# Skills Assessment

**Assessment event 3 of 3**

# Trainer & Assessor Marking Guide

## Criteria

### Unit code, name and release number

MSL974017 - Prepare, standardise and use solutions (1)

### Qualification/Course code, name and release number

MSL40118 - Certificate IV in Laboratory Techniques

MSL50118 – Diploma in Laboratory Technology (1)

\*\*Amend the qualification box before distributing to the student. The information here should only contain the qualification the student is enrolled in\*\*

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For queries, please contact:

Innovative Manufacturing, Robotics and Science SkillsPoint

Hamilton Campus

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This assessment can be found in the: [Learning Bank](https://share.tafensw.edu.au/share/access/searching.do?doc=%3Cxml%2F%3E&in=P7ac4831b-430a-4b8d-8b56-f7b32ed5b9cf&q=&type=standard&sort=rank&dr=AFTER)

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## Assessment instructions

Table 1 Assessment instructions

| Assessment details | Instructions |
| --- | --- |
| **Instructions for the trainer and assessor** | This is a skill based assessment and will be assessing the student on their ability to demonstrate skills required in the unit.  This assessment is in 3 parts:   * Practical * Observation Checklist * Assessment Feedback (Student facing document)   The student is required to standardise three solutions. There will be three practical sessions and the student will work with a different solution at each of these. This will include the:   * preparation * standardisation * use of the three standardised solutions and * monitoring of the quality of laboratory solutions.   The solutions to be standardised have been researched by the student in their Project Assessment. The particular solutions will be familiar to the student and they would have previously worked with the particular chemicals.  The student is to repeat the standardisation process three times using different solutions (one at each occurrence of the Assessment Task). The general procedure is the same for each of the solutions and the student is to complete the Laboratory Report each time.  The following specific instructions relate to what is required of the Trainer/Assessor for this Assessment, **noting** that any breach of laboratory safety protocols would result in the Assessment being stopped.   * **Prepare for Task**:   **Note:**  as this section is assessing the student is able to determine the mass of primary standard and if a dilution is required of the secondary standard. Students **should not** be given the actual laboratory procedure until this section has completed successfully.  All chemicals (available in the correct grade and condition), indicators, equipment (including appropriate storage containers, labels and laboratory methods are required to be available for the student.  Indicate to the student the approximate concentration of the secondary solution to allow them to complete their calculations  Check their calculations and sign off on their Laboratory Record (at 1 f) that the calculations are correct. If they are not correct the student should not be permitted to continue until the error is corrected. In the Observation Checklist record all questions/responses used to prompt the student to achieve the correct answer, or if the student is not yet ready to continue, make a note of this.   * **Prepare solutions**   **Note:** the actual procedure that the student follows may have different masses/ dilutions than those determined by the student in Prepare for the Task.  The student is to choose the appropriate procedures to follow. This could come from the AllSci Laboratory LIMS (electronic or paper based). The student is required to identify and record the correct procedure prior to actually commencing work.  You should verify by signing the Laboratory Record (at 2 l)   * **Standardisation of secondary solution**   Student can be provided with the stoichiometry of the reaction between the primary and secondary standards if required.  Student may choose to complete calculations at the end of all practical work.  You should obtain the true value of the secondary solution for comparison to student result   * **Analysis of unknown**   There will be a laboratory procedure available (electronic or hard copy) that the student can access for the analysis of an unknown sample.  All resources required for the analysis must be available, including an unknown solution previously prepared.  You will need to have the true value for the unknown.  If the laboratory procedure does not include the stoichiometry this must be provided to the student to enable calculations to be completed.  Waste disposal facilities must be available to the student. Should the student be using solutions that cannot be placed down the drain the procedure provided should clearly indicate the laboratory protocols for disposal, for example silver solutions.   * **Monitor laboratory solutions**   A number of laboratory solutions should be on display for the student to check if they have deteriorated. The bench mark responses show possible solutions. The solutions chosen for the particular laboratory should be solutions known to the student for their routine work.  As it is a monitoring exercise the same solutions should be shown at each of the three practical assessments.  The task is open book. There is a Periodic Table and Data sheet provided in the Appendices. The student is to be provided with their marked Project Assessment as additional Reference material. This is to be collected at the conclusion of each of the three occurrences of the Skills Assessment along with the Appendices.  Model answers, sample responses or criteria for each task or activity is provided below. You will need to have determined the responses expected for the particular chemical combination. A set of responses is provided for one combination.  Use these to support your judgement when determining a satisfactory result.  The student’s response to each question must contain the information indicated in this marking guide in order for their response to be correct. However, if a student provides information other than indicated below, and in the professional opinion of the assessor it is appropriate and meets the intent of the question, it may be considered correct.  Complete the Observation Checklist for each task and activity and the Assessment Feedback to the student. Ensure you have taken a copy of the assessment prior to it being returned to the student.  The Assessment Feedback page must be signed by both the student and the assessor so the student displays that they have received, understood and accepted the feedback.  Ensure the students name appears on the bottom of each page of the submitted assessment. |
| **About this marking guide** | The student’s response to each task or activity must contain the criteria indicated in this marking guide in order for their response to be correct.  All tasks and activities must be completed correctly in order to satisfactorily complete this assessment event.  Assessors will need to make a judgement call as to whether each response meets the criteria based upon the:   * Rules of Evidence:   + Validity – does the answer address the skill required and does the evidence reflect the four dimensions of competency?   + Sufficiency – is the task or activity sufficient in terms of length and depth?   + Currency – has the work been done so recently as to be current?   + Authenticity – is this work the student’s own authentic work? * Principles of Assessment   + Fairness – individual student’s needs are considered in the assessment process   + Flexibility – assessment is flexible to the individual student   + Validity – any assessment decision is justified, based on the evidence of performance of the student   + Reliability – evidence presented for assessment is consistently interpreted and assessment results are comparable irrespective of the assessor conducting the assessment * Dimensions of competency   + Task skills   + Task Management Skills   + Contingency Planning Skills   + Job Role Environment Skills |
| **Student must provide** | Calculator, pens, PPE (eye protection, enclosed shoes, protective clothing), reference materials such as class notes. |
| **Assessor must provide** | The combination of chemicals to be prepared and standardised, the unknown solution, the solutions for quality monitoring. PPE (eye protection, enclosed shoes, protective clothing).  The following Standard Operating Procedures must be printed for each student (unless a local decision has been made to work with a different combination of solution preparations and standardisations, see instructions above).  *M104 Analysis of washing soda*  *M107 Preparation of 0.1M HCl from 11.4 M HCl*  *M108 Preparation of 0.05M Na2CO3*  *M110 Standardisation of HCl using 0.05M sodium carbonate*  *M111 Preparation of 0.1M NaOH*  *M112 Standardisation of 0.1M NaOH using solid potassium hydrogen phthalate*  *M114 Preparation of 250 mL 0.1 M potassium hydrogen phthalate*  *M124 Preparation of 1 L 0.01 M EDTA*  *M125 Standardisation of 0.01 M EDTA*  *M126 Determination of water hardness by EDTA*  *M127 Determination of ethanoic acid content of vinegar using 0.1 M NaOH*  *M128 Preparation of 0.01 M calcium (from calcium carbonate)*  Please note that standard operating procedures and forms will be available on Learning Bank at the start of 2020. Contact IMRS SkillsPoint if you require a copy earlier. |
| **Due date/time allowed/venue** | To be arranged in 2 hour blocks for each of the three occasions |

## Specific task instructions

Student is to complete the table for the actual preparation and standardisation reactants

|  |  |
| --- | --- |
| Solution | I have received training in the tasks required for this solution |
| 1. 0.1 M HCl (prepared from 11.4 M HCl. Standardised with 0.05 M Na2CO3 solution | Yes / No |
| 1. 0.1 M NaOH (prepared from solid NaOH) standardised with 0.1 M potassium hydrogen phthalate | Yes / No |
| 1. 0.01M EDTA (prepared from Solid EDTA) standardised with 0.01M Ca2+ (from Ca2+) | Yes / No |

## Part 1: Practical

To complete this part of the assessment, the student is required to participate in a practical demonstration of how to complete a task or activity.

These practicals will be observed by you, or the student can digitally record them and submit them as evidence.

The student’s responses will be used as part of the overall evidence requirements of the unit.

You should refer to the list of criteria provided in the Observation Checklist to understand what skills the student is required to demonstrate in this section of the assessment. This Checklist outlines the Performance Criteria, Performance Evidence and Assessment Conditions you will be marking the student on.

Once completed the student is required to submit this assessment and the tasks and activities required to be completed to you for marking.

**Practical Brief**

* This task will be completed in your laboratory three times using different solutions.
* At the commencement of each session you will be provided with the actual task combination of chemicals.
* The task is open book.
* You are to fill in the details as required by the procedure in the Laboratory Record.
* There is a page for calculations at the end of the Laboratory Record Sheet for each standardisation.
* You should show all your workings.
* All pages are to be returned at the conclusion of each laboratory session

**Prepare for task**

1. Determine and record the solution(s) to be prepared at this session (a) (location on AllSci Laboratory Record)
2. Determine and record the primary standard for the standardisation (b)
3. Calculate the amount of primary standard to be weighed for preparation of a bulk solution (250 mL) of the primary solution. (c)
4. Calculate (if required) the volume of stock required to prepare 1 L of the secondary standard. (d)
5. Determine the appropriate end-point detection for the reaction. (e)
6. Have this information checked prior to the standardisation. (f)

 You may not continue until you have approval of the Assessor.

**Prepare solutions (Record the PPE required)**

1. Obtain the standard procedures for the preparation of the primary and secondary standards. Record the procedure identifying number (g and h). (Note: there may be no procedure for the preparation of the standards as they are already in the form required for the task. In this case enter Not Applicable in the table)
2. Obtain the standard procedure for the standardisation of the secondary standard. Record the procedure identifying number (i)
3. Obtain all required equipment
4. Obtain all reagents required
5. Prepare the stock primary standard solution following the procedure provided and place in labelled container. Noting the actual ass of primary standard taken. (j)
6. Calculate and record the concentration of the primary standard solution (k), showing your calculations on the Calculation worksheet.
7. Prepare the secondary standard solution (if required) and place in labelled container.
8. Have both the primary and secondary standard solutions checked and verified by the Assessor. (l)

 You may not continue until you have verification by the Assessor.

**Standardisation of secondary solution**

1. Follow the procedure (including correct equipment preparation)for the standardisation recording:

* the aliquot of primary standard taken (mL) (m)
* indicator
* titration volumes (mL) (n)

1. Calculate the concentration of the secondary standard. Show you calculations on the Calculation worksheet. Record the Concentration of the secondary solution (o)
2. Determine the relative precision of concentration of your secondary standard using the volume of titrant value. (p)

**Analyse an unknown using the standardised secondary solution**

1. Obtain from your assessor the unknown solution and record the sample number (q).
2. Obtain from your assessor the standard procedure for the analysis of the unknown solution. Record the standard procedure number and title (r).
3. Follow the procedure provided and analyse the unknown using your standardised solution.
4. Record your results (s, t).
5. Calculate the % Relative precision of your titration volumes (u).
6. Calculate the concentration of the analyte as required by the procedure (v).
7. Ensure work area is left clean and tidy, all solutions returned to correct location in the laboratory and all wastes are properly disposed of according to the standard procedure

**Monitor laboratory solutions**

1. Check the available stock solutions and note if they are satisfactory or have deteriorated.
2. Record your findings on the Laboratory Record. (5)



**Laboratory Record**

Analyst: Student name Date: Date of assessment

**Standardisation 1**

1. **Prepare for task**

|  |  |
| --- | --- |
| 1. The solution(s) to be prepared | 0.1M hydrochloric acid  0.05 M sodium carbonate |
| 1. Primary standard | anhydrous sodium carbonate |
| 1. Mass of primary standard (g) | 1.325 g |
| 1. Volume of stock secondary standard (mL) or Mass of chemical for secondary standard | ~9 mL of 11.4 M HCl |
| 1. indicator | Screened methyl orange |
| 1. Assessor signature | Assessor to sign |

 Ensure your assessor has signed off at 1 f above prior to commencing the next section.

1. **Prepare solution**

|  |  |
| --- | --- |
| PPE required (remembering a safety breach will see the task stopped immediately) | Safety glasses, protective clothing, enclosed shoes, gloves for use of 11.4 M HCl |
| 1. Procedure number (primary standard preparation)/title | M108 Preparation of 0.05M Na2CO3  **Note** that if the procedure provided is working with solid primary standard there will be no procedure number available here and student is directed to enter Not Applicable. |
| 1. Procedure number (secondary standard preparation)/title | M107 Preparation of 0.1M HCl from 11.4 M HCl  **Note** that if the procedure does not require further dilution of the secondary standard the student is directed to enter Not Applicable. |
| 1. Procedure standardisation (secondary standard)/ title | M110 Standardisation of HCl using 0.05M sodium carbonate |
| 1. Mass of primary standard (g) | 1.3341 g |
| 1. Calculated concentration of the primary standard solution using the actual mass taken | 0.0503 mol/L |
| 1. Assessor verification of solutions | Assessor to sign |

1. **Standardisation of secondary standard**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Aliquot of primary standard (mL) | 25 mL (0.025) | | | |
| 1. Volume of titrant (mL) | 26.8 | 27.9  Outlier and disregarded | 26.6 | 26.7 |
| 1. Concentration of secondary standard (mol / L) | 0.0942 M | | | |
| 1. Relative precision (%) | 0.037% | | | |

1. **Unknown analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Unknown sample number | SN2019/12 | | | |
| 1. Unknown procedure number/title | M104 Analysis of washing soda | | | |
| 1. Aliquot of unknown taken (mL) | 25 mL | | | |
| 1. Volume of titrant (secondary standard) (mL) | 32.5 | 32.6 | 32.6 |  |
| 1. Relative precision (%) | 0.15% | | | |
| 1. Concentration of unknown | 31.2 % | | | |

1. **Solution Monitoring**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Check | Solution | Solution | Solution | |
|  | **Silver nitrate** | **Starch solution** | **Sodium hydroxide** | |
|  | **Observation** | **Observation** | **Observation** | |
| Turbidity | cloudy | Normal appearance | ok | |
| Deposits | none | none | ok |  |
| Crystallisation | none | none | ok | |
| Colour change | cloudy | Milky as expected | ok | |
| Expiry dates | NA | Out of date | n/a | |
| Other | Not stored in brown bottle |  |  | |
|  |  |  |  | |

Analyst comments:

The silver nitrate was removed from the shelf, a report generated indicating the solution should be stored in a brown glass bottle.

The starch solution was removed as it was past the expiry date of the solution .

Analyst signature:



Calculation Worksheet

Analyst: Student Date: Date of Assessment

**Standardisation 1**

Concentration of Na2CO3 solution = (1.3341/105.99) / 0.250 = 0.0503 mol/L

Concentration of Prepared HCl = (2 x 0.0503 x 0.025) / 0.0267 = 0.0942 mol / L

**Analysis of washing soda.**

Mass of washing soda = 5.2432 g

Volume of washing soda prepared = 250 mL

Concentration HCl = 0.0943 M

Titration volumes (mL) = 32.5 32.6 32.6

Equation 2HCl + Na2CO3 🡪 2NaCl + CO2 + H2O

Moles HCl = 0.0943 x 0.0327 = 0.00308

Moles Na2CO3 = 0.00308 /2 = 0.001542

[Na2CO3] = 0.001542 /0.025 =0.0617 mol/L

Mass of Na2CO3 in 250 mL = (0.0617 / 4) x 105.99 = 1.635 g

% Na2CO3 = (1.635 / 5.2432) x 100 =31.2 %



**Laboratory Record**

Analyst: Date:

**Standardisation 2**

1. **Prepare for task**

|  |  |
| --- | --- |
| 1. The solution(s) to be prepared | * 1. M NaOH   0.1 M potassium hydrogen phthalate |
| 1. Primary standard | Potassium hydrogen phthalate |
| 1. Mass of primary standard (g) | 5.1055g |
| 1. Volume of stock secondary standard (mL) or Mass of chemical for secondary standard | 4 g AR sodium hydroxide pellets |
| 1. indicator | phenolphthalein |
| 1. Assessor signature |  |

 Ensure your assessor has signed off at 1 f above prior to commencing the next section.

1. **Prepare solution**

|  |  |
| --- | --- |
| PPE required (remembering a safety breach will see the task stopped immediately) | Safety glasses, protective clothing, enclosed shoes |
| 1. Procedure number (primary standard preparation)/ title | M114 Preparation of 250 mL 0.1 M potassium hydrogen phthalate |
| 1. Procedure number (secondary standard preparation)/title | M111 Preparation of 0.1M NaOH |
| 1. Procedure standardisation (secondary standard) / title | M112 Standardisation of 0.1M NaOH using solid potassium hydrogen phthalate |
| 1. Mass of primary standard (g) | 5.1055 g |
| 1. Calculated concentration of the primary standard solution using the actual mass taken | 0.1000M |
| 1. Assessor verification of solutions |  |

1. **Standardisation of secondary standard**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Aliquot of primary standard (mL) | 25.0 mL | | | |
| 1. Volume of titrant (mL) | 24.7 | 24.8 | 24.7 |  |
| 1. Concentration of secondary standard (mol / L) | 0.1011 | | | |
| 1. Relative precision (%) | 0.2% | | | |

1. **Unknown analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Unknown sample number | S123 | | | |
| 1. Unknown procedure number/title | M127 Determination of ethanoic acid content of vinegar using 0.1 M NaOH | | | |
| 1. Aliquot of unknown taken (mL) | 25.0 mL | | | |
| 1. Volume of titrant (secondary standard) (mL) | 17.4 | 17.2 | 17.5 |  |
| 1. Relative precision (%) | 0.9% | | | |
| 1. Concentration of unknown | 0.7024 M | | | |

1. **Solution Monitoring**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Check | Solution | Solution | Solution | |
|  | **Silver nitrate** | **Starch solution** | **Sodium hydroxide** | |
|  | **Observation** | **Observation** | **Observation** | |
| Turbidity | cloudy | Normal appearance | ok | |
| Deposits | none | none | ok |  |
| Crystallisation | none | none | ok | |
| Colour change | cloudy | Milky as expected | ok | |
| Expiry dates | NA | Out of date | n/a | |
| Other | Not stored in brown bottle |  |  | |
|  |  |  |  | |

Analyst comments:

The silver nitrate was removed from the shelf, a report generated indicating the solution should be stored in a brown glass bottle.

The starch solution was removed as it was past the expiry date of the solution .

Analyst signature:



**Calculation Worksheet**

Analyst: Date:

**Standardisation 2**

Concentration of Potassium hydrogen phthalate solution = 5.1055 / 204.22 / .25

= 0.1000 M

Concentration of NaOH = .1 x .025 / .024733

= 0.1011 M

Relative precision of standardisation = (0.1/2)/24.733 x 100

= 0.2%

Concentration of ethanoic acid in vinegar:

Dilution factor of original vinegar = 250/25 = 10

Moles of secondary standard used in titration = 0.1011 x 0.017367 = 1.756 x 10-3

Moles of ethanoic acid = 1.756 x 10-3

Moles in original solution = 1.756 x 10-3 x 10 = 1.756 x 10-2

[ethanoic acid] = 1.756 x 10-2 /0.025 = 0.7024 M or 4.2% m/v

Relative precision of vinegar titration = 0.3 / 17.367 x 100 = 0.9%



**Laboratory Record**

Analyst: Date:

Standardisation 3

1. **Prepare for task**

|  |  |
| --- | --- |
| 1. The solution(s) to be prepared | * 1. M EDTA   0.01 M CaCO3 |
| 1. Primary standard | Calcium carbonate |
| 1. Mass of primary standard (g) | 0.2500 g |
| 1. Volume of stock secondary standard (mL) or Mass of chemical for secondary standard | 3.7224g |
| 1. indicator | Erichrome Black T |
| 1. Assessor signature |  |

 Ensure your assessor has signed off at 1 f above prior to commencing the next section.

1. **Prepare solution**

|  |  |
| --- | --- |
| PPE required (remembering a safety breach will see the task stopped immediately) | Safety glasses, protective clothing, enclosed shoes |
| 1. Procedure number (primary standard preparation) | M128 Preparation of 0.01 M calcium (from calcium carbonate) |
| 1. Procedure number (secondary standard preparation) | M124 Preparation of 1 L 0.01 M EDTA |
| 1. Procedure standardisation (secondary standard) | M125 standardisation of 0.01 M EDTA |
| 1. Mass of primary standard (g) | 0.2500g |
| 1. Calculated concentration of the primary standard solution using the actual mass taken | 0.0100 M |
| 1. Assessor verification of solutions |  |

1. **Standardisation of secondary standard**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Aliquot of primary standard (mL) | 25.0 | | | |
| 1. Volume of titrant (mL) | 24.9 | 25.0 | 24.9 |  |
| 1. Concentration of secondary standard (mol / L) | 0.0100 M | | | |
| 1. Relative precision (%) | 0.2% | | | |

1. **Unknown analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Unknown sample number | S222 | | | |
| 1. Unknown procedure number/title | M126 Determination of water hardness by EDTA | | | |
| 1. Aliquot of unknown taken (mL) | 15.0 mL | | | |
| 1. Volume of titrant (secondary standard) (mL) | 19.3 | 19.1 | 19.5 |  |
| 1. Relative precision (%) |  | | | |
| 1. Concentration of unknown | 1287 mg/L | | | |

1. **Solution Monitoring**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Check | Solution | Solution | Solution | |
|  | **Silver nitrate** | **Starch solution** | **Sodium hydroxide** | |
|  | **Observation** | **Observation** | **Observation** | |
| Turbidity | cloudy | Normal appearance | ok | |
| Deposits | none | none | ok |  |
| Crystallisation | none | none | ok | |
| Colour change | cloudy | Milky as expected | ok | |
| Expiry dates | NA | Out of date | n/a | |
| Other | Not stored in brown bottle |  |  | |
|  |  |  |  | |

Analyst comments:

The silver nitrate was removed from the shelf, a report generated indicating the solution should be stored in a brown glass bottle.

The starch solution was removed as it was past the expiry date of the solution .

Analyst signature:



**Calculation Worksheet**

Analyst: Date:

Standardisation 3

Moles of primary standard in aliquot = 0.025 x 0.0100 = 2.5 x 10-4

[EDTA] = 2.5 x 10-4 / 0.02493 = 0.0100 M

Water hardness

Moles of secondary standard in titration = 0.0193 x 0.0100 = 1.93 x 10-4

[Ca] = 1.93 x 10-4 / 0.015 = 0.01287 mol/L

Hardness as CaCO3 = 0.01287 x 100 x 1000 = 1287 mg/L

## Part 4: Observation Checklist

The Observation Checklist will be used by you to mark the students’ performance in the Skills Assessment. Use this Checklist to understand what skills the student is required to demonstrate in this section of the assessment. This Checklist outlines the Performance Criteria, Performance Evidence and Assessment Conditions you will be marking the student on. All the criteria must be met. The student’s demonstration will be used as part of the overall evidence requirements of the unit. You may ask questions while the demonstration is taking place or if appropriate directly after the task/activity has been completed.

| Step | Instruction |  | | |  | | | |  | | | | Assessor Comments |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Solution | 1. | | | 2. | | | | 3. | | | | PPE required (remembering a safety breach will see the task stopped immediately)Describe the student’s ability in demonstrating the required skills and knowledge) |
|  | Date: |  | | |  | | | |  | | | |
|  |  | S | US | | S | | US | | S | | US | |
|  | Assessor Note: Completed AllSci Laboratory Records have been completed as benchmark responses for each of the solutions. Please refer to these when checking student's recordings | | | | | | | | | | | | |
|  | **Prepare for task (record all amounts)** |  | | | | | | | | | | | |
|  | Determines and records the solutions to be prepared |  | |  | |  | |  | |  | |  | Student to correctly record the identity of the solution(s). Indicating on the Laboratory Record (LR) at ‘a’ |
|  | Determines the primary standard |  | |  | |  | |  | |  | |  | Student correctly selects the primary stand and records a ’b’ |
|  | Calculates the mass of primary standard to prepare 250 mL |  | |  | |  | |  | |  | |  | Calculations shown on worksheet and recorded at ‘c’ the mass of primary standard |
|  | Calculate volume of stock for the secondary standard (if required) or the mass of the chemical required to prepare the secondary standard |  | |  | |  | |  | |  | |  | Student records the volume of stock secondary standard required (if necessary) ‘d’ |
|  | Determines appropriate endpoint detection |  | |  | |  | |  | |  | |  | Correct indicator selected and recorded ‘e’ |
|  | Has values checked |  | |  | |  | |  | |  | |  | Values checked by assessor prior to commencing. If values are incorrect additional questioning may be required to ensure the correct values are determined prior to commencement. The questions should be noted at the end of the checklist. Assessor to sign at ‘f’ |
|  | **Prepare solutions** |  | | | | | | | | | | | |
|  | Obtains the procedures for preparation of primary and secondary standard solutions. (if required) |  | |  | |  | |  | |  | |  | Student obtains the correct procedures for solution preparation and records title and document number at ‘g’ and ‘h’ |
|  | Obtains procedure for standardisation of secondary solution. |  | |  | |  | |  | |  | |  | Student obtains the correct procedure for standardisation of each and records at ‘I’ |
|  | Obtains and assembles all equipment as requires |  | |  | |  | |  | |  | |  | Student obtains necessary equipment. This could be: burette, pipettes, wash bottle, beakers, marking pen, retort stand and burette clamp, pipette filler, weigh boat, conical flasks. |
|  | Obtains all reagents |  | |  | |  | |  | |  | |  | Student obtains necessary reagents. This could include indicator solution, primary standard, secondary standard, purified water. The student should only take minimal quantities of reagents to minimise waste and environmental impact of disposal |
|  | Prepares primary standard stock solution, noting mass of primary standard taken |  | |  | |  | |  | |  | |  | Student to prepare the primary stock solution as per method ‘g’. Assessor to ensure they have also obtained the appropriate standard procedure (as indicated by the student) to use when observing students in order to ensure correct procedure was followed. (Mass of primary standard taken should be noted. ‘j’ |
|  | Places stock in labelled container |  | |  | |  | |  | |  | |  | Storage bottle should be correctly labelled with student name, date, solution ID, warning phrases if required. |
|  | Calculates the concentration of primary stock solution using the actual mass taken. |  | |  | |  | |  | |  | |  | Student to calculate the concentration and record at ‘j’ |
|  | Has both solutions checked |  | |  | |  | |  | |  | |  | Assessor to check solutions for correct labelling prior to commence of the standardisation. ‘l’ |
|  | **Standardisation of secondary solution** |  | |  | |  | |  | |  | |  |  |
|  | Follows procedure for standardisation noting:   * Correct equipment preparation * Primary standard aliquot * indicator * Titration volumes |  | |  | |  | |  | |  | |  | Pipette should be prepared by sacrificial rinsing (3 times is ideal) with the solution to be dispensed, then filled using pipette filler above the mark, solution levelled so the bottom of the meniscus is on the line.  Solution should be allowed to drain freely, pipette touched to the side of the flask to drain. The remaining solution, in the pipette should not be shaken into the flask (unless the marking on the pipette is a ‘to contain’ mark. Aliquot volume should be noted at ‘m’  Burette should be sacrificially rinsed with the solution it is to contain, (3 times being the ideal). It should be filled above the zero mark with the solution. If a funnel has been used to fill the burette this must be removed prior to adjusting the level of the burette to zero. Check should be made that there are no air bubbles near the burette tap  Student should use the indicator recorded at ‘e’  Titration should be completed at least 3 times, with reliable results being within 0.2 mL of each other. Values recorded at ‘n’. If an outlier or apparent error is obvious student should follow workplace protocols to deal with this. It was identified in their Project Assessment |
|  | Concentration of secondary standard determined |  | |  | |  | |  | |  | |  | Student should show all working on the calculation worksheet, ignoring apparent outliers ‘o’ |
|  | % Relative precision calculated and recorded |  | |  | |  | |  | |  | |  | Student should calculate the %RP on the work sheet, recording value at ‘p’ |
|  | **Unknown analysis** |  | |  | |  | |  | |  | |  |  |
|  | Obtains sample and records sample number |  | |  | |  | |  | |  | |  | The sample number must match the sample number provided to the student. Recorded at ‘q’ |
|  | Obtains procedure for unknown analysis and records title and procedure number |  | |  | |  | |  | |  | |  | Student should obtain the correct procedure and record the title and document number at ‘r’ |
|  | Dispense aliquot required |  | |  | |  | |  | |  | |  | Aliquot volume should be recorded. Appropriate procedure for the use of the pipette must be followed. Volume taken recorded at ‘s’ |
|  | Titrates and records titres using appropriate indicator |  | |  | |  | |  | |  | |  | Titration completed using the indicator prescribed in the procedure, Titres recorded at ‘t’ |
|  | Calculates unknown concentration |  | |  | |  | |  | |  | |  | Student uses Calculation worksheet to determine the concentration. The value is recorded at ‘v’ |
|  | Calculates % Relative precision using titration volumes |  | |  | |  | |  | |  | |  | Student calculates the % relative precision and records at ‘u” |
|  | Ensures work area is left clean and tidy and all solutions, chemicals and equipment is returned to store. |  | |  | |  | |  | |  | |  | At completion all solutions should be returned, all spills cleaned up according to lab protocols, leftover solutions disposed of according to laboratory requirements considering environmental impacts of disposal. All equipment is returned in good order. |
|  | **Monitor solutions** |  | |  | |  | |  | |  | |  |  |
|  | Checks stock solutions for visual deterioration and expiry dates |  | |  | |  | |  | |  | |  | Student to check the available solutions for deterioration. (should be seen to look at each container) |
|  | Reports stock monitoring |  | |  | |  | |  | |  | |  | Student should make notes of actions |
| **Additional questions** | | | | | | | | | | | | | |
| **Question asked:**  **Response:**  **Question asked:**  **Response:** | | | | | | | | | | | | | |

**APPENDICES**

Data Sheet

|  |  |
| --- | --- |
| Molarity = | [Mass ÷ V(L)] x Formula mass  or  No of mole ÷ V (L) |
| Moles = | Mass / Formula mass  or  C x V (L) |
| Dilution Factor = | Final Volume  Initial Volume |
| Average = | Sum of readings  No. of readings |
| Range = | (highest Value – lowest Value) |
| Absolute precision = | Range  2 |
| Relative precision = | (absolute precision) x 100%  average |
| Accuracy = | [(True Value – Average Value)] ÷ True x 100 |
| % w/w = | (grams of solute / grams of sample) x 100 |
| % v/v = | (mL of solute / mL of solution) x 100 |
| % w/v = | (grams of solute/ mL of solution) x 100 |
| ppm = | (mg of analyte / mL of solution) x 1000 |

