King Saud University
Collage of Science
Chemistry Department

CHEM 101
LABORATORY OF GENERAL CHEMISTRY

Reports

Prepared by
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Student Name:
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Report No. (1)

Evaluation of Error, Accuracy and Precision

The objectives of the experiment:
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Results and calculations

A. Part One

1. Tabulate the results:

m(g)	Δm

2. Calculate the experimental error.

3. Calculate error percentage.

4. Calculate the precision.

B. Part two

1. Tabulate the results:

- **Graduated Cylinder**

m_{gc1} (g)	m_{gc2} (g)	m_{gc3} (g)
Accuracy of the mass value		
the average ($\bar{m}$)		
the experimental error (Δm)		
the percent error (m%)		

- **Graduated Burette**

$m_{burette1}$ (g)	$m_{burette2}$ (g)	$m_{burette3}$ (g)
Accuracy of the mass value		
the average ($\bar{m}$)		
the experimental error (Δm)		
the percent error (m%)		

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Report No. (2)

Determination of The Density Using Different Methods

The objectives of the experiment:
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First method

If you have a cylindrical object, the weight of the mass of the body was taken and the dimensions were taken by the ruler. The measurements were as follows:

L (cm)	**D (cm)**	**M (g)**
3.6	**1.2**	**4.05**

Determination of density directly by calculation of volume and weighing mass of a geometric specimen

1. Calculate the volume of your specimen (massive cylinder).

2. Calculate the density of your specimen (massive cylinder).

3. Tabulate your errors of measurements:

Δ L (cm)	**Δ D (cm)**	**Δ m (g)**

4. Calculate the error in the density (Δdensity), and its accuracy:

Second method:

1. Report your measurements as follows:

V_1 (cm^3)	**V_2 (cm^3)**	**m (g)**

2. Calculate the volume of your specimen (glass ball):

3. Calculate the density of specimen (glass ball):

4. Tabulate the values of experimental errors:

ΔV_1	**ΔV_2**	**Δ m**

5. Calculate the error in the density (Δdensity), and its accuracy:

Third method

Weighted graduate cylinder-100 ml its mass ($\mathbf{m_{gc1}}$) 250.08g. It was then filled 50 mL of water, Then a cylindrical sample was placed inside the cylinder and it was filled with saturated solution of the salt until the body was positioned in the midpoint of the cylinder the total volume of the solution remained in the cylinder is 65 ml, and the Weight the wide 100 mL-graduate cylinder with the remaining solution. its mass ($\mathbf{m_{gc2}}$)310.55g:

1. Calculate the mass of the solution (m solution):

2. Calculate the density of the solution which is at the same time equals that of the cylindrical specimen.

3. Tabulate the experimental errors on the mass and volume

Δ m	**Δ V**

4. Calculate the error in the density (Δdensity), and its accuracy:

Report No. (3)

Reaction Stoichiometry: Determination of The Limiting Reactant and Yield Percentage

Student Name:
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The objectives of the experiment:

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The balanced equations for the reactions is:

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Results:

m $_{INITIAL}$/g	V $_{HCl}$/L	m $_{reactant}$/g	m $_{TOTAL(product)}$/g

Calculations:

Molecular weight of Na_2CO_3

1. The limiting reactant

- Mass of NaCl produced (m_{NaCl}):

- Number of moles (n_{Na2CO3}) and (n_{HCl}):

- n_{Na2CO3} and n_{HCl} must be divided by the coefficient of each reactants in the equation:

The limiting reactant is…………………………………

2. The yield percentage

Molecular weight of NaCl

- The actual mass of NaCl:

- Number of moles (nNaCl,actual):

nNaCl theoretical

- The yield percentage of NaCl:

Report No. (4)

Determination of the Transferred Thermal Energy: Cooling a Metal and a Hot Tea

Student Name:
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Objectives of experiment:

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<u>Results and calculations:</u>

A. Part one

1. Tabulate your results as follows:

m_{water}	$T_{initial,water}$	m_{key}	$T_{initial, key}$	T_{final}

2. Given that c_{water} = 4.184 J/g ^{o}C, c_{iron} = 0.449 J/g ^{o}C and from your tabulated data, calculate the heat quantity changes, in the units of Joule:
3.
   A) The heat gained by water.

   B) The heat lost by the key.

4. Tabulate the values of errors:

Δm_{water}	$\Delta T_{initial,water}$	Δm_{key}	$\Delta T_{initial, key}$	ΔT_{final}

5. Calculate the error in the values of Q_{water} and the heat absorbed by the water (accuracy).

6. Calculate the error in the values of Q_{key} the heat released from the key (accuracy).

B. Part two:

1. Tabulate your results as follows:

$m_{beaker1}$	$m_{beaker2}$	$T_{initial, tea}$	$T_{initial, water}$	T_{final}

2. Given that $c_{water} = c_{tea} = 4.184$ J/g ^{o}C, and from your tabulated data, calculate the enthalpy changes in the units of Joule as follows:

- The heat gained by water.

- The heat lost by tea.

3. Calculate the mass of water (m_{water}) you need to add to your tea in order to make the temperature of the tea low enough to be drinkable:

4. Tabulate the values of errors:

$\Delta m_{beaker1}$	$\Delta m_{beaker2}$	$\Delta T_{initial, tea}$	$\Delta T_{initial, water}$	ΔT_{final}

5. Calculate the error in the values of m_{water}

6. The mass of added water (accuracy).

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Report No. (5)

Graham's Law of Gas Diffusion

The objective of the experiment:
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Reaction equation:
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Graham's Law:
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1- Distance moved by HCl gas (L_{HCl}) =
2- Distance moved by NH_3 gas (NH_3) =

The theoretical ratio between the molar masses of the two gases (Y):

The measured ratio between the molar masses of the two gases (X):

Error Percentage:

Report No. (6)
ENTHALPY OF REACTION: HESS'S LAW

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The objectives of the experiment:
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$m_{calorimeter}$	$m_{1,\ NaOH}$	$m_{2,\ NaOH}$	ρ_{water} J/g °C	ρ_{glass} J/g °C
			4.18	0.836

Mass of the solution for all three reactions = 50g

	Reaction 1	Reaction 2	Reaction 3
t_1 (°C)			
t_2 (°C)			
$\Delta T = t_1 - t_2$ (°C)			
$q_{solution}$ (J) $q_1 = m \times \rho_{water} \times \Delta T$			
$q_{calorimeter}$ (J) $q_2 = m_{calorimeter} \times \rho_{glass} \times \Delta T$			
$Q = q_1 + q_2$ (J)			
n_{NaOH} (mole)			
$\Delta H = -Q/n$ (kJ.mol^{-1})			

Proof Hess's law:
$\Delta H_1 = (\Delta H_2 + \Delta H_3)$

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Report No. (7)

DETERMINATION OF THE MOLAR

MASS OF A GAS

The objectives of the experiment

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Results:

m_1 / g	m_2 / g	m_3 /g	T / K	P / atm
				1 atm

R = 82.06 cm^3.atm/K.mol

Calculations:

1. Mass of the unknown gas:

2. Volume of the test tube: (density of water is 1 g/ml)

3. Molar mass of the unknown substance:

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Report No. (8)

PREPARATION OF A

SOLID/LIQUID SOLUTION

The objectives of the experiment

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Results:

Part one:

1) Tabulate your results:

m_{NaCl} / g	$V_{solution}$ / L

2) Calculate the molarity of your solution:

3) Tabulate the evaluated error:

Δm_{NaCl} / g	$\Delta V_{solution}$ / L

4) Calculate the experimental error of the molarity:

5) Accuracy of the molarity:

Part two:

1) Tabulate your results:

$Molarity_{conc}$ / mol L^{-1}	**V_{conc} / L**	**V_{dil} / L**

2) Calculate the molarity of your diluted solution:

3) Tabulate the evaluated error:

$\Delta Molarity_{conc}$ / mol L^{-1}	**ΔV_{conc} / L**	**ΔV_{dil} / L**

4) Calculate the experimental error of the molarity:

5) Accuracy of the molarity:

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Report No. (9)

PREPARING SOLUTIONS BY

SERIAL DILUTION

The objectives of the experiment

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Results:

1) Tabulate the results of your experiment:

M_0 / mol L^{-1}	V_0 / mL
0.10	1

Test tube number	Initial volume (V_{conc}) / mL	Initial molarity (M_{conc}) / mol L^{-1}	Final volume (V_{dil}) / mL	Final molarity (M_{dil}) / mol L^{-1}
0	1	0.1	10	
1	1		10	
2	1		10	
3	1			

a) Molarity of the diluted solution from stock solution ($M_{dil\ 1}$):

b) Molarity of the diluted solution from test tube 1 ($M_{dil\ 2}$):

c) Molarity of the diluted solution from test tube 2 ($M_{dil\ 3}$):

2) Evaluate and tabulate the errors:

ΔM_0	$\Delta M_{dil\ 1}$	$\Delta M_{dil\ 2}$	$\Delta M_{dil\ 3}$	ΔV_0	$\Delta V_{dil\ 1}$	$\Delta V_{dil\ 2}$	$\Delta V_{dil\ 3}$

a) Experimental error of molarity of the diluted solution 1 ($\Delta M_{dil\ 1}$):

b) Experimental error of molarity of the diluted solution 2 ($\Delta M_{dil\ 2}$):

c) c) Experimental error of molarity of the diluted solution 3 ($\Delta M_{dil\ 3}$):

3) Accuracy of the molarity of each diluted solution:

Test tube number	Molarity $\pm \Delta M_{dil}$
1	
2	
3	

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Report No. (10)
DETERMINATION THE MOLAR MASS OF AN UNKNOWN SUBSTANCE BY FREEZING POINT DEPRESSION

The objectives of the experiment

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Results:

1) Tabulate the results of your experiment in the following table:

	$m_{solvent}$ (g)	m_{solute} (g)	$T_{f,solvent}$ (^{0}C)	$T_{f,solution}$ (^{0}C)	$\Delta T_f = T_{f,solvent} - T_{f,solution}$
Glucose (A)					
Unknown (B)					

A) Determination the $K_{f,water}$ in Glucose solutions ($M_{glucose}$ = 180.16 g/mol).

B) Determination of the molar mass of the unknown substance (K_f = 1.86 $^0C.molal^{-1}$).

2) Tabulate the experimental error of your experiment in the following table:

A)

$\Delta T_{f,solvent}$ (°C)	$\Delta T_{f,solution1}$ (°C)	$\Delta m_{solvent1}$ (g)	$\Delta m_{solute1}$ (g)

B)

$\Delta T_{f,solvent}$ (°C)	$\Delta T_{f,solution2}$ (°C)	$\Delta m_{solvent2}$ (g)	$\Delta m_{solute2}$ (g)

3) Calculate experimental error of $\boldsymbol{K_{f,water}}$ and molar mass of the unknown substance: