2. Periodic classification of elements

1. Rearrange the columns 2 and 3 soa s to match with column 1:

Column 1	Column 2	Column 3
i. Triad	1. Average of the first and the third atomic mass	1. Dobereiner
ii. Octave	2. Properties of the eighth	2. Newlands
iii. Atomic number	3. Element similar to the first Positive charge on the nucleus	3. Moseley
iv. Period	4. Sequential change in molecular formulae	4. Mendeleev
V. Nucleus	5. Concentrated mass and positive charge	5. Rutherford
vi. Electron	6. Lightest and negatively charged particle in all the atoms	6. Thomson

2. Choose the correct option and rewrite the statement.
a. The number of electrons in the outermost shell of alkali metals is..
Ans. 1

b. Alkaline earth metals have valency 2. This means that their position in the modern periodic table is in ..
Ans. Group 2

c. Molecular formula of the chloride of an element X is XCl. This compound is a solid having high melting point Which of the following elements be present in the same group as X.
Ans. Na

d. In which block of the modern periodic table are the nonmetals found?
Ans. P-block

3. An element has its electron configuration as 2, 8, 2. Now answer the following questions:
(1) What is the atomic number of this element?
Ans. The atomic number of this element is 12.

(2) What is the group of this element?
Ans. The group of this element is 2.

(3) To which period does this element belong?
Ans. This element belongs to a period 3.

(4) With which of the following elements would this element resemble? (Atomic numbers are given in brackets) N(7), Be(4), Ar(18), Cl(17).
Ans. This element resembles Be(4).

4. Write down the electronic configuration of the following elements from the given atomic numbers. Answer the following question with explanation.

a. $_3Li$, $_{14}Si$, $_2He$, $_{11}Na$, $_{15}P$,
Which of these elements belong to be period 3?

Elements	Electronic configuration
$_3Li$	21
$_{14}Si$	284
$_2He$	2
$_{11}Na$	281
$_{15}P$	285

b. $_1H$, $_7N$, $_{20}Ca$, $_{16}S$, $_{44}Be$, $_{18}Ar$,
Which of these elements belong to the second group?

Elements	Electronic configuration
$_1H$	1
$_7N$	2, 5
$_{20}Ca$	2, 8, 8, 2
$_{16}S$	2, 8, 6
$_{16}S$	2, 2
$_{16}S$	2, 8, 8

c. $_7N$, $_6C$, $_8O$, $_5B$, $_{13}A1$,
Which is the most electronegative element among these?

Elements	Electronic configuration
$_7N$	2, 5
$_6C$	2, 4
$_8O$	2, 6

$_5B$	2, 3
$_{13}A1$	2, 8, 3

d. $_4Be$, $_6C$, $_8O$, $_5B$, $_{13}A1$,

Which is the most electropositive element among these?

Elements	Electronic configuration
$_4Be$	2, 2
$_6C$	2, 4
$_8O$	2, 6
$_5B$	2, 3
$_{13}A1$	2, 8, 3

e. $_{11}Na$, $_{15}P$, $_{17}C1$, $_{17}Si$, $_{12}Mg$,

Which of these has largest atoms?

Elements	Electronic configuration
$_{11}Na$	2, 8, 1
$_{15}P$	2, 8, 3
$_{17}C1$	2, 8, 7
$_{17}Si$	2, 8, 4
$_{12}Mg$	2, 8, 2

f. $_{19}K$, $_3Li$, $_{11}Na$, $_4Be$,

Which of these atoms has smallest atomic radius?

Elements	Electronic configuration
$_{19}K$	2, 8, 8, 1
$_3Li$	2, 1
$_{11}Na$	2, 8, 1
$_4Be$	2, 2

g. $_{13}A1$, $_{14}Si$, $_{11}Na$, $_{12}Mg$, $_{16}S$,

Which of the above elements has the highest metallic character?

Elements	Electronic configuration
$_{13}A1$	2, 8, 3
$_{14}Si$	2, 8, 4
$_{11}Na$	2, 8, 1
$_{12}Mg$	2, 8, 2
$_{16}S$	2, 8, 6

h. $_{6}C$, $_{3}Li$, $_{9}F$, $_{7}N$, $_{8}O$,

Which of the above elements has the highest nonmetallic character?

Elements	Electronic configuration
$_{6}C$	2, 4
$_{3}Li$	2, 1
$_{9}F$	2, 7
$_{7}N$	2, 5
$_{8}O$	2, 6

5. Write the name and symbol of the element from the description:

(1) The atom having the smallest size.

Ans. Helium (He).

(2) The atom having the smallest atomic mass.

Ans. Hydrogen (H_2).

(3) The most electronegative atom.

Ans. Fluorine (F_2).

(4) The noble gas with the smallest atomic nucleus.

Ans. Helium (He).

(5) The most reactive nonmetal.

Ans. Fluorine (F_{32}).

6. Write short notes.

a. Mendeleev's periodic law.

Ans. When the elements are arranged in the order of their increasing atomic masses, Mendeleev found that the elements with similar physical and chemical properties repeat after a definite

interval. On the basis of these finding Mendeleev stated the periodic law. The physical and chemical properties of elements are a periodic function of their atomic masses.

b. Structure of the modern periodic table.

Ans. (1) In the modern periodic table, the elements are arranged in the order of their increasing atomic number. In the modern periodic table there are seven horizontal rows called periods and eighteen vertical columns (1 to 18) called groups The arrangement of the periods and groups results into formation of boxes. Atomic numbers are serially indicated in the upper part of these boxes.

(2) Each box represents the place for one element, Apart from these seven rows, there are two rows of elements placed separately at the bottom of the periodic table. They are lanthanides and actinides series. There are 118 boxes in the periodic table including the two series that means there are 118 places for elements in the modern periodic table. The formation of a few elements was established experimentally very recently and thereby the modern periodic table is now completely filled with 118 elements.

(3) On the basis of the electronic configuration, the elements in the modern periodic table are divided into four blocks, viz, s-block, p-block, d-block and f block. The s-block constitute groups 1 and 2. The groups 13 to 18 constitute the p-block. Groups 3 to 12 constitute the d-block, while the lanthanide and actinide series at the bottom form the f-block. The d-block elements are called transition elements. A zig-zag line is shown in the p-block of the periodic table. This zig-zag line shows the three traditional types of elements, i.e. metals, nonmetals and metalloids. The metalloid elements lie along the border of zig-zag line. All the metals lie on the left side of the zig-zag line while all the nonmetals lie on the right side.

c. Position of isotopes in the Mendeleev's and the modern periodic table.

Ans. Isotopes were discovered long time after Mendeleev put forth the periodic table. A challenge was posed in placing isotopes in Mendeleev's periodic table, as isotopes have the same chemical properties but different atomic masses. Isotopes do not find separate places in this table. Moseley found out that atomic number is a fundamental property of an element rather than its atomic mass. The atomic number of any element is increased by one unit (number) from the atomic number of subsequent element. In the modern periodic table, the elements are arranged in the order of their increasing atomic numbers, that time the problem of discrepancy in the pairs of isotopes of elements observed in Mendeleev's periodic table was solved.

The isotopes of $_{17}C1^{35}$,and $_{17}C1^{35}$,

were placed in the same group as both have the same atomic number.

7. Write scientific reasons.

a. Atomic radius goes on decreasing while going from left to right in a period.

Ans. (1) In a period while going from left to right, atomic radius goes on decreasing and the atomic number increases one by one, that means positive charge on the nucleus increases by one unit at a time.

(2) However, the additional electron is added to the same outermost shell. Due to the increased nuclear charge the electrons are pulled towards the nucleus to a greater extent, as a result the size of atom decreases i.e., atomic radius decreases.

b. Metallic character goes decreasing while going from left to LIght in a period.
Ans. (1) Metals have a tendency to loose the valence electrons to form cations. This tendency of an element is called the metallic character of the element.
(2) While going from left to right within a period the outermost shell remains the same and electrons are added to the same shell. However, the positive charge on the nucleus goes on increasing while the atomic goes on decreasing and thus the radius effective nuclear charge goes on increasing. As a result of this the tendency of atom to lose electrons decreases, i.e., electropositivity decreases. Thus, metallic character goes on decreasing within a period from left to right.

c. Atomic radius goes on increasing down a group.
Ans. The size of an atom is indicated by its radius While going down a group a new shell is added. Therefore, the distance between the outermost electron and the nucleus goes on increasing, These electrons experience lesser pull from the nucleus. Thus, atomic radius goes on increasing down a group.

d. Elements belonging to the same group have the same valency.
Ans. (1) The valency of an element is determined by the number of valence electron in the outermost shell of an atom of an element.
(2) All the elements in a group have the same number of valence electrons. Therefore, elements in the same group should have the same valency. For example, the elements of group I contain only one valence electron; the valency of elements of group I is one. Similarly for group II, the valency is two.

e. The third period contains only eight elements even through the electron capacity of the third shell is 18.
Ans. (1) In the atoms of the inert gas elements (zero group elements), all the electronic shells, including the outermost shell, are completely filled.
(2) The electronic configuration is stable, and these elements do not lose or accept electrons. These elements do not take part in chemical reactions. These elements are gases. Hence, they are called noble gases.

8. Write the names from the description.
(1) The period with electrons in the shells K, L and M.
Ans. Third period. The

(2) Group with valency zero.
Ans. Group 18.

(3) The family of nonmetals having valency one.
Ans. Halogen family.

(4) The family of metals having valency two.
Ans. Group 2.

(5) The metalloids in the second and third period.
Ans. Boron, silicon.

(6) The family of metals having valency one.
Ans. Group 1.

(7) Nonmetals in the third period.
Ans. Phosphorus, sulphur and chlorine and argon.

(8) Two elements having valency 4.
Ans. Carbon, silicon.