

Year 12 Chemistry
Lawrence



Task Number: 2
Weight: 30%

Notification Date: Monday 06/11/2023
Due Date: By 3.20pm Friday 21/06/2024 Week 8 Term 2 to Mrs Lawrence

Titration Practical Task

OUTCOMES ASSESSED

- CH11/12-1** develops and evaluates questions and hypotheses for scientific investigation
CH11/12-3 conducts investigations to collect valid and reliable primary and secondary data and information
CH11/12-4 selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media
CH11/12-5 analyses and evaluates primary and secondary data and information
CH11/12-6 solves scientific problems using primary and secondary data, critical thinking skills and scientific processes
CH11/12-7 communicates scientific understanding using suitable language and terminology for a specific audience or purpose
CH12-13 describes, explains and quantitatively analyses acids and bases using contemporary models
CH12-14 analyses the structure of, and predicts reactions involving, carbon compounds

TASK DESCRIPTION

PRACTICAL TASK: Titration

Students will:

- conduct background research to provide information regarding chemical nature and properties of acetic acid and acid-base indicators
- conduct background research to outline the processes associated with titration, including specific glassware and rinsing techniques
- conduct a titration to standardise NaOH solution against a known concentration of HCl
- use the known concentration of NaOH to conduct a second titration to calculate the concentration of an unknown sample of acetic acid
- provide a tabulated data set of concordant values, including average titres
- provide titration curves for both titrations

TASK INSTRUCTIONS

- You will be given 6 hours of class time to conduct primary and secondary source research during Week 6 and Week 7, Term 2 2024.
- Support videos are available on the RACI Titration competition website:
https://raci.org.au/RACI/Web/Schools/Titration_Compensation.aspx?hkey=b2aacfe5-a142-4145-b257-84db91969666
- Students can access YouTube channel for tutorials:
https://www.youtube.com/playlist?list=PLH1M6iHMmRI5zjh5uCR9pk_SUSxW_ag9B
- Findings must be original in wording and presented according to the formatting conventions of a scientific research report.
- Secondary sources should be cited within the report and listed using the Harvard Referencing style.
- Tasks are to be printed and submitted in hardcopy to Mrs Lawrence by the due date.

Teacher's signature: _____

Mrs A Lawrence

HT Admin signature: _____

Ms M Eagles

Deputy Principal's signature: _____

Mrs A Lawrence

MARKING RUBRIC

Section	Criteria	Possible Marks	Your Mark
Introduction CH12-7	<ul style="list-style-type: none"> Communicates scientific understanding of the importance of titration as a diagnostic technique Gives examples of applications of titration within industrialised processes 	5	
Background Research: The Nature of Acetic Acid CH12-14	<ul style="list-style-type: none"> Describes the chemical nature and properties of acetic acid, including a structural diagram of acetic acid and acetate ions (5) Explains the classification of acetic acid as a weak acid, including percentage ionisation (3) Models neutralisation of strong and weak acids (4) Label a generalised titration curve (3) Compares and contrasts titration curves of NaOH against HCl and acetic acid (5) 	20	
Background Research: Performing Titrations – Best Practice Techniques CH12-13	<ul style="list-style-type: none"> Provides diagrams of specific glassware to be used in titrations (4) Outlines and justifies rinsing techniques required in preparing for titrations (5) Justifies choices of acid-base indicators for use at equivalence points that are acidic, neutral and basic (6) 	15	
Primary Investigation Planning CH12-1	<ul style="list-style-type: none"> Develops primary investigation question (1) Develops an appropriate aim linking independent and dependent variables (2) Proposes a justified hypothesis regarding investigation outcomes (2) Prepares a risk assessment table and proposed precautions to mitigate risks (4) 	9	
Observed Titration Technique CH12-3	<ul style="list-style-type: none"> Accurately follows prescribed methods to conduct titrations (4) Correctly performs rinsing of all glassware (4) Accurately utilises burette to perform titrations (2) Correctly reads meniscus to collect and record data (1) 	11	
Titration: Standardisation of NaOH CH12-4	<ul style="list-style-type: none"> Tabulated results, including initial, final and dispensed volumes across multiple trials (6) Concordant data set (3) Average titre calculated (1) Writes word equation (1) Writes chemical equation (1) Correctly calculates moles of HCl used (3) Applies stoichiometry from equation (2) Correctly calculates the concentration of NaOH (3) 	20	
Titration: Calculating the Concentration of Acetic Acid CH12-6	<ul style="list-style-type: none"> Tabulated results, including initial, final and dispensed volumes across multiple trials (6) Concordant data set (3) Average titre calculated (1) Writes word equation (1) Writes chemical equation (1) Correctly calculates moles of NaOH used (3) Applies stoichiometry from equation (2) Correctly calculates the concentration of acetic acid (3) 	20	

Section	Criteria	Possible Marks	Your Mark
Secondary Source Analysis CH11/12-4	<ul style="list-style-type: none"> selects a variety of relevant, up to date, valid, and reliable data (5) uses collected data to construct valid, reliable and informed scientific report (5) 	10	
Primary Investigation Discussion CH12-5	<ul style="list-style-type: none"> reflects on their experimental results for the concentration of acetic acid content in contrast with the theoretical values in background research (2) describes sources of error and how they could be reduced to improve experimental accuracy (2) assesses role of neutralisation in performing titrations analysis method prescribed (3) evaluates the appropriateness of the use of conductivity graphs to perform titrations (3) 	10	
Secondary Source Analysis CH11/12-4	<ul style="list-style-type: none"> selects a variety of relevant, up to date, valid, and reliable data (5) uses collected data to construct valid, reliable and informed scientific report (5) 	10	
Reference List and Citations CH11/12-7	<ul style="list-style-type: none"> uses language that is clear and precise including accurate relevant scientific terminology and information (4) provides effective, clear and concise annotations on diagrams and tables (3) information correctly cited throughout the report (3) provides an accurate reference list using the Harvard referencing style (5) 	15	

Additional Feedback:

Teacher signature: _____ Date: _____

Task Mark	Task Rank	Cumulative Rank
/145		

Titration Practical Task: Prescribed Method

APPARATUS:

- 1 x 500 mL bottle each of approx.
- 0.1 mol/L HCl and 0.1 mol/L CH₃COOH (acetic acid)
- 1 x 1000 mL bottle of 0.1 mol/L NaOH
- 1 x bottle phenolphthalein
- 2 x Pasteur pipettes
- 1 x wash bottle and supply of deionised water
- 2 x 25 mL volumetric pipettes and bulbs
- 1 x 50 mL burette, retort stands and clamps
- 6 x 250 mL conical flasks
- 3 x 250 mL beakers
- 1 x funnel for filling burettes
- 1 x white sheets of paper or white tiles

PART A: Titrating NaOH with standardised HCl

1. Rinse a clean 250 mL conical flask with water.
2. Rinse a clean 25.00 mL pipette with standardised HCl.
Pipette 25.00 mL of vinegar into the 250 mL conical flask.
3. Add 2 drops of phenolphthalein indicator to the vinegar.
(The solution will remain colourless)
4. Rinse a clean 50.00 mL burette with standardised 1.00 mol L⁻¹ aqueous sodium hydroxide solution.
Fill the burette with this standardised 1.00 mol L⁻¹ NaOH(aq).
5. Run NaOH(aq) from the burette into the conical flask until the solution changes colour from colourless to pink.
6. Repeat the titration carefully several times until concordant titres are achieved.

PART B: Titrating Acetic Acid with NaOH

1. Rinse a clean 250 mL conical flask with water.
2. Rinse a clean 25.00 mL pipette with vinegar.
Pipette 25.00 mL of vinegar into the 250 mL conical flask.
3. Add 2 drops of phenolphthalein indicator to the vinegar.
(The solution will remain colourless)
4. Run NaOH(aq) from the burette used in PART A into the conical flask until the solution changes colour from colourless to pink.
5. Repeat the titration carefully several times until concordant titres are achieved.