Class :- 8

IIT FOUNDATION PLUS

Periodic Properties - II

Electron Affinity, Electro Negativity, Electron Affinity, Oxidising And Reducing Properties

Teaching Task

JEE Main Level

Q1) Ans:- 3.

Solution:- Fluorine repels with the added electron due to its small size. Hence, among fluorine & chlorine, the electron affinity of chlorine is high.

Q2) Ans:- 3.

Solution:- For alkaline earth metals, filled 's' subshell discourages the addition of an electron. The electron affinity is almost zero. EA is a positive value for the magnesium atom.

Q3) Ans:-

Solution:- Halogens has higher electron affinity and it is supposed to be for fluoride, but chlorine has higher electron affinity than fluorine due to fluorine's smaller size.

Q4) Ans:- 1

Solution:- VII-A → Halogens have high Electron Affinity

Q5) Ans:-1

Solution:- The E.A of an atom is numerically equal to the I.P of uninegative ion.

$X^- - e^- \rightarrow X$ → I.P of atom's uninegative ion.

$X + e^- \rightarrow X^-$ → E.A of the atom.

Q6) Ans:- 3.

Solution:- Cesium is the most electropositive element in the entire periodic table.

Electronic configuration of Cesium → $[Xe]\ 6s^1$.

Q7) Ans:- 4.

Solution:- Electron negativity is the tendency for an atom of a given chemical element to attract shared electrons when forming a chemical bond.

Q8) Ans:- 1

Solution:- Electronegativity is a measure of the tendency of an atom to attract a bonding pair of electron.

Q9) Ans:- 1

Solution:- In moving down to the halogen group E.N decreases hence Iodine has lowest E.N.

Q10) Ans:- 1

Solution:- In a group as size increases ability to attract electrons decreases due to decrease in effective nuclear charge. Hence, phosphorus has the maximum electronegative character.

Q11) Ans:-

Solution:- The formation of the oxide ion $O^{-2}_{(g)}$ required first an exothermic and then an endothermic step.

$O + e^- \rightarrow O^-_{(g)} + 142\ KJ\ mole^{-1}$ → This is because oxygen has high electron affinity.

$O^- + e^- \rightarrow O^{-2}_{(g)} - 844\ KJ\ mole^{-1}$ → This is because anion formed resists addition of another e^-.

JEE Advanced Level Questions:-

Q11) Ans:- 1, 2, 4.

Solution:- With an increase in nuclear charge, the Electron gain enthalpy increases

→ N → $1s^2 2s^2 2p^3$ → stable configuration, difficult to add electron. E.A = 0.

→ Chlorine is the highest E.A Element.

→ F to Cl E.A increases.

Q12) Ans:- C

Solution:- Electron gain enthalpy of fluorine is less than chlorine because of fluorine small size.

Statement-1 → True, Statement-2 → False.

Matrix Matching

Q13) Ans:- a) 5 b) 4. c) 1 d) 3

Solution:-

a) Highest E.N value → 5) F.

b) Least E.N Element → 4) Cs.

c). Electronegativity $\propto$ → 1) Effective nuclear charge.

d) Electronegativity $\frac{1}{\propto}$ → 3) Size of the atom

Q14) Ans:- 2.

Solution:- Electronegativity is a measure of the capacity of an atom to attract electrons.

Q15) Ans:- 2.

Solution:- Across a period from IA to VII A E.N increases because the nuclear charge increases.

Q16) Ans:- 2

Solution:- In series C, N, O, F, E.N increases from C to F. This because E.N increases as you move from left to right across a period on the periodic table.

Learner's Task.

Q1) Ans:- 2

Solution:- 'O' has high Electron Affinity.

Q2) Ans:- 1

Solution:- Units of E.A are

Energy/mol or J/mol or cal/mol or kcal/mol.

Q3) Ans:- 4.

Solution:- The magnitude of E.A depends on

1) Atomic size 2) Screening effect 3) Nuclear charge.

Q4) Ans:- 1

Solution:- Among the given electron configurations

$1s^2$ → helium. As it is a noble gas, it will have low electron affinity value.

Q5) Ans:- 3.

Solution:- $E.N = \frac{I.P + E.A}{2}$

Q6) Ans:- H

Solution:- Hydrogen was chosen as the reference, as it forms covalent bonds with a large variety of elements. It's E.N was fixed first at 2.1, later revised to 2.2.

Q7) Ans:- 3

Solution:- $\Delta EN > 1.7$ → Ionic, $\Delta EN < 1.7$ → Covalent.

$\Delta EN = 1.7$ then its nature is 50% Ionic & 50% covalent.

Q8) Ans:- 2.

Solution:- Halogens have $7e^-$ in their valence shell. They need only $1e^-$ to complete their octet.

Hence, halogens are highly electronegative.

Q9) Ans:- 3.

Solution:- 'F' is considered the most Electronegative element.

Q10) Ans:- 3.

Solution:- Oxidation is the proces of loss of electrons. Reduction is the process of gain of electrons. Atom becomes ion by loss or gain of electrons. Thus, atom becomes ion neither by oxidation or reduction.

JEE Main Level

Q1) Ans:- 3.

Solution:- Alkali metals are most metallic elements. They have one electron in their valence shell. 2,8,1 configuration correponds to that of an alkali metal.

Q2) Ans:- 2.

Solution:- E.N depends on the no of electrons required to get octet. It increases from left to right in a period, hence correct order is F>O>N>C.

Q3) Ans:- 4.

Solution:- Fluorine has the highest E.N value, therefore H-F will have the highest polarity.

Q4) Ans:- 1

Solution:- E.N is a measure of the capacity of an atom to attract shared pair of electrons in a bond.

Q5) Ans:- 1.

Solution:- Left to right in a Period E.N increases

Top to bottom in a group E.N decreases

F > O > Cl > S.

Q6) Ans:- 2.

Solution:- Pauling values of E.N are dependent upon bond energies.

$$\chi_A - \chi_B = 2.808 \sqrt{E_{A-B} - \frac{1}{2}(E_{B-B} + E_{A-A})}$$

Q7) Ans:- 1

Solution:- In a period from Alkali metals to Halogens, the E.N value gradually increases.

Q8) Ans:- 3.

Solution:- As the size increase in a group, effective nuclear charge of the atom decreases. Hence, ability to attract electrons decreases, so E.N decreases

Q9) Ans:- 2.

Solution:- Sulfur (S) has the highest E.N among Mg, S, B, Te.

Q10) Ans:- 3.

Solution:- Fluorine is the strongest oxidizing agent due to low heat of dissociation & high heat of hydration.

JEE Advanced level Questions

Q1) Ans:- 1, 2, 3.

Solution:-
→ Higher Nuclear charge, higher will be the E.A.
→ E.A depends on Electronic configuration.
→ Smaller atomic size will have high Electron gain enthalpy because of their electronic configuration.

Q2) Ans:- 1, 2, 3, 4.

Solution:- Factor affecting E.N are
Nuclear charge, Screening effect, Atomic size & oxidation state.

Q3) Ans:- 1, 2, 3
Solution:- From top to bottom of group E.N decreases.
1) Cs < Li → Correct (Group 1)
2) Ba < Be → Correct (Group 2)
3) Sn < C → Correct (Group 4)

Q4) Ans:- 1, 2, 3.
Solution:- Approaches to express Electro Negativity.
1) Pauling's Approach
2) Mulliken's Approach.
3) Allred- Rochow scale.

Q5) Ans:- D.
Solution:- E.A & I.E are conceptually opposite but numerical value not Equal.
→ Halogens have high E.A.
I- False, II- True.

Q6) Ans:- c

Solution:- An atom with higher oxidation state is more Electronegative.

→ Nuclear charge decreases _ E.N decreases.

Statement-1 → True, Statement-2 → False.

Matrix Matching

Q7) Ans:- a) 3 b) 4 c) 2 d) 1

Solution:-

a) Chlorine → 3) High Electron Affinity.

b) Fluorine → 4) Strong oxiding agent.

c) Argon → 2) Zero Electron affinity.

d) Cesium → 1) Strong reducing agent

Q8) Ans:- 2.

Solution:- Pauling's E.N scale is based on Experimental values of bond energies

Q9) Ans:- 2

Solution:- An Electronegative element has a tendency to accept electrons not to lose an electron. So they will be having high Ionisation potential.

Q10) Ans:- 4.

Solution:- The EN of elements increases towards the right & decreases down the group EN is higher for non metals & lower for metals. Considering these factors among given options 'S' has the highest E.N.