

FINAL EXAM REVIEW

*DIRECTIONS: Complete each question for every unit. SHOW ALL YOUR WORK and use the correct number of significant figures. This is simply a guide to studying for the final and should **not** be the only thing you should use to study.*

UNIT 1:

Determine the number of significant figures in the following numbers...

- | | |
|-------------------------------|-------------|
| 1. 143 g | 2. 0.074 cm |
| 3. 8.7560×10^{-2} mg | 4. 900.43 L |
| 5. 1.0720 moles | 6. 4830 m |

Round each number to three significant figures...

- | | |
|-------------|-----------------|
| 1. 98.473 g | 2. 0.00076321 L |
| 3. 57.0448 | |

Add or subtract and express your answer to the proper number of significant figures...

- | | |
|---------------------------|-------------------|
| 1. $61.52 + 9.35 + 8.6 =$ | 2. $9.44 - 2.1 =$ |
|---------------------------|-------------------|

Multiply or divide and express your answer to the proper number of significant figures...

- | | |
|------------------------|--------------------|
| 1. $8.3 \times 1.22 =$ | 2. $8432 / 12.5 =$ |
|------------------------|--------------------|

Change the following to scientific notation...

- | | |
|-------------|--------------|
| 1. 0.0528 = | 2. 6589000 = |
|-------------|--------------|

Change the following to ordinary notation...

- | | |
|---------------------------|-------------------------|
| 1. $2.56 \times 10^3 =$ | 2. $9 \times 10^{-4} =$ |
| 3. $8.9 \times 10^{-6} =$ | |

Unit Conversions...

- | | |
|--------------------|--|
| 1. 1.0 m → cm | 2. 1.0 m → mm |
| 3. 1.0 km → m | 4. 2570 cm → m |
| 5. 0.000335 m → km | 6. $2.58 \times 10^5 \text{ dm}^3 \rightarrow \text{cm}^3$ |

UNIT 2:

1. Classify each of following as a physical or chemical change.

- | | |
|-----------------------------|-------------------|
| (A) bending a piece of cork | (B) burning coal |
| (C) cooking a steak | (D) cutting glass |

2. Identify each of the following samples of matter as heterogeneous or homogeneous.

- (A) spaghetti sauce
- (B) glass
- (C) table sugar
- (D) river water (with mud)
- (E) sand from the beach
- (F) nitrogen

3. Classify the following properties of the element silicon as chemical or physical properties.

- (A) blue-gray color
- (B) melts at 1410°C
- (C) brittle
- (D) reacts vigorously with fluorine
- (E) insoluble in water

4. Give the symbol for each element described below.

- (A) nonmetal in Group 14
- (B) a metal in Group 15
- (C) the 2 elements that are liquids at room temperature

UNIT 3:

1. List the three subatomic particles and their charges, locations, and relative masses.

2. Isotopes differ in the number of _____, NOT _____, which ALWAYS stays the same as they indicate the atomic number.

3. In the following nuclear notation... A_ZX

Z Means: _____

A Means: _____

4. Answer the following questions regarding the following example of hyphen notation...

Fluorine-20

- (A) What is the atomic number?
- (B) What is the mass number?
- (C) What is the number of neutrons?

5. Fill in the chart...

Isotope	Name	Electrons	Protons	Neutrons	Atomic #	Mass #
^{238}U						
	Hydrogen-1					
$^{16}\text{O}^{2-}$						
			19			39
$^{23}\text{Na}^+$						
				18	17	
	Zinc-65					
			92			235
		2				4

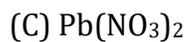
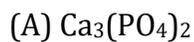
6. What is the difference between average atomic mass and mass number?

7. How many grams are in 2.14 moles of CO?

8. How many grams are in 4.65×10^{24} molecules of NO_2 ?

9. How many moles of magnesium are equal to 3.01×10^{22} atoms of magnesium?

10. Find the molar mass of the following compounds.



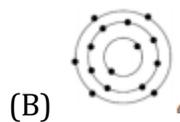
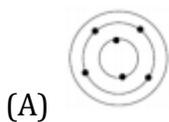
UNIT 4:

1. According to Bohr's model of the atom, where is the only place electrons can be located?

2. Describe the electron cloud.

3. Draw the ^7Li isotope Bohr model.

4. Label each diagram with the element (name and symbol) they represent.



FINAL EXAM REVIEW

- Describe the difference between the ground state and excited state. How do electrons move from one to another?
- Define photon.
- What is the relationship between...
(A) wavelength and frequency (B) energy and frequency
- What is the wavelength of a photon emitted when the electron falls from the third energy level to the second energy level? What type of electromagnetic radiation is it?
- What is the wavelength of a photon emitted when the electron falls from the sixth energy level to the third energy level. What type of electromagnetic radiation is it?
- Niels Bohr produced a model of the hydrogen atom based on experimental observations. This model indicated that...
(A) An electron surrounds the nucleus only in fixed energy ranges called _____.
(B) An electron can neither gain nor lose energy _____ this orbital, but could move up or down to another orbit.
(C) The lowest energy orbit is _____ to the nucleus.

UNIT 5:

- How is an element's outer electron configuration related to its position on the Periodic Table?
- What are the symbols for all of the elements that have the following outer electron configuration?
(A) s^1 (B) $s^2 p^2$ (C) $s^2 p^5$
- Indicate which element in each of the following pairs has the larger atomic radius.
(A) sodium , lithium (B) selenium , oxygen
(C) strontium , magnesium (D) nitrogen , fluorine
(E) carbon , germanium (F) zinc , bromine
- Arrange each set of elements in order of increasing ionization energy.
(A) Be , Mg , Sr (B) Bi , Cs , Ba (C) Na , Al , S
- In each of the following pairs, which element is more electronegative?
(A) Cl , F (B) C , N (C) Kr , Br (D) As , Ca
- How many valence electrons do each of the following atoms have?
(A) K (B) C (C) Mg (D) O

7. State the number of electrons either lost or gained in forming each ion.

- (A) Br⁻ (B) Na⁺ (C) As³⁻
 (D) Ca²⁺ (E) Cu⁺ (F) H⁻

8. Draw the orbital notation for the highest occupied energy level for the following...

- (A) Sulfur (B) Nickel

9. Write the electron configuration for the following elements...

- (A) Boron (B) Copper

10. Identify the element represented by the configurations below...

- (A) $1s^2 2s^2 2p^4$ (B) $[Ar] 4s^2 3d^{10} 4p^3$

UNIT 6:

1. Describe metallic bonding.

2. How are ions formed? Which arrangements are stable? (What rule are we trying to follow?)

3. Explain the difference between cations and anions.

4. Give the ionic charge for the following groups...

- (A) Group 1 (B) Group 2 (C) Group 13 (3A) (D) Group 15 (5A)
 (E) Group 16 (6A) (F) Group 17 (7A) (G) Group 18 (8A)

5. What types of elements form ionic compounds? Explain their electronegativity differences.

6. Predict the chemical formulas of compounds, using Lewis structures.

- (A) Potassium and sulfur
 (B) Magnesium and oxygen

7. Identify three properties of ionic compounds and explain why they have these properties.

8. Describe covalent bonding.

9. Draw the Lewis structures for N₂, O₂, and I₂. Indicate if they contain single, double, or triple bonds.

10. What types of elements are in a covalent bond? Describe their electronegativity differences.

11. Explain why intermolecular forces (IMF's) are weaker than ionic, covalent, or metallic bonds.

12. Explain why hydrogen bonds are stronger than dipole-dipole forces, which are stronger than dispersion forces.

13. What is the relationship between bond energy and bond length?

14. Complete the chart

Molecule	Lewis Structure	Polarity (bond & molecular)	Geometry	IMF's
NH ₃				
SO ₂				
CF ₄				
HBr				
CO ₃ ²⁻				

UNIT 7:

1. Write the formula for the following...

(A) Magnesium fluoride

(B) Sodium carbonate

(C) Copper (III) bromide

(D) Calcium nitride

(E) Ammonium phosphate

(F) Tin (IV) oxide

2. Write the names for the following formulas...

(A) PbS

(B) NH₄NO₂(C) Al₂S₃(D) FeBr₃(E) Ba(OH)₂

3. Write the formula for the following...

(A) Carbon tetrachloride

(B) Dinitrogen pentoxide

(C) Carbon monoxide

(D) Nitrogen monoxide

(E) Phosphorus pentafluoride

(F) Silicon trifluoride

4. Calculate the percent by mass of water in lithium chromate dihydrate, $\text{Li}_2\text{CrO}_4 \cdot \text{H}_2\text{O}$.
5. Analysis of a chemical indicates that it has a composition of 65.45% carbon, 5.45% hydrogen, and the rest is oxygen. The molecular mass is found to be 165.0 grams/mole. Determine the empirical and molecular formula.

UNIT 8:

1. Match each type of reaction with the phrase that best describes it.

- | | |
|------------------------|-----------------------------|
| (A) double replacement | (1) a single reactant |
| (B) combustion | (2) two ionic compounds |
| (C) decomposition | (3) oxygen and a compound |
| (D) single replacement | (4) a single product |
| (E) synthesis | (5) an element & a compound |

2. After balancing the following equations, identify them as to type:

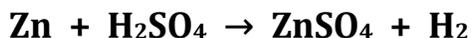
- (A) $__ \text{Ca} + __ \text{N}_2 \rightarrow __ \text{Ca}_3\text{N}_2$
- (B) $__ \text{Mg} + __ \text{H}_2\text{SO}_4 \rightarrow __ \text{MgSO}_4 + __ \text{H}_2$
- (C) $__ \text{C}_2\text{H}_6 + __ \text{O}_2 \rightarrow __ \text{CO}_2 + __ \text{H}_2\text{O}$
- (D) $__ \text{Pb}(\text{NO}_3)_2 + __ \text{NaI} \rightarrow __ \text{PbI}_2 + __ \text{NaNO}_3$
- (E) $__ \text{Fe}_3\text{O}_4 \rightarrow __ \text{Fe} + __ \text{O}_2$

3. Use the Activity Series to determine if the following reactions will occur or not.

- (A) fluorine + sodium bromide \rightarrow
- (B) iron (II) nitrate + potassium \rightarrow
- (C) calcium + zinc phosphate \rightarrow
- (D) iodine + potassium chloride \rightarrow
- (E) magnesium + chromium (III) acetate \rightarrow
- (F) strontium chlorate + manganese \rightarrow

UNIT 9:

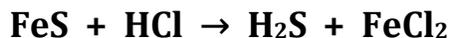
1. How many grams of zinc are needed to prepare 3.00 liters of H_2 collected at STP?



2. How many grams of ammonium chloride are needed to make 0.100 mole of ammonia?



3. How many grams of H₂S can be made if you completely react 3.4 moles of HCl?

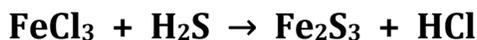


4. Chlorine is prepared by the following reaction...



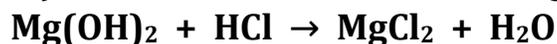
How many moles of KMnO₄ is needed to prepare 2.50 liters of Cl₂ at STP?

5. Use the following reaction to solve...



How many grams of HCl is produced when 90.0 grams of FeCl₃ reacts with excess H₂S?

6. A 50.6 gram sample of Mg(OH)₂ is reacted with excess HCl according to this reaction...



How many grams of water are formed?

7. Quicklime, CaO, can be prepared by roasting limestone, CaCO₃, according to the following chemical equation:



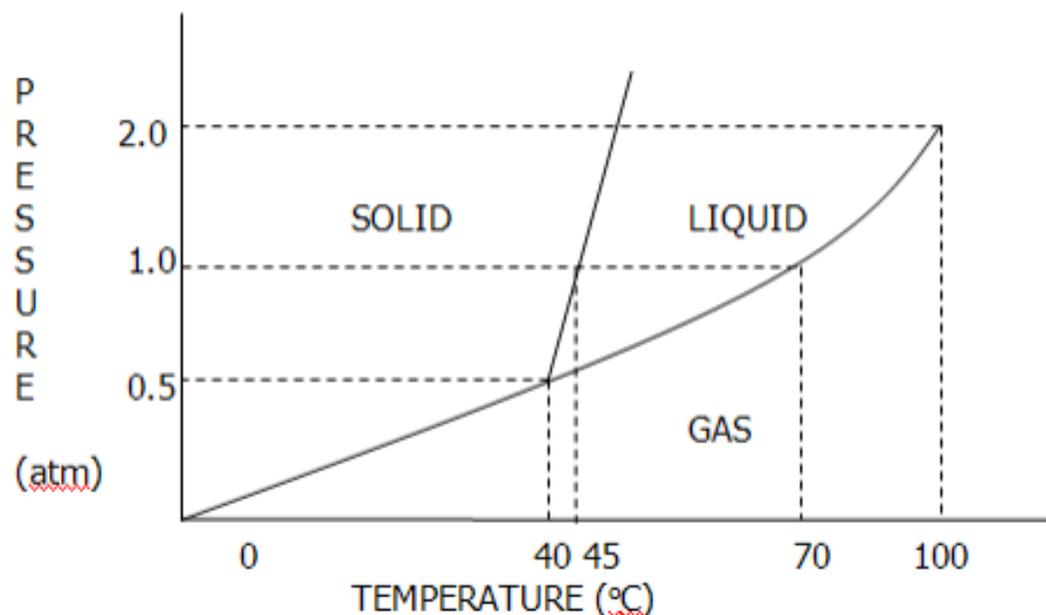
When 2.00×10^{23} particles of CaCO₃ are heated, how many liters of carbon dioxide are formed?

UNIT 10:

1. What is the mass of nitrogen gas (N₂) is contained in a 355 mL container at a pressure of 802 torr and a temperature of 73°C?
2. At 54°C, a gas has a pressure of 1.25 atm and a volume of 625 mL. When the temperature is decreased to 25°C and the pressure is changed to 745 mm Hg, what is the new volume?
3. A mixture of gases contains helium, neon, and argon. The total pressure of the mixture of gases is 1510 mmHg. If the pressure of neon is 1.02 atm and the pressure of argon is 97.2 kPa, what is the partial pressure of the helium (in mmHg)?
4. A gas effuses 4.7 times faster than PCl₃. What is the molar mass of the unknown gas?
5. At STP, 23.6 liters of acetylene are burned in excess oxygen gas. How many grams of carbon dioxide are formed?

$$\underline{\quad} \text{C}_2\text{H}_2 + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O}$$
6. AT STP, how many liters of oxygen are needed to produce 19.8 liters of SO₃ according to this equation?

$$\underline{\quad} \text{SO}_2 (\text{g}) + \underline{\quad} \text{O}_2 (\text{g}) \rightarrow \underline{\quad} \text{SO}_3 (\text{g})$$

UNIT 11:

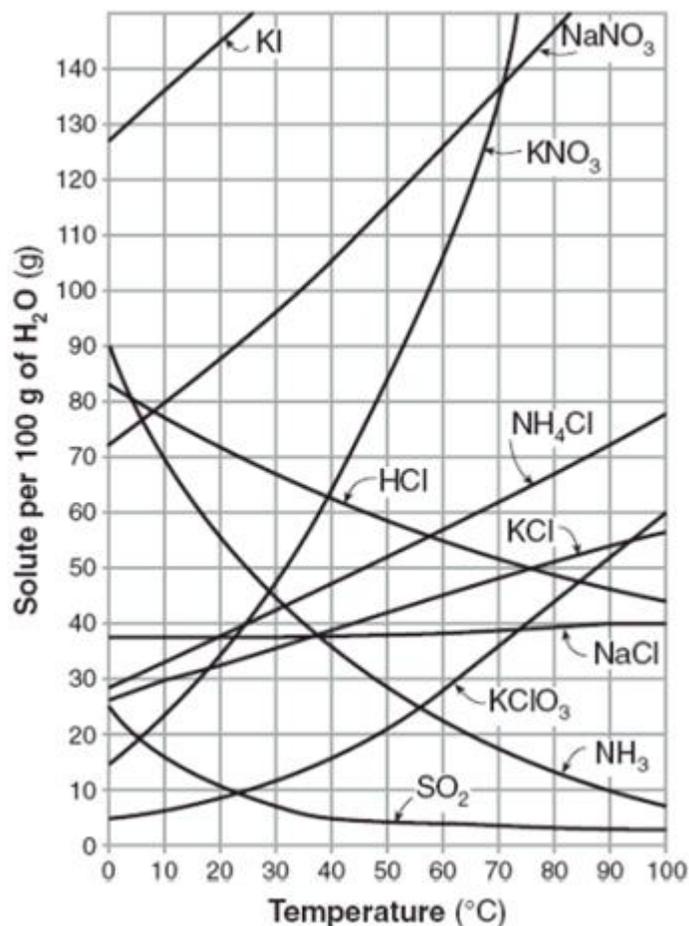
Use the diagram to answer questions 1-5.

1. What are the temperature and pressure at the triple point?
2. What is the critical temperature of this substance?
3. What is the normal melting point for this substance? The normal boiling point?
4. At 1.0 atm pressure (standard pressure), does this substance undergo sublimation?
5. Indicate the state(s) of matter present at:

(A) 102°C and 2.5 atm	(B) 40°C and 0.5 atm
(C) 45°C and 1.0 atm	(D) 0°C and 0.75 atm
(E) 75°C and 2.0 atm	(F) 70°C and 1.0 atm
6. How many Joules of heat are required to melt a 17.5 gram sample of ice at 0.00°C?
7. How many Joules of heat are required to heat a 17.5 gram sample of water from 0.00°C to 24.3°C?
8. **HONORS:** How many Joules of heat are required to heat a 20.0 gram sample of ice at -17.5°C to steam at 123°C?

UNIT 12:

Part 1: Use the following graph to answer questions 1-4.



1. At what temperature does 50 grams of KCl dissolved in 100 grams of water form a saturated solution?
2. How many grams of NaNO₃ will dissolve in 300 grams of water at 60°C?
3. If 32 grams of NaCl are dissolved in 100 grams of water at 30°C, is the solution saturated, unsaturated, or supersaturated?
4. How many grams of solid precipitate will form if a saturated NH₄Cl solution is cooled from 80°C to 20°C?

Part 2 – Concentration of Solutions

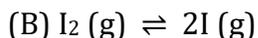
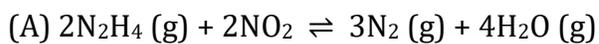
5. How many grams of Al(C₂H₃O₂)₃ are needed to dissolve to make 500. mL of a 2.50 M solution?
6. What is the molarity of a solution made by diluting 25.0 mL of 12 M hydrochloric acid to 350. mL?

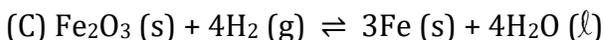
Part 3 – Solubility – Write (s) or (aq) next to each product. Then, write the net ionic equation.

7. ___ Mg(NO₃)₂ (aq) + ___ Na₂O (aq) → ___ NaNO₃ () + ___ MgO ()
8. ___ Zn(ClO₃)₂ (aq) + ___ K₂CO₃ (aq) → ___ KClO₃ () + ___ ZnCO₃ ()

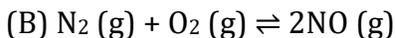
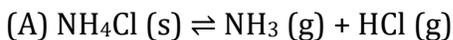
UNIT 13:

1. Define chemical equilibrium.
2. If K is less than 1, what does that tell us about equilibrium for that reaction?
3. If K is greater than 1, what does that tell us about equilibrium for that reaction?
4. Write the equilibrium constant expressions for the following reactions...

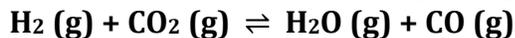




5. How would increasing the volume of the reaction vessel affect these equilibria?



6. Use Le Chatelier's principle to predict how each of the following changes would affect this equilibrium...

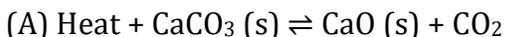


(A) adding H_2O to the system

(B) Removing $\text{CO} (\text{g})$ from the system

(C) Adding something to the system to absorb $\text{CO}_2 (\text{g})$

7. How would simultaneously decreasing the temperature of the system affect these equilibria?



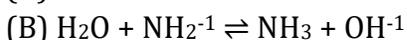
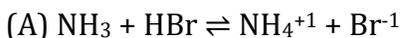
UNIT 14:

1. A standardized (known) 1.03 M solution of KOH is used to determine the concentration of an unknown H_2SO_4 solution.

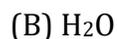
(A) What type of lab procedure would you use to determine the concentration (molarity) of the acid?

(B) If 50.0 mL of KOH is needed to neutralize 200.0 mL of H_2SO_4 , what is the concentration of the acid?

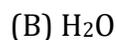
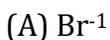
2. Identify the acid (A), base (B), conjugate acid (CA), and conjugate base (CB) in the following reactions:



3. What is the conjugate base of...



4. What is the conjugate acid of...



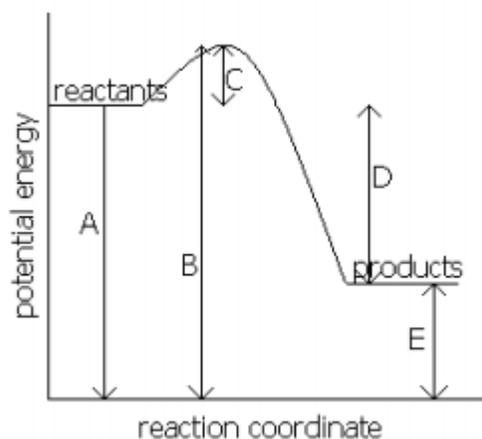
5. Fill in the following chart:

[H ⁺]	pH	[OH ⁻]	pOH	A, B, or N
$2.29 \times 10^{-6} \text{ M}$				
	11.29			
		$4.03 \times 10^{-9} \text{ M}$		
			2.04	

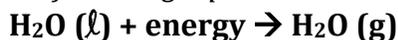
UNIT 15:

Use the diagram to the right to answer questions 1-4.

1. Does the diagram represent an exothermic or an endothermic reaction?
2. Which letter represents ΔH ?
3. Which letter represents E_a ?
4. If a catalyst were added to this reaction, what letters would change?



Use the following equation to answer # 5 – 8.



5. Is this reaction exothermic or endothermic?
6. Is the value of ΔH for this reaction positive or negative?
7. Is the value of ΔS for this reaction positive or negative?
8. This reaction is (sometimes / always / never) spontaneous.

Answer the following questions regarding chemical reactions.

9. What 2 things must happen for a reaction to take place?
10. What is happening to the bonds when reactions are taking place?
11. What happens to the reaction rate when temperature is increased? Explain.
12. What happens to the reaction rate when concentration is increased? Explain.
13. What happens to the reaction rate when pressure is increased? Explain.
14. What happens to the reaction rate when a catalyst is added? Explain.

UNIT 16:

1. If you start with 75.0 grams of Cs-137, how much time will pass before the amount remaining is 4.6875 grams? The half-life of Cs-137 is 30.17 years.
2. The half-life of Zn-71 is 2.4 minutes. If one had 100.0 g at the beginning, how many grams would be left after 7.2 minutes has elapsed?
3. After 24.0 days, 2.00 milligrams of an original 128.0 milligram sample remain. What is the half-life of the sample?
4. $^{214}_{84}\text{Po} + 2\ ^4_2\text{He} + 2\ ^0_{-1}\text{e} \rightarrow$ _____
5. _____ + $^1_0\text{n} \rightarrow ^{142}_{56}\text{Ba} + ^{91}_{36}\text{Kr} + 3\ ^1_0\text{n}$
6. $^{27}_{13}\text{Al} +$ _____ $\rightarrow ^{24}_{11}\text{Na} + ^4_2\text{He}$
7. Identify the type of nuclear reaction and fuel used in most nuclear reactors