VALENCY

Valency is a term that defines the combining capacity of elements. The term itself is derived from the Italian word "Valentia," which signifies combining capacity.

Valency with respect to Hydrogen

The valency of hydrogen is 1, representing the number of hydrogen atoms attached to a specific element.

	IA	IIA	IIIA	IVA	VA	VIA	VIIA
	NaH	MgH_2	AlH_3	SiH_4	PH_3	H_2S	$H–Cl$
Valency	1	2	3	4	3	2	1

Note: The valency relative to hydrogen increases across the period up to 4 and then decreases back to 1.

Valency with respect to oxygen

The valency of 'O' is 2, defined as twice the number of oxygen atoms attached to a particular atom.

	IA	IIA	IIIA	IVA	VA	VIA	VIIA
	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl_2O_7
Valency	1	2	3	4	5	6	7

Note: The valency concerning oxygen increases from 1 to 7 across the period, and the valency with respect to 'O' is equal to the group number.

New concept

This concept relies on electronic configuration. According to this idea, the valency for IA to IVA group elements equals the number of valence shell electrons, and for VA to zero group, it is [8 – (number of valence electrons)].

Valency = No. of valence e^- Valency = (8– no. of valence e^-)

IA	IIA	IIIA	IVA	VA	VIA	VII	0
ns^1	ns^2	ns^2np^1	$ns^2\ np^2$	ns^2np^3	$ns^2\ np^4$	$ns^2\ np^5$	ns^2np^6

Valence shell e^- 1   2   3   4   5   6   7   8

Valency 1   2   3   4   3   2   1   0

(8 – 5) = 3   (8 – 8) = 0

Note: All members within a group exhibit identical valencies due to their shared quantity of valence shell electrons.

Nature of oxides

The elements positioned at the far left of the periodic table exhibit oxides that are predominantly basic in their nature, while those situated at the extreme right tend to form oxides with distinctly acidic properties upon reacting with oxygen. In contrast, elements positioned in the central region of the periodic table produce oxides that display amphoteric characteristics or neutrality.

Consider an oxide AO

If $X_A - X_O > 2.3$ Basic oxide

If	$X_A - X_O = 2.3$	Amphoteric oxide
If	$X_A - X_O < 2.3$	Acidic oxide

(I) Along a period, acidic nature of oxide increases.

(II) Down the group basic nature of oxide increases

$$Na_2O \quad MgO \quad Al_2O_3 \quad SiO_2 \quad P_4O_{10} \quad SO_3 \quad Cl_2O_7$$

$$\longleftrightarrow$$

$X_A - X_O > 2.3$	$X_A - X_O = 2.3$	$X_A - X_O < 2.3$
Basic	Amphoteric	Acidic

i.e., when in periodic table the distance between the element and oxygen increases, basic character increases.

$$NO_2 > ZnO > K_2O$$

$$\xrightarrow{\hspace{3cm}}$$

acidic character decreases

To illustrate, sodium oxide (Na_2O) exemplifies strong basicity, while chlorine dioxide (Cl_2O) showcases strong acidity. Aluminum oxide (Al_2O_3) stands out as an amphoteric compound, capable of exhibiting both acidic and basic properties, while carbon monoxide (CO), nitrogen monoxide (NO), and dinitrogen trioxide (N_2O_3) are examples of oxides that are inherently neutral in their behavior.