# Knowledge Assessment

**Assessment event 1 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.\*\*

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For queries, please contact:

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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 is in four parts:   1. Multiple choice questions (Questions 1 to 5) 2. True or False questions (Questions 6 to 17) 3. Short answer questions (Questions 18 to 29) 4. Assessment Feedback   The assessment is open book. The student is permitted to bring into the assessment an A4 double sided sheet of personal study notes they have individually prepared. You will need to provide the student with the assessment paper.  There is an appendix at the end of the document that contains a Periodic Table and a Valency Table that the student can remove for the assessment.  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.  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.  The student is to submit the Periodic Table and the Table of Valency with their completed Knowledge assessment  Ensure the student’s name appears on the bottom of each page of the submitted assessment including the Appendices. |
| **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** | Calculator, pens, A4 double sided sheet of personal study notes |
| **Assessor must provide** | Assessment paper |
| **Time allowed** | 2 hours |

## Multiple choice (Questions 1 – 5)

Read the question and each answer carefully. Put an X in the table next to your chosen answer.

1. Both Ionic and covalent bonds are found in the following compounds:

Table 2 Multiple choice

| Answer choices | Put X next to your answer |
| --- | --- |
| 1. Hydrogen sulfide |  |
| 1. Methanoic acid |  |
| 1. Potassium fluoride |  |
| 1. Sodium hydroxide | X |

1. Chemical tests can be performed to:

Table 3 Multiple choice

| Answer choices | Put X next to your answer |
| --- | --- |
| 1. Determine the composition of material |  |
| 1. Determine pollutants in a waterway |  |
| 1. Identify contaminants in a pharmaceutical product |  |
| 1. All of the above | X |

1. As you go across the Periodic Table, the trend in bond types between fluorine and the elements of Row 2 is:

Table 4 Multiple choice

| Answer choices | Put X next to your answer |
| --- | --- |
| 1. Ionic 🡪 dispersion |  |
| 1. Ionic 🡪 covalent | X |
| 1. Metallic 🡪 covalent |  |
| 1. Metallic 🡪 ionic |  |

1. Nitric acid (HNO3(aq)) is a strong acid. In a 0.01M solution the concentration of H+(aq) is:

Table 5 Multiple choice

| Answer choices | Put X next to your answer |
| --- | --- |
| 1. 2 mol L-1 |  |
| 1. 1 x 10-12  mol L-1 |  |
| 1. 0.01 mol L-1 | X |
| 1. 1 x 10-14 mol L-1 |  |

1. Which of the following indicates a chemical reaction has occurred?

Table 6 Multiple choice

| Answer choices | Put X next to your answer |
| --- | --- |
| 1. A large change in temperature |  |
| 1. A change in colour |  |
| 1. A gas given off |  |
| 1. A precipitate formed |  |
| 1. All of the above | X |

## True or false (Question 6 – 17)

Read the question and then write **True** or **False** in the space provided.

Table 7 Multiple choice

| Question | Write *True* or *False* |
| --- | --- |
| 1. An example of an intermolecular bond is dipole-dipole bonding | T |
| 1. Fe2+ is an anion | F |
| 1. The Periodic Table predicts the order of elements using their Atomic Mass | F |
| 1. A weak acid is one that does not completely ionise in water | T |
| 1. The colour visible when a firecracker explodes is due to the emission of absorbed energy as light | T |
| 1. Emission spectra can be used to identify elements | T |
| 1. The boiling of water is a chemical reaction | F |
| 1. 500 mL of 1 M solution of C6H12O6 contains 90.078 g of C6H12O6 | T |
| 1. The SI unit for mass is the kilogram | T |
| 1. A sample sent for analysis should be representative of the bulk material. | T |
| 1. The molecular weight for molecule of ethanol (C2H5OH) is 9 au | F |
| 1. 15.0 mL of a 1000mg/L stock solution is diluted to 200 mL. The concentration of the resulting solution is 75 mg/L | T |

## Question (18 – 29) Short answer

Read the question carefully. Your answer should be a minimum of 5 words but no longer than 100 words for questions requiring a response other than a formula, calculation or equation.

1. Complete the table by providing the correct formula or name for the chemicals identified.

Table 8 Multiple choice

|  |  |  |  |
| --- | --- | --- | --- |
| Chemical | Formula | Formula | Chemical |
| Iron II sulfate | FeSO4 | CO | Carbon monoxide |
| Potassium oxide | K2O | N2O4 | Dinitrogen tetroxide |
| ammonia | NH3 | PbO2 | Lead IV oxide |
| Diphosphorous pentoxide | P2O5 | KMnO4 | Potassium permanganate |

1. Explain the following terms using an example in your response

Element: composed of one type of atom only. Example any provided from the periodic table, oxygen, nitrogen, manganese, etc

Compound: Is a pure material composed of two or more elements chemically combined in a fixed ratio. Example water H2O composed of two hydrogen atoms and an oxygen atom in the ratio 2:1.

Ion: an ion is a charged particle, it can be negative (anion) such as chloride, Cl- or positive (cation) such as Ca2+. The negative charge is formed by accepting electrons. The positive charge is formed by donating electrons.

Atom: the smallest discrete particle. Generally considered to be a central nucleus containing protons and neutrons and electrons that are in orbit around the nucleus.

Molecule: small discrete unit of two or more atoms chemically joined. May be composed of only one type of atom for example oxygen, O2 or contain two or more elements chemically combined for example carbon dioxide composed of carbon and oxygen atoms chemically combined.

1. Explain how the position of an element in the Periodic Table assists in predicting characteristics of another element. Provide an example in your response.

The periodic table is arranged in columns and rows.

The rows (periods) are characterised by an increasing number of electrons across the row until the outer shell is completed at inert gas such as helium and neon

Columns (Groups) are arranged with the same number of electrons in the outer shell.

Group 1 triad Lithium, Sodium and Potassium all have one electron in their outer shell. They react similarly in chemical reactions. Caesium also with one electron would be expected to act similarly.

1. The Haber process to product ammonia involves the reaction of hydrogen and nitrogen gas. This an equilibrium reaction. Complete the following:
2. Write the chemical equation for the reaction

3H2(g) + N2(g) ⬄ 2NH3(g)

1. Write the equilibrium expression for the reaction

Keq = . [NH3]2 .

[H2]3 x [N2]

1. Explain the use of a catalyst in the commercial production of ammonia

A catalyst is a material that is designed to speed up a reaction, but not take part in the reaction. The production of ammonia industrially uses a catalyst to speed up the ammonia by lowering the activation energy. This allows for reduced costs for heating and the formation of the ammonia at a quicker rate.

1. Write the balanced neutralisation equation for the reaction of methanoic acid (HCOOH) and barium hydroxide (Ba(OH)2).

2HCOOH(l)  + Ba(OH)2 (aq)  🡪 Ba(HCOO)2(aq) + 2H2O

**The following questions relate to practices in your laboratory/simulated laboratory.**

Students from different workplaces/simulated workplaces may have different responses. You are to check with the workplace to verify acceptable responses. Typical responses are provided as a guide.

1. Metrology is the study of measurement. The function of a laboratory is to measure something and report a result. How are the following relevant to your laboratory?
2. sources of error: Error is defined as the difference between the true value and the reported value. The laboratory will always endeavour to reduce the error. Errors can be random or systematic. Random errors are unpredictable and cannot be corrected for. An example would be the measurement of the correct level in a pipette in the reading of the meniscus and hence the delivery of the liquid volume. These can be minimised by running a number of samples and averaging the result. Systematic errors are those that repeatable each time the analysis is done. They could be due to incorrect calibration of equipment such as balance weighing consistently high or low. These may be adjusted for by running a QC sample at the same time and making a correction.
3. uncertainty: is the range of values in which the expected value is expected to lie. A laboratory may report the result as 0.106 ± 0.0013 mol L-1. This means the actual value lies between 0.1047 and 0.1073 mol L-1 .
4. precision: is how close a number of results for a tested sample are to each other. A result may be precise but not accurate if there is a consistent error in the procedure or equipment.
5. repeatability: is the variation in a replicate measurements determined by a single person using the same method and equipment. It is a measure of precision.
6. accuracy: is how close the measured measurement is to the true measurement. A laboratory would endeavour to be accurate and precise.
7. significant figures: these are values that have real meaning in relation to the actual measurement. A calculator could give many decimal places but many of these values would have no meaning for an actual reported result. In the laboratory significant figures are the number of digits that have meaning in relation to the actual measurement process. The number of significant figures reported is generally limited by the measurement step with the least number of significant figures.
8. all measurements only estimates: every piece of equipment or instrument has some degree of error hence the value taken only approximates (or estimates) the true value. The emphasis for the workplace is to use the most appropriate measuring device for the task.
9. In a laboratory where would you find information regarding any hazard related to a particular sample or test method?

Hazards identified would be found in the SOP for the particular method. There would be a risk assessment that would have identified the hazards and the appropriate control measures noted for action. This could be hardcopy in the laboratory or on the LIMS.

1. How do you ensure you are following the correct method for the testing of a sample?

The LIMS would generally issue information related to the sample, the test required and either the action method or a direction as to where the method was stored.

1. If atypical results are evident for a particular sample, what trouble-shooting procedures are in place? (You should consider calibration, equipment functionality and the actual procedure being followed.)

Responses may include some of the following:

Check the sample method is correct for the actual test

Check calibration of instrument/equipment using historical data as a reference

Run a duplicate sample

Check the reagents for contamination

Check sample was prepared and stored correctly

Check results for quality control sample

Ask for a new sample to be prepared

Check with supervisor

1. In a laboratory what systems are in place to ensure the traceability of samples at all points of the process, from sampling to testing through to reporting?

Chain of custody paperwork accompanies sample attached is barcode sample numbers. These go with the sample from the source, through sample preparation, logging of sample into LIMS (either electronic or manual), testing by analyst and final reporting of result.

As sample passes from one section to another the paperwork/barcode also is transferred. Systems may also the actual instrumentation on which the measurements were made. This provides a way of checking the reliability of data on a particular day.

1. How is confidentiality and physical security of data managed in the laboratory?

Each user of the LIMS has a password for access. There are levels of access for different employee positions.

1. The generation of waste and the impacts to the environment must be considered for all laboratory testing. How can these be minimised in the laboratory?

Analysts are trained for each method they complete and this includes training in the importance of limiting waste for cost and environmental impact. Limited amounts of reagents will be taken for an analysis, thus reducing wasteage. Where possible a less hazardous chemical will be used if applicable.

Training also focusses on spill clean-up to minimise effects on personnel and the environment.

**Appendices**

**Valency Table**

***Common ions and their charges***

| +1 | +2 | +3 | +4 | -1 | -2 | -3 |
| --- | --- | --- | --- | --- | --- | --- |
| ammonium  NH4+ | barium  Ba2+ | aluminium  Al3+ | Lead (IV)  Pb4+ | acetate (ethanonate)  CH3COO - | carbonate  CO32- | phosphate  PO43- |
| potassium  K+ | calcium  Ca2+ | iron (III)  Fe3+ | tin (IV)  Sn4+ | bromide  Br - | chromate  CrO42- | phosphide  P3- |
| silver  Ag+ | Copper (II)  Cu2+ |  |  | chlorate  ClO3 - | dichromate  Cr2O72- | nitride  N3- |
| sodium  Na+ | iron (II)  Fe2+ |  |  | chloride  Cl - | oxide  O2- |  |
| Hydrogen  H+ | lead (II)  Pb2+ |  |  | fluoride  F - | peroxide  O22- |  |
|  | magnesium  Mg2+ |  |  | hydrogen carbonate HCO3- | sulfate  SO42- |  |
|  | mercury(II)  Hg2+ |  |  | hydrogen sulfate  HSO4 - | sulfite  SO32- |  |
|  | nickel  Ni2+ |  |  | hydroxide  OH - | sulfide  S2- |  |
|  | tin (II)  Sn2+ |  |  | iodide  I - |  |  |
|  |  |  |  | nitrate  NO3 - |  |  |
|  |  |  |  | nitrite  NO2 - |  |  |
|  |  |  |  | permanganate  MnO4- |  |  |

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