# Topic Test 1 - Metrology

# Trainer & Assessor Marking Guide

## Criteria

### Unit code, name and release number

MSL924003 - Process and interpret data Release 1

\*\*This unit sits in all qualifications below. This assessment is not to be amended\*\*

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

MSL60118 Advanced Diploma of Laboratory Operations Release 1

MSL50118 Diploma of Laboratory Technology Release 1

MSL40118 Certificate IV in Laboratory Operations Release 1

MSL30118 Certificate III in Laboratory Skills Release 1

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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 written assessment and will be assessing the student on their knowledge of the unit.  This assessment has 13 questions. It is to be conducted as a supervised open book test. Students are able to bring the Student Workbook into the test but no other information resources.  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 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.  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.  Arrange a time for each student to view their marked tests and the assessor feedback. Assessors are to retain all tests after students have viewed their results. Students may not keep a copy of their completed test.  Ensure the student’s name appears on the bottom of each page of the submitted assessment. |
| **About this marking guide** | The student’s response to each question must contain the information indicated in this marking guide in order for their response to be correct.  All questions must be answered 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** | Students must provide a pen/s, calculator and their Student Workbook. |
| **Assessor must provide** | One copy of the assessment task per student, filename MSL924003\_AE\_Kn\_1of7. |
| **Time allowed** | 1 hour |

## Short answer

Read each question carefully and write your answer in the space provided.

1. What is metrology? Why is it important in laboratory work?

Metrology is the study of the science of measurement.

Laboratories measure things. Any general answer about the importance of measurements to quality outcomes is an acceptable answer.

1. Identify the three key international bodies that contribute to metrology in a laboratory setting.

Acceptable responses would be the acronym and/or the name. Each organisation needs to be in the answer.

Bureau International des Poids et Mesures or BIPM or International Bureau of Weights and Measures

International Organisation for Standardisation or ISO

Organisation for Economic Cooperation and Development or OECD

1. Identify and list the two national bodies associated with the quality of metrology in Australia.

Acceptable responses would be the acronym and/or the name. Each organisation needs to be in the answer.

National Association of Testing Authorities or NATA

National Measurement Institute or NMI

1. a) Define the term **base unit**.

Base units are the primary units from which all other units are derived.

b) In the table below, list all the base units used in the metric system by **physical quantity,** **name** and **symbol** (mass is given as an example).

| Physical quantity | Name | Symbol |
| --- | --- | --- |
| Mass | kilogram | kg |
| Length | Metre | m |
| Time | Second | s |
| Amount of substance | Mole | mol |
| Electric current | Ampere | A |
| Temperature | Kelvin | K |
| Luminous intensity | Candela | cd |

Students need to list all 7 units for a correct answer

1. a) What is a derived unit?.

When any of the base units are combined with each other they form what is called a derived unit

• ()

• ()

• ()

b) List three examples of derived units and **explain** the type of measurement that the unit relates to. *Example: Decibel (related to noise or signal measurements)*

|  |  |
| --- | --- |
| Derived unit | Type of measurement it relates to |
| Litre | special volume based on length |
| Watts | energy measurements |
| Decibel | noise or signal amplitude |

Correct answer can contain any other unit from Table 1.4 of the Learner resource.

1. What is the difference between metric and imperial units?

Metric units are derived from base 10. Imperial units are derived from any historical reference.

1. Why is a measurement considered an estimate?

Because we can never know the true value as the decimal places would go on forever. As soon as we truncate (shorten) an answer, it turns into an estimate.

1. What is the difference between accuracy and precision?

Accuracy refers to the closeness of a result to a true or otherwise accepted true value.

Precision refers to the relative closeness of repeated measurements of the same thing.

1. a) What is meant by the term error in metrology? Identify and list four different categories or types of error.

Error can mean several things, but expresses the range of values that an estimate could be.

b) Identify and list four different categories or types of error.

• Operator error

• Equipment error

• Type 1. II error

• Systematic

• Random

• Any other accepted term.

1. a) What is calibration when applied to metrology?

Calibration refers to the use of standard reference materials and processes that a measurement system is aligned to, to ensure that the measurements taken with the system will be as accurate as possible.

b) List two pieces of equipment in your lab that need to be calibrated.

Acceptable responses will vary depending on what equipment the students have been exposed to. Example responses could include: pH meter, DO meter etc.

1. What is traceability when applied to metrology?

Traceability refers to being able to ‘trace’ an analytical result back through to the national testing authority.

1. a) What is **repeatability** when applied to metrology?

Testing the same measurement under the same conditions over and over to ensure the precision of the test procedure meets quality objectives.

b) Why is **repeatability** important?

Repeatability is essential for ensuring quality results in the laboratory.

1. Using an example of where you have measured something in the lab (such as pH, temperature or conductivity), identify three **sources of error** that can occur in this measurement process.

Any of the following

Reagent quality

Operator error

Power supply issues

Lack of calibration

Poor calibration

Equipment malfunction

Software malfunction

Span drift

Dirty probe