

## CERTIFICATE IV IN ADULT TERTIARY PREPARATION (10765NAT)

### CHEMISTRY

The Chemistry Specialisation applies to those who require foundation Chemistry knowledge and skills for entrance to tertiary study in a relevant discipline or field.

*There are three units of study within the Chemistry Specialisation.*

#### **ATPCHE001 - Unit 1:**

*Demonstrate the practical and theoretical application of introductory chemistry.*

This unit describes the performance outcomes, skills and knowledge required to apply introductory chemistry both in theory and in practice. It requires the ability to solve problems, refine experiments and conduct scientific investigations relating to chemistry fundamentals, physical and chemical changes, chemical reactions and stoichiometry. Explaining chemistry concepts requires proficient use of scientific and everyday language and conventions.

#### **ATPCHE001 - Performance Criteria:**

<b>1. Prepare and conduct laboratory investigations</b>	<p>1.1 Follow procedures to prepare, perform and record introductory laboratory operations.</p> <p>1.2 Select and use laboratory equipment appropriately to conduct chemical laboratory investigations.</p> <p>1.3 Comply with safe laboratory practices according to chemical properties.</p>
<b>2. Collect and use data</b>	<p>2.1 Collect and collate primary and secondary source data.</p> <p>2.2 Apply data to calculations and chemical equations.</p> <p>2.3 Determine the reliability of the data and account for result errors.</p>
<b>3. Solve Chemistry problems</b>	<p>3.1 Identify procedures, concepts, principles and technology to be used to develop solutions using the problem solving process.</p> <p>3.2 Formulate a plan to solve the problem.</p> <p>3.3 Select and apply chemistry information and theory to calculate solutions.</p> <p>3.4 Analyse the validity of the result, make judgments and draw conclusions.</p>
<b>4. Communicate ideas and information</b>	<p>4.1 Explain scientific reasoning using logical and sequenced ideas and information in chemistry.</p> <p>4.2 Organise and represent chemistry ideas and information using scientific language, conventions and technology appropriate to the audience and purpose.</p>

#### **ATPCHE001 – Performance Evidence:**

- Calculated chemical quantities using Avogadro's number, the mole, molar mass and molar volume
- Balanced chemical equations using the principles of stoichiometry
- Applied the electron configuration of elements to explain periodic trends, valence structures and molecular shapes
- Explained the physical and chemical properties of matter by applying knowledge of intra- and inter-molecular bonding
- Demonstrated proficiency in a variety of laboratory procedures that includes
  - Taking accurate measurements
  - Separation using filtration
  - Transferring substances between containers
  - Heating substances safely
  - Observing and recording changes that include colour and temperature, and identifying the formation of new substances
  - Recording data accurately
  - working safely
- Collected and analysed data to explain observations, identify trends, determine quantitative reactions and perform calculations in chemistry

#### **ATPCHE001 – Knowledge Evidence:**

- Bohr's Atomic Model
- Fundamental knowledge of matter including elements, compounds, mixtures and their different phases.
- Electron configuration of elements
- Arrangement and trends in the Periodic Table.
- Types of bonds including ionic, metallic and covalent and their properties
- Molecular shapes and valence structures
- Bond polarity and intermolecular forces including dispersion, dipole-dipole and hydrogen bonding.
- Avogadro's number, the mole, molar mass and molar volume.
- Symbols of elements and formulae of compounds, including molecular and empirical.
- Balanced chemical equations and stoichiometry.
- Limiting and excess reagents
- Knowledge of hazards associated with the substances and equipment used in laboratory work and risk mitigation strategies
- Strategies to assess the reliability of data and to account for errors in data
- Laboratory procedures including
  - Use of basic laboratory equipment
  - Taking accurate measurements
  - Separation of mixtures
  - Transferring substances between containers
  - Heating substances safely
  - Observing and recording changes in colour, temperature, and identifying the formation of new substances
  - Recording data accurately
- Primary and secondary sources of academically credible data and information
- Scientific language and conventions used in a chemistry including symbols, terms and definitions

### **ATPCHE002 - Unit 2:**

*Apply principles of chemical reactions and systems in theory and practice.*

This unit describes the performance outcomes, skills and knowledge required to understand and apply principles of chemical reactions and chemical systems in theory and practice. It requires the ability to solve problems, refine experiments and conduct scientific investigations relating to thermochemistry, equilibrium, acids and bases. Presenting ideas, information, problems and solutions effectively requires communication using scientific and everyday language and conventions is required.

### **ATPCHE002 - Performance Criteria:**

<b>1. Conduct laboratory chemical system experiments</b>	1.1 Follow procedures to prepare, perform and record laboratory operations. 1.2 Select and use laboratory equipment appropriately to conduct chemical system reaction experiments and investigations. 1.3 Comply with safe laboratory practices according to chemical properties.
<b>2. Collect and use data</b>	2.1 Collect and collate thermochemistry, equilibrium and acid/base theory data from primary and/or secondary data sources. 2.2 Perform calculations and chemical equations and record results. 2.3 Analyse data to explain observations and identify trends.
<b>3. Solve and report on chemical reaction and systems problems</b>	3.1 Select data, chemistry information and theory from primary and secondary sources. 3.2 Formulate a plan to solve the problem using logical and sequenced ideas and information. 3.3 Analyse the validity of the result, make judgments and report on conclusions.

**ATPCHE002 – Performance Evidence:**

- Calculated heats of reaction directly and indirectly using Hess's Law
- Identified and explained factors affecting the rate of a chemical reaction.
- Applied Equilibrium Law and Le Chatelier's Principle to problems in solubility and acids and bases.
- Analysed acids and bases using volumetric analysis.
- Collected and manipulated data to explain
  - reaction kinetics
  - energetics and rate of a chemical reaction.
- Solved problems relating to equilibrium, reaction kinetics and acids and bases.
- Demonstrated proficiency in applying introductory laboratory procedures that includes
  - Monitoring the rate of a chemical reaction
  - Measuring energy changes associated with chemical reactions
  - Volumetric analysis of acids and bases
  - Observing equilibrium systems to explain system changes

**ATPCHE002 – Knowledge Evidence:**

- Solvents, solute and solutions
- Molarity (concentration)
- Thermochemistry including exothermic and endothermic reactions
- Heats of reaction and Hess's Law
- Phase changes and energy
- Kinetic theory including reaction rate, collision theory and activation energy
- Effect of concentration/molarity, temperature, surface area and catalysts on rate of reaction
- Chemical equilibrium including equilibrium law, equilibrium constant and Le Chatelier's Principle
- Equilibrium and its application to physical systems
- Arrhenius and Bronsted–Lowry definitions of acids and bases.
- Acid/Base strength including  $K_a$ ,  $K_w$  and pH
- Fundamentals of Volumetric Analysis.
- Format and terminology used in chemical investigation reports

**ATPCHE003 - Unit 3:**

*Demonstrate the application of theory relating to electrochemistry and organic chemistry.*

This unit describes the outcomes required to apply theory relating to redox reactions, electrochemistry and organic chemistry. It requires the ability to conduct experiments, collect and manipulate data and apply chemistry information, theory and data to solve problems. The communication of chemistry concepts using scientific reasoning and proficient use of scientific and everyday language and conventions is required.

**ATPCHE003 - Performance Criteria:**

<b>1. Collect and analyse chemistry related data</b>	<p>1.1 Conduct laboratory operations to collect redox reaction, electrochemistry and organic data as required.</p> <p>1.2 Collect and collate data from primary and secondary data sources.</p> <p>1.3 Use data to perform calculations and chemical equations.</p> <p>1.4 Analyse data to identify trends, explain observations, determine reliability and account for errors.</p>
<b>2. Solve chemistry problems</b>	<p>2.1 Organise relevant data and information into a logical sequence to form a coherent strategy for problem solving.</p> <p>2.2 Select and apply relevant facts and theory and perform calculations to solve chemistry problems relating to redox reactions, electrochemistry and organic chemistry.</p> <p>2.3 Analyse the validity of the result, make judgments and draw conclusions.</p>
<b>3. Communicate ideas, information and problems effectively</b>	<p>3.1 Explain scientific reasoning using logical and sequenced ideas and information in chemistry.</p> <p>3.2 Organise and represent electrochemistry and organic chemistry ideas and information using scientific language, conventions and technology appropriate to the audience and purpose.</p>

**ATPCHE003 – Performance Evidence:**

- Balanced chemical equations for redox reactions using the principles of electrochemistry
- Calculated cell potentials, standard reduction potentials and cell EMF
- Explained electrochemical processes and organic reactions using data
- Detected products of redox reactions and organic reactions
- Applied international naming conventions for saturated and unsaturated organic substances
- Identified nature of organic compounds from IUPAC name and structure

**ATPCHE003 – Knowledge Evidence:**

- Electron transfer in chemical reactions including oxidation, reduction, oxidizing agents (oxidants) and reducing agents (reductants).
- Identification of oxidation and reduction using oxidation numbers.
- Balanced equations for redox reactions
- Electrochemical cells
- Cell potentials, standard reduction potentials and cell EMF and their application.
- Electrolysis and its applications.
- Introductory organic chemistry
- IUPAC nomenclature of saturated and unsaturated organic substances
- Introductory functional group chemistry
  - hydrocarbons (alkanes, alkenes, alkynes)
  - alkyl halides
  - alcohols
  - aldehydes and ketones
- Reactions of organic substances including addition, substitution, and oxidation reactions.
- Polymerisation reactions.
- Format and terminology used in chemical investigation reports