

# IX) Anhydrides X) Acid Rain XI) Testing

March 5, 2018 1:50 PM

- What volume of NaOH must be added to reach the endpoint?
- b) Is HX weak or strong? How do you know?
- c) Select an indicator that would be ideal for this titration and give the colour at the equivalence point.
- 3) Draw a typical curve for a weak base/strong acid titration (strong acid in the buret). Show all characteristics and estimate the endpoint pH.

## IX) Acidic and Basic Anhydrides

How are acids and bases produced in nature?

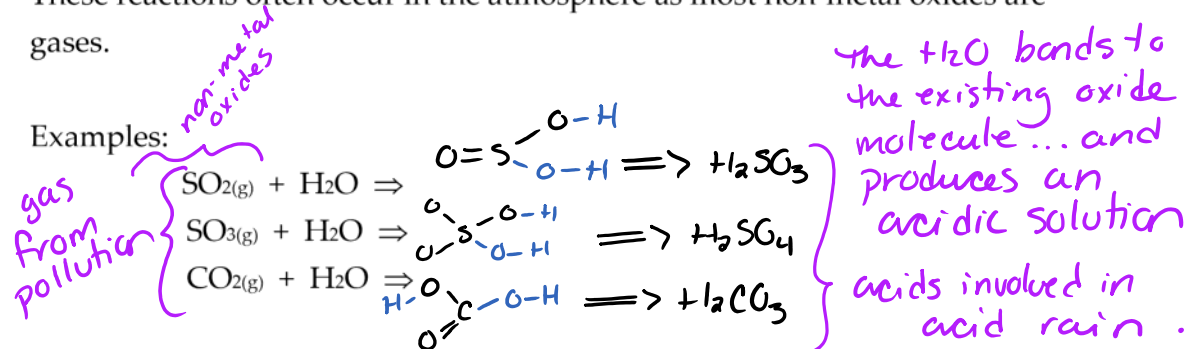
Both are produced from **oxides**. What are oxides?

*compounds made from oxygen + one other element.*

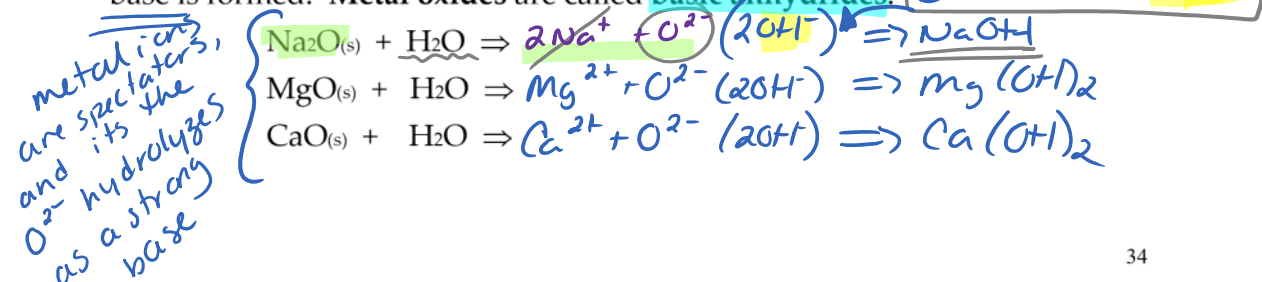
\* **Acids** are produced from **non-metal oxides** and **bases** are produced from **metal oxides**.

When **non-metal oxides** react with water in a **synthesis** reaction, an acid is formed. Thus, **non-metal oxides** are called **acidic anhydrides** (*acids without water*).

These reactions often occur in the atmosphere as most non-metal oxides are gases.



When **Group 1 and 2 metal oxides** react with water in a synthesis reaction, a base is formed. **Metal oxides** are called **basic anhydrides**.



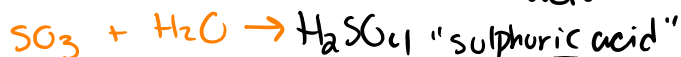
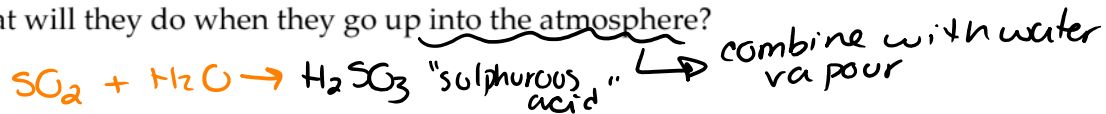
## X) Acid Rain



Fuels that contain sulfur are combusted in an industrial setting to form sulfur dioxide gas ( $SO_2$ ). Some of that sulfur dioxide then reacts with  $SO_2 + O_2 \Rightarrow SO_3(g)$  oxygen in the air to produce sulfur trioxide gas ( $SO_3(g)$ ). What do we call these compounds?

$SO_2$  and  $SO_3$  = non-metal oxides  $\Rightarrow$  acidic anhydrides.

What will they do when they go up into the atmosphere?



Thus, what results?

Acid Rain  
pH < 5.6  
( $H_2SO_3, H_2SO_4, HNO_2, HNO_3$ )  
"acid rain" soup  
 $SO_x + NO_x$

When fuel combusts in a car engine, it is so hot that  $N_2$  from the air reacts with  $O_2$  to form nitrogen monoxide gas ( $NO$ ). Though the catalytic converter reverses this reaction, some nitrogen monoxide escapes through the exhaust and reacts with  $O_2$  in the air to make nitrogen dioxide ( $NO_2$ ).



What happens next?



Some  $NO_2$  react with water vapour

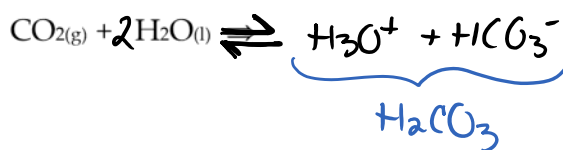


contribute to acid rain

Acid rain is defined as rainwater that has a pH less than 5.6.

It is important to note that even "normal" rainwater is acidic (between pH 5.6 and 7) due to atmospheric  $CO_2$  (an acidic anhydride) dissolving in water to produce carbonic acid.

non-metal oxide.



### Assignment 9:

- 1) There are many environmental problems associated with acid rain.  
Read Hebden pages 187 & 188.
- 2) Do Hebden p. 185 #144, 145 & p.188 #147

### XI Acid/Base Testing

Suppose you had a 1.0M solution of a strong acid and weak acid but did not know which was which. Describe any testing you could do to identify each solution.

- ① use an indicator to show pH
- ② pH paper (universal, litmus)
- ③ pH meter
- ④ Conductivity Test => strong acid will have greater conductivity
- ⑤ Titration