

Unit 1: Matter, Chemical Bonding, and Trends Review

Multiple Choice: Identify the letter of the choice that best completes the statement or answers the question.

- The person given credit for developing the first modern periodic table is
 - Dalton
 - Democritus
 - Thomson
 - Mendeleev
 - Chadwick
- Which of the following matches of group number and common name is incorrect?
 - Group 7 - transition metals
 - Group 2 - alkali earth metals
 - Group 17 - halogens
 - Group 2 - actinides
 - Group 18 - noble gases
- Which of the following formulas does **NOT** represent a molecular compound?
 - $\text{CO}_{2(g)}$
 - $\text{CoCl}_{2(s)}$
 - $\text{SO}_{2(g)}$
 - $\text{PCl}_{5(g)}$
 - $\text{HCl}_{(g)}$
- An electron dot diagram for a nitrogen atom should show
 - 1 lone pair and 3 bonding electrons
 - 2 lone pairs and 2 bonding electrons
 - 2 lone pairs and 3 bonding electrons
 - 3 lone pairs and 1 bonding electrons
 - 3 bonding electrons
- The formula for lithium sulfate is
 - $\text{Li}_1\text{SO}_{4(s)}$
 - $\text{Li}_2\text{SO}_{3(s)}$
 - $\text{Li}_2\text{SO}_{4(s)}$
 - $\text{Li}_3\text{SO}_{4(s)}$
 - $\text{Li}_1\text{SO}_{3(s)}$
- Hydrogen can be used as an alternative fuel for automobiles. Classify the following chemical reaction:
 $2\text{H}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{H}_2\text{O}_{(g)}$
 - combustion reaction
 - decomposition reaction
 - single displacement
 - double displacement
 - simple decomposition
- Classify the following reaction: $\text{Mg}(\text{OH})_2 + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$
 - combustion
 - synthesis
 - decomposition
 - single displacement
 - double displacement
- Classify the following chemical reaction: $3\text{NaOH} + \text{H}_3\text{PO}_4 \rightarrow \text{Na}_3\text{PO}_4 + 3\text{H}_2\text{O}$
 - combustion
 - synthesis
 - decomposition
 - single displacement
 - double displacement

Short Answer

9. Provide both the IUPAC name or chemical formula for the following.

Chemical Formula	IUPAC Name
(a) NaClO_3	
(b) $\text{Mg}(\text{NO}_2)_2$	
(c) HI	
(d)	Calcium sulfate
(e)	Hydrogen peroxide
(f)	Carbon tetrachloride

- Draw the electron dot diagrams for oxygen, sodium, boron, and neon.
- Use electron dot diagrams to explain why hydrogen and nitrogen are diatomic elements.
- Predict the products and write a balanced chemical equation for the following chemical reaction:
Sodium metal is added to water.
- Complete the following chemical reaction equation, including states of matter and balancing:
 $\text{Na}_2\text{SO}_{4(aq)} + \text{Pb}(\text{NO}_3)_{2(aq)} \rightarrow$ What type of reaction is this?
- Explain, in your own words, why ionic compounds are brittle, have extremely high melting points, and are solid at room temperature.
- What is the structural diagram for CaCl_2 and MgO ?
- Give an example of a compound that has polar covalent bonds but is a) non-polar overall b) polar overall. Represent these compounds with proper diagrams indicating their bond and overall polarity.
- What type of intermolecular forces would be present for each structure drawn in question 15?

Unit 2: Quantities in Chemical Reactions Review

Multiple Choice: Identify the letter of the choice that best completes the statement or answers the question.

- A mass of 2.20 kg of sodium phosphate is converted into the following number of moles
a. 7.45 mol
b. 74.5 mol
c. 1.34×10^{-2} mol
d. 13.4 mol
e. 45.8 mol
- The number of molecules found in 0.87 mol of carbon monoxide is
a. 4.1×10^{23} molecules
b. 5.2×10^{23} molecules
c. 2.9×10^{24} molecules
d. 9.3×10^{24} molecules
e. 1.5×10^{25} molecules
- A 100.0-g sample of a compound is composed of 16.3 g of carbon, 32.1 g of chlorine, and 51.6 g of fluorine. The empirical formula of the compound is
a. CClF
b. CClF₃
c. C₂Cl₂F₆
d. C₃Cl₂F₆
e. C₉Cl₆F₁₈
- When copper is combined with a solution of silver nitrate, the resulting products are copper(II) nitrate and silver. The balanced equation for this reaction is
a. $\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$
b. $3\text{Cu} + 3\text{AgNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 3\text{Ag}$
c. $2\text{Cu} + 2\text{AgNO}_3 \rightarrow 2\text{CuNO}_3 + 2\text{Ag}$
d. $\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{CuNO}_3 + 2\text{Ag}$
e. $2\text{Cu} + 2\text{AgNO}_3 \rightarrow 2\text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$

Problems

- Magnesium hydroxide, Mg(OH)₂, can be commonly found in antacids. Calculate the percentage composition, by mass, of each element in magnesium hydroxide.
- A compound was found to contain 10.06% C, 89.10% Cl, and 0.84% H, by mass. If the molar mass of the compound is 119.6 g/mol, calculate its molecular formula.
- Consider the following reaction: $\text{AlCl}_3(\text{aq}) + 4\text{NaOH}(\text{aq}) \rightarrow \text{NaAlO}_2(\text{aq}) + 3\text{NaCl}(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
How many grams of sodium chloride can be obtained from 4.46 g of AlCl₃?
- Sodium chloride is produced when sodium metal combines with chlorine gas as shown in the following balanced equation: $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
In an experiment, 36.9 g of sodium chloride is produced when 15.9 g of Na and 27.4 g of chlorine are combined. Determine the percentage yield of the product.

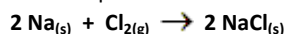
Quantitative Analysis Unit

Problem # 1 – Converting between mass and number of particles.

A fire extinguisher contains 350 g of carbon dioxide. How many carbon dioxide molecules are in the fire extinguisher?

Problem # 2 – Stoichiometry Problem / Percentage Yield

Sodium chloride is produced when sodium metal combines with chlorine gas as shown in the following balanced equation:



- In an experiment, 27.4 g of chlorine is reacted with excess sodium. Determine how much salt will be produced.
- 36.9 g of sodium chloride is actually produced during this experiment. What is the percentage yield?
- Why is the percentage yield often less than 100%?

Problem # 3 – Percent Composition

What is the percent composition by mass of water?

Problem # 4 – Limiting Reactants

Silver metal can be produced by reacting copper with silver nitrate, as shown in the equation: $\text{Cu}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \rightarrow 2\text{Ag}(\text{s}) + \text{Cu}(\text{NO}_3)_2(\text{aq})$

- What type of reaction is this? _____
- If 3 moles of copper reacted with 7 moles of silver nitrate, which reactant is limiting? Which reactant is excess?
- How much silver would be produced? Give your answer in moles and in grams.

Practice Problems:

- What is Avogadro's number and what does it mean?
- A silver necklace contains 2.06×10^{22} atoms of silver. What's the mass of the silver in the necklace?
- Find the molar mass of carbon dioxide.
- What is the percent composition of H₂O₂?
- How many grams of oxygen are required to react with 9.7 g of magnesium to produce magnesium oxide? Balanced equation:
 $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{MgO}(\text{s})$
- Hydrogen and chlorine gases react to form hydrogen chloride gas according to the following reaction: $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$
 - If 2 moles of hydrogen react with 3 moles of chlorine, what is the limiting reactant?
 - How many moles of hydrogen chloride will form?
- Sugar (C₆H₁₂O₆) will decompose into ethanol (C₂H₅OH) and carbon dioxide over time according to the following reaction:
 $\text{C}_6\text{H}_{12}\text{O}_6(\text{s}) \rightarrow 2\text{C}_2\text{H}_5\text{OH}(\text{l}) + 2\text{CO}_2(\text{g})$
 - What is the theoretical yield of ethanol available from 10.0 g of sugar?
 - An experiment done in the lab produces 0.66 g of ethanol from 10.0g of sugar. What is the percent yield?

Unit 3: Chemistry and the Environment Review

Multiple Choice: Identify the letter of the choice that best completes the statement or answers the question.

- Which of the following has a concentration of 2 mol/L?
 - 2 mol/1 L
 - 2 mol/1000 mL
 - 5 mol/2.5 L
 - 2 mol/2 L
 - a, b, and c only
- Which of the following combinations of aqueous solutions would produce a precipitate?
 - ammonium sulphide and zinc bromide
 - potassium chloride and sodium nitrate
 - iron(III) nitrate and potassium hydroxide
 - all of the above
 - a and c only
- A compound that ionizes in water to form hydroxide ions is
 - an acid
 - a salt
 - a base
 - both a and b
 - both b and c
- According to its Arrhenius definition, a weak base
 - partially reacts with water to form $\text{OH}^-_{(\text{aq})}$
 - fully reacts with water to form $\text{OH}^-_{(\text{aq})}$
 - completely dissociates to form $\text{OH}^-_{(\text{aq})}$
 - has very high pH
 - is an ionic hydroxide

Problems

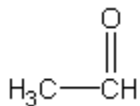
- T.S.P. is an all purpose cleaner that can be used to clean driveways. What volume of solution would you get if you dissolved 150.0 g of sodium phosphate with water to produce a 0.23 mol/L solution?
- What volume of a 17.4 mol/L acetic acid stock solution is required to make 2.0 L of a 1.5 mol/L acetic acid solution?
- A student mixed 100.0 mL of a 0.100 mol/L solution of barium chloride with 100.0 mL of a 0.100 mol/L solution of iron (III) sulfate. The barium sulfate precipitate was filtered, dried, and was measured to have a mass of 2.0 g. Calculate the % yield of the barium sulfate.
- A swimming pool has a pH of 7.5. Calculate the hydrogen ion concentration in the pool.
- A titration was performed on a 10.00-mL sample of water taken from an acidic lake. If it took 8.66 mL of 0.0512 mol/L $\text{NaOH}_{(\text{aq})}$ to neutralize the sulfuric acid in the lake water sample, calculate the concentration of the sulfuric acid. What is the pH of this lake water?
- The hydrogen ion concentration in beer is 3.12×10^{-5} mol/L. Calculate the pH of beer.

Unit 4: Organic Chemistry Review

Multiple Choice: Identify the letter of the choice that best completes the statement or answers the question.

- Which of the following is not a structural isomer of pentane?
 - $\text{H}_3\text{C}-\text{CH}-\text{CH}_2-\text{CH}_3$
|
 CH_3
 - $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$
 - $\text{H}_3\text{C}-\text{C}-\text{CH}_3$
|
 CH_3
|
 CH_3
 - $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_3$
- What is the smallest member of the alkene family?
 - methene
 - ethene
 - propene
 - butene
- The main difference between alkanes and alkenes is that alkanes
 - contain double bonds, while alkenes have only single bonds
 - contain only single bonds, while alkenes have at least one double bond
 - are very reactive, while alkenes are unreactive
 - form a homologous series, while alkenes do not
- Which of the following is an alcohol?
 - NaOH
 - $\text{H}_3\text{C}-\text{NH}_2$
 - $\text{H}_3\text{C}-\text{C}(\text{OH})=\text{O}$
 - $\text{CH}_3\text{CH}_2\text{OH}$

5. The compound below is classified as a(n)



- a) alkane
b) carboxylic acid
c) aldehyde
d) ketone

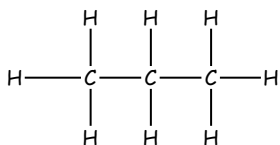
6. Which of the following is a sensible precaution when working with organic solvents?

- a) work in an enclosed space
b) store the container below ground
c) keep away from open flames
d) breathe deeply

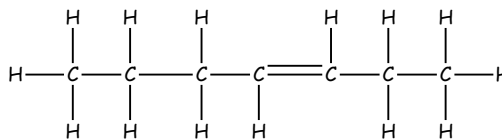
Problems

Give the IUPAC name for each of the following:

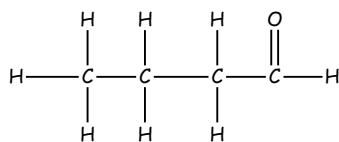
a)



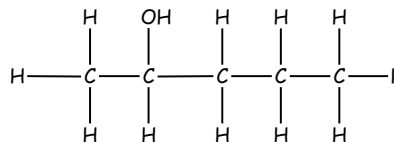
b)



c)



d)



8. Draw structural diagrams for the following compounds:

- a) ethanol
b) propyne
c) hexanoic acid
d) 2-butanone
e) propanal
f) 3-heptene
g) ethanoic acid
h) 2-butanol