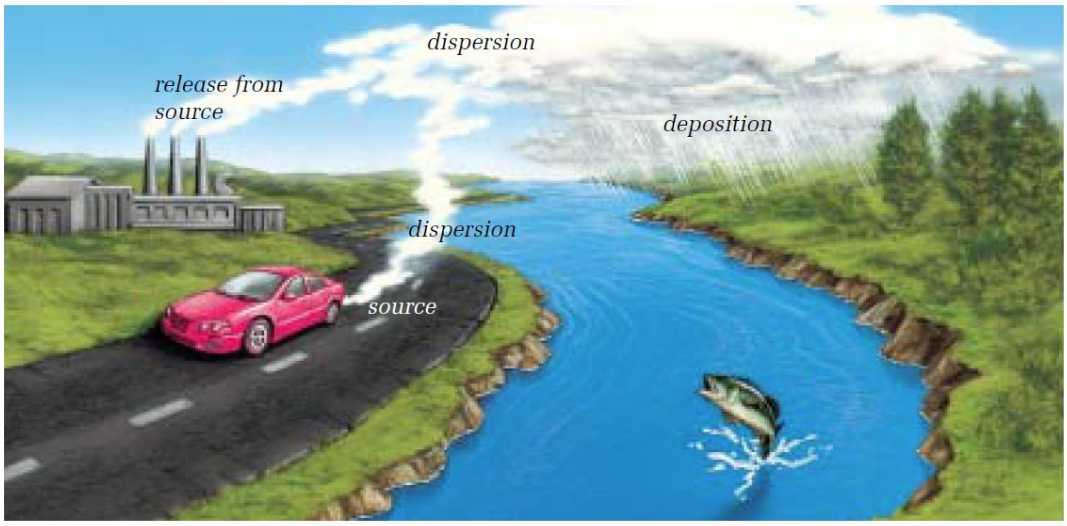
Science 30	Unit B: Chemistry
Lesson 2 - Chemistry of Acids and Bases	84 mins

The Release of Chemicals



wet deposition: gases or particles that are removed from the atmosphere by water (liquid or solid) and deposited as precipitation

dry deposition: gases or particles that are transported by winds and absorbed by Earth's surface

Acids, Bases and Neutral Compounds

Acid - Have and release hydrogen ions in water	electrolytic (conducts a current) corrosive turns blue litmus red reacts with active metals (e.g., Mg, Zn, and Fe) to produce hydrogen gas neutralized by bases and basic solutions tastes sour
Base - produces OH ions in water	electrolytic (conducts a current) corrosive turns red litmus blue feels slippery (when diluted) neutralized by acids and acidic solutions tastes bitter
Neutral - may produce ions in water but not H or OH	can be electrolytic (if solute is an ionic compound) does not change red or blue litmus

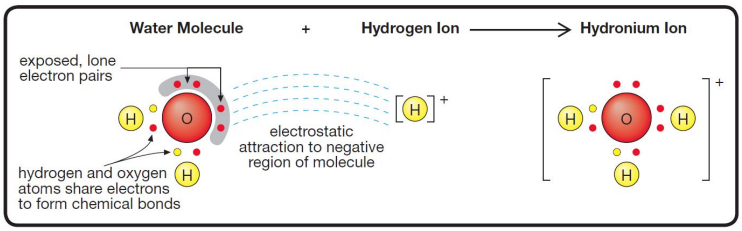
Determining if a Substance is and Acid, Base or Neutral

- Dissociate in water (split into ions)
  - If H produced, Acid
  - If OH produced, Base
  - If Neither is produced… neutral
	Arrhenius Acids and Bases

Modified Arrhenius Theory

$Na_2CO_{3(aq)} \rightarrow 2Na+_{(aq)} + CO_32-_{(aq)}$ **- No OH- … but is a base**	**CO_32- is strong enough to pull hydrogen ions off WATER.. Thus creating OH-**

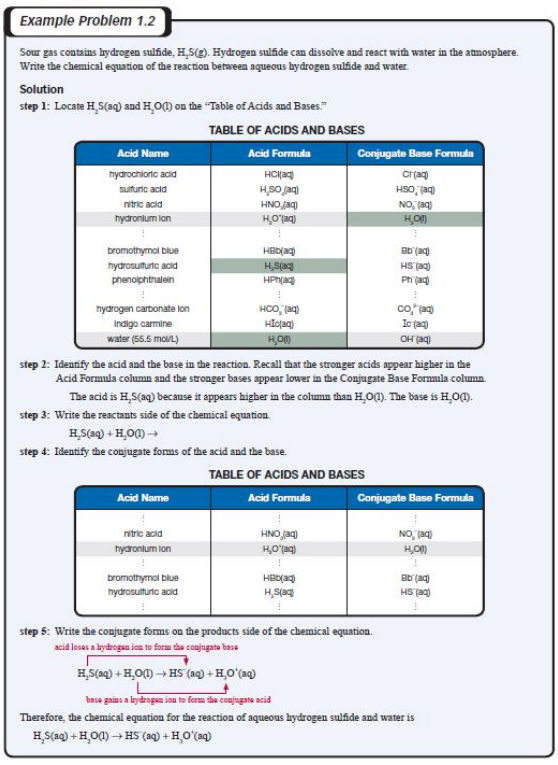
Hydronium (The Acid Molecule)

- Hydrogen ions are just free protons - Water Picks up these protons from there polar nature.	

Brønsted-Lowry Acid-Base

Pg. 12 of Data Booklet
- Acids PRODUCE protons
- Bases ACCEPT protons
  - Depending on the strength of the base of acid could act as either.
  - WATER
	acid: the substance that donates or loses a hydrogen ion to another substance during a chemical reaction
	
	base: the substance that accepts or gains a hydrogen ion from another substance during a chemical reaction
	
	conjugate acid: an acid formed in an acid-base reaction when a base accepts a hydrogen ion
	(or proton)
	
	conjugate base: a base formed in an acid-base reaction when an acid donates a hydrogen ion
	(or proton)

Writing Brønsted-Lowry Acid-Base Reactions



Example Problem 1.2

Sour gas contains hydrogen sulfide, $H_2S(g)$. Hydrogen sulfide can dissolve and react with water in the atmosphere. Write the chemical equation of the reaction between aqueous hydrogen sulfide and water.

Solution

step 1: Locate $H_2S(aq)$ and $H_2O(l)$ on the "Table of Acids and Bases."

TABLE OF ACIDS AND BASES

Acid Name	Acid Formula	Conjugate Base Formula
hydrochloric acid	$HCl(aq)$	$Cl^-(aq)$
sulfuric acid	$H_2SO_4(aq)$	$HSO_4^-(aq)$
nitric acid	$HNO_3(aq)$	$NO_3^-(aq)$
hydronium ion	$H_3O^+(aq)$	$H_2O(l)$
⋮	⋮	⋮
bromothymol blue	$HBb(aq)$	$Bb^-(aq)$
hydrosulfuric acid	$H_2S(aq)$	$HS^-(aq)$
phenolphthalein	$HPh(aq)$	$Ph^-(aq)$
⋮	⋮	⋮
hydrogen carbonate ion	$HCO_3^-(aq)$	$CO_3^{2-}(aq)$
indigo carmine	$HIc(aq)$	$Ic^-(aq)$
water (55.5 mol/L)	$H_2O(l)$	$OH^-(aq)$

step 2: Identify the acid and the base in the reaction. Recall that the stronger acids appear higher in the Acid Formula column and the stronger bases appear lower in the Conjugate Base Formula column.

The acid is $H_2S(aq)$ because it appears higher in the column than $H_2O(l)$. The base is $H_2O(l)$.

step 3: Write the reactants side of the chemical equation.

$H_2S(aq) + H_2O(l) \rightarrow$

step 4: Identify the conjugate forms of the acid and the base.

TABLE OF ACIDS AND BASES

Acid Name	Acid Formula	Conjugate Base Formula
⋮	⋮	⋮
nitric acid	$HNO_3(aq)$	$NO_3^-(aq)$
hydronium ion	$H_3O^+(aq)$	$H_2O(l)$
⋮	⋮	⋮
bromothymol blue	$HBb(aq)$	$Bb^-(aq)$
hydrosulfuric acid	$H_2S(aq)$	$HS^-(aq)$
⋮	⋮	⋮

step 5: Write the conjugate forms on the products side of the chemical equation.

acid loses a hydrogen ion to form the conjugate base

$H_2S(aq) + H_2O(l) \rightarrow HS^-(aq) + H_3O^+(aq)$

base gains a hydrogen ion to form the conjugate acid

Therefore, the chemical equation for the reaction of aqueous hydrogen sulfide and water is

$H_2S(aq) + H_2O(l) \rightarrow HS^-(aq) + H_3O^+(aq)$

Science 30 - Lesson 16 - Chemistry of Acids and Bases

Name: _____

1) Identify whether each example affects the validity or reliability of scientific work.
    a) Repeating an experiment

    _____

    b) Comparing your data with the data collected by other students completing the same experiment

    _____

    c) Two groups of scientists arriving at the same result using different methods

    _____

2) Write a balanced equation for the change that occurred with each substance when it was dissolved in water. Identify is it's an Arrhenius acid, base or neutral
    a) $HNO_{3(aq)}$:_____
    b) $H_2SO_{4(aq)}$:_____
    c) $H_2S_{(aq)}$:_____
    d) $NaOH_{(aq)}$:_____
    e) $Na_2CO_{3(aq)}$:_____
    f) $Na_2SO_{4(aq)}$:_____
    g) $NaCl_{(aq)}$:_____
3) Write the chemical equation for the following reactions. Label the acid, the base, the conjugate acid, and the conjugate base in each reaction.
    a) Dissolved nitric acid, $HNO_{3(aq)}$, reacts with water, $H_2O_{(l)}$.

    _____

    b) Carbonic acid in rainwater reacts with water.

    _____

    c) Ethanoic acid and ammonia

    _____

4) List similarities and differences between Arrhenius's theory and the Brønsted-Lowry theory.

    _____

    _____

5) Compare and contrast the terms proton, hydrogen ion, and hydronium ion.

    _____

    _____

6) Antacids are usually taken to relieve heartburn. State the type of compound an antacid needs to be in order to be effective. Calcium carbonate, $CaCO_3(s)$, and aluminium hydroxide, $Al(OH)_3(s)$, are substances used in commercially available antacids. List the empirical properties common to these two antacids. Write a balanced chemical equation that represents the reaction between each of these antacids and aqueous hydronium ions that would occur in the stomach.

_____

_____

7) A chemical spill releases concentrated ammonia, $NH_3(aq)$, along a dangerous-goods route. The spill has been contained. Identify the general properties of the concentrated ammonia spill. If a decision is made to treat the spill to reduce the risk to people or the environment, indicate a substance that can be used. Support your answer with a balanced chemical equation.

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_____

_____

_____

8) “The total amount of acid being deposited in an area is equal to the amount of wet acidic deposition deposited in the area plus the amount of dry acidic deposition deposited in the area.” Use the concepts you applied in this lesson to explain whether you think this statement is correct or incorrect.

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