



Holiday Assignments

Section Name (A/L)

Subject: Chemistry

Grade : 12 E Sci

Medium: English

Periodic trends shown by s and p block elements

1. The valence electron configuration

The valence electron configuration of an element can be predicted from their position in the periodic table.

Group number	1	2	13	14	15	16	17	18
Valance shell electron configuration	ns^1	ns^2	ns^2np^1	ns^2np^2	ns^2np^3	ns^2np^4	ns^2np^5	ns^2np^6

2. Metallic character

Metals have lower ionization energies compared to the other elements. Hence, metals can easily release electrons to produce cations.

The atomic radii increase and ionization energy decreases when going down a group. Therefore, the metallic nature increases down the group.

Also, across a period, atomic radii decrease and ionization energy increases. Therefore, the metallic nature decreases.

The third period shows a gradual increase in melting point and then a decrease across the period. Most abundant elemental form, type of bonding between similar atoms and the melting point of the third period elements are shown below.

	Na	Mg	Al	Si	P ₄	S ₈	Cl ₂	Ar
Melting point/ °C	98	649	660	1420	44	119	-101	-189
Bonding type	M	M	M	NC	C	C	C	-

Metallic - M, Network covalent - NC, Covalent - C

3. Acid, base and amphoteric nature of oxides

Across the third period variation of type of bonding in oxides in which the elements are at their highest oxidation number are given below.

	Na ₂ O(s)	MgO(s)	Al ₂ O ₃ (s)	SiO ₂ (s)	P ₄ O ₁₀ (s)	SO ₃ (g)	Cl ₂ O ₇ (l)
Oxidation number	+1	+2	+3	+4	+5	+6	+7
Bonding type	I	I	I	NC	C	C	C
Nature	Strongly B	B	Am	Very weakly A	Weakly A	A	Strong A

*Ionic - I, Network covalent - NC, Covalent - C
Basic - B, Amphoteric - Am, Acidic - A*

Oxides with the highest oxidation number are considered to compare the chemical nature. The nature from strong basic on the left to strong acidic to the right can be seen. Amphoteric nature can be seen in the middle of the series.

Reactions of third period oxides with water, acids and bases.

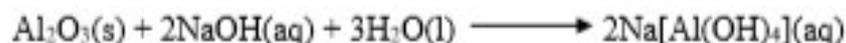
Oxides of sodium and magnesium react with water to produce hydroxides.



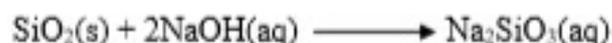
As these two oxides are basic, they react with acids to produce salt and water.



Aluminum oxide is amphoteric and it reacts with acids as well as with bases to produce salts.



SiO_2 is weakly acidic and reacts with strong bases. Also, SiO_2 shows no reaction with water.



P_4O_{10} , SO_3 , and Cl_2O_7 are acidic and produce acids when dissolved in water. Those reactions are shown below.



These oxides also react with bases to produce salts and water.



4. Acid, base and amphoteric nature of hydroxides and hydrides



Hydroxides of the third period show a trend similar to oxides of the same period. The following table shows a comparison of the third period hydroxides.

	NaOH	Mg(OH) ₂	Al(OH) ₃	Si(OH) ₄	P(OH) ₃	S(OH) ₂	Cl(OH) ₂
Stable form				H ₂ SiO ₃	H ₃ PO ₄	H ₂ SO ₄	HClO ₄
Oxidation number	+1	+2	+3	+4	+5	+6	+7
Bonding type	I	I	C	C	C	C	C
Nature	Strongly B	B	Am	Very weakly A	Weakly A	Strongly A	Very strongly A
<i>Ionic - I, Network covalent - NC, Covalent - C</i>							
<i>Basic - B, Amphoteric - Am, Acidic - A</i>							

Nature of hydrides of third period varies from strong bases to strong acids across the period. Amphoteric nature can be seen in the middle of the series.

	NaH(s)	MgH ₂ (s)	(AlH ₃) ₂ (s)	SiH ₄ (g)	PH ₃ (g)	H ₂ S(g)	HCl(g)
Oxidation number	+1	+2	+3	-4	-3	-2	-1
Nature of the aqueous solution	Strongly B	Weakly B	Am	Very weakly A	N	Weakly A	Very strongly A
Bonding type	I	I	NC	C	C	C	C
<i>Ionic - I, Network covalent - NC, Covalent - C</i>							
<i>Basic - B, Amphoteric - Am, Acidic - A, Neutral - N</i>							

Hydrides of sodium and magnesium react with water to produce basic solutions.



PH₃ is weakly soluble in water and produces a neutral solution. H₂S and HCl are acidic and aqueous solutions are also acidic.



5. Nature of the halides across the third period

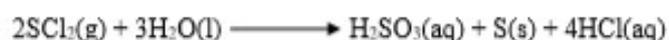
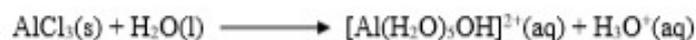
As the electronegativity of elements increases across the period from left to right, the ability of hydrolyzation of chlorides increases accordingly. Corresponding reactions are given below. Chlorides of s block elements in the third period are ionic and the p block elements are covalent.

	NaCl(s)	MgCl ₂ (s)	AlCl ₃ (s)	SiCl ₄ (l)	PCl ₅ (g)	SCl ₂ (g)
Oxidation number	+1	+2	+3	+4	+5	+2
Bonding type	I	I	C	C	C	C
Nature of the aqueous solution	N	Very weakly A	A	A	A	A

Ionic – I, Covalent - C

Basic – B, Amphoteric – Am, Acidic – A, Neutral - N

Reactions with water of third period covalent chlorides are,



Group 15 can be used to understand the variation of properties down the group. Down a group the ionization energy decreases, and the metallic nature increases. Use the information given for the Group 15 and correlate the variation in ionization energies with the increase of metallic properties down the group. Both N and P are non-metals and produce acidic oxides. However, As and Sb oxides are amphoteric and bismuth oxide is basic. Reactions with water of group 15 halides are given in the respective section under the halides of group 17.