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Chemistry Worksheets Class 11 on Chapter 3 Classification of Elements and Periodicity in Properties with Answers - Set 1

Q-1: What happens when a neutral atom is converted into an anion?
a) Atomic weight increases
b) Atomic weight decreases
c) Size increases
d) Size decreases

Answer: c) Size increases
Explanation: A neutral atom's effective nuclear charge falls when it becomes an anion, increasing the atom's size.

Q-2: The element with the highest affinity for electrons will belong to
a) Period 2, Group 17
b) Period 2, Group 18
c) Period 3, Group 17
d) Period 2, Group 1

Answer: c) Period 3, Group 17
Explanation: The element with the highest electron affinity is Cl. Additionally, it is a member of Group 17 of Period 3 of the periodic table.

Q-3: Which of the following is not a representative element?
a) Z = 38
b) Z = 31
c) Z = 54
d) Z = 26

Answer: d) Z= 26
Explanation: The representative elements include both the p-block and the s-block elements. The Fe element, a d-block element, is represented by Z = 26 among the provided elements. Therefore, not a representative component.

Q-4: Find the incorrect statement.
a) For group 2, the valence electron and valency are identical.
b) Metal, non-metal, and metalloids are all present in P-block elements.

c) Helium (He) is the only noble gas with two valence electrons.
d) The smallest element on the periodic table is He.

Answer: d) The smallest element on the periodic table is He.
Explanation: Hydrogen is the smallest element on the periodic table. The second smallest element in the periodic table is Helium.

Q-5: The symbol of an element with atomic number Z = 109 is
a) Unp
b) Uns
c) Uno
d) Une

Answer: d) Une
Explanation: The roots for 1, 0, and 9 are un, nil and enn, respectively. Hence, the name becomes unnilennium, and the symbol is Une.

Q-6: Which among the following will have the largest atomic radii based on their positions in the periodic table?
Be, N, O, Ne

Answer: Ne
Explanation: Neon is a noble gas, and van der Waals forces of attraction are considered noble gases. And van der Waals forces are greater than the covalent radius. Hence, neon has the largest size in the period due to van der Waals's forces of attraction.

Q-7: Is the electronegativity of an atom constant?
Answer: No, the electronegativity of any given element is not constant. It varies depending on the element to which it is bonded.

Q-8: Which element among the following has the highest positive electron gain enthalpy? Neon, Nitrogen, and Fluorine
Answer: Positive electron gain enthalpies are shared by neon and nitrogen. However, neon has a significantly larger positive electron gain enthalpy due to its far more stable inert gas configuration than nitrogen, which has a less stable exactly half-filled electronic configuration.

Q-9: Give the inert gas atom's name and atomic number in which the total number of d-electrons equals the difference in numbers of total p and s-electrons.
Answer: The first inert gas which contains d-electrons is krypton. Its atomic number is 36, and its electronic configuration is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$.
According to the configuration, we can conclude the following:

Total number of d-electrons = 10
Total number of p-electrons = 18
Total number of s-electrons = 8
Therefore, the difference in the total number of p and s-electrons = 18-8 = 10.
Thus, the inert gas is krypton.

Q-10: Show by chemical reaction with water that K_2O is a basic oxide and Cl_2O_7 is an acidic oxide.
Answer: K_2O forms a strong base, whereas Cl_2O_7 forms a strong acid with water. The following reactions are:

$K_2O + H_2O \rightarrow 2KOH$
(Sodium hydroxide)

$Cl_2O_7 + H_2O \rightarrow 2HClO_4$
(Perchloric acid)

Q-11: What would be the atomic number for the following if they were discovered in the future?
(i) Next alkali metal
(ii) Next alkaline earth metal
(iii) Next inert gas

Answer:
(i) The next alkali metal, if discovered, will have to be placed in the eighth period, and hence its outer electronic configuration will be $8s^1$. Therefore, its atomic number will be (118+1) = 119.
(ii) Similarly, if discovered, the next alkaline earth metal will have $8s^2$ as its outer electronic configuration; hence its atomic number will be (118+2) = 120.
(iii) The next inert gas, if discovered, will have $7s^2 7p^6$ as its outer electronic configuration, and its atomic number will be (112+6) = 118.

Q-12: Give the general valence shell electronic configuration of transition elements and some characteristics. Also, tell the block to which they belong and why?

Answer: The general valence shell electronic configuration of transition elements is $(n-1)d^{1-10}ns^{0-2}$.
Following are some features of transition elements:
1. Each of them is metal.
2. They frequently create coloured complexes.
3. They display a range of oxidation states.
4. They behave paramagnetically.
5. They function as a catalyst.

These elements belong to the d-block since they are characterised by the filling of inner d-orbitals by electrons.

Q-13: Do the non-metallic character exhibited by the halogens have any relation to ionisation enthalpy?
Answer: No, the non-metallic character exhibited by the halogens has no relation to ionisation enthalpy.
Explanation: The elements of the 17^{th} group are called halogens. Non-metallic character is characteristic of elements that tend to gain electrons. Since this group of elements have high negative electron gain enthalpy, they can readily gain one electron to attain noble gas configuration. Hence, the non-metallic character exhibited by the halogens relates to electron gain enthalpy.

Q-14: Why do s-block elements act as strong reducing agents?
Answer: A reducing agent causes the reduction of other species, but itself undergoes oxidation (loss of electron). A strong reducing agent will have low ionisation enthalpy. Since the ionisation enthalpy of the s-block elements is extremely low, indicating a significant inclination to donate (lose) electrons. acting as a potent reducing agent.

Q-15: What will be the fluorine atom's atomic radius in a covalently bound fluorine molecule with a 128 pm internuclear distance?
Answer: The fluorine atom's atomic radius is half the internuclear distance between a molecule's two successively covalently bonded atoms.
Mathematically, it can be expressed as
Atomic radius = ½ × d
= ½ × 128
= 64 pm

Q-16: Why are there only 14 lanthanides and only 14 actinides?
Answer: Lanthanides and actinides are the two series of f-block elements. These have the general electronic configuration of $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$. As only 14 electrons are filled up in the f-subshell, 14 lanthanides and 14 actinides are placed at the bottom of the periodic table.

Q-17:
a) What do you understand by shielding effect or screening effect? How does it affect the ionisation enthalpy?
b) Why Na cannot exhibit a +2 oxidation state?

Answer:
a) The electrons in the inner shells act as a screen or shield between the nucleus and electrons in the outermost shell. This phenomenon is known as the shielding or screening effect. The larger the number of electrons in the inner shells, the greater the screening effect and the smaller the force of attraction and thus decreasing the ionisation enthalpy.

b) In the ground state, Na has the electronic configuration $1s^22s^22p^63s^1$. Since it only has one electron in its outermost shell (3s), it will easily lose it to achieve a stable electronic configuration for a noble gas. It won't lose any more electrons and won't display a +2 oxidation state because its electronic configuration is now stable after losing one electron.

Q-18: Li < Na < K < Rb < Cs are in increasing order of reactivity in group 1, while F > Cl > Br > I are in that group 17. Explain.
Answer: The reactivity of group 1 elements is proportional to their metallic character, and from Li to Cs, metallic nature rises. Thus, the order of reactivity is Li < Na < K < Rb < Cs.
The group 17 element's reactivity varies with how non-metallic it is. From F to I, non-metallic nature declines. As a result, F > Cl>Br > I is the order of reactivity.

Q-19: What is the diagonal relationship? What are the main reasons for the anomalous behaviour of the elements belonging to the second period?
Answer: On observation, it had been found that the elements of the second period are strikingly similar to the elements of the third period, placed diagonally to each other, though belonging to different groups. This similarity in the group of elements placed diagonally is called a diagonal relationship in periodic properties.
For example, the behaviour of lithium and beryllium is more similar to magnesium and aluminium, respectively.

The main reasons for the anomalous behaviour of the elements belonging to the second period are as follows:
(i) Small size
(ii) Large charge/radius ratio
(iii) High electronegativity of the elements

Q-20: The amount of energy released when 1×10^{10} atoms of bromine in vapour state are converted to Br^- ions according to the equation, $Br(g) + e^- \rightarrow Br^-(g)$ is 60.90×10^{-10} J. Calculate the electron gain enthalpy of bromine atom in terms of eV per atom.

Answer: The amount of energy released when 1×10^{10} atoms of bromine in vapour state are converted to Br^- ions, according to the equation, $Br(g) + e^- \rightarrow Br^-(g)$, is 60.90×10^{-10} J.
Therefore, the electron gain enthalpy of bromine, that is, the amount of energy released when 1 mole (6.023×10^{23}) atoms of bromine are converted into Br^- ions according to the above equation, will be
$= (-60.90 \times 10^{-10}\ J/1 \times 10^{10}) \times 6.023 \times 10^{23}$
$= -366.8 \times 10^3 J/mol$
= -366.8 kJ/mol
Now, 1 ev/atom = 96.49 kJ/mol,
Therefore, electron gain enthalpy of bromine = -366.8/96.49
= -3.8 ev/atom