1. Tick (✓) the best answer.

a. Who is regarded as the pioneer in the systematic classification of elements?
→ **Dmitri Mendeleev (iii)** ✓

b. Which of the following is the isotope of hydrogen?
→ **Deuterium (i)** ✓

c. How many elements are in the fifth period of the periodic table?
→ **18 (iv)** ✓

d. Which of the following salts is formed by the reaction of an alkali metal with a halogen?
→ **NaCl (ii)** ✓

e. Which of the following elements has the smallest atomic size?
→ **Al (iii)** ✓

2. Answer these questions in one sentence.

a. Define periodic table.
The periodic table is a tabular arrangement of elements in order of increasing atomic number, showing periodic recurrence of properties.

b. Why can't Mendeleev's periodic table explain the position of isotopes?
Because isotopes have the same atomic number but different atomic masses, and Mendeleev arranged elements by atomic mass.

c. Write down the position of inner transition metals in modern periodic table.
Inner transition metals occupy the **f-block** and are placed separately at the bottom of the periodic table (lanthanides and actinides).

d. How many electrons can be accommodated in d-subshell?
A d-subshell can accommodate a maximum of **10 electrons**.

e. What is meant by octet rule?
The octet rule states that atoms tend to attain eight electrons in their outermost shell to achieve stability like noble gases.

f. What is the cause of chemical reaction between elements?
The tendency of atoms to achieve a stable electronic configuration (usually an octet) causes chemical reactions.

g. State the Modern Periodic Law.
The modern periodic law states that the properties of elements are periodic functions of their atomic numbers.

h. Why are the elements of group 1 called alkali metals?
Because they form strong alkaline hydroxides (like NaOH, KOH) when they react with water.

i. Define halogens.
Halogens are group 17 elements (F, Cl, Br, I, At) that form salts with metals and have seven valence electrons.

j. What are alkaline earth metals?
Group 2 elements (Be, Mg, Ca, Sr, Ba, Ra) are called alkaline earth metals because their oxides and hydroxides are alkaline in nature.

k. Write the electronic configuration of chromium in terms of subshells.
Chromium (Z = 24): **$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$**

3. Answer these questions in brief.

a. In which group of modern periodic table are alkali metals, alkaline earth metals and halogens kept?

Alkali metals → **Group 1,** Alkaline earth metals → **Group 2,** Halogens → **Group 17**

b. In which groups are noble gases, most reactive non-metals, most reactive metals and metalloids placed?

Noble gases → **Group 18**

Most reactive non-metals (halogens) → **Group 17**

Most reactive metals (alkali metals) → **Group 1**

Metalloids → Lie along the **zig-zag line** (e.g., B, Si, As, Sb).

c. What is the cause of placing calcium in group IIA (Group 2) of the modern periodic table?
Calcium is placed in group 2 because it has **two valence electrons** in its outermost shell and shows similar properties to other alkaline earth metals.

d. Mention any two differences between Mendeleev's Periodic Table and Modern Periodic Table.

Mendeleev arranged elements by **atomic mass**, while the modern table is arranged by **atomic number**.

In Mendeleev's table, isotopes could not be placed, but in the modern table, isotopes occupy the same position.

e. Write down two factors that determine the reactivity of elements.

The two factors that determine the reactivity of elements are:

Electronic configuration (number of valence electrons).

Atomic size (distance of valence electrons from nucleus).

f. Write any two differences between s-block and p-block elements.

s-block elements have valence electrons in the **s-orbital**, while p-block elements have valence electrons in the **p-orbital**.

s-block elements are mostly **metals** (highly reactive), whereas p-block elements include **metals, non-metals, and metalloids**.

g. Study the electronic configuration given below and answer the following questions:
$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^{10}$

The element is **Copper (Cu)**.

It belongs to the **d-block** of the periodic table.

h. Write two characteristics of 's' block elements.

They are highly **reactive metals.**

They have **one or two electrons** in their outermost shell.

i. Write any two reasons for keeping hydrogen in group IA in the periodic table.

Hydrogen has **one electron** in its outermost shell like alkali metals.

Hydrogen also forms **one positive ion (H^+)** just like alkali metals form (Na^+, K^+).

j. Write two differences between IA group elements and VIIA group elements.

Group IA (Alkali Metals):
• They have **1 valence electron** in the outermost shell.
• They are **electropositive** and form cations (+1).

Group VIIA (Halogens):
• They have **7 valence electrons** in the outermost shell.
• They are **electronegative** and form anions (–1).

k. Write electronic configuration of calcium on the basis of sub-shell. Among magnesium and calcium, which element is more reactive and why?

Calcium (Z = 20): **$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$**

Between magnesium (Mg) and calcium (Ca):
• **Calcium is more reactive** because it has a larger atomic size and its outermost electrons are more easily lost.

l. What happens to the reactivity of non-metal when its size increases? Why?

As the size of a non-metal atom increases, its **reactivity decreases**.

Reason: The **nuclear attraction** for gaining electrons becomes weaker due to increased distance between nucleus and outermost shell.

m. Write down the electronic configuration of the element which lies in second period and group 16 (VIA) in modern periodic table on basis of sub-shells.

The element is **Oxygen (Z = 8)**.

Configuration: **$1s^2\ 2s^2\ 2p^4$**

n. Write down the electronic configuration of following elements in terms of sub-shells:

Na (Z = 11): $1s^2\ 2s^2\ 2p^6\ 3s^1$

N (Z = 7): $1s^2\ 2s^2\ 2p^3$

K (Z = 19): $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

Ca (Z = 20): $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

Si (Z = 14): $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$

Ar (Z = 18): $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

Give reason:

a. Elements of group 7A are called halogens.
Because they readily react with metals to form salts (e.g., NaCl, KBr). The term “halogen” means “salt-former.”

b. Sodium is called a metal although it is very soft.
Because it has metallic properties like high conductivity, malleability, and it forms positive ions (Na^+) in reactions.

c. Atomic size of inert gases does not affect their inertness.
Because inertness is due to their completely filled outermost shells, not atomic size.

d. Elements of Group IA (1), IIA (2), and IIIA (13) are more reactive as we go down the group of the periodic table.
Because atomic size increases down the group, nuclear attraction on valence electrons decreases, and reactivity increases.

e. K is more reactive than Na.
Potassium (K) is more reactive than Sodium (Na) because potassium is placed **below sodium in the periodic table**. As we move down a group, the **size of the atom increases** and the **outermost electron is farther from the nucleus**, so it can be lost more easily. Therefore, potassium is more reactive than sodium.

f. Fluorine is more reactive than chlorine.
Fluorine is the most reactive non-metal because it has the **smallest atomic size** among the halogens. Its outermost shell is very close to the nucleus, so it can **attract and gain an electron very easily**.

g. Li, Na, and K are placed in the same group of the periodic table.
Because they have similar outermost electronic configuration (one electron in their outermost s-orbital).

h. Hydrogen can also be placed in group 7 (VIIA).
Because like halogens, hydrogen needs only one electron to complete its duplet ($1s^2$ configuration).

i. Elements of group VIIA are called halogens.
Because they react with metals to form salts such as NaCl, KBr (salt-formers).

j. Bromine is more reactive than iodine although both lie in the same group.
Because bromine is smaller in size and has higher electronegativity than iodine, so it gains electrons more easily.

Answer these questions:

a. Mention any three defects in Mendeleev's periodic table.

The three defects in mendeleev's periodic table are:

Position of hydrogen was not fixed.

Isotopes could not be placed properly.

Increasing atomic mass order was violated in some cases (e.g., Co and Ni).

b. Describe the significance of the modern form of periodic table in any four points.

The significance of the modern form of periodic table are:

Elements are arranged by atomic number (removes defect of isotopes).

Similar elements fall in the same groups showing periodicity.

Position of elements can predict their properties.

It accommodates all discovered elements including noble gases, lanthanides, and actinides.

c. Write any three characteristics of Modern Periodic Table.

The three characteristics of Modern Periodic Table are:

Elements are arranged in order of increasing atomic number.

It has 18 groups and 7 periods.

It separates metals, non-metals, and metalloids systematically.

d. On the basis of which property are the elements classified as metals, non-metals, and metalloids?
On the basis of their **electronic configuration** and the nature of their chemical bonding.

e. What do you mean by lanthanides and actinides? Why are they kept separately in the periodic table?

Lanthanides: Elements with atomic numbers 57–71.

Actinides: Elements with atomic numbers 89–103.
They are kept separately (f-block) to maintain the proper structure and avoid making the periodic table too wide.

f. How does the chemical reactivity of metals vary as we move down in a group? Explain.
Reactivity of metals **increases** down a group because atomic size increases, ionization energy decreases, and electrons are lost more easily.

g. What variation in atomic size is observed on moving from left to right in a period of the modern periodic table? Explain.
Atomic size **decreases** across a period because the number of protons (nuclear charge) increases while electrons are added in the same shell, pulling them closer to the nucleus.

h. Study the electronic configuration of elements A and B and answer the following questions.
A = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$ (Z = 19 → Potassium, K)
B = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$ (Z = 20 → Calcium, Ca)

Name the element and group of A. → Potassium (K), Group 1 (alkali metal).

Which one is more reactive among A and B? Why? → A (K) is more reactive because it can lose its one outer electron more easily than Ca which has two.

Write the valency of A and B. → Valency of K = 1, Valency of Ca = 2.