PENANG SANGAM HIGH SCHOOL
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LESSON NOTES

Subject: Chemistry **Year/Level:** 12

Week 21

Strand	3 Quantitative Chemistry
Sub Strand	3.3 Physical Chemistry
Content Learning Outcome	To discuss the acidic oxides of period 3 elements and then chlorides of period 3 elements, properties and equations.

Acidic oxides

- Acidic oxides are the oxides of non-metals. These oxides form acids with water.

i. Silicon dioxide (SiO_2)

- White solid at 20 °C.
- Melting point is 1610 °C.
- Has covalent bonding with giant molecular structure.
- A non-conductor of heat and electricity.
- Does not react with water.

ii. Phosphorous pentoxide (P_4O_{10})

- White solid at 20 °C.
- Has covalent bonding with simple molecular structure
- Melting point is 340 °C.
- A non-conductor of heat and electricity
- Reacts with water to form phosphoric acid. $P_4O_{10(s)} + 6H_2O_{(l)} \rightarrow 4H_3PO_{4(aq)}$

iii. Sulphur trioxide (SO_3)

- Gas at 20 °C.
- Melting point for SO_3 is 17 °C.
- Covalent bonding with simple molecular structure.
- They are non-conductors of heat and electricity.

Reaction with water: SO_3 reacts to form sulphuric acid: $SO_{3(g)} + H_2O_{(l)} \rightarrow H_2SO_{4(aq)}$

iv. Chlorine monoxide (Cl_2O)

- Gas at 20 °C.
- Melting point is -20 °C.
- Covalent bonding with simple molecular structure.
- They are non-conductors of heat and electricity.
- Reacts with water to form hypochlorous acid.

Reaction with water: $Cl_2O_{(g)} + H_2O_{(l)} \rightarrow 2HClO_{(aq)}$

B. CHLORIDES- Chlorides of Period 3 elements

i. Sodium chloride (NaCl)

- White solid at 20 °C.
- Melting point is 801 °C.
- Has ionic bonds and a giant array of sodium and chloride ions (ionic lattice).
- A conductor of electricity in solution and molten form but not in solid state.
- Dissolves readily in water to form sodium and chloride ions (neutral solution).

$$NaCl_{(aq)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)}$$

ii. Magnesium chloride ($MgCl_2$)

- White solid at 20 °C.
- Melting point is 712 °C.
- Has ionic bonds and a giant array of magnesium and chloride ions (ionic lattice).
- A conductor of electricity in solution and molten form but not in solid state.
- Dissolves readily in water to form magnesium and chloride ions. The solution is slightly acidic.

$$MgCl_{2(aq)} \rightarrow Mg^{2+}_{(aq)} + 2Cl^{-}_{(aq)}$$

iii. Aluminum chloride ($AlCl_3$)

- White solid at 20 °C.
- Melting point is 180 °C.
- Has an ionic lattice but with a lot of covalent character at room temperature.
- A very poor conductor of electricity in molten form.
- Aluminum chloride reacts dramatically with small amounts of water producing heat and hydrogen chloride fumes.

$$AlCl_{3(s)} + H_2O_{(l)} \rightarrow AlCl_2OH_{(s)} + HCl_{(g)}$$

iv. Silicon tetrachloride ($SiCl_4$)

- Colorless liquid at 20 °C.
- Melting point is 68 °C.
- Has covalent bonds and simple molecular structure.
- It does not conduct electricity.
- Reacts violently with small amounts of water producing heat and hydrogen chloride fumes.

$$SiCl_{4(l)} + 4H_2O_{(l)} \rightarrow Si(OH)_{4(s)} + 4HCl_{(g)}$$

v. Phosphorous trichloride (PCl_3)

- A colorless fuming liquid at 20 °C.
- Melting point is -91 °C.
- Has covalent bonds with simple molecular structure.
- It does not conduct electricity.
- It reacts violently with water to produce phosphorous acid (acidic solution) and fumes of hydrogen chloride.

$$PCl_{3(l)} + 3H_2O_{(l)} \rightarrow H_3PO_{3\,(aq)} + 3HCl_{(g)}$$

vi. Sulphur dichloride (SCl_2)

- Cherry red liquid at 20 °C.
- Melting point is -80 °C.
- Has covalent bonds with simple molecular structure.
- Is a non-conductor of heat and electricity.
- It reacts violently with water to form HCl (acidic solution) and sulphur dioxide.

$$SCl_{2\,(l)} + H_2O_{\,(l)} \rightarrow SO_{2\,(g)} + HCl_{\,(aq)}$$

vii. Chlorine (Cl_2)

- Greenish yellow gas at 20 °C.
- Melting point is -101 °C.
- Has covalent bonds with simple molecular structure.
- Is a non-conductor of heat and electricity.
- Reacts with water to form hypochlorous and hydrochloric acids.

$Cl_{2(g)} + H_2O_{(l)} \longrightarrow HClO_{(aq)} + HCl_{(aq)}$

Summary

General trends in the chlorides of Period 3 elements:

1. Bonding and structure

   Ionic (lattice) ⟶ covalent (simple molecular)

2. Melting Point

   High ⟶ low (decreases across the period)

3. Nature

   Neutral ⟶ acidic

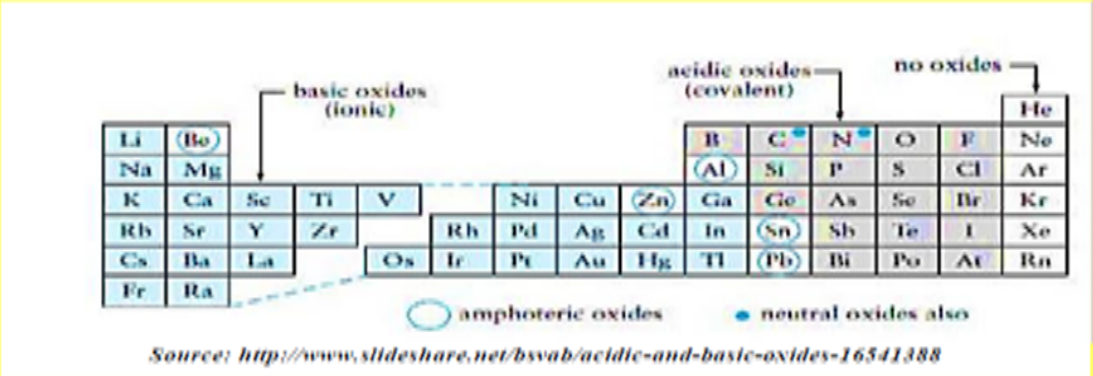
4. Conductivity

   Conductor to non-conductor

5. State

   Solid ⟶ liquid ⟶ gas

Summary:



Source: http://www.slideshare.net/bsvab/acidic-and-basic-oxides-16541388

General trends in the oxides of Period 3 elements across left to right of the period are:

- Bonding changes from ionic to covalent.
- Structure changes from giant ionic to macromolecular to simple (discrete).
- The melting point decreases.
- The nature of the oxides changes from basic to amphoteric to acidic.

Activity Complete the table given below.

Oxide	State at 25°C	Bonding	Structure
Na_2O	(i)	(ii)	(iii)
SiO_2	solid	(iv)	(v)
P_4O_{10}	solid	covalent	simple molecular where molecules are held together by weak intermolecular forces
SO_3	(vi)	(vii)	(viii)

Chloride	State at 25°C	Bonding	Structure
NaCl	(i)	(ii)	ionic lattice
$SiCl_4$	solid	covalent	(iii)
PCl_3	(iv)	(v)	(vi)
SCl_2	(vii)	(viii)	simple molecular where molecules are held together by weak intermolecular forces