Calculate the electron gain enthalpy of chlorine atom in terms of kJ mol^{-1} and eV per atom.

Soln.: The amount of energy released when 1×10^{10} atoms of chlorine in vapour state are converted to Cl^- ions, according to the equation,

$Cl_{(g)} + e^- \to Cl^-_{(g)}$ is 57.86×10^{-10} J.

∴ The electron gain enthalpy of chlorine, *i.e.*, the amount of energy released when 1 mole (6.023×10^{23}) atoms of chlorine are converted into Cl^- ions according to the above equation will be

$$= -\frac{57.86 \times 10^{-10}}{1 \times 10^{10}} \times 6.023 \times 10^{23}$$

$= -348.49 \times 10^3$ J/mol $= -348.49$ kJ/mol

Now 1 eV/atom = 96.49 kJ mol^{-1}

∴ Electron gain enthalpy of chlorine

$$= -\frac{348.49}{96.49} = -3.61 \text{ eV/atom}$$

Electronegativity

- The relative tendency of an atom in a molecule to attract a shared pair of electrons towards itself is termed as electronegativity. Electronegativity is measured on a number of scales but most commonly used are of Pauling or Mulliken.
- **Factors affecting electronegativity**
  - ➢ ***Atomic size :*** Size increases, electronegativity decreases.
  - ➢ ***Ionisation enthalpy and electron affinity :*** Ionisation energy and electron affinity increase, electronegativity also increases.
  - ➢ ***s-Character :*** *s*-Character increases electronegativity increases.

    Order of electronegativity : $sp > sp^2 > sp^3$
  - ➢ ***Charge on the ion :*** Electronegativity order : cation > parent ion > anion.
- **Variation along a period :** Electronegativity increases in a period from left to right since atomic size decreases and nuclear charge increases from going left to right in a period. Electronegativity of a series of transition metals is almost similar.
- **Variation in the group :** Electronegativity decreases down the group because the atomic size increases.

Group →	1 IA	2 IIA	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA
I Period	H 2.1						
II Period	Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
III Period	Na 0.9	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0
IV Period	K 0.8	Ca 1.0	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8
V Period	Rb 0.8	Sr 1.0	In 1.7	Sn 1.8	Sb 1.9	Te 2.01	I 2.5
VI Period	Cs 0.7	Ba 0.9	Tl 1.8	Pb 1.9	Bi 1.9	Po 1.76	At 2.2

Increases →

Decreases ↓

Valency

- The electrons present in the outermost shell are called valence electrons. The valency of an element is defined as its 'combining capacity'. Number of valence electrons determine the valency of an atom.
- **Variation along a period :** The number of valence electrons increases from left to right in a period. So, the valency of the elements first increase from 1 to 4 and then decrease to zero. Noble gases have zero valency.

Group	1	2	13	14	15	16	17	18
Number of valence electrons	1	2	3	4	5	6	7	8
Valence on hydrogen scale	1	2	3	4	3	2	1	0

- **Variation in a group :** On moving down the group the number of valence electrons remains same and therefore all the elements in the group exhibit the same valency. For example, the elements of group-1 show monovalency while the elements of group-2 show divalency.

	In a period	In a group
Atomic radii	Decreases	Increases
Ionic radii	Decreases	Increases
Ionisation enthalpy	Increases	Decreases
Electron affinity	Increases	Decreases
Electronegativity	Increases	Decreases