# Project: Research and assignment

**Assessment event 2 of 3**

# Trainer & Assessor Marking Guide

## Criteria

### Unit code, name and release number

MSL974019 - Perform chemical tests and procedures (1)

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

MSL40118 - Certificate IV in Laboratory Techniques (1)

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.\*\*

Version: 1.0

Date created: 07/06/2019

Date modified: 19/11/2019

For queries, please contact:

Innovative Manufacturing, Robotics and Science Skills Point

TAFE Hamilton Campus

© 2019 TAFE NSW, Sydney  
RTO Provider Number 90003 | CRICOS Provider Code: 00591E

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)

The contents of this document are copyright © TAFE NSW 2019, and should not be reproduced without the permission of the TAFE NSW. Information contained in this document is correct at time of printing: 19 November 2019. For current information please refer to our website or your teacher as appropriate.

## Assessment instructions

Table 1 Assessment instructions

| Assessment details | Instructions |
| --- | --- |
| **Instructions for the trainer and assessor** | This is a research/assignment based assessment and will be assessing the student on their knowledge and performance of the unit.  This assessment is in four parts and includes an Assessment Feedback form:   1. Research report 2. Assignment 3. Assessment Checklist 4. Assessment Feedback form (student facing)   In Part 1 students will research the 3 tests that they will be performing in the skills assessment for this unit.  The 3 tests you choose for Part 1 of this assessment must be the same as the tests you selected for the Skills Assessment and must be tests that the students have received training in. To meet the unit requirements, you need to choose at least 1 of the following:   * colorimetric techniques * infrared and ultraviolet-visible (UV-VIS) spectrophotometry * other spectrometric techniques * chromatographic techniques * electrochemical techniques * electrophoretic techniques * soil testing techniques * gravimetric analysis * titrimetric analysis * filtration, separation and solvent extraction techniques * corrosion testing, cement content and accelerated weathering.   The remaining 2 tests can be from the above list or others that the student completed in their laboratory training.  The test identities are to be provided to the student for the research component of this task using the table in the Specific Task Instructions.  For each test you choose the following must be available:   * Instrument/equipment manuals * Standard methods (SOPs) for the tests chosen * SDS for any chemicals involved * Pre-use and calibration requirements * Risk assessments   Only tests for which all of the above are available to students can be chosen.  You will need to provide a customised marking guide for each of the allocated tests that will be retained for audit purposes. All of the above information must also be retained with the student submissions for audit purposes.  Model answers, sample responses or a criteria for each question are provided below.  Use these to support your judgement when determining a satisfactory result.  The student’s research/assignment must contain the information indicated in this marking guide in order to deem it satisfactory. 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 criteria, it may be considered correct.  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.  Complete the assessment feedback to the student and ensure you have taken a copy of the assessment prior to it being returned to the student. |
| **About this marking guide** | All tasks and activities must be responded to correctly in order to satisfactorily complete this assessment event.  Assessors will need to make a judgement call as to whether each answer/response meets the criteria based upon the:   * Rules of Evidence:   + Validity – does the answer address the assessment question and does the evidence reflect the four dimensions of competency?   + Sufficiency – is the answer 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** | Pens |
| **Assessor must provide** | The Assessment task including the three tests to be researched and all methods and procedures required for the test. |
| **Due date and time allowed** | The entire project is due for submission three weeks prior to Skills Assessment. |

## Specific task instructions

The student has been provided with the following information.

The instructions and the criteria in the tasks and activities below will be used by the assessor to determine if you have satisfactorily completed this assessment event. Use these instructions as a guide to ensure you demonstrate the required knowledge.

In this task you will research the three tests that you will later perform in the Skills Assessment for this unit. Your Assessor will advise you of the three tests. You should only be assessed on tests that you have also been trained in. Use the table below to indicate whether or not you have received training in the tests that you will be assessed in. If you have not been trained notify your assessor/trainer.

The task is research that specifically relates to three tests that you complete in the laboratory. Your Assessor will advise you of the tests researched will also be the tests observed in the Skills assessment.

The assessor will allocate the three tests to you. You should record these tests in the table below. Your research is to be based on these three tests.

|  |
| --- |
| Allocated test |
|  |
|  |
|  |

**Part 1: Research Reports**

The student is to complete this part of the assessment by researching the three allocated test procedures and completing the templates provided.

**Brief:**

The unit of competency requires you to safely perform at least three different tests and you will be observed completing these tests within the Skills Assessments.

This research will prepare you for your Skills Assessment.

Complete a Report Template for each of the tests. Where a particular item is not applicable to your test you should indicate “Not Applicable” in your report.

You will need to access the standard operating procedures for equipment/instruments used, the method for the chemical test, relevant SDS and risk assessments. These will be available in your laboratory.

**Research:**

Your research report should include the following for each test:

1. The test investigated
2. The purpose of the test
3. The principles and concepts related to the identified test
4. Sample preparation required for the test, if applicable
5. Documentation required for pre-analysis and final results (this could be as a form placed with the Appendix)
6. Standard preparation (if required) and calibration of equipment/instrument
7. The basic operational components of any testing equipment/instruments needed
8. Hazard identification and controls required the test.
9. Common causes of analytical errors and how these can be minimised for the test
10. Laboratory requirements for the cleaning up of spills for the test.
11. An Appendix that includes the actual Method for the 3 tests and also a risk assessment you have prepared for each of the tests (Note: these do not form part of your word count)

Your submission for each test should be no more than 1500 words and cover the points 1-11 noted above.

The following is a generalised report for one particular test. You are required to prepare a similar marking guide for each of the tests that have been allocated to the student.

| Test 1 |
| --- |
| 1. The test investigated: Nickel in steel by AAS |
| 1. The purpose of the test:   To determine the Ni concentration in steel using the AAS. Result in %Ni |
| 1. Principles and concepts related to the test   Steel is dissolved in HCl followed by HNO3 to ensure complete oxidation to the required form (done in duplicate for precision checking) The solution is quantitatively transferred to 100 mL vol flasks, made up and a 1:10 dilution also prepared from the original solution.  Nickel standards are prepared from 1000 mg/L Ni2+ solution containing HCl to match the matrix.  AAS is able to analyse for metal ions using specific hollow cathode lamps at particular wavelengths. The instrument must be optimised according to the manufacturer’s instructions for each metal. The sample solution is aspirated into an air/acetylene flame, the solvent vaporised and the atoms of nickel in the flame absorb radiation produced by the Nickel Hollow cathode lamp.  When optimised correctly absorbance of the standards will increase proportionally with concentration.  Calculation is then possible |
| 1. Sample preparation required for the test   Steel sample is provided as metal filings.  Steel is dissolved and solution made up quantitatively. |
| 1. Documentation required (note if added to Appendix) for pre-analysis and final results.   Instrument log including pre-use check paperwork  Report sheets as required |
| 1. Standard preparation and instrument/equipment calibration (if required).   1000mg/L nickel solution is the stock from which the calibration standards are prepared.  Intermediate 100mg/L is prepared and from this 10,20 and 40 mg/L standards are prepared each containing HCl.  Instrument optimisation.:   * Ni lamp * 5 mA current * 2nm slitwidth * Air/acetylene/oxidising flame |
| 1. Basic operational components   Hollow cathode lamp (Ni)  Air/acetylene gas availability  AAS  Extraction hood |
| 1. Hazard identification and controls for the test:   Extreme temperatures (in excess of 2300 oC/ Safety shield  Gas under pressure: operator training  Electrical components: tag and test/ operator training  Hazardous chemicals: training, limit volumes available |
| 1. Causes of analytical errors and minimisation of errors   Instrument not correctly optimised/ check standard values (calibrated) with historical, Beer’s Law indicates Abs will increase proportionally with concentration.  Flame not optimised; training |
| 1. Requirements for spill clean-up   Spill kits available  Samples kept in trays to prevent increasing surface area of spill  Training  Incident reporting |
| 1. Appendix (what documents are included in the submission),   This would include method. Risk analysis if done  Student could include examples of calibration data from AAS and calibration graph prepared (Note: that many computer controlled instruments will automatically generate the graph and student may only be able to show the equation of the line for the calculations.). The signed Supervisor report would be included. |

## Part 2: Assignment

General responses are provided for each question, you will need to verify the responses against the actual laboratory procedures.

To complete this part of the assessment, you will be required to provide answers to the questions as they relate to your Laboratory.

**All your responses to the following should relate to your laboratory, actual or simulated and routine work you complete.** Your responses should be a maximum of 250 words for each question or part of a question).

1. What is the procedure for determining what testing is required and the actual test method to be followed?

* Responses will differ depending on the laboratory.
* Procedure could be from sampling plan, notification from the LIMS, provided in a toolbox meeting, regular testing requirements.
* If unsure the student should indicate they would ask a supervisor.
* The actual test method should be noted in the LIMS or on daily worksheets. Eg it might indicate analysis of water for sulfate by gravimetric analysis not ion selective electrode.

1. Choose one test method you are familiar with and identify the hazards associated with each of the following:

Responses provided for sulfate by gravimetric analysis. Student responses will be for the actual test chosen.

* test chosen: sulfate by gravimetric analysis
* the actual sample: the sample specification should indicate if the sample is from hazardous waste and additional precautions would be necessary. For routine (non-hazardous) water samples the liquid should still be handled as if it were contaminated.
* sample preparation: sample requires acidification with HCl,
* test method: involves use of strong acid, filtration under vacuum, heating and digestion
* reagents: SDS indicates HCl and BaCl2 are hazardous.
* equipment: drying equipment will be hot, digestion is at high temperature, vacuum filtration

1. How are the risks for the hazards identified above controlled?

Risks are mitigated by having safety briefing prior to testing. Compliant PPE must be worn. SDS are available, Standard method has been prepared and operator has been authorised to undertake the task. Volumes of reagents are controlled by using automatic dispensers reducing the exposure to the chemical. Vacuum glass is inspected prior to use to identify any defects. Digestion occurs in fumehood. All electrical leads (balance, hotplate and drying cabinets) regularly inspected by Tag and Test team. Hot hands available for moving hot glassware.

1. How are daily tasks scheduled in your laboratory?

Routine analysis is scheduled by the planner eg BOD analysis arrives every Wednesday, 100 samples weekly tested. The test is 5 days so on Day 5 the concluding steps are completed.

Additional work is identified by supervisor when requests made, work allocated as needed.

Production tasks must be completed first.

1. How would a change of testing schedule be managed in the laboratory?

Notification by supervisor of change

Staff reallocated to tasks

Additional staff brought in if required

1. How are samples logged for analysis in your laboratory?

|  |
| --- |
| Samples arrive from sampling points after collection by sampler.  Sample paperwork completed and if required lab sample taken from bulk sample. Samples logged via the barcode into the LIMS or data entry via keyboard input.  Maybe a manual entry onto recording sheet. |

1. What information is required to be logged?

|  |
| --- |
| For traceability required information could include:  Date and time of sampling  Method of sampling  Description of sample including location of sample point  Sampler identification  Sample number issued  Any preservatives added to sample container  How sample was transported  Any changes made to normal sampling processes |

1. What would you do if the sample provided does not meet the expected specification?

|  |
| --- |
| Supervisor to be notified.  Request another sample be taken if possible. |

1. For one test you conduct in the laboratory indicate the:

|  |
| --- |
| * Test:   Nickel in steel by AAS   * Sample preparation:   Sample to be milled to specification.   * Standards required (if any): Standard 1000mg/L Ni2+ stock solution available to be used to prepare 10, 20 and 40 mg/L Ni2+ standards * Reagents required (if any):5M HCl, 1:1 HNO3, distilled (deionised) water * Procedures to ensure sample integrity and traceability is maintained.   Labelled sample receipted by technician, analytical samples (3) labelled with corresponding sample numbers. Sample is run in triplicate in batch with QC sample. |

1. Where do you find the operating instructions for any instruments required for testing?

|  |
| --- |
| Operating instructions located beside the instrument and files also available in the LIMS. |

1. What checks would be made on reagents to confirm they are appropriate for use?

|  |
| --- |
| Reagents would be checked for:  Use-by –date  Discoloration  Labels not degraded  No precipitate |

1. What safety pre-checks are required before commencing laboratory tasks?

|  |
| --- |
| Check all electrical leads for tag and test date, ensure leads have no exposed wires  Check glassware to ensure no cracks  Read SDS to be aware of use of the chemicals |

1. What are the laboratory procedures to be followed if the equipment is found to be faulty?

|  |
| --- |
| Equipment tagged out and maintenance/service requested via supervisor notification or LIMS. |

1. Why is it important to ensure test instruments/equipment are operated according to specified procedures?

|  |
| --- |
| The test result is only as good the standard method and this includes the operation of the equipment/instrument. Procedures are designed to minimise uncertainty in measurement, so operating outside of the provided parameters will increase error and uncertainty in the result. |

1. What is the purpose of each of the following in relation to testing in your laboratory?

|  |
| --- |
| 1. training on the method and the instrumentation involved: the operator should be familiar with method in order to be able to anticipate problems. Errors are reduced when a competent operator sets up the equipment correctly. Safety considerations are also important particularly if the operator is expected to work with hazardous materials. 2. running standards or quality control samples: this is a validation process that is necessary to identify if the method, the instrumentation, the operator etc are functioning correctly. 3. recording data immediately: unless there is a computer system attached to the instrument and the data generated is captured immediately it is best for the operator to note the data when it us available. This may reduce confusion with data and records later. 4. Completing workplace logs accurately: this could include instrument and maintenance logs. Where instruments are under servicing agreements the time of use is very important. Maintenance records will show the instrument use time and many components will be regularly changed/checked after a set period of operation. 5. Hazard identification and control: this is best practice in the laboratory. It can reduce incidents/accidents, reduces costs to laboratory. Provides staff with confidence in management. |

1. For the tests you complete how do you identify atypical test data or that the value is consistent with expectations?

|  |
| --- |
| Routine tests on regular samples are generally easy to pick an outlier. This could be obvious in the raw data if the procedure is instrumental. Unexpected numbers could be higher or lower than anticipated.  If results are being monitored on run charts trends could indicate a change from the average. A quick change on the chart could be an outlier and would require checking. |

1. What are the laboratory procedures when atypical or abnormal data is found?

|  |
| --- |
| The sample data is checked immediately, the standard or QC results are verified. If the value is still found to be a typical another sample is run and if this is still atypical a new sample is requested for testing.  The atypical result is notified immediately to the supervisor verbally or via the LIMS. |

1. List some of the reasons that could result in atypical data or results

|  |
| --- |
| Atypical results could be correct if there has been a change of production process.  If the results are not expected to have changed then errors in equipment, the operator or the method could be the reason. QC samples will generally indicate if there is a problem with equipment or reagents  Checks will need to be made on operator as they may have made the same error through all samples. Things such as incorrect reagent concentrations, volumes etc |

1. Which of the following is the typical way of presenting data in your laboratory:

* Numbers only
* Bar or pie charts
* Tables
* Calibration graphs
* Run charts
* Control charts
* Other?

|  |
| --- |
| Student will provide the method applicable to their workplace.  If it is calibration information it could be as a run chart  If it is production information it could be on a control chart  If it is environmental site data it may be in tables |

1. Why are the trends that data show an important diagnostic tool in the laboratory?

|  |
| --- |
| Trends indicate that a production process is going smoothly, if results are not changing. If there is a gradual change either up or down the operator will need to make small changes to keep a process under control. If there is a sudden change it could indicate that something serious has happened to the process. These would need to be looked at closely and quickly. |

1. What is the typical PPE required in your laboratory? Are there particular tests that require additional PPE?

|  |
| --- |
| Generally a laboratory worker would require enclosed shoes, safety glasses, protective clothing (laboratory coat or trousers and shirt). If the SDS indicates additional equipment it could be things such as face mask, particular gloves, overalls. If the test is done online it could be hot metal boots, woollen coat and trousers if sampling, testing molten metal, it could be an airline if sampling and testing HF. |

1. Who is responsible for the maintenance of PPE in your laboratory?

|  |
| --- |
| Each employee is responsible for their own PPE as supplied by the workplace. For specialised PPE there may be particular checks made by authorised personnel. |

1. Why is it important that wastes are minimised during any laboratory procedure? How is this done in the laboratory?

|  |
| --- |
| Cost is an obvious factor. Hazardous wastes apart from the safety implications is expensive to dispose of. There are legal obligations to companies regarding the disposal of hazardous wastes. There will also be Environmental implications as there are guidelines and regulations that companies must met related to their emissions. |

1. Are hazardous wastes generated in your laboratory? What are the requirements for collection and disposal of hazardous wastes?

|  |
| --- |
| This will be specific for a particular workplace. For TAFE campuses this could be:  Organic chemicals  Silver ions  Lead solutions  Student should indicate the types of hazardous wastes generated  Disposal will be dependent on the waste. Generally each hazardous waste will be collected separately (following SDS recommendations) and specialised waste collections are requested. |

1. What are the environmental impacts of the analysis you do in the laboratory?

|  |
| --- |
| Laboratory wastes are important to minimise.  Where laboratory is working in the area of production, keeping process within specification means less waste, cuts requirements for services such as electricity and water. |

1. For your routine laboratory work indicate how equipment/instruments and reagents are cared for and stored, noting the following:

* Cleaning and maintenance required
* Storage conditions
* Use by date of reagents (if applicable)
* Reporting of unsafe equipment, hazards and incidents

|  |
| --- |
| Equipment/instruments required daily are stored on the bench in specific areas. For Specialised analysis that occurs irregularly, the equipment will be stored in storeroom and brought out as required. Prior to packing away it will be cleaned according to the SOP.  Reagents are generally stored in a preparation laboratory where they are accessed as required. Reagents are stored according to DET protocols. Bulk flammables are stored in a separate storeroom outside the main building. There are specialised cabinets for storage of small quantities of flammables, acids and bases are stored in specialised cabinets.  SDS are used to determine what chemicals require isolation from others.  All reagents are checked for suitability of use (use-by dates, discolouration, cloudy, solids present etc).  All equipment that is found to be faulty and not safe for use is to be tagged out of service and appropriate information logged in the correct paperwork or LIMS.  Spills are cleaned up according to laboratory procedures and information available in the relevant SDS. All hazards/incidents are reported according to laboratory procedures. |

1. How is information managed in your laboratory?

|  |
| --- |
| The response should indicate if there is a LIMS in place or if the record keeping is done manually.  The lab technician may be responsible for input of data while the final test report is signed off by a signatory, this is particularly important if the Lab is NATA certified. |

1. Why is confidentiality of results important for a laboratory?

|  |
| --- |
| Confidentiality is an ethic issue and is particularly important in various laboratories such as research, pathology, industrial and other medical.  Many laboratories companies will have confidentiality agreements in place with their employees in relation to the type of work and the analysis of work completed |

1. Why does the laboratory need to ensure all sample information is traceable?

|  |
| --- |
| There may be questions asked about product quality months out from the actual sampling and testing. In many areas it is a legal requirement that samples can be traced. This is important in medical facilities, food industry, research programs etc. |

## Part 3: Assessment Checklist

The student’s copy of the Assessment Checklist will be used by you to capture evidence of their performance in any type of project. This checklist outlines all the required criteria you will be marking the student on. All criteria must be met. The following checklist contains benchmark responses for you to use when assessing to ensure reliability of judgement. You may ask questions during the demonstration or if appropriate directly after the assessment has been completed noting that both the question and student response needs to be captured on the checklist.

| PART |  |  |  |  |  |  |  | Assessor Comments |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Solution | 1. | | 2. | | 3. | | *Date of Submission:* |
|  |  | S | US | S | US | S | US |  |
| 1 | Part A research report should: |  |  |  |  |  |  | *Assessors are to record their observations in sufficient detail to demonstrate their judgement of the students performance against the criteria*  *You will need to identify possible responses for the tests you chose. Each laboratory will be different and each test will have different possible responses. The assessor needs to refer to completed benchmark response provided in the marking guide for typical content – one benchmark response has been provided.*  *Responses provided here relate to Ni in steel by AAS. They are to provide a guide as to expectations. Remember that not all tests will have calibration standards, or require calibration of instrumentation etc* |
| 1.1 | identify the three tests in the table provided in the Specific Task Instructions |  |  |  |  |  |  | *Each of the three tests should be identified* |
| 1.2 | the purpose of the test |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.3 | the chemical principles and concepts related to the identified test |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.4 | sample preparation required for the test |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.5 | documentation required for pre-analysis and final results (this could be as a form placed with the Appendix) |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.6 | standard preparation (if required) and calibration of equipment/instrument |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.7 | the basic operational components of any testing equipment/instruments needed |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.8 | hazard identification for the chemical test |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.9 | common causes of analytical errors and how these can be identified and minimised |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.10 | workplace requirements for the cleaning up of spills for each test |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 1.11 | an Appendix with additional information as identified in the report including the Supervisor report indicating that the tests were satisfactorily completed to industry standard and the dates of completion. |  |  |  |  |  |  | *Please refer to sample completed benchmark report* |
| 2 | Part 2 Assignment: all questions answered correctly |  | | | | | | *Responses are provided in the actual questions in Part 2.* |