1. Which one of the following elements will remain as liquid inside pure boiling water?
[2023 (06 Apr Shift 2)]
(1) Ga
(2) Br
(3) Li
(4) Cs

2. Group-13 elements react with O_2 in amorphous form to form oxides of type M_2O_3 (M = element). Which among the following is the most basic oxide?
[2023 (06 Apr Shift 2)]
(1) Al_2O_3
(2) B_2O_3
(3) Tl_2O_3
(4) Ga_2O_3

3. The correct order of electronegativity for given elements is
[2023 (08 Apr Shift 1)]
(1) P > Br > C > At
(2) Br > P > At > C
(3) Br > C > At > P
(4) C > P > At > Br

4. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.
Assertion A : The energy required to form Mg^{2+} from Mg is much higher than that required to produce Mg^{+}
Reason R:Mg^{2+} is small ion and carry more charge than Mg^{+}
In the light of the above statements, choose the correct answer from the options given below.
[2023 (10 Apr Shift 2)]
(1) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
(2) **A** is true but **R** is false
(3) **A** is false but **R** is true
(4) Both **A** and **R** are true and **R** is the correct explanation of **A**

5. The correct order of metallic character is
[2023 (10 Apr Shift 2)]
(1) K > Be > Ca
(2) Be > Ca > K
(3) Ca > K > Be
(4) K > Ca > Be

6. For compound having the formula $GaAlCl_4$, the correct option from the following is
[2023 (11 Apr Shift 1)]
(1) Ga is coordinated with CI in $GaAlCl_4$
(2) Ga is more electronegative than AI and is present as a cationic part of the salt $GaAlCl_4$
(3) CI forms bond with both AI and Ga in $GaAlCl_4$
(4) Oxidation state of Ga in the salt $GaAlCl_4$ is $+3$

7. For elements B, C, N Li, Be, O and F, the correct order of first ionisation enthalpy is
[2023 (11 Apr Shift 1)]
(1) Li < Be < B < C < O < N < F
(2) B < Li < Be < C < N < O < F
(3) Li < Be < B < C < N < O < F
(4) Li < B < Be < C < O < N < F

8. Which of the following statements are not correct?

A. The electron gain enthalpy of F is more negative than that of Cl.

B. Ionization enthalpy decreases in a group of periodic table.

C. The electronegativity of an atom depends upon the atoms bonded to it.

D. Al_2O_3 and NO are examples of amphoteric oxides.

Choose the most appropriate answer from the options given below:

[2023 (13 Apr Shift 1)]

(1) A, B, C and D

(2) A, B and D only

(3) B and D only

(4) A, C and D only

9. . Identify the correct order of standard enthalpy of formation of sodium halides.

[2023 (13 Apr Shift 2)]

(1) $NaI < NaBr < NaF < NaCl$

(2) $NaI < NaBr < NaCl < NaF$

(3) $NaF < NaCl < NaBr < NaI$

(4) $NaCl < NaF < NaBr < NaI$

ANSWER KEYS

1. (1) **2.** (3) **3.** (3) **4.** (4) **5.** (4) **6.** (2) **7.** (4) **8.** (4)
9. (2)

1. (1)

Gallium (Ga) remains as liquid inside boiling water, and the other elements mentioned in options can react with water.

Bromine is a halogen that reacts readily with water to form hydrobromic acid and hypobromous acid, which can further react to form bromic acid. Lithium and Caesium are alkali metals that react violently with water, producing hydrogen gas and the corresponding metal hydroxide.

2. (3)

The basicity of an oxide is closely related to the electropositive character of the element. The more electropositive the element, the more basic its oxide will be. This is because the oxide ion can react with a cation to form a basic oxide. As we move down Group 13, the electropositive character of the elements increases, and so does the basicity of their oxides.

$B_2O_3 < Al_2O_3 < Ga_2O_3 < In_2O_3 < Tl_2O_3$

So most basic oxide among the given options is Tl_2O_3.

3. (3)

On the periodic table, electronegativity generally increases as you move from left to right across a period and decreases as you move down a group. As a result, the most electronegative elements are found on the top right of the periodic table, while the least electronegative elements are found on the bottom left.

Element	Electronegativity
P	2.1
C	2.5
Br	3.0
At	2.2

Hence, the correct order is Br > C > At > P.

4. (4)

Mg have 2 electrons in valance shell and after donation of 2 electrons it converts into Mg^{2+} ion and attains inert gas configuration, now to ionize one more electron from inert gas configuration is very difficult, hence it is easy to ionize Mg to Mg^{2+}. IE_2 is always greater than IE_1 because on removal of e^-, size decreases and effective nuclear charge increases.So Assertion is correct.

Mg^{2+} is a smaller ion than Mg^+ and has a greater charge density. This means that Mg^{2+} has a stronger attraction to its electrons than Mg^+ and requires more energy to remove an electron from it. So reason is also correct.

5. (4)

The metallic character of an element is defined as the easiness of its atom in losing electrons. According to the modern periodic table, the metallic character of an element decreases while moving from left to right across a period. K is an alkali metal. For alkaline earth metals, metallic character increases down the group. Hence, the correct order of metallic character is $K > Ca > Be$.

6. (2)

Gallous tetrachloro aluminate ($GaAlCl_4$) exists as $Ga^+\ AlCl_4^-$.

Due to the presence of d-orbital in the case of Ga, the shielding effect of the d-orbital electrons is very poor so the size of the Ga atom is smaller than expected and so it can attract the shared pairs of electrons more effectively. Hence, the electronegativity of Ga is more than Al.

7. (4)

The first ionisation energy varies predictably across the periodic table. As we move from left to right across a period, the ionisation energy of elements increases. This is due to the decrease in the size of atoms across a period. The valence electrons get closer to the nucleus of an atom as we move from left to right due to increased nuclear charge. The force of attraction between the nucleus and the electrons increases and hence more energy is required to remove an electron from the valence shell. Ionisation energy of boron being unexpectedly less than that for beryllium due to the 2s orbital being totally filled in beryllium, whereas boron has one electron in a 2p orbital as well, and the 2s orbital is shielded much more than the 2p orbital. Ionisation energy is more for nitrogen than oxygen because nitrogen is more stable due to its half-filled electronic configuration.

$Li < B < Be < C < O < N < F$

8. (4)

A is incorrect. F and Cl belong to the same group of the periodic table. The electron gain enthalpy usually becomes less negative on moving down a group. However, in this case, the value of the electron gain enthalpy of Cl is more negative than that of F. This is because the atomic size of F is smaller than that of Cl .

B is correct (ionisation energy decreases down the group).

C is incorrect (Electronegativity is a fixed property of an element and is typically measured on scales such as the Pauling scale or the Mulliken scale.).

D is incorrect. The oxides which behave as both acidic and basic oxides are called amphoteric oxides. . Here Al_2O_3 is amphoteric oxide and NO is neutral oxide.

Hence, A, C and D are incorrect.

9. (2)

The lattice energy of an ionic compound is the energy required to separate one mole of the compound into its constituent ions in the gas phase.

$\text{Lattice energy} \propto \frac{1}{(r_+ + r_-)}$

The lattice energy is inversely proportional to the sum of the ionic radii $(r_+ + r_-)$ of the ions involved. When the size of the ions increases, the distance between them also increases, leading to a decrease in the attractive forces between the ions and a decrease in the lattice energy. Therefore, if the size of the ions increases, the lattice energy generally decreases.

So Order : $NaF > NaCl > NaBr > NaI$