Readiness Review Series

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Tips for Chemistry Success

Believe that your intelligence can grow.

The first battle in learning anything is believing you're capable. Cultivating a growth mindset (i.e. believing you're fully capable of mastering new material) will help immeasurably in achieving academic success.

Practice by teaching someone else a difficult concept.

Explaining a concept to someone else will help you work through the material yourself and reinforce the information in your own mind. Once you can successfully teach someone else the concept, you know you've mastered it.

Get tutoring weekly.

ACE, CARE, and Libraries' Learning District all offer free help for math courses. Visit tutoring.fsu.edu for more information on what you can get help with and how to access those programs.

Memorize key formulas/theorems/reactions/etc.

Having crucial formulas and concepts on hand will help you navigate the more complex concepts to come.

Tips for Chemistry Success

Always attend class.

This is the best chance to hear extra explanations, ask questions, and gain a stronger understanding of how each concept fits into the overall subject matter.

Start homework the day it is assigned.

The best practice is to complete homework problems without using example problems as a guide or copying answers from another source. Also, even when it is not worth points, you should focus on mastering the content of these assignments.

Make your schedule work for you.

If you are taking 15 credits this semester, create a weekly study schedule with 25 hours of study time during the week. It's also better to create 30-minute time blocks per class throughout the week as opposed to cramming. You'll remember a lot more when exposed to the material multiple times by practicing problems 2 or 3 times outside of class each week.

Be an active reader.

When you read your textbook, paraphrase each paragraph or section to ensure you understand. It can also help to color code your notes to help you identify what you do not understand and give you the chance to ask for clarification later.

Tips for Chemistry Success

Ask for help.

Spend a little bit of time trying to resolve it yourself, but don't spin your wheels. If something doesn't make sense or you feel stuck on a problem or concept, reach out to the instructor or the TAs for guidance. Visiting your instructors regularly in office hours will help you to develop better communication channels and to master the content you do not understand.

If you work with a tutor, make sure you have done some legwork before the tutoring session.

Make sure you know where you could use the additional help so that your tutoring session is effective and efficient.

Work well in advance of deadlines.

Last-minute emergencies and conflicts can never be predicted. You don't want to miss out on earning points because of procrastination.

Learn to be comfortable being uncomfortable.

Learning takes time, and until we have mastered something, we may often lack confidence in our abilities and our knowledge. The more time you spend studying something, the more comfortable you will become with the topic. However, be patient with yourself as you are learning.

CHM1045 – General Chemistry I

Concepts to review before CHM1046

- Lewis Dot Structures
- Thermochemistry
- Polyatomic Ions
- Periodic Trends
- Colligative Properties
- Acids & Bases
- Molarity & Molality
- Ideal Gas Law
- Polarity

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Vocabulary Review

Test your knowledge with these key terms.

- **Enthalpy**: heat content of a system
- **Entropy**: disorder of a system
- **Exothermic**: reaction that releases heat
- **Endothermic**: reaction that absorbs heat
- **Equilibrium**: forward reaction is equivalent to reverse
- Actual/ Theoretical Yield
- **Anode**: electrode where oxidation occurs in electrochemical cell
- **Cathode**: electrode where reduction occurs in electrochemical cell
- **Electronegativity**: tendency of an element to attract an electron
- **Oxidation Number**: charge an atom would have if the molecule were composed of ions
- **Covalent Bond**: bond in which electrons are shared
- **Ionic Bond**: bond between ions were an electron is transferred
- **Van der Waals Forces**: weak attraction between molecules with permanent poles
- **London Dispersion Forces**: weak attraction between molecules with momentary dipoles
- **Acid**: proton donor/ electron acceptor
- **Base**: electron donor/ proton acceptor

Lewis Dot Structures

Definition: A way of representing atoms or molecules by showing electrons as dots surrounding the element symbol

1. Determine the total number of valence (outer shell) electrons. For cations, subtract one electron for each positive charge. For anions, add one electron for each negative charge.
2. Draw a skeleton structure of the molecule or ion, arranging the atoms around a central atom. Connect each atom to the central atom with a single bond Distribute the remaining electrons as lone pairs on the terminal atoms, completing an octet around each atom.
3. Place all remaining electrons on the central atom.
4. Rearrange the electrons of the outer atoms to make multiple bonds with the central atom in order to obtain octets wherever possible.

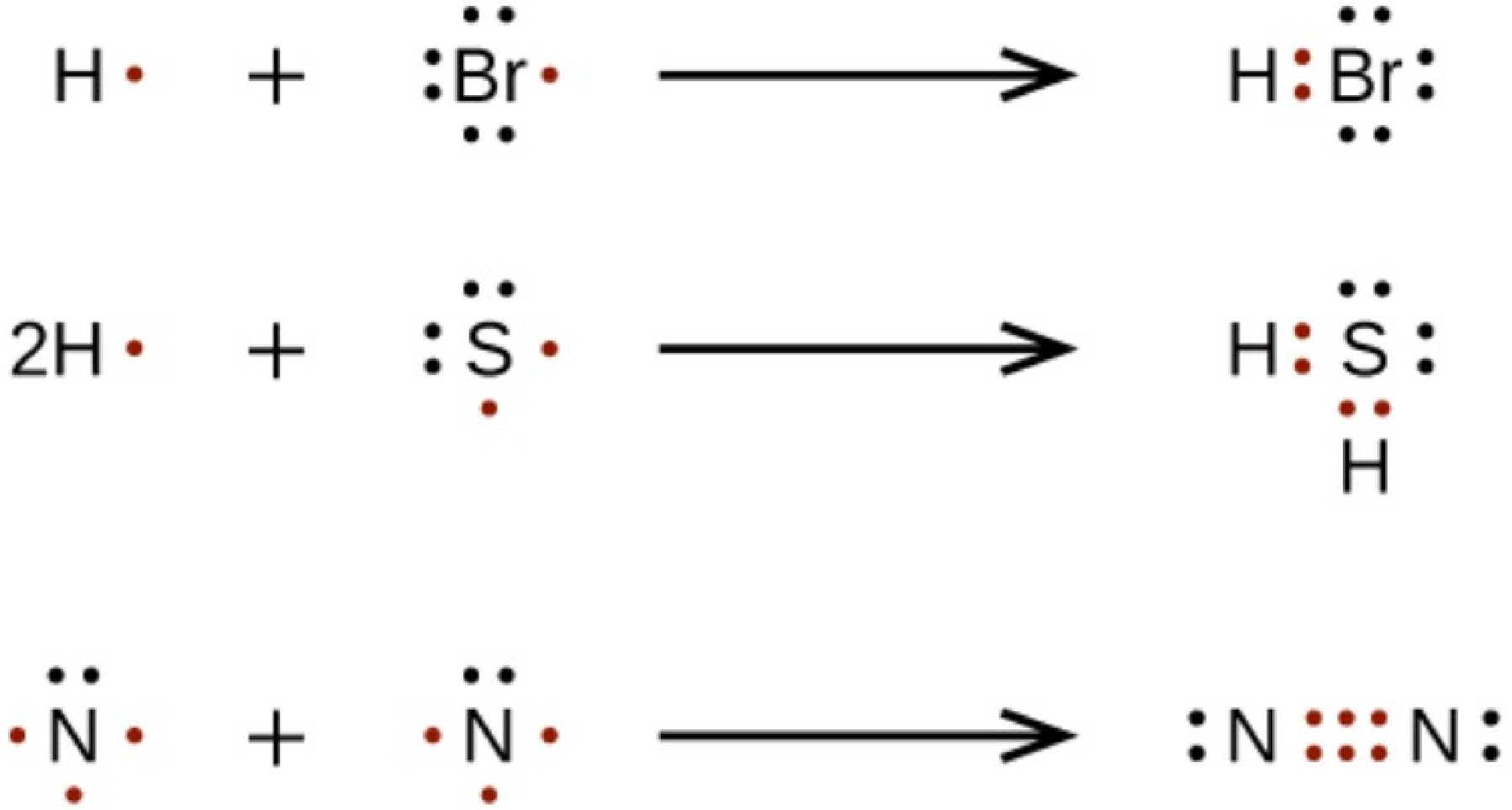
Table 5.1 Covalent Bonding Patterns — OBJECTIVE 20

Element	Frequency of pattern	Number of bonds	Number of lone pairs	Example
H	always	1	0	H–
B	most common	3	0	–B–
C	most common	4	0	–C– or –C= or –C≡
	rare	3	1	≡C:
N, P, & As	most common	3	1	–N–
	common	4	0	–N–
O, S, & Se	most common	2	2	–O– or =O
	common	1	3	–O:
	rare	3	1	≡O:
F, Cl, Br, & I	most common	1	3	–X:

***Be ware of resonance/expanded octets. Always count final drawing for electrons, much have exact number of lone pairs + bonds as total number of electrons.*

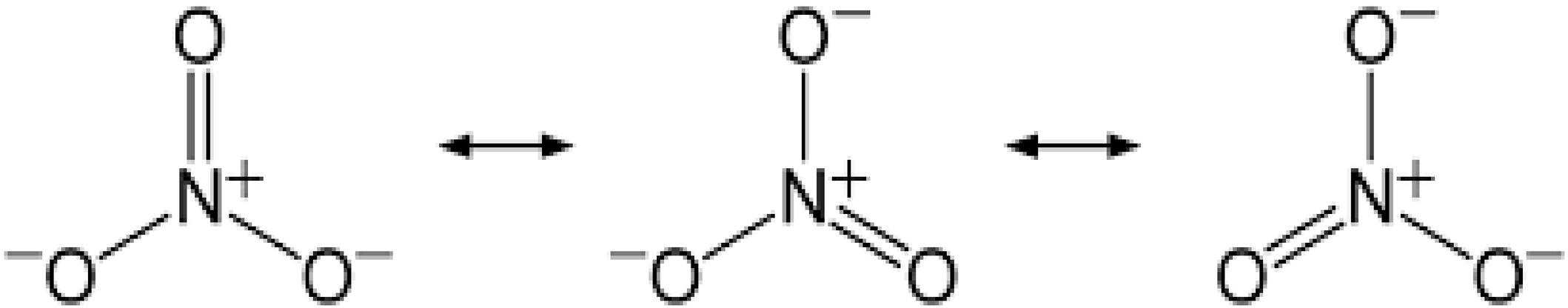
Lewis Dot Structures

Visual representations



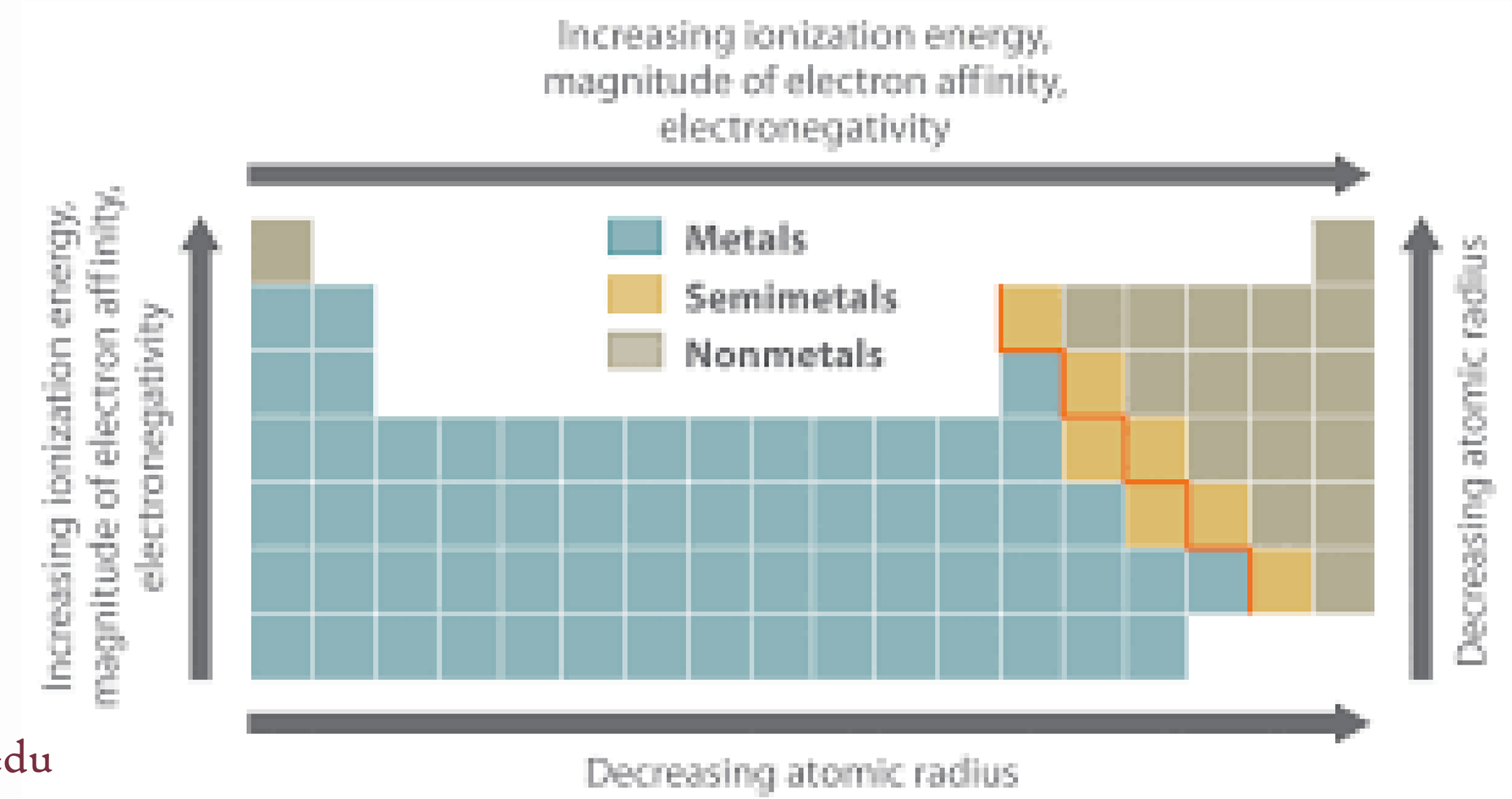
Lewis Dot Structures

Visual representations



Periodic Trends

Electronegativity - how good an element is at attracting a single electron.
Remember, Fluorine is the more electronegative element.



Molarity vs. Molality

$$Molality = m = \frac{moles\ of\ solute}{kg\ of\ solvent}$$

Formula on Green Sheet

$$\textbf{Molarity} = M = \frac{\text{moles of solute}}{\text{Liters of solution}}$$

If grams are given, convert to moles 1st

If mL are given, convert to L 1st

Example Problems:

- Calculate the molarity of 6.52 g of $CoCl_2$ (128.9 g/mol) dissolved in an aqueous solution with a total volume of 75.0 mL.

- How many grams of NaCl are contained in 0.250 L of a 5.30-*M* solution?

- The antifreeze in most automobile radiators is a mixture of equal volumes of ethylene glycol and water, with minor amounts of other additives that prevent corrosion. What are the (a) mole fraction and (b) molality of ethylene glycol, C2H4(OH)2, in a solution prepared from 2.22 × 103 g of ethylene glycol and 2.00 × 103 g of water (approximately 2 L of glycol and 2 L of water)?

Thermochemistry

Definitions

- **Entropy**: disorder of a system
- **Enthalpy**: total heat content of a system
- **Temperature**: measure of the average amount of energy in a system
- **Hess's Law**: states that total enthalpy change during a reaction is independent of steps

Thermochemistry

Hess's Law, Entropy, & Enthalpy

Summary of the Four Scenarios for Enthalpy and Entropy Changes

	$\Delta H > 0$ (endothermic)	$\Delta H < 0$ (exothermic)
$\Delta S > 0$ (increase in entropy)	$\Delta G < 0$ at high temperature $\Delta G > 0$ at low temperature Process is spontaneous at high temperature	$\Delta G < 0$ at any temperature Process is spontaneous at any temperature
$\Delta S < 0$ (decrease in entropy)	$\Delta G > 0$ at any temperature Process is nonspontaneous at any temperature	$\Delta G < 0$ at low temperature $\Delta G > 0$ at high temperature Process is spontaneous at low temperature

Thermochemistry

Hess's Law, Entropy, & Enthalpy

1. Find ΔH_{rxn} for the reaction below, from the following data:

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$	$\Delta H = ???$
$N_2(g) + O_2(g) \rightarrow 2NO(g)$	$\Delta H = -180.5kJ$
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	$\Delta H = -91.8kJ$
$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(g)$	$\Delta H = -241.8kJ$

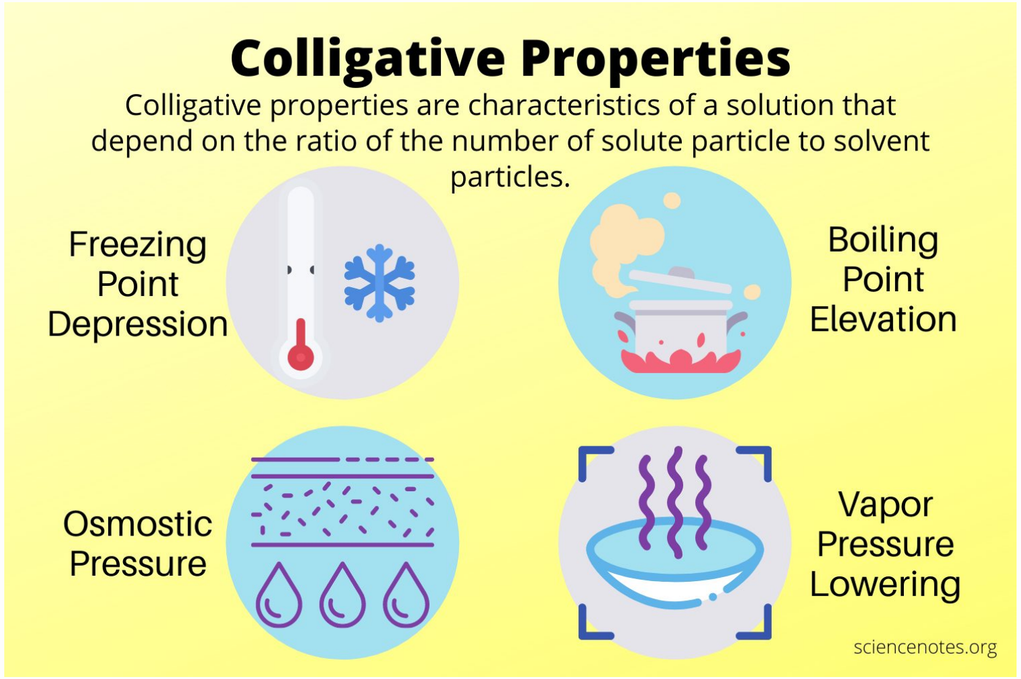
2. Find ΔH_{rxn} for the reaction below, from the following data:

$3H_2(g) + 2C(s) + \frac{1}{2} O_2(g) \rightarrow C_2H_5OH(l)$	$\Delta H = ???$
$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$	$\Delta H = -875kJ$
$C(s) + O_2(g) \rightarrow CO_2(g)$	$\Delta H = -394.51kJ$
$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l)$	$\Delta H = -285.8kJ$

Colligative Properties

Definition: property that is based on the number of particles solute versus number of particles of solvent in a solution, not on the identity of the solution

Example:
2.00 g of some unknown compound reduces the freezing point of 75.00 g of benzene from 5.53 to 4.90 $^{\circ}C$. What is the molar mass of the compound?



Colligative Properties

Example:
A 0.500 L sample of an aqueous solution containing 10.0 g of hemoglobin has an osmotic pressure of 5.9 torr at 22 °C. Assuming ideal solution behavior, what is the molar mass of hemoglobin?

COLLIGATIVE PROPERTIES

- Depends on the collective effect of the number of solute particles but not on the nature of the solute.

1. Boiling point elevation
$$\Delta T_b = k_b M$$

2. Freezing point depression
$$\Delta T_f = -k_f M$$

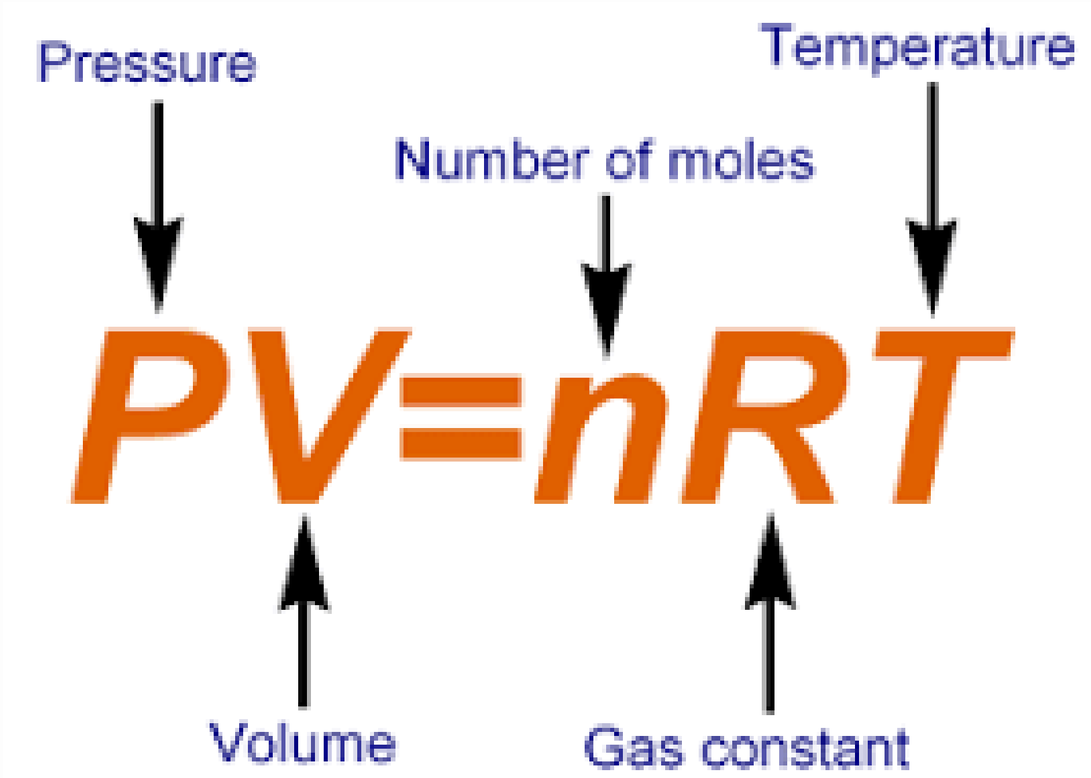
3. Vapor pressure lowering
Raoult's law $P_s = X_A P^\circ_A$

4. Osmotic Pressure
$$\Pi = MRT = \left[\frac{N}{V}\right] RT$$

Ideal Gas Law

Definition:

- Ideal Gas Law: an equation of state to describe a theoretical ideal gas
  - Relates pressure, volume and temperature when given a quantity
- Ideal Gas: a gas whose molecules experience no intermolecular forces



Examples:

A sample of carbon dioxide, CO_2, occupies 0.300 L at 10 °C and 750 torr. What volume will the gas have at 30 °C and 750 torr?

What is the volume of a sample of ethane at 467 K and 1.1 atm if it occupies 405 mL at 298 K and 1.1 atm?

Polyatomic Ions & Nomenclature

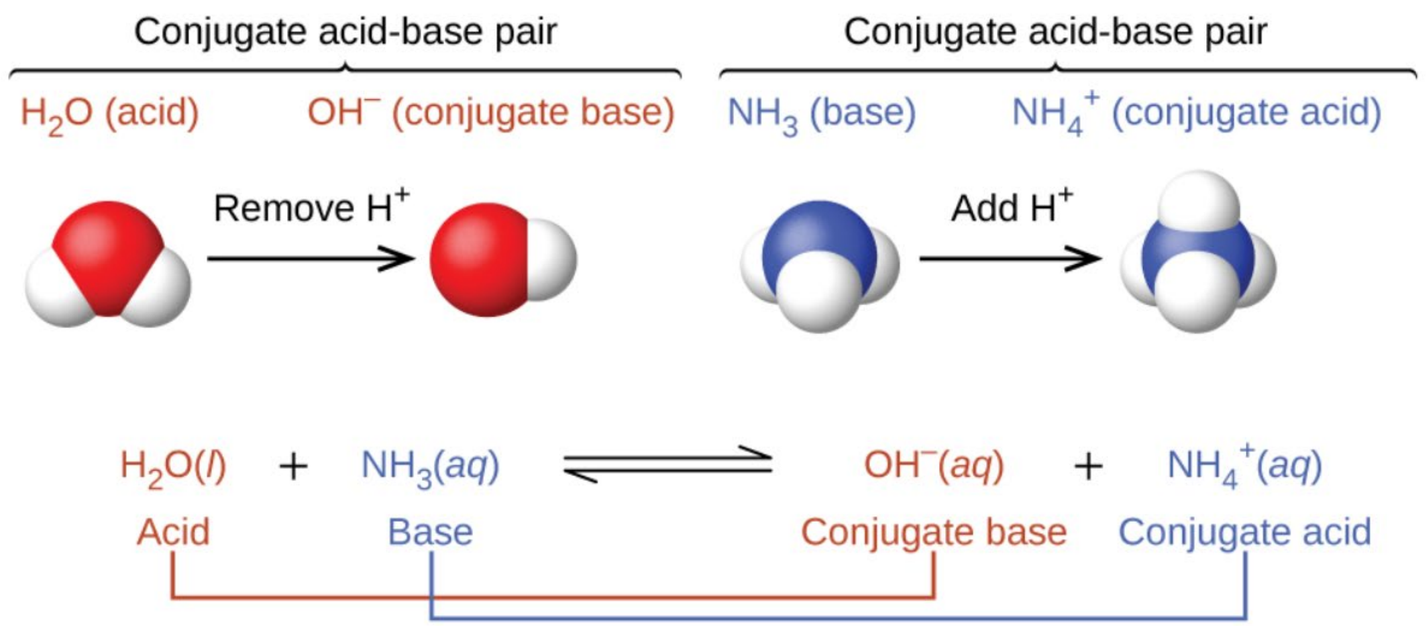
Polyatomic Ion: Ion consisting of more than one atom

Name	Formula	Related Acid	Formula
ammonium	NH_4^+		
hydronium	H_3O^+		
peroxide	O_2^{2-}		
hydroxide	OH^-		
acetate	CH_3COO^-	acetic acid	CH_3COOH
cyanide	CN^-	hydrocyanic acid	HCN
azide	N_3^-	hydrazoic acid	HN_3
carbonate	CO_3^{2-}	carbonic acid	H_2CO_3
bicarbonate	HCO_3^-		
nitrate	NO_3^-	nitric acid	HNO_3
nitrite	NO_2^-	nitrous acid	HNO_2
sulfate	SO_4^{2-}	sulfuric acid	H_2SO_4
hydrogen sulfate	HSO_4^-		
sulfite	SO_3^{2-}	sulfurous acid	H_2SO_3
hydrogen sulfite	HSO_3^-		
phosphate	PO_4^{3-}	phosphoric acid	H_3PO_4
hydrogen phosphate	HPO_4^{2-}		
dihydrogen phosphate	$H_2PO_4^-$		
perchlorate	ClO_4^-	perchloric acid	$HClO_4$
chlorate	ClO_3^-	chloric acid	$HClO_3$
chlorite	ClO_2^-	chlorous acid	$HClO_2$
hypochlorite	ClO^-	hypochlorous acid	HClO
chromate	CrO_4^{2-}	chromic acid	H_2CrO_4
dichromate	$Cr_2O_7^{2-}$	dichromic acid	$H_2Cr_2O_7$
permanganate	MnO_4^-	permanganic acid	$HMnO_4$

Acids, Bases, & PH Scale

Definition:

- Acid: molecule that donates a proton or accepts an electron
  - PH<7
- Base: molecule that accepts a proton or donates an electron
  - pH>7



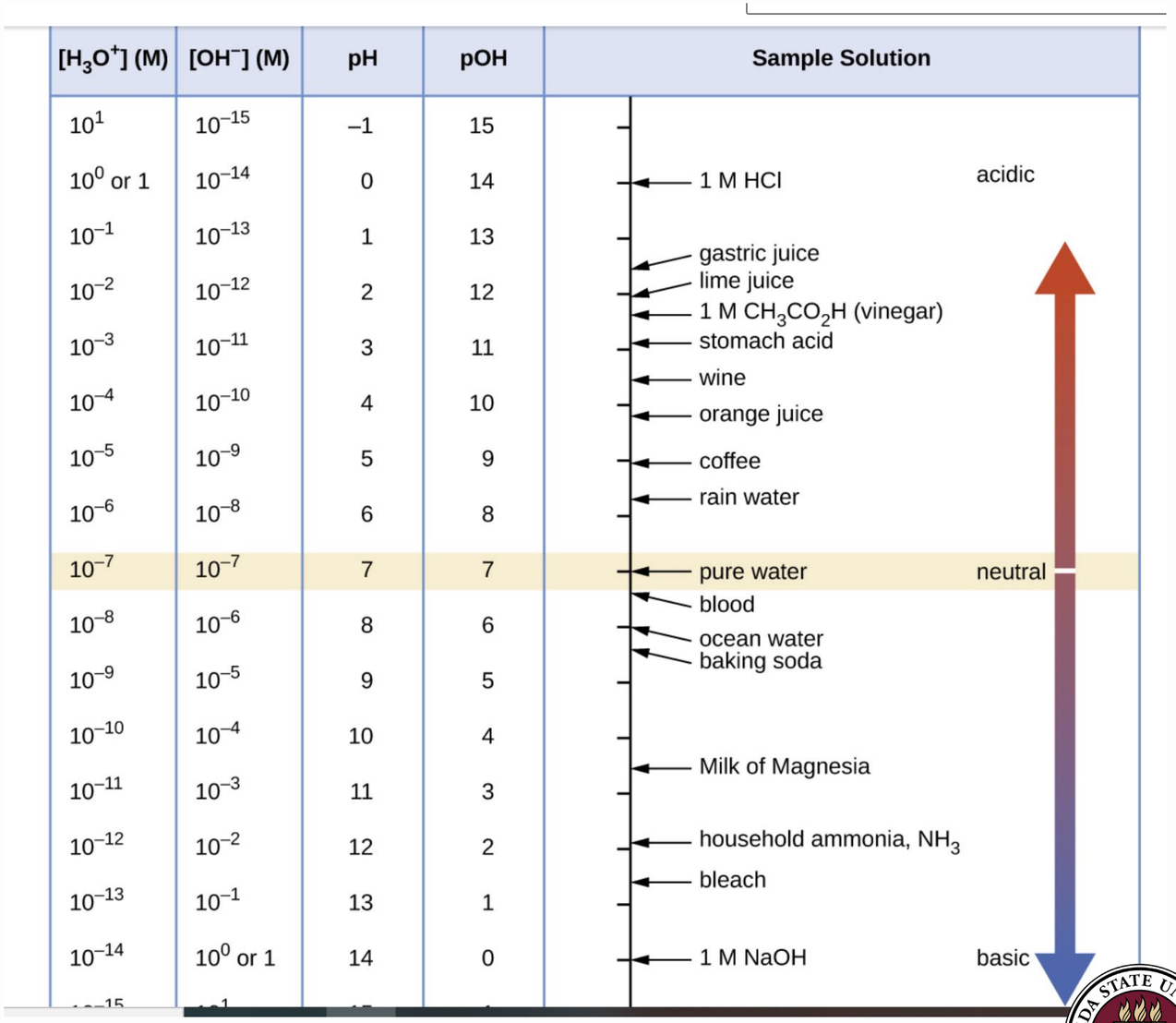
Example:
What is the pH of stomach acid, a solution of HCl with a hydronium ion concentration of 1.2 × 10−3 M?

Acids, Bases, & PH Scale

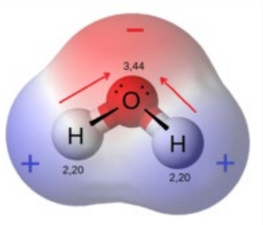
Definition:

- pH: a measurement of how acidic or basic a substance is
  - Ranges from 0 to 14

Example:
Calculate the hydronium ion concentration of blood, the pH of which is 7.3.

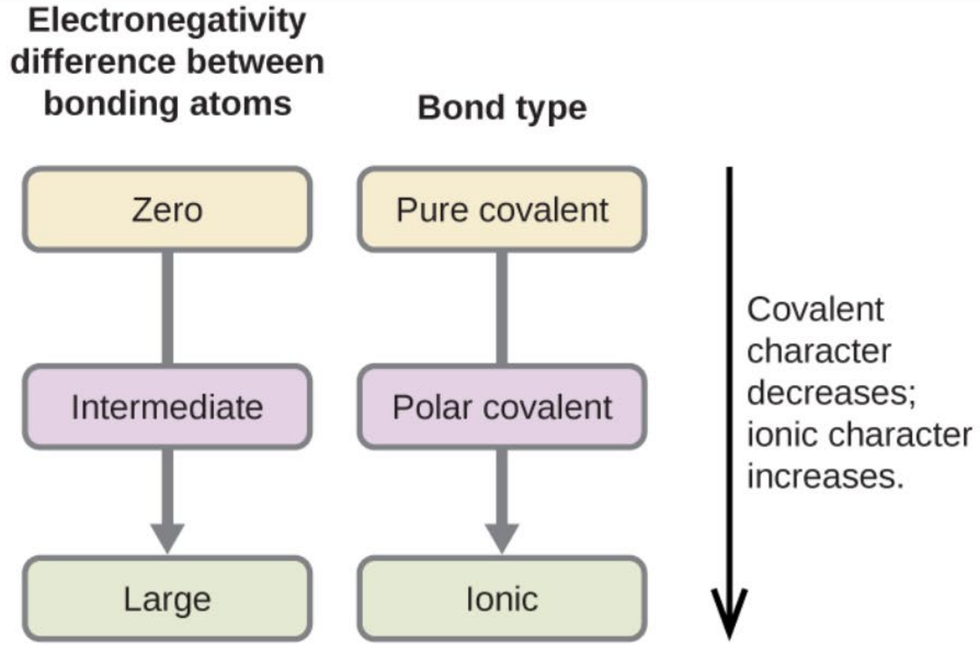


Polarity



Definition:

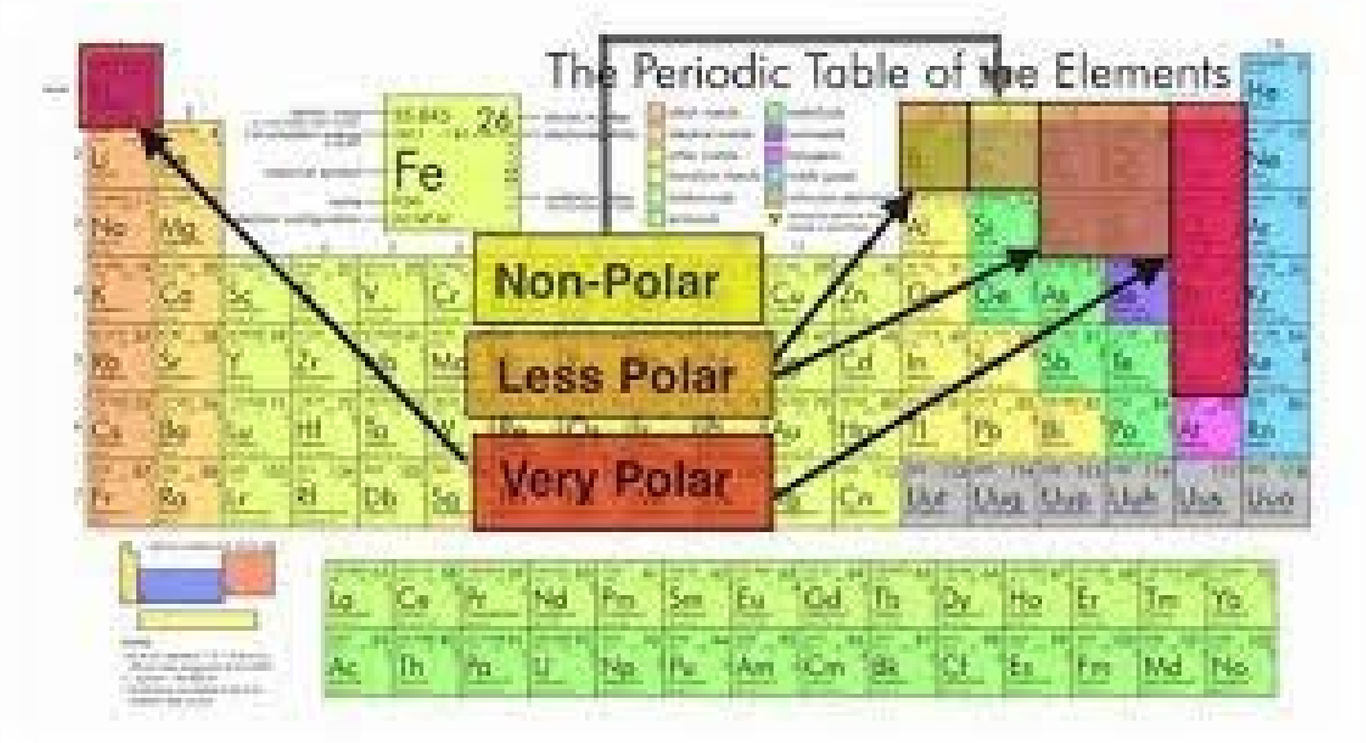
- Polarity: uneven distribution of electrons in a molecule or atom causing an electric dipole moment



Bond Type	Electronegativity Difference
pure covalent	< 0.4
polar covalent	between 0.4 and 1.8
ionic	> 1.8

Figure 7.8 As the electronegativity difference increases between two atoms, the bond becomes more ionic.

Polarity


The Periodic Table of the Elements
Non-Polar
Less Polar
Very Polar

References & Resources

Use these links for more information or come visit one of the FSU tutoring programs for one-on-one help!

- **ChemDraw** (chem.fsu.edu/computer-support/): This program is a drawing tool that allows users to draw chemical structures and reactions as well as biological objects, and it is available to FSU students. For instructions on how to access it, please visit the Chemistry department's computer support page.

- **ChemDoodle** (web.chemdoodle.com/): The ChemDoodle Web Components (CWC) library is a pure JavaScript chemical graphics and cheminformatics library derived from the ChemDoodle® application and produced by iChemLabs.

- **ChemSpider** (chemspider.com/StructureSearch.aspx): ChemSpider is a free chemical structure database providing fast access to over 100 million structures, properties, and associated information.

References & Resources

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- **Chemistry LibreTexts** (chem.libretexts.org/): This Living Library is a principal hub of the LibreTexts project, which is a multi-institutional collaborative venture to develop the next generation of open-access texts.

- **Lumen Learning Open Textbooks**: These full online textbooks are provided by universities for the enhancement of learning opportunities.
    - Introduction to Chemistry (courses.lumenlearning.com/introchem/)
    - Boundless Chemistry (courses.lumenlearning.com/boundless-chemistry/)
    - MCC Organic Chemistry (courses.lumenlearning.com/suny-mcc-organicchemistry/)
    - Organic Chemistry 1 (courses.lumenlearning.com/suny-potsdam-organicchemistry/)

Tell us how we're doing!

The QR code below will take you to a survey about the Readiness Review Series.

We're always interested in improving, so we're asking for your feedback.

What was your experience like? Is there anything we should add, change, or remove?

Do you have ideas for how this program should be expanded in the future?

Scan the code and fill out the short survey to let us know!