VALENCIA COLLEGE

Experiment 1: Mass, Volume, and Density Data Tables

Version 2

Name: _____ Date: _____

Lab Partner: _____ Section: _____

Remember to include units of measure with each entry, and to read and record each measurement to the full precision allowed by the instrument used. Make sure that your work is neat and legible so that you may communicate your results to others such as your instructor.

Data Table 1. Reading Common Glassware.

Known Readings	10 mL grad. cylinder	50 mL grad. cylinder	buret
Unknown Readings Unk. #_____ (if given)	10 mL grad. cylinder	50 mL grad. cylinder	buret

Data Table 2. Measuring Volume with a Volumetric Pipet.

Mass of flask 1						
Mass of flask 1 + H_2O						
Mass of H_2O	0.000 g					
Total Volume of H_2O	0.00 mL	10.00 mL	20.00 mL	30.00 mL	40.00 mL	50.00 mL
Density of H_2O						
Mean of Density						
Standard Deviation						

(Note: the clear cells should contain your data; the shaded cells will contain calculated values.)

Name: _____

Data Table 3. Measuring Volume with a Graduated Cylinder.

Mass of flask 2						
Mass of flask 2+H_2O						
Mass of H_2O	0.000 g					
Total Volume H_2O (check the sig figs of your graduated cylinder)	0.0 mL	10.0 mL	20.0 mL	30.0 mL	40.0 mL	50.0 mL
Density of H_2O						
Mean of Density						
Standard Deviation						

Show your work for one example of each type of calculation in Data Tables 2/3:

Name: _____

Data Table 4. Temperature and Pressure Measurements.

Barometric Pressure	
Water Temperature	
Density from Appendix 1	

- Using the mass and volume data obtained for each flask (from Data Table 2 and Data Table 3), use Excel to plot two mass (y-axis) versus volume (x-axis) scatter plots (see Appendix 7 Using Excel).
    - Add a trend line for each plot; the slope of each line will be the density. Make sure to include the line equation and the coefficient of determination (R-squared value).
    - You can place both lines on the same plot. Make sure to use a legend to label each line.
    - Add a title to the plot.
    - Print the Excel plot, and include it in your lab report.
- Use the slope of each line to fill in the density in Data Table 5. Use the accepted value for density from Appendix 1 (Data Table 4) to calculate the relative percent error.

Data Table 5. Relative Percent Error for the Density of Water.

	Density from Excel Plot	Rel. % Error
Flask 1 (using pipet)		
Flask 2 (using graduated cylinder)		

Show your work for one example of each calculation:

Name: _____

Data Table 6. Density and Identity of Unknown Plastics in Set Number _____.

Unknowns	Observations	Mass	Volume	Density	Identity
example object	clear, colorless flake	0.2790 g	too small to measure by ruler or displacement	• floats on water • sinks in sol'n 3 • density must be between 0.945 and 1.00 g/mL	HDPE
Object 1					
Object 2					
Object 3					
Object 4					
Object 5					

Show your work for one example of each type of calculation:

Name: _____

Post-lab

1. Instruments that were used to measure volume included a graduated cylinder, a volumetric pipet, and a buret, whereas a beaker does not provide volume with any reasonable certainty. Provide one explanation as to why this is true.
2. Among the two instruments that you used to measure density of water in Data Table 2 and Data Table 3, which one was most accurate? Most precise? What in the data supports your argument?
3. Which method, average or graph, was more accurate in determining the density of water?
4. Which has a greater effect on density of water: temperature or pressure? How do you know?
5. Briefly explain a process for how you would scale up your density technique to sort a whole batch of mixed plastics for recycling.
6. Conclusions: Once you have completed your experiment, you will need to prepare a report (see Appendix 6 How to Write a Lab Notebook). Your report should be less than 5 pages, be clear and readable to the instructor and anyone that would need your data, and include:

   Title and lab partner names

   Purpose

   Any diagrams, figures, or tables with your lab data (units and significant figures are important, remember your Excel graph too)

   Calculations (include one example calculation for each type)

   Post-lab questions

   Conclusions (see Appendix 9 How to Write a Scientific Conclusion: What concept were you investigating and how does it relate to the experimental procedure? How did you go about your work and why? This is **not** the details of your procedure repeated again, but discussion of the processes. For example, describe the methods for finding volume of the unknown objects. What is your conclusion for each part? Use the values you obtain as evidence in your reasoning. Statements like, "see data table for values" are not acceptable! Discuss the validity and reliability of your data in answering the question. Clearly state the identity of each unknown plastic.)

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VALENCIA COLLEGE

Experiment 2: Empirical Formulas

Version 3

Name: _____ Date: _____

Lab Partner: _____ Section: _____

Table 1. Empirical formula of the Product of the Reaction of Mg with O_2

	Trial 1*	Trial 2
mass of lid		
mass of crucible + lid		
mass of crucible + lid + Mg		
mass of Mg		
moles of Mg		
mass of burned Mg product + lid + crucible		
1st mass recording after heating		
2nd mass recording after heating		
3rd mass recording after heating (if needed)		
mass of oxygen		
moles of oxygen		
formula of the magnesium oxide		

*Show calculations for trial 1.

Name: _____

Table 2. Empirical Formula of a Copper Hydrate

	Trial 1*	Trial 2
mass of evaporating dish		
mass of evaporating dish + $CuCl_2 \cdot nH_2O$		
mass of copper(II) chloride hydrate		
mass of copper(II) chloride + evaporating dish (after heating) (g)		
1st mass recording after heating		
2nd mass recording after heating		
3rd mass recording after heating (if needed)		
mass of H_2O		
moles of H_2O		
mass of anhydrous $CuCl_2$		
moles of $CuCl_2$		
formula of the copper(II) chloride hydrate		

*Show calculations for trial 1.

Name: ____

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VALENCIA COLLEGE

Experiment 3: Electrolytes and Nonelectrolytes

Version 3

Name: _____ Date: _____

Lab Partner: _____ Section: _____

Experimental Data

Unknown Sample Number _____

Table 1. Conductivity and pH of the Known Solutions

Known Solutions	Conductivity ( )	pH
1) 0.50 M glucose ($C_6H_{12}O_6$)		
2) 50 % isopropyl alcohol (C_3H_8O)		
3) 0.50 M acetic acid ($HC_2H_3O_2$)		
4) 0.50 M hydrochloric acid (HCl)		
5) 0.50 M magnesium sulfate ($MgSO_4$)		
6) 0.50 M aluminum chloride ($AlCl_3$)		
7) Deionized water (H_2O)		

Table 2: Tests Results for Glucose and Isopropyl Alcohol Mixed With Several Test Reagents

Known Solutions	Observations Upon Mixing	
	Chromic acid	Benedict's reagent
1) 0.50 M glucose ($C_6H_{12}O_6$)		
2) 50 % isopropyl alcohol (C_3H_8O)		

Name: _____

Table 3: Tests Results for Ionic Compounds and Acids Mixed With Several Test Reagents

Number and Identity Known Solutions	**Observations Upon Mixing**		
	0.2 M $AgNO_3$	**0.2 M Na_2CO_3**	**3 M NH_4OH**
3) 0.50 M acetic acid ($HC_2H_3O_2$)			
4) 0.50 M hydrochloric acid (HCl)			
5) 0.50 M magnesium sulfate ($MgSO_4$)			
6) 0.50 M aluminum chloride ($AlCl_3$)			

Analyses Performed on Unknown and Results

Unknown Solution Number _____

Identity of Unknown Solution _____

VALENCIA COLLEGE

Experiment 4: Limiting Reactant Data Tables

Version 4

Name: _____ Date: _____

Lab Partner: _____ Section: _____

Experimental Data and Calculations

Remember to include units of measure with each entry, and to read and record each measurement to the full precision allowed by the instrument used. Make sure that your work is neat and legible so that you may communicate your results to others such as your instructor. All tables should have a title; add a title where needed.

Table 1. Molar Mass of Reactants and Solid Product

1. Molar mass of copper(II) chloride	
2. Molar mass of Al metal	
3. Molar mass of Cu metal	

Table 2. Amount of Reactants Used in Each Trial and Observations

1. Trial #		Trial 1	Trial 2
2. Molarity of copper(II) chloride solution			
3. Volume of copper(II) chloride solution			
4. Moles of copper(II) chloride			
5. Mass of Al foil			
6. Moles of Al			
7. Observations	Reactants before mixing		
	Mixture after rection		

(Note: the clear cells should contain your data; the shaded cells will contain calculated values.) *Show your work for each type of calculation for each trial on the back of this sheet.*

Name: _____

Table 3. Amount of Copper Produced in Each Trial

1. Trial #	Trial 1	Trial 2
2. Mass of empty beaker		
3. Mass of filter paper		
4. Mass of beaker + filter paper + solid product, after:		
a. First heating		
b. Second heating		
c. Third heating		
d. Final mass of beaker + filter paper + product, after heating		
5. Mass of solid copper formed in the experiment (actual yield)		

Show your work each type of calculation for each trial:

Name: _____

Table 4. _____

1. Trial #	Trial 1	Trial 2
2. Moles of the product formed from copper(II) chloride		
3. Moles of the product that formed from Al		
4. Limiting reactant in the reaction (chemical formula)		
5. Excess reactant in the reaction (chemical formula)		
6. Theoretical yield in moles		
7. Theoretical yield in grams		
8. Theoretical mass of the unreacted excess reactant		

Show your work each type of calculation for each trial:

Name: _____

Table 5. _____

1. Trial #	Trial 1	Trial 2
2. Actual yield (mass of solid copper formed in the experiment)		
3. Theoretical yield		
4. Percent yield		

Show your work each type of calculation for each trial:

Name: _____

Post-lab

Show your calculations neatly for ***each*** trial as outlined by the tables 1-5. Also, write a conclusion (see Appendix 9 How to Write a Scientific Conclusion). Include:

1. A balanced chemical equation for the reaction in this experiment. Indicate the states of the reactants and products.
2. The limiting reactant and excess reactant in each trial. Back up your decisions with observations and calculations from the experiment.
3. Comment on your percent yield. Comment on any unusual or notable results. For example, if you received greater than 100 % yield, that would be an error since matter cannot be created; give some ideas for the source of the error. Likewise, give potential reasons for a very low yield, unexpected color changes, etc.

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VALENCIACOLLEGE

Experiment 5: Observing and Classifying Reactions

Version 2

Name: _____ Date: _____

Lab Partner: _____ Section: _____

Purpose

Experimental Data and Equations

Reactions and No Reactions

1. Deionized water + of zinc granules.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

Molecular Equation (ME):

Ionic Equation (IE):

Net Ionic Equation (NIE):

Name: _____

2. 6 M hydrochloric acid + zinc granules. Perform splint test.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

Instructor's Signature _____

3. 0.2 M ammonium oxalate (the oxalate ion is $C_2O_4^{2-}$) + 0.1 M calcium chloride.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

Instructor's Signature _____

Name: _____

4. Copper metal + 6 M hydrochloric acid. Observe reaction several times for 10 - 15 minutes.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

Instructor's Signature _____

5. Copper metal + 0.5 M silver nitrate. Observe reaction several times for 10 - 15 minutes.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

Instructor's Signature _____

Name: _____

6. 0.1 M barium chloride + 0.1 M sodium sulfate.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

7. 1.0 M sodium hydroxide + hydrochloric acid. Measure temperature and pH before and after.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

Instructor's Signature _____

Name: _____

8. 0.1 M ammonium chloride + 0.1 M copper (II) nitrate.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

A Sequence of Reactions

9. 6.0 M sodium hydroxide dropwise + 0.1 M copper (II) nitrate.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

Name: _____

10. Centrifuge the product from experiment 9. Decant the liquid. Heat the solid.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

11. 6 M hydrochloric acid + solid produced in experiment 10.

Observations	
Reactants before combining	After combining and mixing
Reacted?	Reaction type:

ME:

IE:

NIE:

VALENCIA COLLEGE

Experiment 6A: Amount of Active Ingredient in Aspirin

Name: _____ **Date:** _____

Lab Partner: _____ **Section:** _____

Experimental Data and Calculations

Table 1. Determination of NaOH Concentration. (Part A due next Lab.)

1) HCl concentration written on carboy			
2) NaOH concentration written on carboy			
3) NaOH Solution A concentration (Theoretical value)			
4) NaOH Solution B concentration (Theoretical value)			
	Trial 1*	Trial 2	Trial 3
5) Volume of HCl sample			
6) Moles HCl			
7) Moles of NaOH			
8) Initial buret reading			
9) Final buret reading			
10) Volume NaOH added			
11) Molar concentration of NaOH Solution B (Experimental Value)			
12) Mean molar concentration of NaOH Solution B			
13) Standard deviation			
14) RSD			
15) Relative percent error (%)			

* Show calculations for Trial 1, standard deviation, RSD and relative % error. (Continue on back of sheet if needed.)

Name: _____

Data Table 2. Determination of Acetylsalicylic Acid in Aspirin.

1) Aspirin Brand (and amount of acetylsalicylic acid on label)			
2) Average molar concentration of NaOH Solution B (from Part A)			
	Trial 1*	Trial 2	Trial 3
3) Mass of aspirin tablet			
4) Mass of pulverized aspirin sample			
5) Initial buret reading			
6) Final buret reading			
7) Volume of NaOH Solution B added			
8) Moles of NaOH			
9) Moles of acetylsalicylic acid in sample			
10) Mass of acetylsalicylic acid in sample			
11) Amount of acetylsalicylic acid per tablet			

12) Mean amount of acetylsalicylic acid per tablet	
13) Standard deviation for acetylsalicylic acid per tablet	
14) RSD for acetylsalicylic acid per tablet	
15) Relative percent error (%)	

*Show all calculations related to Trial 1, standard deviation, RSD, and relative % error.

Report: Include tables 1 and 2, calculations, and written conclusion.

VALENCIACOLLEGE

Experiment 7: Analysis of a Gaseous Product

Version 2

Name: _____ Date: _____

Lab Partner: _____ Section: _____

Experimental Data and Calculations

Unknown Sample Number _____

Table 1. Mass of Unknown Sample Used

	Trial 1	Trial 2	Trial 3
1) Mass of weighing boat ( )			
2) Mass of weighing boat + sample ( )			
3) Mass of sample ( )			

Table 2: Determination of Temperature and Volume of the Carbon Dioxide Gas Collected

	*Trial 1	Trial 2	Trial 3
1) Adjusted water level after reaction done (student's signature)			
2) Temperature of CO_2 ( )			
3) Volume of CO_2 ( )			
4) Temperature of CO_2 (K)			
5) Volume of CO_2 (L)			

* Show calculations for Trial 1 here:

Name: _____

Table 3: Determination of the Pressure of the Carbon Dioxide Gas Generated

	*Trial 1	Trial 2	Trial 3
1) Barometric Pressure (inches of Hg)			
2) Vapor Pressure of H_2O ( ) (Appendix 5)			
3) Barometric Pressure (atm)			
4) Vapor Pressure of H_2O (atm)			
5) Vapor Pressure of CO_2 (atm)			

* Show calculations for Trial 1 here:

Table 4. Percent by Mass of Calcium Carbonate in Unknown Sample Number _____

Trial #:	% Calcium Carbonate
1) Trial 1**	
2) Trial 2	
3) Trial 3	

** Show calculations for trial 1, mean, standard deviation and relative percent error on next page.

Table 5. Results Summary

1) Mean percent by mass of calcium carbonate	
2) Standard deviation of the percent by mass of calcium carbonate	
3) Relative percent error of the mean percent by mass of calcium carbonate	

Report: Hand in all sheets of the experimental data, calculations, and write a conclusion.

VALENCIACOLLEGE

Experiment 8: Calorimetry

Version 2

Name: _____ Date: _____

Lab Partner: _____ Section: _____

Experimental Data and Calculations

Table 1. Determination of the Specific Heat Capacity of One Vienna Sausage

1) Mass of the Vienna sausage	
2) Mass of calorimeter and lid	
3) Mass of calorimeter and lid + water	
4) Mass of the water	
5) Ti, initial temperature of water	
6) Tf, final temperature of water	
7) ΔT, change in temp of the water	
8) Heat change of water	
9) Heat change of sausage	
10) Ti, initial temperature of sausage	
11) Tf, final temperature of sausage	
12) ΔT, change in temp of the sausage	
13) Specific heat, Cs, of one sausage	

Calculations:

Name: _____

Table 2. Estimation of the Heat Needed to Warm an Average Size Adult Person's Hand

1) Estimated mass of 16 Vienna sausages	
2) Heat needed to warm 16 Vienna sausages from 15.0 °C to 37.0 °C	

Calculations:

Table 3. _____

	NaCl	KCl	$CaCl_2$
1) temperature water			
2) temperature of mixture at 30 s			
3) ΔT			
4) visible observations of mixture			
5) type of reaction			

Conclusion:

Name: _____

Table _____. _____

(**Read over Part C**. Develop your own Table before coming to Lab. Note: you do not need to use all the columns and rows in the table below. Extra provided to not limit your creativity.)

Calculations:

Report: Hand in Tables 1-4, calculations, and write a conclusion.

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VALENCIA COLLEGE

Experiment 10: Dye Concentration Using UV-Vis Data Tables

Version 2

Name: _____ Date: _____

Lab Partner: _____ Section: _____

Part A and B: Preparing Solutions and Measuring UV-Vis Absorbances for the Calibration Curve

Concentration of Allura Red AC Stock Solution _____

Data Table 1. Preparation and Absorbance of Allura Red AC Standards.

Standard #	Volume of Stock Solution Used ( )	Concentration of Standards ( )	Absorbance
1			
2			
3			
4			
5			

Show your work for calculation of the concentration of standard 1:

Name: _____

Part C: Measuring the Absorbance for the Unknown Drink

Drink Analyzed: _____

Data Table 2. Preparation and Absorbance of Unknown Drink.

Preparation:	Absorbance
1.00 mL unknown drink diluted with DI water to 10.00 mL	

Show your work for calculation of the concentration of Allura Red AC in the Unknown Drink: