THE RIVERS SECONDARY COLLEGE
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Assessment Task Notification

RICHMOND RIVER HIGH CAMPUS

Task Number	2	**Task Name**	Depth Study
Course	12 Chemistry	**Faculty**	Science
Teacher	Ms Hinchey	**Head Teacher**	Mr Yates
Issue date	Friday 2nd February 2024	**Due date**	Tuesday 2nd April, 2024
Focus (Topic)	Acids and Bases	**Task Weighting**	30%

Outcomes

A student:

CH12-1 develops and evaluates questions and hypotheses for scientific investigation

- develop and evaluate inquiry questions and hypotheses to identify a concept that can be investigated scientifically, involving primary and secondary data
- modify questions and hypotheses to reflect new evidence

CH12-4 selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media

- derive trends, patterns and relationships in data and information
- assess error, uncertainty and limitations in data
- assess the relevance, accuracy, validity and reliability of primary and secondary data and suggest improvements to investigations

CH12-5 analyses and evaluates primary and secondary data and information

- derive trends, patterns and relationships in data and information
- assess error, uncertainty and limitations in data
- assess the relevance, accuracy, validity and reliability of primary and secondary data and suggest improvements to investigations

CH12-7 communicates scientific understanding using suitable language and terminology for a specific audience or purpose

- select and use suitable forms of digital, visual, written and/or oral communication
- select and apply appropriate scientific notations, nomenclature and scientific language to communicate in a variety of contexts
- construct evidence-based arguments and engage in peer feedback to evaluate an argument or conclusion

CH12-13 describes, explains and quantitatively analyses acids and bases using contemporary models

Task description

Overview

Acids and bases, and their reactions, are used extensively in everyday life and in the human body. The chemistry of acids and bases contributes to industrial contexts and the environment. It is essential that the degree of acidity in these situations is continually monitored.

This depth study will involve a practical investigation to determine the concentration of acetic acid in a range of commercially available vinegars. In order to accurately determine the concentration a series of standards will have to be made and titrations conducted.

Students will then compare the concentration determined experimentally with the concentration listed in available material safety data sheets for the vinegars tested. Students will use this comparison as a basis to complete a further research task as an extended discussion.

Practical investigation and scientific report – Acid/Base Titrations *(54 marks)*

Practical investigation and scientific report, including extended discussion

1) **Follow a prescribed method** to make a primary standard (solution of oxalic acid).
2) **Follow a prescribed method** to standardise a solution of sodium hydroxide.
3) **Write and follow a method** to quantitatively determine the concentration of acetic acid in vinegar solutions.
4) **Complete a formal scientific report** for the investigation. This will be formally assessed and contribute to the total grade.
5) **Inquiry question:** Complete an extended discussion as part of practical write up which is based on a focus topic.

As part of an extended discussion, you will focus on a topic of: **Quality of supermarket vinegars.**
Using the focus topic, develop inquiry questions in order to guide extended research.

Examples are shown below:

- ***Does price affect the quality of commercially available vinegars?***
- ***Do commercially available vinegars contain as much acetic acid as they should?***
- ***Does the method of production affect the amount of acetic acid in vinegar?***

You need to use the above as well as two more questions of your own.

Perform secondary sources investigation to answer questions associated with the focus topic. Clearly link the focus topic and research findings to the practical investigation performed in Part A and communicate findings.

Marking Criteria

Section of Task	Marks
<u>Research Report:</u> CH12-1, CH12-4, CH12-5, CH12-7, CH12-13	
Introduction includes:	
Definition of acids and bases as well of some common places where they are found.	0-1-2
Description of main active ingredient in Vinegar and its formula (structural and condensed)	0-1-2
Body: Quality of supermarket Vinegars	
What are the typical ingredients and ratios in supermarket vinegars?	0-1-2
Development of 2 individual inquiry questions	0-1-2
Answer all 3 inquiry questions	0-1-2-3-4-5-6
Conclusion summarizes main points from report	0-1-2
Report includes Introduction, Body and Conclusion	0-1-2
<u>Scientific Investigation</u> (Aim, Hypothesis, Method, Results, Discussion Conclusion) **CH12-4, CH12-5, CH12-7**	
Aim	
Addresses the experiment you designed and performed	0-1
Hypothesis	
Written in "if … then…" format *eg: If we change x then y will happen*	0-1-2
Method	
Risk assessment	0-1-2
Paragraph form	0-1
All necessary information for experiment	0-1-2
Results	
Tables	
Heading	0-1
Appropriate column labels	0-1
Appropriate row labels	0-1
Units listed in headings not cells	0-1
Accurate recording of data	0-1
Graphs	
Heading	0-1
Appropriate x axis label	0-1
Appropriate y axis labels	0-1
Correct units on each axis	0-1-2
Accurate recording of data	0-1
Discussion	
Describe the trends you found from performing your experiment	0-1-2
Describe how this relates to your research on vinegars	0-1-2
Identify how you could improve on this experiment	0-1-2
Conclusion	
Was your aim answered?	0-1-2
Relate back to your hypothesis	0-1-2
<u>Reference List:</u> CH12-5	
Five or more reliable sources are referenced (2*marks for 2 references, 1 mark for 2 or less*)	0-1-2-3
Sources are referenced using the correct format (*1 mark web address only*)	0-1-2
Total:	**/50**
Teacher Comment:	

Experiments – to prepare standard solutions for titrations of vinegar

RISK ASSESSMENT
To be completed individually prior to beginning practical work.

Hazard (Chemical/Physical)	What is the risk associated with the hazard?	What are the precautions put in place to control the risk?

Experiment Part 1: Preparation of an oxalic acid primary standard.

AIM
To create a 0.25M oxalic acid primary standard.

EQUIPMENT

- Oxalic acid (Lab reagent or higher grade)
- Distilled water
- Balance
- 250 mL volumetric flasks
- pipettes
- Funnel
- Wash bottle

METHOD

1. Calculate the mass of oxalic acid needed to make 250 mL of 0.25M solution.
2. Weigh out calculated mass of oxalic acid (record the exact mass).
3. Transfer the oxalic acid into a 250 mL volumetric flask.
4. Half fill the volumetric flask and swirl the mixture to dissolve the oxalic acid.
5. Carefully fill the volumetric flask so that the meniscus sits on the line.
6. Stopper the flask and invert several times to make sure that the mixture is homogenous.
7. Calculate the exact concentration of the oxalic acid standard.

Experiment Part 2: Preparation and standardisation of a sodium hydroxide solution.

AIM

To prepare a 0.5M sodium hydroxide solution. To determine the exact concentration of the solution by titrating against an oxalic acid primary standard.

EQUIPMENT

- Oxalic acid standard
- NaOH (solid)
- Distilled water
- 2L beaker
- Large measuring cylinder
- Magnetic stirrer
- Stirrer hotplate
- Reagent storage bottles
- Top loading balance
- 50 mL burette
- Burette Clamp
- Retort stand
- 25 mL Bulb pipette
- Pipette filler
- Phenolphthalein indicator
- Wash bottle

METHOD

1. Calculate the mass of NaOH needed to make 2L of 0.5M stock solution.
2. Weigh the mass required and transfer to a 2 L beaker.
3. Add a magnetic stirrer to the beaker and add 2 L of water using a measuring cylinder.
4. Mix the solution until all the NaOH is dissolved then transfer this stock solution to labelled reagent storage bottles and cap them to prevent reaction with air.
5. Rinse a 50 mL burette with distilled water 3 times, then 3 times with about 5-10 mL of NaOH stock solution (making sure to rinse entire inside including tap and tip)
6. Rinse a 25 mL bulb pipette with distilled water 3 times then with about 10 mL of oxalic acid 3 times, making sure to rinse above the line and the inside of the bulb.
7. Fill the burette with NaOH stock solution making sure there are no air bubbles present in the burette or below the tap.
8. Read the initial volume of NaOH in the burette.
9. Transfer a 25 mL aliquot of oxalic acid standard to a clean conical flask.
10. Add 3 drops of phenolphthalein to the oxalic acid.
11. Add sodium hydroxide solution to the conical flask while swirling until the pink phenolphthalein is taking a few seconds to disappear.
12. Wash down the conical flask neck and sides with distilled water.
13. Slowly add NaOH to the solution until a faint pink colour remains on mixing for at least 30s. This is the endpoint of your titration.
14. Record the final volume of NaOH in the burette.
15. Repeat steps 7-14 until 3 titrations have been achieved with volumes within 0.2 mL.

Disposal of waste

All waste may be disposed of down the sink and rinsed with excess water.

These solutions will then be used to titrate students chosen vinegars for analysis in their experiments.