Early Booklet E.C.: + 2
Unit 9.A Hwk. Pts.: / 36
Unit 9.A Lab Pts.: / 32
Late, Incomplete, No Work, No Units **Fees**? Y / N

Unit 9 – The Mole

Chapter 10 of your textbook

Learning Targets for Unit 9

1.1 I can explain how a mole is used to indirectly count the number of particles of matter.
1.2 I can convert between moles and number of representative particles.
1.3 I can convert between number of moles and the mass of an element or compound.
1.4 I can convert between number of moles and number of atoms of an element.
1.5 I can apply conversion factors to determine the number of atoms or ions in a known mass of a compound.
1.6 I can explain what is meant by the percent composition of a compound.
1.7 I can determine the empirical and molecular formulas for a compound from mass percent **and** mass data.
1.8 I can explain what a hydrate is and relate the name of a hydrate to its composition.
1.9 I can determine the formula of a hydrate form laboratory data.
1.10 I can describe the types of relationships indicated by a balanced chemical equation.
1.11 I can state the mole ratios from a balanced chemical equation.

Unit Vocabulary for Unit 7

Mole	Avogadro's number	Molar mass	Percent composition
Empirical formula	Molecular formula	Hydrate	Stoichiometry
Mole ratio			

Possible 9.1 Pts.: 7
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 7

9.1 Problems – Measuring Matter

Section 10.1 of your textbook.

1. How many atoms of potassium does 1 mol of potassium contain?

Determine the number of representative particles in each substance.

2. A. 0.250 mol of silver

3. A. 35.3 mol of carbon dioxide

Perform the following conversions:

4. 1.51 E 13 atoms of Si to mol Si

5. 4.25 E – 2 mol of H_2SO_4 to molecules of H_2SO_4

6. 8.95 E 25 molecules of CCl_4 to mol of CCl_4

7. 5.90 mol of Ca to atoms of Ca

Possible 9.2 Pts.: 6
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 6

9.2 Problems – Mass and the Mole
Section 10.2 of your textbook.

1. Which contains more atoms, a mole of silver atoms or a mole of gold atoms? Explain your answer.

2. Which has more mass, a mole of potassium or a mole of sodium? Explain your answer.

For the following two problems, calculate the mass of each element

3. 5.22 mol of He

4. 0.0455 mol of Ni

5. How many atoms are there in 2.22 grams of Ti?

6. Arrange from least to most in moles: 3.00 E 24 atoms Ne, 4.25 mol Ar, 2.69 E 24 atoms Xe, 65.96 g Kr.

Possible 9.3 Pts.: 7
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 7

9.3 Problems – Moles of Compounds
Section 10.3 of your textbook.

For the following two problems, how many moles of oxygen are contained in each sample?

1. 2.50 mol of $KMnO_4$

2. 45.9 mol of CO_2

3. What is the molar mass of sodium nitrate, $NaNO_3$?

4. **Garlic**. Determine the molar mass of allyl sulfide, the compound responsible for the smell of garlic. The chemical formula of allyl sulfide is $(C_3H_5)_2S$.

For the following two problems, how many moles are in 100.0 g of each compound?

5. dinitrogen monoxide (N_2O)

6. methanol (CH_3OH)

7. **Iron.** How many moles of iron can be recovered from 200.0 g of Fe_3O_4?

Possible 9.4 Pts.: 5
Late, Incomplete, No work, No Units Fee: - 1 - 2
Final Score: / 5

9.4 Problems – Percent Composition
Section 10.4 of your textbook.

1. **Cholesterol**. Heart disease is linked to high blood cholesterol levels. What is the percent composition of the elements in a molecule of cholesterol ($C_{27}H_{45}OH$)?

2. What is the percent composition of the elements in calcium carbonate: $CaCO_3$?

3. What is the percent composition of oxygen in barium acetate, $Ba(C_2H_3O_2)_2$?

4. What is the percent composition of carbon in methane, CH_4?

5. What is the percent composition of aluminum in aluminum phosphate, $AlPO_4$?

Possible 9.5 Pts.: 6
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 6

9.5 Problems – Empirical & Molecular Formulas
Section 10.4 of your textbook.

1. Choose the two formulas that represent the empirical and molecular formulas of the same compound? Explain your choice.

NO N_2O NO_2 N_2O_4 N_2O_5

Determine the empirical formula for each compound:

2. Ethylene (C_2H_4)

3. ascorbic acid ($C_6H_8O_6$)

4. naphthalene ($C_{10}H_8$)

5. hydrogen peroxide (H_2O_2)

6. Determine the empirical formula of a compound with the following percent composition:

Ba = 69.58%, C = 6.09%, O = 24.32%

Possible 9.6 Pts.: 6
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 6

9.6 Problems – Hydrated Formulas
Section 10.5 of your textbook.

1. **Desiccants**. Why are certain electronic devices transported with desiccants?

Write the formula for the following hydrates:

2. nickel (II) chloride hexahydrate

3. Tin (II) chloride tetrahydrate

4. magnesium carbonate pentahydrate

5. sodium sulfate decahydrate

6. A 1.628-g sample of a hydrate of magnesium iodide (MgI_2) is heated until its mass is reduced to 1.072 g and all water has been removed. What is the formula of the hydrate?

Chemistry	Lab 9.1: Moles of Matter Activity				
Name:					Correction Credit: Half
Lab Points:	Missed:	Late, No Units, No Work Fee:	First Score:	Corrections:	Final Score:
16		-1 -2 -3 -4			

In your lab groups, complete the tasks involving molar calculations. Use the balances to measure masses of objects, then make calculations using your knowledge of molar relations and molar masses. Show all calculations and units, or get a fee.

Materials: 2 of 5 different elements: Zn, Al, Pb, Cu, and Sn
A paraffin candle – chemical formula = $C_{25}H_{52}$
100 mL beakers
100 mL graduated cylinders

Task 1 (8 Points) Select two different metals from the green cart and write their names down in the blank. Then, measure and record their masses. Next, determine:

1. How many moles of the metal you have in your sample, and
2. How many atoms of the metal you have in your sample.

Metal 1: _____ **Molar Mass of Metal 1: _____**

Mass of metal 1: _____

1. Moles of metal 1: _____
2. Atoms of metal 1: _____

Calculations:

Metal 2: _____ **Molar Mass of Metal 2: _____**

Mass of metal 2: _____

1. Moles of metal 2: _____
2. Atoms of metal 2: _____

Calculations:

Task 2 (4 pts) Measure and record the mass of your candle, then determine:

1. The molar mass of paraffin ($C_{25}H_{52}$),
2. How many moles of paraffin your sample has,
3. How many moles of carbon your sample has, and
4. How many moles of hydrogen your sample has.

Candle's mass: _____

1. Molar mass of paraffin: _____
2. Moles of paraffin: _____
3. Moles of carbon: _____
4. Moles of hydrogen:_____

Calculations:

Task 3 (4 pts)

1. Calculate the molar mass of water.
2. Calculate the mass that 4.05 moles of water has.
3. Use the 100 ml beakers and balances to weigh out that mass. You will need to subtract the beaker's mass from the water/beaker mass to get your exact water weight. Finally, pour the water from the beaker into one of the 100 mL graduated cylinders determine its volume.

1. Molar mass of water: _____
2. Calculated mass of 4.05 moles of water: _____
3. Volume of 4.05 moles of water: _____

Calculations:

Chemistry	Lab 9.2: Hydrated Crystals Lab					
Name:						Correction Credit: Half
Lab Points:	E.C.	Missed:	Late, No Units, No Work Fee:	First Score:	Corrections:	Final Score:
16	1		-1 -2 -3 -4			

Objective:

Experimentally determine the formula of a hydrated chemical.

Overview:

Many chemicals, called hydrates, have water molecules entrained within their crystal matrices. One of these is cobalt (II) chloride – $CoCl_2 \cdot ? H_2O$. The question mark will be what you determine in this lab!

Safety:

1. Wear goggles throughout the lab – even when you are finished but others are still working.
2. Tie loose clothing and hair back.
3. You will need to move the hot test tube carefully with metal tongs.
4. Cool the test tube thoroughly before measuring its mass – hot items have an apparently greater mass than cold ones (how can this be?).

Materials:

Ring Stand	Triple Beam Balance	Clamp
Bunsen Burner	Small Test Tube	Cobalt (II) Chloride

Procedure:

1. Read through the lab before starting.
2. Measure and record the mass of a small, dry test tube plus an attached clamp.
3. Obtain about **3 grams** of cobalt (II) chloride using the balances. Use a piece of weighing paper with a crease in it to put your sample on, then use the crease as a channel to pour it into the test tube. Next, measure and record the mass of the test tube and cobalt (II) chloride.
4. Gently heat your sample in the test tube at an angle for 10 minutes, or until steam stops, using the clamp. Record your observations in question 1 as this process continues.
5. Let your tube cool down for 10 minutes.
6. Measure and record the mass of the tube and anhydrous (dry) cobalt (II) chloride.
7. **Clean up and Disposal**:
    a. Feel the temperature of the test tube with your hand (being sure first that it is not too hot).
    b. Put about 3 mL of deionized water into the tube, and then feel it again. Write down your observations in question 2.
    c. Let the water dissolve your hydrate for a few minutes. Heating it GENTLY will speed this up – but don't boil it!
    d. Pour the re-dissolved cobalt chloride into the container labeled "Cobalt Chloride Waste."
8. Make sure your area is tidy before you leave, so you don't lose points.

Data Table: (5 Points)

As you go through the lab procedure, fill out the following data table. Measure masses to the hundredths place.

	Measured Item:	Mass (grams)	Moles
1.	Test tube and clamp		--------- ---------
2.	Test tube, clamp, and $CoCl_2 \cdot ? H_2O$		--------- ---------
3.	$CoCl_2 \cdot ? H_2O$		--------- ---------
4.	Test tube, clamp, + anhydrous $CoCl_2$		--------- ---------
5.	Mass of water lost		--------- ---------
6.	Molar mass of water		--------- ---------
7.	Moles of water	--------- ---------	
8.	Mass of anhydrous $CoCl_2$		--------- ---------
9.	Molar mass of anhydrous $CoCl_2$		--------- ---------
10.	Moles of anhydrous $CoCl_2$	--------- ---------	

Data Table Work Area

Data Analysis:

(2 pts for your calculations, 1 pt for proposed formula, 1 E. C. if your formula is correct) Calculate the formula of hydrated cobalt (II) chloride. Round to the nearest whole number. Use your notes from section 7.A.6 to help you. **Be sure to show all your steps!** I'm grading on the process more than the result.

Calculations Work Area:

Write your proposed formula here: _____

Questions:

1. (2 pts) What did you observe as you heated the test tube? Write complete observations down.

2. (2 pts) Explain thoroughly what happened when you poured water into your cooled, anhydrous sample.

3. (2 pts) Why do you think there was a temperature change when you added water?

4. (2 pts) Why might heating not be a suitable method for determining the water of hydration for all hydrates?

Points:	/ 10
Late/Inc. Fee:	- 1 - 2 - 3

Unit 9 – Moles – Test Preparation Questions

This serves as test preparation for the Unit 7.A Quiz. Points earned are based on completion, and we will go over any questions you have during the review.

1. How many particles are there in 2.4 moles of gold?

2. **All Play** You have 415 grams of silver chloride. How many formula units of silver chloride do you have? (Two step process).

3. How many moles is 2.4 E 22 formula units of zinc chloride?

4. When would a mole ratio be used?

5. **All Play:** How many moles of carbon are there in one mole of $Na_2C_7H_{22}O_2Cl$?

6. What is the percent by mass of chlorine in sodium chlorate, $NaClO_3$?

7. How many individual atoms are there in 2 moles of water?

8. Write the empirical formula for the following: $Na_2C_8H_{16}O_4N_4$

9. **All Play** If the empirical formula of a compound is CH_2O, and its molar mass is 180.18, what is the molecular formula?

10. **All Play** What is the empirical formula of a compound that is 82.22% nitrogen and 17.78 % hydrogen?

11. Write the formula of barium hydroxide octahydrate.

12. Name $MgSO_4 \cdot 7\ H_2O$.

13. Write the formula of sodium carbonate decahydrate.

14. Describe a use for a desiccant.