



Australian Government

Department of Education, Employment and Workplace Relations

MSATCM406A Apply basic chemical principles to metallurgy

Revision Number: 1

MSATCM406A Apply basic chemical principles to metallurgy

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor	This competency provides basic underpinning chemistry knowledge for industrial metallurgical processes.
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Application of the Unit

Application of the unit	This competency applies to metallurgists working in industrial environments including foundries, steel plants, smelters, die casting, fabrication, welding etc. The unit provides the general chemical knowledge for basic metallurgy operations. Note: This unit covers some but not all of the content in Year 12 chemistry subjects such as the NSW Chemistry Stage 6 syllabus and equivalents in other States and Territories. Students who have completed these chemistry subjects at school should be given the opportunity for recognition of prior learning (RPL).
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Pre-requisite Units	

Pre-requisite Units		

Employability Skills Information

Employability Skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Not applicable.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Demonstrate knowledge of basic chemical concepts relevant to metallurgical processes	1.1. The structure of atoms is described including sub-atomic particles, charge, atomic number, mass number, and valency . 1.2. The properties of elements is determined from the periodic table of elements. 1.3. The three states of matter are described in terms of shape, volume, and compression. 1.4. Boyles and Charles laws are used to determine the relationship between volume, temperature, and pressure for a gas. 1.5. Elements, compounds and mixtures are defined and examples given 1.6. Chemical formulae are used 1.7. The difference between organic and inorganic compounds is described 1.8. Ionic, covalent, and metallic bonding are described. 1.9. The relationship between temperature and the kinetic energy of particles is identified 1.10. The concepts of latent and sensible heat are described.
2. Contrast the physical properties of crystalline solids.	2.1. Solids are categorised from their physical properties 2.2. The physical properties of crystalline solids are related to the nature of the forces between particles.
3. Define the key chemical properties of metals.	3.1. The activity of metals and other key properties are described in terms of their position on the Periodic Table. 3.2. The importance of first ionisation energy in determining the relative reactivity of metals is described. 3.3.
4. Define the key chemical properties of acids and bases.	4.1. Definitions of acids and bases are described. 4.2. The pH scale is described and applied 4.3. The relationship between an acid and its conjugate base and a base and its conjugate acid is described 4.4. A range of salts which form acidic, basic or neutral solutions are identified and their acidic,

ELEMENT	PERFORMANCE CRITERIA
	neutral or basic nature explained 4.5.Strong and weak acids and bases are defined and identified. 4.6.
5. Analyse chemical reactions	5.1.Chemical reactions are described using appropriate balanced chemical equations 5.2.Chemical reactions between elements and compounds are explained in terms of atomic structures and periodicity 5.3.The heat of reaction in chemical reactions is determined. 5.4.Factors affecting reaction rate are explained including concentration, surface area, pressure, temperature and catalysis 5.5.The stoichiometry of a reaction is used to determine amounts of reactants consumed/products made

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- write chemical formulae
- write and balance chemical equations
- calculate heat of reaction

Required knowledge:

Competence in this unit requires knowledge of:

- Kinetic Theory;
- Boyles Law, Charles Law,
- Ideal Gas equation $PV=nRT$,
- molar volume of a gas;
- Gay-Lussac's Law, Avogadro's Law;
- gas reaction calculations
- symbols of common elements
- importance of valence in formulae and reactions
- model of an atom including electron shells.
- The chemical basis of energy transformations in chemical reactions
- Periodic table
- Acids and Bases,
- Stoichiometry

Evidence Guide

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

This competency also requires evidence of competency in the description of chemical laws, principles and terminology. The application of the chemical laws and principles to a selection of appropriate scenarios should also be required. The scenarios may be drawn directly from the workplace or may be simulated case studies.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that competence is demonstrated in the ability to:

- describe elements and compounds according to their chemical properties
- use recognised and appropriate chemical symbols and terminology

Consistent performance should be demonstrated. In particular look to see that:

- a wide variety of elements and compounds can be described
- the application of chemical laws and reactions to non laboratory situations can be explained

Relationship to other units

This unit may be assessed concurrently with other relevant units.

Assessment method and context

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge. The unit is suitable for assessment in conjunction with other metallurgy units and a holistic approach should be taken to the assessment wherever possible.

Competence in this unit may be assessed:

- in a workplace
- in a suitable laboratory facility,
- by use of a suitable simulation and/or a range of case studies/scenarios
- by a combination of these techniques.

EVIDENCE GUIDE**Resource implications**

This section should be read in conjunction with the range of variables for this unit of competency. No special resources are required. However resources may be required where holistic assessment with other units is undertaken including suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Range Statement

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Codes of practice/standards	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used.
Context	This competency applies to metallurgical technicians who are responsible for determining the chemical composition of materials, products and work in progress and making recommendations as to what needs to be done to produce the required product. The unit is intended to complement other more specific metallurgy units by providing general chemical knowledge.
Physical properties of crystalline solids	Crystalline solids include molecular, metallic, ionic, extended covalent solids. Physical properties include but are not limited to - boiling point, melting point, solubility in polar and/or non-polar solvents, conductivity, ductility, brittleness, hardness.
Key properties	The key properties of metals in terms of their position on the Periodic Table are: • electrical conductivity • ionisation energy • atomic radius • melting point • boiling point • combining power (valency) • electronegativity • reactivity
Use of formulae	Formulae will be correctly written for given compounds and correct names will be written from given formulae
Definitions of acids and bases	• Arrhenius definition • Brønsted-Lowry definition
Strong Acid	Strong acids are those that have high degrees of dissociation yielding hydrogen ions
Weak acids	Weak acids have partial dissociation of hydrogen ions and exist

RANGE STATEMENT	
	mostly in the associated form.
Strong bases	Strong bases completely or almost completely dissociate into hydroxide ions and a conjugate acid.
Weak bases	Weak bases partially dissociate into hydroxide ions and a conjugate acid.
Stoichiometry	The calculation of the quantities of chemical elements or compounds involved in a chemical reaction.

Unit Sector(s)

Unit Sector	Metallurgy
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Competency field

Competency Field	
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Co-requisite units

Co-requisite Units		