NAME:	CLASS::

EXPERIMENT 2
ACID-BASE TITRATION - DETERMINATION OF THE CONCENTRATION OF HYDROCHLORIC ACID SOLUTION

Course Learning Outcome:

Solve chemistry related problems by applying basic concepts and principles in physical chemistry. (C4, PLO4, CTPS3, MQF LO6)

Learning Outcomes:

At the end of this lesson, students will be able:

i. To define molarity and standard solution
ii. To state the use of standard solution
iii. To describe the preparation of a standard solution of oxalic acid
iv. To differentiate between end point and equivalnce point.
v. To explain the precautions required during titration
vi. To calculate the concentration of HCl solution in an acid-base titration

Student-Learning Time:

Face-to-face	Non face-to-face
1 hour	1 hour

Direction: Read over the lab manual and then answer the following question.

Instruction:

1) **Read over the lab manual and then answer the following question.**
2) **Drag and drop the answer for the questions below.**
3) **Choose the multiple-choice question of Data Analysis.**
4) **Click FINISH when you already done and print screen your result and share into the telegram class/ google classroom.**

Introduction

1. Define molarity.

   _____ is the number of moles of solute per litre of solution.

2. What is a standard solution? State the use of a standard solution.

   A _____ is a solution of accurately known concentration of an element or a substance.

A standard solution is used to determine the concentration (_____) of the other substances such as solution in titration.

3. What is the difference between end point and equivalence point?

_____ is the point at which the indicator changes colour.

_____ is the point at which exact reaction occurs between the two reagents according to stoichiometry.

Procedure

1. State three precautions that must be taken during titration to ensure the accuracy of results. State a reason for each precaution.

i. To ensure the accuracy of burette reading, take the bottom of the meniscus that alligns with the calibration mark at eye level as the reading.

ii. Ensure there are no _____ in the burette tip. This is because the presence of air bubbles will affect the _____ used in the titration.

iii. Upon reaching the_____, titrate slowly until a _____ colour persist for more than 30 seconds. This is to ensure the accurate burette reading is recorded at the end point.

2. Briefly describe how to prepare 250 mL standard solution of hydrated oxalic acid ($C_2H_2O_4.2H_2O$) with a concentration of 0.25 M.

Moles of hydrated oxalic acid, $C2H2O4.2H2O$ $= MV$

$= (0.25)(250 \times 10^{-3})$

$= \_\_\_\_\_$

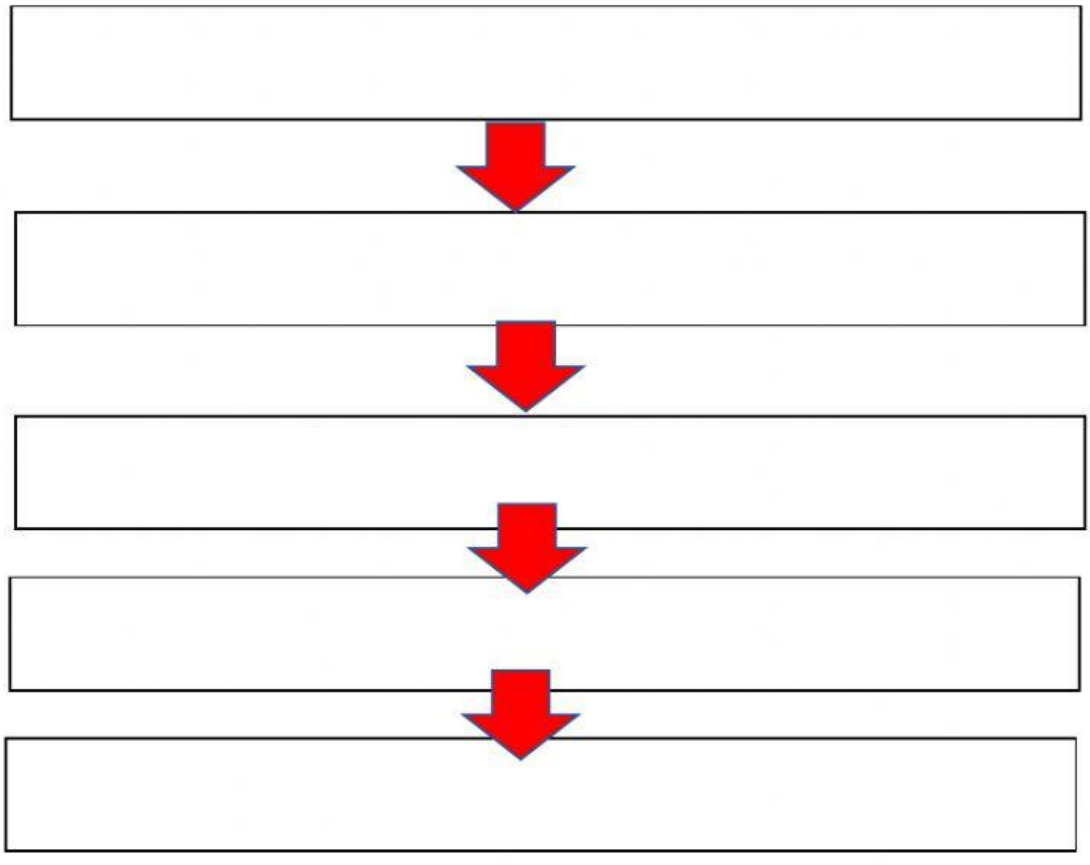
$mass_{C2H2O4.2H2O}$ $=$ moles $\times$ molar mass

$= 6.25 \times 10^{-2} \times 126$

$= \_\_\_\_\_$

Drag and drop the steps how to prepare 250 mL standard solution of hydrated oxalic acid with a concentration of 0.25 M.

Transfer the solution into a 250 mL volumetric flask. Rinse the beaker and pour the content into the flask.
Stopper and shake the flask to obtain a homogenous solution.
Weigh 7.8750 g of hydrated oxalic acid ($C_2H_2O_4.2H_2O$) in a 50 mL beaker.
Add distilled water up to the calibrated mark of the volumetric flask.
Add approximately 30 mL of distilled water to dissolve the oxalic acid.



3. How to determine the end point of the titration?
The end point is reached when the _____ colour appears and persists for more than _____.

Experiment 2 : Data Analysis

A titration of 25.00 mL of an *x* M HCl solution with 0.15 M NaOH starts at a burette reading for NaOH of 0.20 mL. The burette reading of the end point is 24.10 mL.

i. What was the volume of NaOH dispensed?

$V_{NaOH} = 24.10\ mL - 0.20\ mL =$ _____

ii. Calculate the number of moles of NaOH dispensed.

$$\text{Moles of NaOH} = MV$$
$$= (0.15)(23.90 \times 10^{-3})$$
$$=$$ _____

iii. Write the balanced equation for the neutralisation reaction.

iv. Calculate the number of moles of HCl present in the acid solution.

$$1\ \text{mol NaOH} \equiv 1\ \text{mol HCl}$$
$$3.585 \times 10^{-3}\ \text{mol NaOH} \equiv$$ _____ **HCl**

v. Determine the value of *x*.

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{volume of solution(L)}}$$

$$= \frac{3.585 \times 10^{-3}}{25.00 \times 10^{-3}}$$

$$= \_\_\_\_\_$$