – 2, 8, 7

   (Symbols are not real)

   a. Which of these elements has bigger atom, A or B?

   b. Which atom is bigger, B or C?

7. A portion of the modern periodic table is given. (Symbols are not real)
   Answer the following questions.



   a. Which of these elements belong to the halogen family?

   b. Which are the transition elements?

   c. Write the elements of group 1 in the decreasing order of their atomic size.

   d. Which element has smaller atom, B or I?

   e. Write the elements of period 3 in the increasing order of their atomic size.

   f. Which of these are alkaline earth metals?

   g. Which element has 8 electrons in its outermost shell?

   h. Find the real symbols of the given elements with the help of the periodic table.

8. An element belonging to the 2nd period has 2 electrons in the outermost shell of its atom.

   a. Write the electron configuration of this element.

   b. Write the electron configuration of the noble gas belonging to the same period.

   c. What is its group number?

   d. Write the electron configuration of an element in the same group and in the third period.

9. Analyse the table and answer the following questions.

Element	Mass number	Number of neutrons
A	9	5
B	35	18
C	39	20
D	40	22

(Hint : Symbols are not real)

a. Find the atomic number of these elements.

b. Write their electron configurations.

c. Which among these is a noble gas?

d. To which family does the element B belong?

e. To which period and group does the element C belong?

f. Which of these elements belong to the same period?

Extended Activities

1. Two English alphabets have not been used as symbols of elements so far. Find them with the help of the periodic table.
2. Prepare the biography of scientists involved in the classification of elements and publish it in the science magazine.
3. Draw a model of the modern periodic table and exhibit it in your class room.
4. Prepare a table including the symbol, the electron configuration, and the physical state of elements having atomic number 1 to 36, using Kalzium software.
5. Using cardboard pieces, design a periodic table as shown in the figure given in the first page of this unit.