Classification of Elements and Periodicity in Properties

Assertion Reason Questions

In the following question no. (10-14) a statement of assertion followed by a statement reason is given Choose the correct answer out of the following choices.

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but R is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) is true.

1. Assertion (A): Second period consists of 8 elements.
Reason (R): Number of elements in each period is four times the number of atomic orbitals available in the energy level that is being filled.

Ans. (c) (A) is true but (R) is false.
Explanation: The number of elements in each period is twice the number of atomic orbitals available in the energy level that is being filled.

2. Assertion (A): According to Mendeleev, the properties of elements are a periodic function of their atomic masses.
Reason (R): Atomic number is equal to the number of protons.

Ans. (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
Explanation: Mendeleev arranged elements in horizontal rows and vertical columns of a table in order of their increasing atomic weights in such a way that the elements with similar properties occupied the same vertical column or group.

3. Assertion (A): The three elements in a triad have the same atomic mass gaps.
Reason (R): The properties of the elements in a trio ar comparable.

Ans. (d) (A) is false but (R) is true.
Explanation: In a triad, the atomic mass of the middle element is equal to the mean of the atomic masses of the first and third elements.

4. Assertion (A): The element ununbium has an atomic number of 112.
Reason (R): In Latin terms, the names for numerals 1 and 2 are un-and bi-respectively.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
Explanation: For 112, the root will be bi, and the symbol will be b. As a result, it will be known as ununbium, and its symbol will be Uub. Finally, we may deduce that the name and symbol for an element with the atomic number 112 are ununbium and Uub.

5. Assertion (A): Mendeleev's periodic law states that the properties of elements are a periodic function of their atomic numbers.
Reason (R): Mendeleev's periodic law could not account for the phenomenon of anomalous pairs.

Ans. (d) (A) is false but (R) is true.
Explanation: According to Mendeleev's periodic law, the atomic weight is the basis for all attributes. This means that the assumption that the properties of elements are a periodic function of their atomic numbers is inaccurate. It failed because they did not totally correspond to the sequence of atomic mass and were unable to identify hydrogen in the periodic table. The increase in atomic mass was discovered to be uneven when travelling from one element to another. They failed due to anomalous pairs, in which atoms are placed in the periodic table according to their atomic masses, with the element with the lowest atomic weight coming first. These are known as anomalous pairs, as they defy the rule.

6. Assertion (A): Isoelectronic species consist of different radii.
Reason (R): There are a different number of electrons in isoelectronic species.

Ans. (c) (A) is true but (R) is false.
Explanation: Isoelectronic species do not have the same radii as they have a dissimilar number of protons and neutrons. Moreover, these are the type of ions or atoms which contain the same number of electrons. For example, Mg2+, 02, Ne, etc.

7. Assertion (A): Electron gain enthalpy becomes less negative as we go down a group.
Reason (R): The size of the atom increases on going down the group and the added electron would be farther from the nucleus.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
Explanation: Because the size of the atom increases as the electron is added farther away from the nucleus of the atom, on moving down the group, the screening effect

increases resulting in making electron gain enthalpy less negative.

8. Assertion (A): Boron has a smaller first ionisation enthalpy than beryllium.
Reason (R): The penetration of a 2s electron to the nucleus is more than the 2p electron hence 2p electron is more shielded by the inner core of electrons than the 2s electrons.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
Explanation: During ionisation, the electron removed in case of beryllium is from the s-orbital and the electron removed from the boron atom is from the p-orbital, and the penetration of 2s electron to the nucleus is more than that of 2p electron hence, 2p electron of boron is more shielded from the nucleus than the 2s electron.

9. Assertion (A): Generally, ionisation enthalpy increases from left to right in a period.
Reason (R): When successive electrons are added to the orbitals in the same principal quantum level, the shielding effect of the inner core of electrons does not increase very much to compensate for the increased attraction of the electron to the nucleus.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
Explanation: The minimum amount of energy required for the removal of the loosely bound electron from the isolated gaseous atom is referred to as Ionisation enthalpy. Here because of the rise in the attraction of the nucleus resulting in a rising in ionisation enthalpy while moving along the period from left to right which is accurately explained in the reason. So, it is the correct explanation of the given assertion.