ElCoM
ELECTRICAL COMPUTER MECHATRONICS

تقدم لجنة ElCoM الاكاديمية

ريبورتات لمادة:

أساسيات الكيمياء العامة العملية

Experiment (6)

Molar Mass of a Volatile Liquid

Report Sheet

Unknown No. ______________

Data:

		Trial I	Trial II
1.	Mass of empty Erlenmeyer flask + Aluminum foil + Wire (g)	,32g ±,01	____
2.	Temperature of boiling water (K)	98C + 273 = 371K	____
3.	Atmospheric pressure (atm)	756 mm Hg = ,9947 atm	____
4.	Mass of Erlenmeyer flask + Condensed vapor + aluminum foil + wire (g)	756 ∓ ,01 ,32g ± ,01	____
5.	Mass of condensed vapor (g)	____	____
6.	Volume of Erlenmeyer flask	150x10⁻³ → ,15L	____
7.	Molar mass of the liquid, calculated	65,43g/mol	____
8.	Average molar mass	~~X~~	

R = 0821

PV = nRT

$\frac{,9947 * ,15}{,0821 * 371}$ = ,00489 Mole

n = $\frac{mass}{M.M}$ → M.M = $\frac{,32}{,00489}$ =

65,43 g/Mole

Note: *A more accurate calculation of the molar mass uses a corrected mass for the vapor which takes into consideration the mass of air displaced by vapor at room temperature.*

Partner Name: ______ Group No.: ______

Experiment (7)

Determination of the Molar Volume of Hydrogen Gas

Report Sheet

	Trial 1	Trial 2
Volume of burette from 50 mL mark to the sealed end	~~2.6~~	2.5 ml
Mass of piece of magnesium ribbon	~~0.04~~	0.05 g
Burette reading from Step 11	~~16.8~~	11.00 ml
Temperature of the water in the graduated cylinder (Step 13)	~~17~~	18 °C
Room temperature	~~17~~	18 °C
Room pressure	~~756~~	756 mmHg
Vapor pressure of water—use the water temperature from Step 13 and the Table below.	~~14.5~~	15.5 mmHg

Vapor Pressure of Water at Various Temperatures			
Temperature °C	Pressure torr	Temperature °C	Pressure torr
16	13.6	21	18.6
17	14.5	22	19.8
18	15.5	23	21.0
19	16.5	24	22.4
20	17.5	25	23.8

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Calculations:

Set up each problem completely and SHOW UNITS. Cancel the units when you do the calculation. Use the correct number of significant figures in your answers.

1. Write the balanced equation for the reaction.

$Mg_{(s)} + 2HCl \rightarrow MgCl_2 + H_2(g)$

2. Determine the number of moles of magnesium used. Find the average for the 2 trials.

Mass = .05 g   mole (Mg) = wt / M.M = .05 / 24.305 = 2.05 × 10⁻³ mole

M.M = 24.304 g/mol

3. Determine the volume of gas produced. Find this by the following equation:
Volume of gas = (Volume of burette from 50 mL to sealed end) + (50.0 mL − burette reading). Find the average for the 2 trials.
Use the average of your data from the previous page for these calculations.

$V_1 = 2.5 + (50 - 11) = 41.5$ mL

4. Determine the partial pressure of the H_2 gas. Since the H_2 is collected over water, the gas in the burette consists of a mixture of H_2 and water vapor. The total pressure is $P_{room} = P_{H_2} + P_{H_2O}$.

$P_{total} = P_{H_2} + P_{H_2O} \rightarrow 756 = P_{H_2} + 15.5$

$\rightarrow P_{H_2} = 740.5$ mmHg

5. Using the results of your calculations in the previous steps, determine the volume (in liters) of the H_2 at one atmosphere pressure (760 torr) if no water were present.

1 atm = 760 mmHg

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \rightarrow .9743 \times 41.5 \times 10^{-3} = 1 \times V_2$

$V_2 = .0404$ L

6. Using the results of your calculations in the previous steps, calculate the molar volume (in liters/mol) of dry H_2 at room temperature and 1 atmosphere pressure. (*Don't* simply use the ideal gas law, use your own results!)

$V = \frac{V_2}{mole} = \frac{.0404}{.00205} = 19.72$ L/mol.

7. Using the results of your calculations in the previous step, calculate the molar volume (in liters/mol) of dry H_2 at STP.

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \rightarrow \frac{.974 \times 41.5 \times 10^{-3}}{291} = \frac{1 \times V_2}{273}$

$V_2 = .0379$ L

$\bar{V} = V_2/n = \frac{.0379}{.00205} = 18.49$ L/mol

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Student Name:
ID Number:
Partner Name: ____________

Section No.:
Date :
Group No.:

Experiment (9)

Calorimetry

Report Sheet

Part A: Determination of the heat of solution of NaOH (ΔH_1)

Data:

		Trial I	Trial II
1.	Volume of water	—	
2.	Mass of water	100g ∓.01	
3.	Mass of NaOH	2,00g ∓.01	
4.	Molar mass of NaOH	40.0g/mol	
5.	Moles of NaOH	,05mole	
6.	Mass of solution	100+2=102g ∓,01	
7.	Initial temperature	18C = 291 K	
8.	Final temperature	22C = 295 K	
9.	ΔH_1 of solution	ΔH_1 = -1707,072J = -	
10.	Average ΔH_1		

8°C

2°C

NaOH = mass / molar mass

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Part B: Determination of the heat of reaction of NaOH with HCl (ΔH_2) and the heat of neutralization (ΔH_n)

Data:

		Trial I	Trial II
1.	Volume of HCl solution		
2.	Mass of HCl solution	100,00g ±/0.1	
3.	Mass of NaOH	8,00g ±/0.1	
4.	Molar mass of NaOH	40.0 g/mol	
5.	Moles of NaOH reacted →	0,2 mol	
6.	Mass of solution	108,00 g ±/0.1	
7.	Initial temperature	18 C°	
8.	Final temperature	22 C°	
9.	ΔH_2 of solution	-93,88 kJ/mol	
10.	Heat of neutralization ($\Delta H_2 - \Delta H_1$)	-59,747 kJ/mol	
11.	Average heat of neutralization		

$T_1 = 15 C°$
$T_2 = 24 C°$

Part C: Determination of the heat of solution of an unknown salt:

Data:

		Trial I	Trial II
1.	Volume of water		
2.	Mass of water		
3.	Mass of unknown salt		
4.	Initial temperature		
5.	Final temperature		
6.	ΔH of solution		
7.	Average ΔH		

Show your calculation for Trial I:

Student Name: ______________ Section No.: ______________
ID Number: ______________ Date : ______________
Partner Name: ______________ Group No.: ______________

Experiment (8)

Colligative Properties: Molar Mass Determination

Report Sheet

$\Delta T_f = T_f$ solvent $- T_f$ solution
$2.5c^\circ = 6.4 - 3.9$

mass of cyclexance sol
$\frac{10}{1000} = 10\times10^{-3}$ Kg

Unknown Number ______________

Data:

A. Freezing Point of Cyclohexane

1. Mass of test tube (g) ______
2. Mass of cyclohexane (g) 10g
3. Freezing point, from cooling curve (°C) 6.4c°

B. Freezing Point of a Solvent-Unknown Solute	Trial I	Trial II
1. Mass of test tube + cyclohexane (g)		
2. Mass of cyclohexane (g)	10g	
3. Mass of solute (g)	.327 ∓ 01	
4. Freezing point, from cooling curve (°C)	3.9c°	

Calculations:

1. Freezing point constant, Kf, of cyclohexane	20.0° C.kg/mol	
2. Freezing point change, ΔT_f (C°)	2.5c°	
3. Mass of solute in solution (g)	.327 ∓ .01	
4. Mass of cyclohexane in solution (kg)	10.009 ∓ 0.01 = .010 Kg	
5. Molar mass (g/mol)	160 g/mol	
6. Average molar mass (g/mol)		

Molar mass
$\Delta T_f = Kf \times \frac{\text{mass solute}}{\text{M. M solute} \times \text{mass solvent}} \rightarrow 2.5 = \frac{20 \times .02}{\text{M. M} \times .01}$

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M.M = 160 g/mol

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REPORT SHEET

9.5 / 18 Prelab

Student Name :- 　　Student No. :

Instructor Name : د. فداء العتيبي 　　Section No.:

Partner Name : Mohammed Hasan 　　Date : 25

	Data	Trial I	Trial II
1.	Mass of empty crucible	18.4 g	18.4 g
2.	Mass of crucible and Mg	18.65 g	18.65 g
3.	Mass of Mg	.25	.25
4.	Mass of Crucible and oxide	18.8	18.8
5.	Mass of magnesium oxide	.4	.4
6.	Mass of oxygen	.15	.15
7.	Moles of Mg (FM of Mg = 24.3 g /mol)	.0102	.0102
8.	Moles of oxygen (FM of O = 16.0 g/ mol)	9.375×10^{-3}	9.375×10^{-3}
9.	Mol Mg: Mol O	1 : .0102	1 : 1
10.	Empirical formula of magnesium oxide	MgO	MgO
11.	% of O in the compound	39.7 %	39.7
12.	% of Mg in the compound	60.3 %	60.3 %

Sample calculation for Trial I:- mass of Mg = 18.65 − 18.4 = .25 g.

% of Mg_xO_y = 18.8 − 18.4 = 0.4

mass of O = 0.4 − 0.25 = 0.15

moles of Mg = $\frac{0.25}{24.3}$ = 0.0102

moles of O = $\frac{0.15}{16}$ = 9.4×10^{-3}

% of O = $\frac{0.15}{0.4}$ = 39.7 %

% of Mg = 60.3 %

POST-LABORATORY QUESTIONS

1. What is the effect of Mg_3N_2 if it is not decomposed on the reported (**Mg to oxygen**) mole ratio? the Mg_3N_2 —— Mg_xO_y Mg_3N_2 ($\uparrow 14$) —— Mg_xO_y ($\uparrow 16$)

ratio Mg : O $\frac{\text{mole Mg}}{(\downarrow)\text{mole O}}$ } $\uparrow$ → constant.

$\text{mole O} = \frac{\text{mass } Mg_xO_y - \text{mass Mg}}{16} = \frac{\text{mass O}}{16}$

2. Describe the effect of each of the following factors, whether increases, decreases, or has no effect on the reported value of (Mg to O) mole ratios:

a. If carbon is deposited on the crucible's surface (because of improper heating) and the crucible with contents is weighed without removing the carbon residue by further heating.

Decrease / mole O $\uparrow$ / mole ratio $\downarrow$

b. If the magnesium oxide ash is not dried completely. increases.

Decrease / mole O $\uparrow$ / mole ratio $\downarrow$

c. If rapid oxidation of magnesium occurs by too much air, and some Mg is lost.

mole O $\downarrow$ / ratio $\uparrow$

d. If air is not sufficient to react with all the magnesium.

mole O $\downarrow$ / ratio $\uparrow$.

3. Explain how magnesium nitride is formed during heating? Write a chemical equation for its formation. $3Mg + N_2$ —— Mg_3N_2

4. Explain, by a chemical equation, the effect of the added water in the decomposition of magnesium nitride.

$$Mg_3N_2 + H_2O \rightleftharpoons Mg(OH)_2 + NH_{3(g)}$$

$$Mg(OH)_2 \xrightarrow{\Delta} Mg_xO_y + H_2O_{(g)}$$

Name ______________ Lab Instructor م. هداي القيسي

ID Number ٨٣٣١٥٠ Date __________ Lab Bench ١١

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Prelab assignment: Experiment (2)

EMPIRICAL FORMULA OF A COMPOUND

1. How many grams of magnesium combine with 1.50 g of chloride ions in $MgCl_2$?

moles of Cl = $\frac{1.5}{35.4}$ = .0423

1 mole Mg → 2 mole Cl

X → .0423

X = .0211 mole

mass = moles * mm = .0211 * 24.3

= .5148 gram.

2. If 11.80 g of iron reacts with 5.06 g of oxygen. Determine the empirical formula of the resulting oxide?

moles of Fe = $\frac{11.8}{56}$ = .21 mole

moles of O = $\frac{5.06}{16}$ = .316

$Fe_{.21}O_{.316} \overset{\div .21}{\Rightarrow} FeO_{1.5} \overset{*2}{\Rightarrow}$ Fe_2O_3

3. A 20.882 g sample of an ionic compound was found to contain 6.072 g Na, 8.474 g S, and 6.336 g O. What is the empirical formula of the compound?

moles of Na = $\frac{6.072}{23}$ = .133

moles of S = $\frac{8.474}{32}$ = .26

moles of O = $\frac{6.336}{16}$ = .396

$Na_{.133}S_{.26}O_{.396} \overset{\div .133}{\Rightarrow}$ NaS_2O_3 (2)

0.5

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REPORT SHEET

Student Name : ________ Student No. : ________

Instructor Name : ________ Section No.: (١١ - ٨), (ربع، ١١)

Partner Name : ________ Date : 4/3/2009.

→ الأحد 2-5

Observe the appearance of the hydrate BEFORE HEATING. Write down your observations.

solid crystals, that appears perfectally dry.

Observe the appearance of the hydrate AFTER HEATING. Write down your observations.

pouder, with small particles, that reacts with vapor.

Mass of crucible, cover, and hydrate before heating (Step 4)	44.64 g
Mass of empty crucible and cover (after cooling in Step 3)	42.1 g
Mass of hydrate before heating	2.54 g
Mass of crucible, cover, and salt after **first** heating (Step 8)	43.52 g
Mass of crucible, cover, and salt after **second** heating (Step 10)	43.47 g

Note: If the mass after your second heating does not agree within 0.02 g of the mass after the first heating, see your instructor.

Mass of anhydrous salt 1.37 g

Molecular mass of the anhydrous salt (Written on your unknown sample vial) 387.58 g/mole.

Calculations:

Solve each problem completely and **SHOW UNITS.** Cancel the units when you do the calculations. Use the correct number of significant figures in your answers.

1. Calculate the mass and the number of moles of the anhydrous salt you prepared.

mass = 1.37 g

moles = $\frac{1.37}{387.58}$ = 3.53×10^{-3} mole.

2. Calculate the mass and the number of moles of water lost by heating.

H_2O mass = 2.54 - 1.37 = 1.17 g

moles = $\frac{1.17}{18}$ = 0.065 mole.

3. Calculate the ratio of moles of water to moles of anhydrous salt. Use the correct number of decimal places.

$x = \frac{\text{moles water}}{\text{mole Anhydrous}} = \frac{.065}{3.53 \times 10^{-3}} = 18.41$

4. From your data, what would be the empirical formula for your hydrate? Use the form "salt•$x$$H_2O$", where x is a whole number.

$x \approx 18 \Rightarrow$ Salt . 18 H_2O

5. Calculate the percentage by mass of water in the hydrate.

percentage = $\frac{18 \times 18 \times 100\%}{18 \times 18 + 387.58}$ = 45.5 %

_____ Lab Instructor م. ضياء

1/3/2009 Lab Bench 2-5

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Prelab assignment: Experiment (3)

THE FORMULA OF A HYDRATE

> Do the prelab assignment **before** coming to the lab. Give it to your instructor when you enter the lab.

1. Define the follwing terms and give examples.

a. Hydrate: It's a salt React with water (Salt x H_2O) like ($CuSO_4 \cdot 5H_2O$) / ($NaCl \cdot H_2O$).

b. Anhydrous: The Hydrate when it heated the salt that produce Knowing as anhydrous.

2. A student heated a salt hydrate 3 consecutive times; after each heating he weighed the anhydrous product. He obtained the following results:

   1st : 2.38 g.

   2nd : 2.31 g.

   3rd : 2.35 g.

   from these results, it is clear that he made a mistake. What is his mistake?

   The 3rd result is wrong, because the molecular in water decrease after heating so the mass of salt Reduced.

   0

3. Calculate the percentage of water in $CuSO_4.5H_2O$.

$$W\% = \frac{(2+16)*5}{(2+16)*5+32.07+16.4+365} * 100\% = 36\%$$

4. A 1.40 g sample of a salt hydrate ($Salt.nH_2O$) when heated gave 1.00 g. of the anhydrous salt. What is the value of "n" in the formula of the hydrate?

   molar mass of the anhydrous salt = 90.0 g mol^{-1}

   molar mass water = 18.02 g mol^{-1}

   moles of hydrous $= \frac{1g}{90\ g/m} = 0.011$ moll

   moles of $H_2O = \frac{1.4-1}{18.02} = 0.022$ moll's

   $n = \frac{0.022}{} = 2$

Lab Instructor م. وفاء القيسي

Lab Bench 15

Prelab assignment: Experiment (3)

THE FORMULA OF A HYDRATE

Do the prelab assignment **before** coming to the lab. Give it to your instructor when you enter the lab.

1. Define the follwing terms and give examples.

a. Hydrate: Salts which have crystallized form a water solution.

b. Anhydrous: salt crystal which doesnt have any amount of water as an integral part of it's of it's structure

2. A student heated a salt hydrate 3 consecutive times; after each heating he weighed the anhydrous product. He obtained the following results:

1^{st} : 2.38 g.

2^{nd} : 2.31 g.] less weight

3^{rd} : 2.35 g.] more weight

from these results, it is clear that he made a mistake. What is his mistake?

The more hydrate is heated more water should be drivin off, so the mass ~~of~~ should be less each time

3. Calculate the percentage of water in $CuSO_4.5H_2O$.

$$\text{water Percentage} = \frac{5 * 18}{5*18 + (4*16 + 32 + 63.5)} * 100\%$$

$= 36\%$

4. A 1.40 g sample of a salt hydrate (Salt.$n$$H_2O$) when heated gave 1.00 g. of the anhydrous salt. What is the value of "n" in the formula of the hydrate?

molar mass of the anhydrous salt = 90.0 g mol^{-1}

molar mass water = 18.02 g mol^{-1}

mass of anhydrous salt in the sample = 1 g

mass // water in the sample = 1.4 - 1 = 0.4 g

water % $= \frac{0.4}{1.4} * 100\% = \frac{4}{14}$

assume 1 mole :-

$$\frac{4}{14} = \frac{N * 18}{N * 18 + 90}$$

$252N = 72N + 360$

$180N = 360$ $N = 2$

Name ____________________ Lab Instructor م. هداء القيسي

ID Number ٨٣٣١٥٠ Date ____________________ Lab Bench ١١

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Prelab assignment: Experiment (3)

THE FORMULA OF A HYDRATE

Do the prelab assignment **before** coming to the lab. Give it to your instructor when you enter the lab.

1. Define the follwing terms and give examples.

a. Hydrate: Salts which have crystallized from a water's solution.

b. Anhydrous: salt crystal which doesn't have any amount of water as an integral part of it's of it's structure.

2. A student heated a salt hydrate 3 consecutive times; after each heating he weighed the anhydrous product. He obtained the following results:

   1st : 2.38 g.
   2nd : 2.31 g. ← less weigh (✓)
   3rd : 2.35 g. ← more weigh (X)

   from these results, it is clear that he made a mistake. What is his mistake?

   The more a hydrate is heated more water should be drivin off, so the mass should be less each time.

3. Calculate the percentage of water in $CuSO_4.5H_2O$.

   $$\text{Water percentage} = \frac{5 * 18}{5*18 + (4*16+32+63.5)} * 100\% = 36\%$$

4. A 1.40 g sample of a salt hydrate (Salt.$n$$H_2O$) when heated gave 1.00 g. of the anhydrous salt. What is the value of "n" in the formula of the hydrate?

   molar mass of the anhydrous salt = 90.0 g mol^{-1}

   molar mass water = 18.02 g mol^{-1}

   خلف الورقة.

mass of anhydrous salt in the sample = 1 gram

mass of water in the sample = 1.4 − 1 = .4 gram.

$$\text{water \%} = \frac{.4}{1.4} * 100\% = \frac{4}{14}$$

assume 1 mole s-

$$\frac{4}{14} = \frac{N * 18}{N * 18 + 90}$$

$$252 N = 72 N + 360$$

$$180 N = 360 \Rightarrow \boxed{N = 2}$$

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T SHEET

Student Name

Instructor Nam

Partner Name

Student No. : ____________________

Section No.: 8-11. اربعاء

Date : 11/3/2009

Data

	Trial I	Trial II	
(I) Preparation of $Ba_3(PO_4)_2$			
Unknown number	60		
1. Mass of mixture	1g.		g
2. Mass of Filter paper + $Ba_3(PO_4)_2$	63.28		g
3. Mass of filter Paper	63		g
4. Mass of $Ba_3(PO_4)_2$	0.28		g
(II) Determination of Liming reactant			
1. Limiting reactan in salt mixture	$BaCl_2.2H_2O$		
2. Excess reactant in salt mixture	$Na_3PO_4.12H_2O$		
Calculations			
1. Mass of $Ba_3(PO_4)_2$	0.28		g
2. Moles $Ba_3(PO_4)_2$: (FM = 602.2 g/mol)	4.65×10^{-4}		mol
3. Moles $BaCl_2.2H_2O$; (FM = 244.2g/mol)	1.39×10^{-3}		mol
4. Mass of $BaCl_2.2H_2O$ reacted	0.34		g
5. Moles $Na_3PO_4.12H_2O$; (FM = 380.2 g/mol)	9.3×10^{-4}		mol
6. Mass of $Na_3PO_4.12H_2O$ reacted	.354		g
7. Mass of salt mixture	1.00		g
8. Mass of excess reactant	1.00 - 0.34 =	0.66 g.	
9. % of $BaCl_2.2H_2O$ in the mixture	0.34 * 100% =	34%	
10. % of $Na_3PO_4.12H_2O$ in the mixture	0.66 * 100% =	66%	

Show your calculations on a separate paper.

$$\frac{\text{moles } Ba_3(PO_4)_2}{\text{moles } BaCl_2.2H_2O} = \frac{1}{3} = \frac{4.65 * 10^{-4}}{X}$$

$X = 1.39 * 10^{-3}$ (moles of $BaCl_2 . 2H_2O$).

mass of $BaCl_2 . 2H_2O$ = $1.39 \times 10^{-3} * 244.2$ = 0.34 g

---

moles of $Na_3PO_4 . 12H_2O$ = $2 \times 4.65 * 10^{-4}$ = $9.3 * 10^{-4}$ moles.

mass " " = $9.3 * 10^{-4} * 380.2$ = 0.354 g.

---

mass of excess reactant = 1 - 0.34 = 0.66 g

% of $BaCl_2 . 2H_2O$ = 0.34 * 100 % = 34 %

% of $Na_3PO_4 . 12H_2O$ = 0.66 * 100 % = 66 %

POST-LABORATORY QUESTIONS

1. If the solubility of $Ba_3(PO_4)_2$ is 8.62 X 10^{-7} mol. L^{-1}, Calculate the number of moles and mass of $Ba_3(PO_4)_2$ that dissolve in 20 mL of solution.

moles = $8.62 \times 10^{-7} \times 20 \times 10^{-3} = 1.7 \times 10^{-8}$ mole

1.5

2. What is the effect of heating the solution on the particle size of $Ba_3(PO_4)_2$ precipitate?

co-agulation (the particle will be bigger).

3. Describe the effect of each of the following factors (whether increase, decrease, or has no effect) on the actual yield of $Ba_3(PO_4)_2$

   a. Using a coarse filter paper instead of one with fine porosity.

   less percent yield.

   b. Insufficient washing of the precipitate.

   more percent yield.

   c. If the precipitate is washed with an acidic solution.

   d. If the preciptate was not dried completely. more actual yield.

   less percent yield

$Ba_3(PO_4)_2 \xrightarrow{HA} BaA_2 + H_3PO_4$

Lab Instructor ____________________________

____________ Lab Bench ______________

(2

Prelab assignment: Experiment (4)

LIMITING REACTANT

1. A 25.00 g sample of $Na_3PO_4.12H_2O$ reacts with excess $BaCl_2.H_2O$. If the mass of $Ba_3(PO_4)_2$ obtained is 17.56 g. Calculate the % yield of $Ba_3(PO_4)_2$?

$2Na_3PO_4.12H_2O + 3BaCl_2.2H_2O \rightarrow Ba_3(PO_4)_2 + 6NaCl + 3H_2O$

* $Na_3PO_4.12H_2O$ moles = $\frac{25}{380.2}$ = 0.06575

moles ∈[$\frac{Na_3PO_4.12H_2O}{Ba_3(PO_4)_2} = \frac{2}{1} = \frac{.06575}{X} \Rightarrow X = .03287$ mole

grams = 19.8 → percent yield = $\frac{17.65}{19.8} * 100\% =$ **89.1 %**

2. A 1.68 g sample of $BaCl_2.2H_2O$ and a 2.90 g sample of $Na_3PO_4.12H_2O$ were dissolved in 1 L of distilled water. Calculate the mass of $Ba_3(PO_4)_2$ produced?

* $BaCl_2.2H_2O$ moles = $\frac{1.68}{244.2} = 6.88 * 10^{-3}$ mole → Limiting

* $Na_3PO_4.12H_2O$ moles = $\frac{2.9}{380.2} = 7.62 * 10^{-3}$ mole

moles $\frac{BaCl_2.2H_2O}{Ba_3(PO_4)_2} = \frac{3}{1} = \frac{6.88 * 10^{-3}}{X}$

$X = 2.3 * 10^{-3}$ mole

mass = $2.3 * 10^{-3} * 602.2 = 1.38506$ gram.

Name Lab. Instructor . د. منذر

ID No. 532265 Date 11/3/2009 Lab Bench صفحة ٧٨

prelab assignment Exp. (4).

LIMITING REACTANT

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1) A 25.00 g sample of $Na_3PO_4 \cdot 12H_2O$ react with excess $BaCl_2 \cdot H_2O$ If the mass of $Ba_3(PO_4)_2$ obtained is 17.56 g. Calculate the % yield of $Ba_3(PO_4)_2$?

Actual yield = 17.56 g.

$$2Na_3PO_4 \cdot 12H_2O + 3BaCl_2 \cdot 2H_2O \rightarrow Ba_3(PO_4)_2 + 6NaCl + 3H_2O$$

$$\text{mol } PO_4^{-2} = \frac{25\,g}{380.2\,g} = 0.0657 \text{ mol}.$$

$$\text{" } Ba^{+2} = \frac{205}{244.2} = 0.1023 \text{ mol}.$$

$$\frac{0.0657}{2} = 3.3 \times 10^{-2} \text{ mole } Ba_3(PO_4)_2$$

$$\Rightarrow 3.3 \times 10^{-2} \times 605.2 = 19.74\,g.$$

$$\%\ \text{Yield} = \frac{\text{Actual}}{\text{thea}} \times 100\% = \frac{17.56}{19.74} \times 100\% = 88.9\%$$

Lab Instructor ______________________

__________ Lab Bench ____________

2

Prelab assignment: Experiment (4)

LIMITING REACTANT

1. A 25.00 g sample of $Na_3PO_4.12H_2O$ reacts with excess $BaCl_2.H_2O$. If the mass of $Ba_3(PO_4)_2$ obtained is 17.56 g. Calculate the % yield of $Ba_3(PO_4)_2$?

~~moles of $Ba_3(PO_4)_2$ = 17.56~~

~~$Ba_3(PO_4)_2$~~ $2Na_3PO_4.12H_2O$ $3BaCl_2.H_2O$ $\rightleftharpoons Ba_3(PO_4)_2 + 6NaCl + 30 H_2O$

moles of $Na_3PO_4.12H_2O = \frac{25}{380.2} = 0.065775$

moles $\frac{Na_3PO_4.12H_2O}{Ba_3(PO_4)_2} = \frac{2}{1} = \frac{0.065775}{X} \Rightarrow X = 0.0328$ mole.

grams = 19.8 ⟹ Percent yield = $\frac{17.65}{19.8} * 100\% = 89.1\%$.

2. A 1.68 g sample of $BaCl_2.2H_2O$ and a 2.90 g sample of $Na_3PO_4.12H_2O$ were dissolved in 1 L of distilled water. Calculate the mass of $Ba_3(PO_4)_2$ produced?

أزعبت

المحدد ←

$BaCl_2.2H_2O$ moles $= \frac{1.68}{244.2} = 6.88 * 10^{-3}$ mole

* $Na_3PO_4.12H_2O$ moles $= \frac{2.9}{380.2} = 7.62 * 10^{-3}$ mole

moles of $\frac{BaCl_2.2H_2O}{Ba_3(PO_4)_2} = \frac{3}{1} = \frac{6.88 * 10^{-3}}{X}$

$X = 2.3 * 10^{-3}$ mole

mass $= 2.3 * 10^{-3} * 602.2 = 1.38506$ gram.

Lab Instructor م. منار القيسي

Lab Bench 11

Prelab assignment: Experiment (5)

MOLAR MASS OF A VOLATILE LIQUID

1) For which of the following compounds can we determine the molar mass using the method described in this experiment? Give reasons. Benzene (b.p. 78°C), Glycerol (b.p. 180°C).

Benzene, because the boiling point of Benzene (78c°) is less than the boiling point of water (100c°) which will make the Benzene vaporize First allowing us to measure it's mass accuratly, then we will be able to determinate it's molar mass.

2

Lab Instructor ________________________

________________ Lab Bench ______________

Prelab assignment: Experiment (5)

MOLAR MASS OF A VOLATILE LIQUID

1) For which of the following compounds can we determine the molar mass using the method described in this experiment? Give reasons. Benzene (b.p. 78°C), Glycerol (b.p. 180°C).

Benzene we can determine the molar mass because his boiling point less than Boiling point of water Glycerol we cant determine because his boiling Poing bigger than the boiling Point of water

2

Lab Instructor م. عذراء

18 /3/2007 Lab Bench

Prelab assignment: Experiment (5)

MOLAR MASS OF A VOLATILE LIQUID

1) For which of the following compounds can we determine the molar mass using the method described in this experiment? Give reasons. Benzene (b.p. 78°C), Glycerol (b.p. 180°C).

Benzene, because the boiling point of Benzene 78C is less than the boiling point of water 100, which will make the Benzene vaporize first allowing us to measure it's mass accurately. then we will be able to determine it's molar mass.

2

REPORT SHEET

Student Name :

Instructor Name :

Partner Name :

Student No. : ______________

Section No.: [illegible]

Date : 18/3/2009

DATA AND CALCULATIONS:

		Trial I (11)	Trial II
1.	Mass of empty Erlenmeyer flask + Aluminum foil (8x8 cm) + Wire (g)	unknown. 78.24 g	
2.	Temperature of boiling water (K)	95C° ⇒ 368 K.	
3.	Atmospheric pressure (atm)	764 torr ⇒ 1.00562	
4.	Mass of Erlenmeyer flask + condensed vapor + aluminum foil (8x8 cm) + wire (g)	79.25g	
5.	Volume of Erlenmeyer flask (L)	145ml ⇒ 0.145L	
6.	Mass of condensed vapor (g)	79.25 - 78.24 = 1.01g	
7.	Molar mass of the liquid, calculated	209 g/mol	
8.	Average molar mass		

Note: *A more accurate calculation of the molar mass uses a corrected mass for the vapor which takes into consideration the mass of air displaced by vapor at room temperature.*

Sample calculation for Trial I:

Calculation

$P = 764$ torr [1 atm = 760 torr = 760 mmHg].

✓ $\Rightarrow P = \frac{764}{760} = 1.00526$ atm

$\Rightarrow V = 145$ mL. /1000.

✓ $\Rightarrow V = 0.145$ L

✓ $R = 0.082$ atm. L. K^{-1}. mol^{-1}.

✓ $T = 95$ C° + 273.

$\Rightarrow T = 368$ K

✓ mass of volitile $= 79.25 - 78.24$ g $= 1.01$ g.

$$\text{molar mass} = \frac{m R T}{P V} = \frac{(1.01)(0.082)(368)}{(1.005)(0.145)}$$

$= 209$ g/mol

POST-LABORATORY QUESTION

1) A cylinder contains compressed hydrogen gas and the mass of the hydrogen is 20.0 g. What mass of oxygen would be contained in an identical cylinder at the same temperature and pressure ?

Moles H = moles O $PV = nRT$

moles H_2 = $\frac{20}{2}$ = 10 mole = moles O_2

mass O_2 = 10 * 32 = 320 gram.

REPORT SHEET

Student Name :
Instructor Name :
Partner Name :

Student No. :
Section No.: 8-11 الاربعاء
Date : 1/4/2009

A. Standarization of NaOH solution

	Trial 1	Trial 2
Mass of KHP(g)	.40	.42
Moles of KHP (Molar mass of KHP = 204.23 g/mol)	1.95 × 10^{-3}	2.05 × 10^{-3}
Intial reading of NaOH buret	0.0	9.3
Final reading of NaOH buret	9.3	19.3
Volume of NaOH used (mL)	9.3	10
Moles of NaOH used	1.95 × 10^{-3}	2.05 × 10^{-3}
Molarity of NaOH (mol/L)	0.2096 mol/L	0.205
Average molarity of NaOH (mol/L)	0.2073	

unknown 14

B. Titrating an unknown solution of sulfuric acid

	Trial 1	Trial 2
Volume of H_2SO_4 solution used (mL)	5ml	5ml
Intial reading of NaOH buret	19.3	34.1
Final reading of NaOH buret	34.1	47.5
Volume of NaOH used (mL)	14.6	13.4
Average molarity of NaOH (mol/L)	0.2073	0.2073
Moles of NaOH used	3.02 × 10^{-3}	2.77 × 10^{-3}
Moles of H_2SO_4	1.51 × 10^{-3}	1.385 × 10^{-3}
Molarity of H_2SO_4 (mol/L)	0.302	0.277
Average molarity of H_2SO_4 (mol/L)	0.2895	

Show your calculation for trial 1 in part A and part B:-

Part A :-

① moles of KHP = $\frac{\text{mass of KHP}}{\text{Molar mass} = 204.23} = \frac{0.4}{204.23}$ = $1.95 * 10^{-3}$ moles

Trial ② = $\frac{0.42}{204.23}$ = $2.05 * 10^{-3}$ moles.

moles of NaOH = moles of KHP.

→ Trial ① moles of NaOH = $1.95 * 10^{-3}$ moles.
" ② " " KHP = $2.05 * 10^{-3}$ ".

② molarity mass of (NaOH) = $\frac{\text{moles}}{\text{Volume (L)}}$

Trial ①. = $\frac{1.95 * 10^{-3}}{9.3 * 10^{-3}}$ = 0.2096. mol/L

" ② = $\frac{2.05 \times 10^{-3}}{10 * 10^{-3}}$ = 0.205 mol/L

⇒ Average molarity, = $\frac{0.2096 + 0.205}{2}$ = 0.2073 mol/L

Part B.

① Average molarity of NaOH = Trial ① 0.2073 Trial ② 0.2073 mol/L

Mols of NaOH used = Molarity * Volume

Trial. ①. mols of NaOH = 0.2073 * 14.6 E-3 = 3.02 E-3
" ②. " " " = 0.2073 * 13.4 E-3 = 2.77 E-3 mols

② Moles of H_2SO_4 = $\frac{1}{2}$ mols of NaOH

trial ① mols of H_2SO_4 = 3.02 E-3/2 = 1.51 E-3 mols.
" ② " " H_2SO_4 = 2.77 E-3/2 = 1.387 E-3

③ molarity of H_2SO_4 = $\frac{\text{mols}}{\text{Volume}}$ = Trial ①. $\frac{1.51}{5}$ = 0.302 mol/L Trial ②. $\frac{1.387}{5}$ = 0.277 mol/L

Average molarity of H_2SO_4 = $\frac{0.302 + 0.277}{2}$

= 0.2895 mol/L

Lab Instructor م. هناء القيسي

Lab Bench ______________

Prelab assignment: Experiment (6)

ACID – BASE TITRATIONS

1) In a titration of NaOH against HCl, 26.12 mL of 0.1624 M NaOH was used to neutralise 0.1438 M HCl. What volum of HCl was neutralised?

Moles NaOH = Moles Hcl

Moles NaoH = $26.12 * 10^{-3} * .1624 = 4.241886 * 10^{-3}$ mole

Moles HCl = $4.241886 * 10^{-3} = .1438 *$ Volume

volume = .029498 L = 29.49498 mL

12

T SHEET

16.5

Student No. :

Instructor Name : د. نزار

Section No.: الاربعاء 8-11

Partner Name :

Date : 8/4/2009

Part A: Determination of the heat of solution of NaOH (ΔH_1)

	Data	**Trial I**	**Trial II**
1.	Volume of water	100 mL	
2.	Mass of water	100 g	
3.	Mass of NaOH	2.05 g.	
4.	Molar mass of NaOH	40.0g/mol	
5.	Moles of NaOH	0.05125	moles
6.	Mass of solution	102	
7.	Initial temperature	18 C°	
8.	Final temperature	23 C°	
9.	ΔH_1 of solution	(exotherm) −2131.6 J ⇒	$\Delta H = \frac{2131.6 \times 10^{-3}}{(0.05125)}$
10.	Average ΔH_1		= 0.0416 KJ/mol

ΔH =

Part B: Determination of the heat of reaction of NaOH with HCl (ΔH_2) and the heat of neutralization (ΔH_n)

2

	Data	**Trial I**	**Trial II**
1.	Volume of HCl solution	100 ml	
2.	Mass of HCl solution	100 g	
3.	Mass of NaOH	2.1 g	
4.	Molar mass of NaOH	40.0 g/mol	
5.	Moles of NaOH reacted	0.0525	Moles
6.	Mass of solution	102 g	
7.	Initial temperature	18 C°	
8.	Final temperature	30 C°	
9.	ΔH_2 of solution	−5116.32 J ⇒	$= \frac{5116.32 \times 10^{-3}}{0.0525} = 0.0975$ kJ/mole
10.	Heat of neutralization ($\Delta H_2 - \Delta H_1$)	−0.0558	kJ/mole
11.	Average heat of neutralization		

unknown MM = 101.1 g/mol

Part C: Determination of the heat of solution of an unknown salt:

	Data	Trial I	Trial II
1.	Volume of water	100 Ml	
2.	Mass of water	100 g	
3.	Mass of unknown salt	3 g	
4.	Initial temperature	18 C°	
5.	Final temperature	26 C°	
6.	ΔH of solution	-4.18 * 8 * 103 = -3444.32 J	
7.	Average ΔH	=> -115.97 KJ/mol	

Moles of unknown = 0.0297

Show your calculation for Trial I:

Part (A)

mass of water = V * d = 100 mL * 1 = 100 g

moles of NaOH = $\frac{2.05}{40}$ = 0.05125 mole.

Total mass of solution = mass of water + mass of NaOH
= 100 + 2 = 102 g.

ΔH₁ = Specific Heat * ΔT * Total mass.
= 4.18 * (23 - 18) * 102 = -2131.6 J
(ex0.)

=> ΔH = $\frac{2131.6 * 10^{-3}}{0.05125}$ = 0.0416 kJ/mol

Part (B).

ΔH = 4.18 * (30 - 13) * 102 = -5116.32 J
(ex0.)

=> ΔH = $\frac{5166.32 * 10^{-3}}{0.0525}$ = 0.0955 KJ/mol.

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PRELABORATORY ASSIGNMENT - EXPERIMENT 9

COLLIGATIVE PROPERTIES : MOLAR MASS DETERMINATION

NA[redacted] DATE 24/3 LAB SEC. 6 DESK NO. 11

1. Students prepared two cyclohexane solutions having the same mass of solute. However Student 1 used 13 g of cyclohexane, Student 2 used 15 g. Which student will observe the larger freezing point change ? Explain.

student 1 ; because $\Delta T_f = K_f\, m$ and $m = \frac{\text{moles (solute)}}{\text{mass solvent}}$ → equal for both solutions → The less, The more of m and the more of ΔT_f.

2. A 0.597 g sample of a non-electrolyte dissolves in 20.0g of cyclohexane. The freezing point depression is 3.62 °C. What is the molar mass of the non-electrolyte?
(K_f for Cyclohexane is 20.0 °C Kg/mol).

$\Delta T_f = K_f * m$

$3.62 = 20 * m \Rightarrow m = 0.181$ mol/kg

$m = \frac{\text{moles}}{\text{mass solvent (kg)}} \Rightarrow .181 = \frac{\text{moles}}{20 * 10^{-3}}$

$\text{moles} = 3.62 * 10^{-3} \rightarrow \text{moles} = \frac{\text{mass}}{\text{molar mass}}$

$\text{molar mass} = \frac{\text{mass}}{\text{moles}} = \frac{0.597}{3.62 * 10^{-3}} = 164.9$ g/mole.

REPORT SHEET - EXPERIMENT 9

COLLIGATIVE PROPERTIES : MOLAR MASS DETERMINATION

LAB SEC. 6 DATE 24/3/20.. DESK NO. ______

Unknown Number 39

DATA

A. **Freezing Point of Cyclohexane**

1.	Mass of test tube + cyclohexane (g)	209.64 g
2.	Mass of test tube (g)	198.74 g
3.	Mass of cyclohexane (g)	10.9 g
4.	Freezing point, from cooling curve(°C)	6 C°

B.	**Freezing Point of a Solvent-Unknown Solute**	**Trial 1**	**Trial 2**
1.	Mass of test tube + cyclohexane (g)	209.64 g	
2.	Mass of cyclohexane (g)	10.9 g	
3.	Mass of solute (g)	0.22 g	
4.	Freezing point, from cooling curve (°C)	4.5 °C	
5.	Instructor's Approval of Graphs		

CALCULATIONS

1.	Freezing point constant, K_f, of cyclohexane	20.0° C.kg/mol
2.	Freezing point change, ΔT_f (C°)	6°C - 4.5°C = 1.5°C
3.	Mass of solute in solution (g)	0.22 g
4.	Mass of cyclohexane in solution (kg)	10.9 g
5.	Molar mass (g/mol)	269.113 g/mol
6.	Average molar mass (g/mol)	

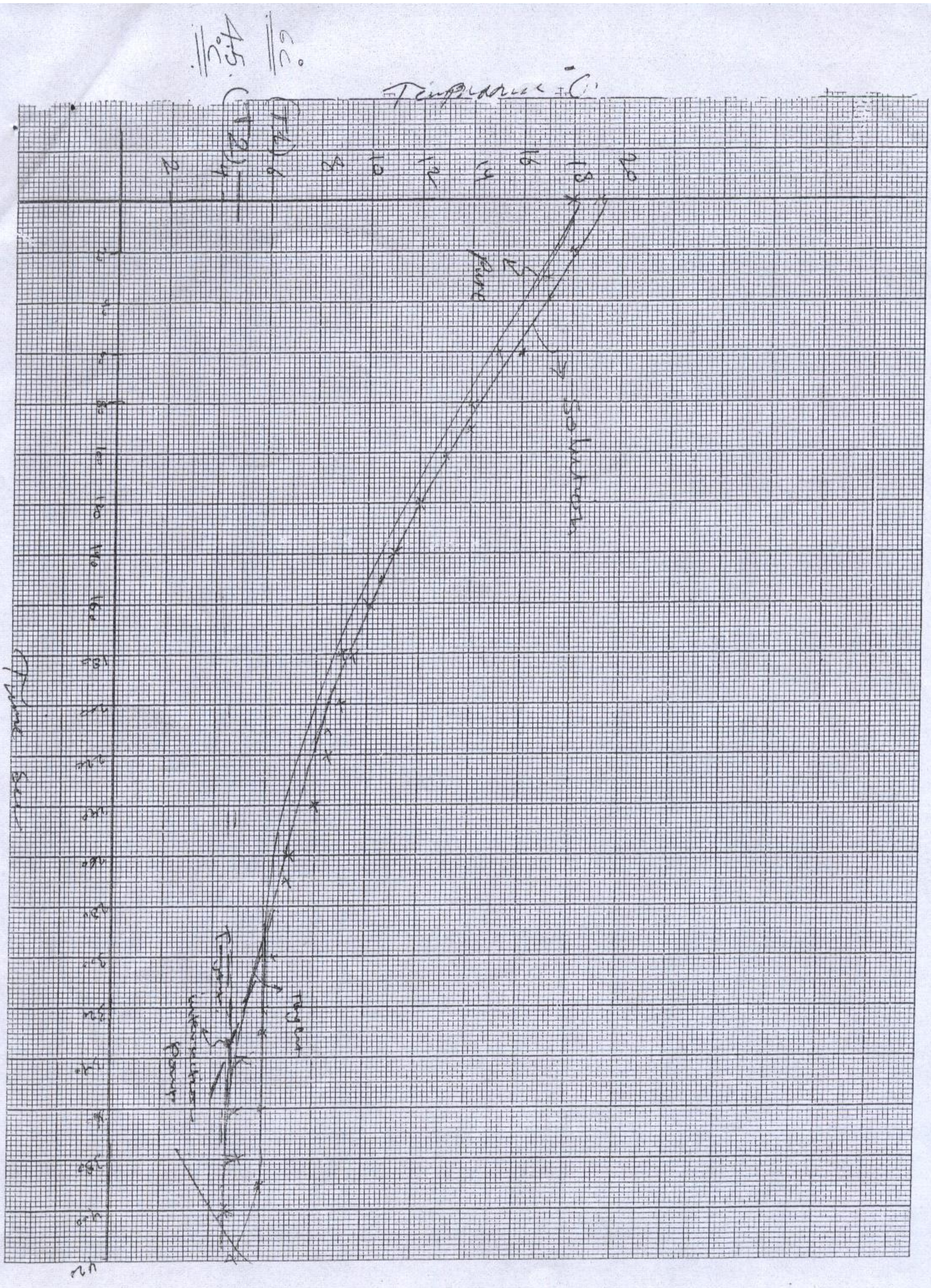
$$\text{Molar mass} = \frac{K_f \cdot \text{mass (solute)}}{\Delta T_f \cdot \text{kg}_{\text{solvent}}} = \frac{20 \times 0.22}{1.5 \times 10.9 \times 10^{-3}}$$

$$= 269.113 \text{ g/mol}$$

i = 1 ; No of ions for tested material.

DATA FOR COOLING CURVES					
PART A (SOLVENT)		PART B (SOLUTION)			
Trial 1		Trial 1		Trial 2	
Time(second)	Temp.	Time	Temp.	Time	Temp.
0	8	0	19	0	
30	17	20	18	20	
60	16	40	17	40	
90	14	60	15	60	
120	12	80	14	80	
150	10.5	100	13	100	
180	9	120	12	120	
210	8.5	140	11	140	
240	8	160	10	160	
270	7	180	9.5	180	
300	6.5	200	9.	200	
330	6	220	8.5	220	
360	6	240	8	240	
390	6	260	7	260	
420	6	280	6.5	280	
450	6	300	6	300	
480		320	6	320	
510		340	5.5	340	
540		360	5	360	
570		380	5	380	
600		400	4.5	400	
630		420		420	
660		440		440	

➢ If needed, continue recording your data on separate sheets of papers and submit them with your Lab Report.



Temperature °C
T1
T2
Pure
Solution
Time (Sec)
Tangent

POST-LABORATORY QUESTIONS:

1. If the solution's freezing point is erroneously read 0.2°C lower than it should be, will the unknown's calculated molar mass be too high or too low ? Explain!

If $T_{solution}$ < 0.2°C from Real Temperature
$\uparrow \Delta T_f = T_{solvent} - T_{solution} \downarrow \Rightarrow \Delta T_f \uparrow \Leftrightarrow M_t \downarrow$

2. How will the freezing point change of cyclohexane be affected (compared with the freezing point change by a non-volatile, non-associating and non-dissociating solute) by:

i = 1. A + B → AB A → A

(a) a non-volatile solute that dissociates ? Explain.

$A_{(s)} \rightarrow B + C + D$ but $\Delta T_f = i\, K_f . m$
i = 1 i > 1
ΔT_f will increase.

(b) two solutes that react according to the equation,

A + B ⟶ C ? Explain!
i = 2 i = 1

i ↓ but ⇒ $\Delta T_f = i\, K_f . m$

ΔT_f ↓ decrease

3. If some solute adheres to the test tube's wall in Part B.1, is the freezing point change greater or less than it should be? Explain!

ΔT_f ↓ decrease because mass ↓ because
($\Delta T_f \propto$ mass)
$\Delta T_f = i\, K_f . m$