IX Chemistry - 4. Periodic Classification of Elements

Exercise Solutions

Level 1

Sol 1: (d) It helps in correlating the properties of all states of matter.

Sol 2: (c) C, N and O are not a part of Dobereiner triad as the elements don't exhibit similar properties.

Sol 3: (b) Mass of Sr = (Mass of Ca + Mss of Ba) / 2
88.5 = (40 + Mass of Ba) /2
Mass of Ba = 137

Sol 4: (a) Cosidering volume is same for all the three, then mass = density,
So, Density of As = (Density of P + Density of Sb) /2
= (2 + 9)/ 2 = 5.5

Sol 5: (a) Newland arranged the elements in the order of atomic masses.

Sol 6: (a) It starts with hydrogen.

Sol 7: (c) The last element is Thorium.

Sol 8: (b) Every first and eighth element exhibit similar properties, according to Newland's classification.

Sol 9: (b) Every first and eighth element exhibit similar properties, according to Newland's classification. So, fifth element will have similar properties as 12^{th} element.
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Sol 10: (d) During roasting, the sulfide is converted to an oxide, and sulfur is released as sulfur dioxide, a gas.

Sol 11: (b) All the other elements belong to same group except Al and Cr.

Sol 12: (d) Newland's law is valid upto calcium.

Sol 13: (c) Newland's law is valid upto calcium.

Sol 14: (d) Refer to limitations of law of octaves, P-78.

Sol 15: (a) Mendeleev classified the elements in the order of increasing atomic masses.

Sol 16: (a) Mendeleev predicted the properties of the elements on the basis of their hydride formula.

Sol 17: (a) There are 8 periods in Mendeleev's table.

Sol 18: (d) Based on the valency of elements, the formula of oxide is R_2O_6 or RO_3

Sol 19: (a) Based on the valency of elements, the formula of hydride is R_2H_2 or RH.

Sol 20: (a) Based on the valency of elements, the formula of oxide of phosphorus is P_2O_5.Sol 21: (c) Eka-silicon is later predicted as germanium.

Sol 22: (d) Based on the valency of elements, the formula of oxide of gallium is Ga_2O_3

Sol 23: (c) The only common property between the elements of subgroups is their valency.

Sol 24: (b) Third period elements are known as typical elements.

Sol 25: (b) The elements present in IIB and IIIB belongs to transition elements.

Sol 26: (d) Nickel is placed after cobalt in the Mendeleev's periodic table.

Sol 27: (d) The cause of periodicity is the similar electronic configuration of elements.

Sol 28: (d) Modern periodic table consists of 18 groups and 7 periods.

Sol 29: (a)

Sol 30: (c) F, P and Cl don't exhibit similar properties as P belongs to different group than F and Cl.

Sol 31: (b) Last two shells of these elements namely outermost and penultimate shells are incomplete.

Sol 32: (c) Group 18 elements are also known as inert gases or noble gases.

Sol 33: (c) The chalcogens are the chemical elements in group 16 of the periodic table. This group is also known as the oxygen family.

Sol 34: (b) No. of shells is equal to the period number in which that element is present.

Sol 35: (b) The configuration is $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $4s^2$, $3d^{10}$. The electron goes to d-subshell, so belongs to transition element.

Sol 36: (a) The electronic configuration starts with filling the electrons in the s-subshell first.

Sol 37: (d) 6^{th} and 7^{th} period consist of 32 elements.

Sol 38: (b) 14 elements ranging from atomic number 58-71 belongs to lanthanide series.

Sol 39: (b) 14 elements ranging from atomic number 58-71 i.e. from cerium to lutetium, belongs to lanthanide series.

Sol 40: (a) Actinides belong to 7^{th} period and 3^{rd} group.

Level – 2

Sol 1: (b) No. of shells increases down the group so the no of shells of bromine is more than chlorine.

Sol 2: (c) No of valence electrons remains same on moving down the group.

Sol 3: (c) Along the period, valency increases from 1 to 4 then decreases till 0.

Sol 4: (c) Valency = 8 – No of valence electrons = 8-8 = 0

Sol 5: (a) Valency = 8 – No of valence electrons = 8 - 7 = 1

Sol 6: (b) All the elements belong to same period and size decreases along the period.

Sol 7: (b) The atomic radius decreases along the period because of increase in effective nuclear charge, Which results in greater attraction for the outermost shell thus resulting in decrease in radius.

Sol 8: (a) Atomic size increases down the group because of the increase in no of shells.

Sol 9: (d) All the elements belong to same group and size increases down the group.

Sol 10: (b) Atomic size increases down the group and La is placed above Y in the periodic table.

Sol 11: (c) Na+ is formed by removing one electron from sodium atom having 11 electrons.

Sol 12: (a) The size of parent atom is more than that of its cation because of increase in nuclear charge because of less no of electrons in cation.

Sol 13: (b) In case of isoelectronic ions, the anions are of larger radii as compared to cations.

Sol 14: (c) The metallic character increase because of the lesser pull of nuclear charge for the outermost electrons.

Sol 15: (b) The metallic character increases down the group and decreases along the period.

Sol 16: (b) Metallic character decreases along the period.

Sol 17: (d) Non-metallic character increases along the period.

Sol 18: (b) Electronegativity and atomic radius are inversely proportional to each other.

Sol 19: (a) Electronegativity and oxidation number are directly proportional to each other.

Sol 20: (b) Fluorine is the most electronegative atom of the periodic table.

Sol 21: (c) I.E decreases along the period but Be and N, because of their fully filled and half filled configuration, are having higher I.E than the elements placed after them in the periodic table.

Sol 22: (a) A, B and C, based on their electronic configuration, belong to the same group and I.E decreases down the group.

Sol 23: (b) The second ionisation energy of Mg is less than that of Na because sodium after losing one electron, acquires the noble gas configuration.

Sol 24: (a) The ionisation energy increases along the period but Mg is having higher I.E than Al because of fully filled 3s-orbital.

Sol 25: (d) The element is having highest I.E because of its half filled configuration.

Sol 26: (c) Successive ionisation energy involves a higher amount of energy.

Sol 27: (c) Electron affinity is an exothermic progress.

Sol 28: (b) The electron affinity increases from F to Cl and then decreases from Cl to Br..

Sol 29: (d) The second electron affinity is an endothermic process.

Sol 30: (b) Cl is the element of highest electron affinity.

Subjective

Sol 1: Newland found that every eight element had properties similar that of the first. He compared this to the octaves found in music. Therefore, he called it the "Law of Octaves". It is known as "Newland's Law of Octaves".

Sol 2: Mendeleev left gaps in his periodic table because the properties of known elements predicted other, as-yet-undiscovered, elements in these locations. As Mendeleev organized his periodic table, he recognized that these gaps would be filled as future scientists identified new elements.

Sol 3: The modern periodic law states that the physical and chemical properties of the elements are the periodic functions of their atomic numbers.
Mendeleev's period law is based on atomic mass and modern periodic law is based on atomic number.

Sol 4: Elements of group 3 have 3 electrons in their valence shell. Ex: B, Al, Ga.

Sol 5: A group (also known as a family) is a column of elements in the periodic table of the chemical elements. There are 18 groups in the periodic table.

Sol 6: Group no = No of valence electrons. So, if the element belongs to 2nd group, then it has 2 valence electrons.

Sol 7: The atomic radius of Na^+ is less than that of Na,because due to the loss of $1e^-$,the inter electronic repulsion by the electrons in the inner shell decreases. As the interelectronic repulsion decreases, the attraction between the nuclei and the outermost electron increases,leading to the decrease in the atomic size.

Sol 8: Metallic Character: Increases down the group and decreases along the period.
Non-metallic character: Decreases down the group and increases along the period.

Sol 9: In the case of the halogens, the atoms of each element has seven valence electrons, ns^2np^5 , where n represents the energy level. The electron configuration of fluorine is $[He]2s^22p^5$, chlorine is $[Ne]3s^23p^5$, and the electron configuration of bromine is $[Ar]3d^{10}4s^24p^5$.

Sol 10: Oxygen being smaller in size than sulfur, has its valence shell electrons placed more closely than sulfur. As an external electron is introduced, energy is released (which is called electron affinity) but at the same time, some of the energy is consumed due to the instability caused by electron-electron repulsion.

Sol 11: This is because on removal of an electron a positive charge is acquired by the atom that is it becomes a cation. The presence of the positive charge increases the force of attraction of the nucleus (Zeffective) of the atom. It can be easily understood that greater is the force of attraction exerted by the nucleus on a given electron higher will be the energy required to remove that electron from the atom/ion.

Sol 12: (i) Atomic radii increases down the group. Therefore, Br is of largest radii.
(ii) F is most reactive because of its highest non-metallic character.

Sol 13: a) The electronegativity increases along the group. So, Cl is most electronegative.

b) The electropositive character decreases along the period. So, Na is most electropositive.

c) Ar, being a noble gas, is least rective.

d) Si is the most abundant element among all.

e) Cl and Ar are gases at room temperature.

Sol 14: i) These are 2^{nd} group elements.

ii) N is missing among these elements and is should be placed after C.

iii) Carbon has the highest tendency to show catenation because of 4 valence electrons.

iv) Electronegativity increases along the period. The correct order is : Be < N < F

v) Fluorine belongs to the halogen series.

Sol 15: A group (also known as a family) is a column of elements in the periodic table of the chemical elements. There are 18 groups in the periodic table.

i) Metallic character decreases down the group. So the first element of every period is of greatest metallic character.

ii) The atomic size decreases down the group. So the last elment of every group is of largest size.