Sample Assessment Task Year 12 Chemistry

Sample for implementation for Year 12 from Term 4, 2018

Context:

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. Therefore, it is essential that the degree of acidity in these situations is continually monitored. By investigating the qualitative and quantitative properties of acids and bases, students learn to appreciate the importance of factors such as pH and indicators.

Students have studied these acid/base reactions and will demonstrate their understanding and skill by carrying out an unknown titration.

Task number: 2	**Weighting:** 25%	**Timing:** 1 hour

Outcomes assessed

- designs and evaluates investigations in order to obtain primary and secondary data and information **CH11/12-2**
- conducts investigations to collect valid and reliable primary and secondary data and information **CH11/12-3**
- analyses and evaluates primary and secondary data and information **CH11/12-5**
- describes, explains and quantitatively analyses acids and bases using contemporary models **CH12-13**

Nature of the task: Titration - practical

Students will plan and carry out an unknown titration, gather data and report on that data.

Student information is attached.

Marking criteria:

Planning and conducting investigations

CH11/12-2 designs and evaluates investigations in order to obtain primary and secondary data and information

Students:

- design a dilution and titration that will lead to the collection of valid, accurate and reliable data
- plan an efficient procedure that minimises hazards and wastage of resources, including safe work practices
- plan a procedure that enables effective measurement, observation and recording of results in accessible and recognisable forms and repeat trials as appropriate

CH11/12-3 conducts investigations to collect valid and reliable primary and secondary data and information

Students:

- produce accurate dilute solutions to a specified concentration
- carry out the practical exercise efficiently and safely and clear and clean the experimental area

Analysis and evaluation of data

CH11/12-5 analyses and evaluates primary and secondary data and information

Students:

- identify and apply appropriate mathematical formulae and concepts
- assess the accuracy of any measurements and calculations and the relative importance of any data and information gathered

Knowledge and understanding

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

Students:

- use symbols and formulae accurately to express relationships and use appropriate units for physical quantities
- describe the correct technique for conducting titrations

Feedback provided:

To inform future learning your feedback will consist of:

- an annotated marking criteria sheet
- student reflection and teacher feedback sheet

Student information:

PROBLEM:
To analyse a sample of vinegar for the ethanoic acid content using a neutralisation reaction with sodium hydroxide.

EQUIPMENT PROVIDED:

- 100 mL of various brands of vinegar. The brands are in sample bottles labelled A, B, C, D and E
- 150 mL of previously standardised 0.15 mol/L sodium hydroxide solution
- distilled water
- dropper bottles of methyl orange, phenolphthalein and bromothymol blue indicators
- 25 mL pipette and bulb pipette filler
- 250 mL volumetric flask and filter funnel
- 250 mL conical flask
- 50 mL burette, retort stand, burette clamp, wash bottle
- 150 mL and 250 mL beakers
- droppers as required
- Periodic Table and Data Sheet and table of common acid-base indicators

Students may ask for other pieces of equipment, such as more flasks and beakers.

STUDENT INSTRUCTIONS:

1. You are required to make a 1 in 10 dilution of the sample of vinegar by using the equipment that will provide the most accurate result. ***You must record the letter on your sample of vinegar; otherwise your results will be invalid.***
2. This diluted solution of vinegar is to be titrated with the sodium hydroxide solution and its concentration in moles/litre is to be determined as accurately as possible.
3. You need to complete all sections on the accompanying Report pages, including the descriptions of how you carried out the dilution and titration; the Results Table and Calculations.
4. You must also complete the questions related to your choice of indicator and overall accuracy and reliability of your results.

THE REPORT

The Dilution:

- Letter on Sample Bottle: _____
- Briefly describe how you diluted the sample of vinegar.

The Titration:

- Outline the method you used.
- Explain your choice of indicator for this titration.

Results:

- Draw up a table to record ALL measurements and results.

Calculations: All working must be shown

- Calculate the molarity of the diluted sample and the original sample.
- Calculate the percentage of ethanoic acid in the original sample in g/L.

Analysis of results:

- Identify TWO sources of error in this experiment.
- Describe TWO ways of improving the accuracy and TWO ways of improving the reliability of your results.

Application:

- A student wants to make a standard solution of sodium hydroxide.
- She realises it is not wise, having calculated the mass of sodium hydroxide, to weigh it out and dissolve it in the appropriate volume of water. The concentration of the sodium hydroxide solution will *not* be the value expected.
- Give TWO reasons why a standard solution of sodium hydroxide cannot be made in this way.

Feedback: Student
I think I demonstrated proficiency in these areas of the assessment:
I think I need to work on these areas for future success:
My plan for achieving success in these areas is to:
Feedback: Teacher
You demonstrated proficiency in these areas of the assessment:
You need to work on these areas of the assessment in the future:
Some ideas to help you achieve success in these areas include:

Marking guidelines

Dilution	Marks
▪ Correctly states appropriate use of glassware and that dilution is made with deionized or distilled water ▪ States that pipette must be rinsed with vinegar prior to use	2
▪ States appropriate use of glassware and dilution made with deionized or distilled water **OR** ▪ States that pipette must be rinsed with vinegar prior to use	1
Titration - method	
▪ States correct steps outlining the indicator used. Includes the rinsing of the burette with standard solution, the correct volumes and terms for glassware. Explains that the experiment is repeated until consistent titres are achieved. Ensures steps are in logical sequence.	3
▪ One of the above is omitted.	2
▪ Two of the above are omitted.	1
Titration - indicator	
▪ States that the titration is between strong base and weak acid therefore end point is in basic region. ▪ ID phenolphthalein as an indicator that changes in Basic solution pH >8.	2
▪ States that the titration is between strong base and weak acid therefore end point is in basic region. **OR** ▪ ID phenolphthalein as an indicator that changes in Basic solution pH >8.	1
Results	
▪ Table has appropriate headings, all data in the table, units are in the headings of each column, more than two titres, two concordant titres, average of concordant titres shown, organised and well set out allowing easy access of data.	3- 4
▪ Some data in table, data organised with some missing, at least two sets of results shown.	1-2
Calculations – a)	
▪ Answer shows correct calculations, consistent use of significant figures, uses the average of the concordant titres and has consistent and correct units.	2
▪ One of the above is omitted.	1
Calculations – b)	
▪ Answer shows correct calculations, consistent use of significant figures, uses the average of the concordant titres and has consistent and correct units.	2
▪ One of the above is omitted.	1
Analysis - errors	
▪ Identifies two appropriate errors such as inaccuracy in transferring aliquots, parallax error in reading burette, not rinsing burette with NaOH solution before filling, not washing drops of NaOH	2

solution off side of conical flask or end of burette, not rinsing conical flask with distilled water.	
▪ Identifies only one appropriate error source.	1
Analysis - improvement	**Marks**
▪ Describes two ways to increase accuracy AND two ways to increase reliability.	4
▪ Describes one way to increase accuracy AND two ways to increase reliability. OR ▪ Describes two ways to increase accuracy AND one way to increase reliability.	3
▪ Describes one way to increase accuracy AND one way to increase reliability.	2
▪ Describes one way to increase accuracy OR one way to increase reliability.	1
Application	
▪ Explains why NaOH cannot be used as a primary standard. ▪ Explains that an acidic standard solution is required to determine NaOH concentration.	2
▪ Explains why NaOH cannot be used as a primary standard. OR ▪ Explains that an acidic standard solution is required to determine NaOH concentration.	1