ST. FRANCIS ACADEMY

A division of St. Francis Methodist School

Curriculum Description for Australian Matriculation (Tertiary Entrance Examinations)

CHEMISTRY

Chemistry, the study of matter and its interactions, is an indispensable human activity that has contributed essential knowledge and understanding of the world around us. Chemical knowledge has enabled us to understand matter and devise processes for activities such as: cooking and preserving food; purifying air and water; recycling plastics; anaesthetising patients; creating and building computers; and communicating with others around the world about chemistry. It has also allowed people to design and produce materials for purposes that include: transport and fuels; cosmetic and beauty products; building products; medical treatments and pharmaceuticals; and cleaning agents. The significant achievements of chemistry stretch across every facet of our lives. However, some may come at a price if they are not used with the greatest of care. Chemical monitoring tells us that some materials, that may pose a threat to ourselves and other life forms, have entered the environment. Ongoing developments and improved understanding of chemistry can also be used to solve these problems.

The Chemistry course equips students with a knowledge and understanding of chemistry to enable them to appreciate the natural and built environment, its materials, and interactions between them. The course helps students to predict chemical effects, recognise hazards and make informed, balanced decisions about chemical use and sustainable resource management. This enables students to confidently and responsibly use the range of materials and substances available to them.

Chemistry requires observation, investigation, experimentation, collection and evaluation of data and the application of new understandings. Over the years chemists have developed a theoretical framework that allows these new understandings to be organised and related to existing knowledge. The Chemistry course mirrors this process by providing opportunities for students to investigate properties and reactions of matter within a developing theoretical framework, enabling them to recommend applications and possible future uses, and hazards, of materials.

In achieving the course outcomes, students develop knowledge, skills, understandings and values relating to materials, reactions and the practices of chemistry. By studying its applications, students appreciate the role and value of chemistry in their daily lives. Through undertaking chemical investigations and laboratory activities using specialised technologies, they develop an appreciation of the need for precision, critical analysis and informed decision making.

The Chemistry course is designed to stimulate and foster intellectual curiosity and promote logical and analytical thinking. It aims to equip students to become informed citizens able to participate in discussion of challenging social and environmental issues. The course enables students to relate chemistry to other sciences including biology, physics, geology, medicine, molecular biology and agriculture, and to take advantage of vocational opportunities that arise through its application. It also helps them to prepare for further study and to be responsible and efficient users of specialised chemical products and processes at home or in the workplace.

Through engaging with this course, students have the opportunity to further their achievement of specific overarching learning outcomes from the Curriculum Framework. The course also provides opportunities for the promotion of core-shared values identified from the Curriculum Framework.

Course outcomes
The Chemistry course is designed to facilitate the achievement of five outcomes. These outcomes are based on the Science learning area outcomes in the Curriculum Framework. Outcomes are statements of what students should know, understand, value and be able to do as a result of their learning.

Outcomes are elaborated into aspects that identify the underpinning knowledge, concepts and/or skills in more detail.

Outcome 1:
Investigating in chemistry
Students use investigative processes in order to communicate their understandings of the chemical world.
In achieving this outcome, students:
- plan experiments to investigate, illustrate and validate ideas about the chemical world;
- conduct experiments safely, making observations, collecting and recording data and presenting them in an organised and logical way;
- analyse data and draw appropriate conclusions based on evidence and their findings; and
- evaluate investigation plans, processes and findings.

Outcome 2: Structure, properties and uses of materials
Students understand the structures of materials to explain their properties and uses.
In achieving this outcome, students:
- understand the properties of materials are related to their structure; and
- understand the uses of materials in terms of their properties.

Outcome 3:
Interaction and change
Students understand interactions between, and changes to, materials.
In achieving this outcome, students:
- understand that chemical change involves the production of new substances and this production can be classified and represented in varied ways; and
- understand the significance of energy in chemical and physical change processes and that these changes can be predicted and controlled.

Outcome 4: Problem-solving and quantities in chemistry
Students understand problem-solving techniques and how to apply them to quantitative problems in a chemical context.
In achieving this outcome, students:
- understand the quantitative nature of chemistry to solve problems in a chemical context; and
- understand the processes involved in solving problems in a chemical context.

Outcome 5: Chemistry in action
Students understand the role of chemistry in biological, environmental and industrial processes. In achieving this outcome, students:
- understand the role of chemistry in processes important in daily life; and
- understand the role of chemistry in evaluating the sustainability of processes important in society.

For each of these outcomes, standards are defined in terms of progressive levels of achievement (see Course Standards).

Course content
The course content is the focus of the learning program. It enables students to maximise their achievement of both the overarching learning outcomes from the Curriculum Framework and the Chemistry course outcomes. By engaging with this essential content, students can demonstrate their achievement.

The course content is divided into seven areas:
- macroscopic properties of matter
- atomic structure and bonding
- chemical reactions
- acids and bases in aqueous solutions
- oxidation and reduction
- organic chemistry
- applied chemistry.

The content areas have been divided between the A units and the B units. The A units include topics such as macroscopic properties of matter and atomic structure and bonding. The B units include such topics as acids, bases and organic chemistry, and the application of many of the concepts from the A units. Both A and B units increase in cognitive complexity from one unit pair to the next.

The Data Booklet contains specified information that the students are expected to apply. It includes information such as details of ions, compound formulas, colours of ions and solubility data.

Macroscopic properties of matter
Macroscopic properties of matter deals with the observable properties of matter. Substances can be classified as elements, compounds or mixtures. Understanding the differences between these classifications provides a basis for choosing appropriate separation techniques for mixtures.

Pure substances generally exist as one of three states of matter at room temperature. An understanding of the behaviour of gases is useful in interpreting everyday situations. Understanding the difference between chemical and physical change is also important.

Atomic structure and bonding
Understanding the particle models of matter is important in explaining the properties of materials, their interactions and uses. Atoms, ions and molecules can be differentiated and elements, compounds and mixtures more readily understood using atomic models. An understanding of atomic structure including electron configuration and bonding theories are used to distinguish metals, ionic substances, covalent network substances and covalent molecular substances. Understanding intermolecular forces in hydrogen bonding, dipole-dipole and dispersion forces aids in explaining properties of covalent molecular substances.

Chemical reactions
It is essential to read, write and interpret chemical equations including word, molecular and ionic equations to understand and communicate change processes in chemistry, why reactions occur, how fast they go and how far they go. The collision theory explains reversible reactions, energy changes in reactions and equilibrium.

Acids and bases in aqueous solutions
Acids and bases have particular characteristics and are chemicals commonly found in and around the home. Acid-base theory and indicator theory are used to explain acidic and basic salts and solution equilibria. Use of aids such as pH colour charts provides links to real world applications.

Oxidation and reduction
Oxidation and reduction are best understood as an electron transfer process and interrelationships between chemical change and electrical energy in electrochemical and electrolytic cells.

Organic chemistry
Organic chemistry is the chemistry of carbon compounds other than carbon dioxide, carbon monoxide and carbonates. Hydrocarbons, compounds containing only carbon and hydrogen, undergo specific reactions such as substitution, combustion and addition reactions. Most organic compounds have functional groups. These functional groups can be identified, named and reactions about them understood.

Applied chemistry
Applied chemistry deals with the application of chemical models, principles and concepts to real world processes. An understanding of chemistry can be used to describe, explain and predict the conditions and behaviour of biological, environmental and industrial processes.

Course units
To cater for the full range of students, six units have been developed to sequence the syllabus content. Stage 1 units enable student achievement at levels 3 to 5; Stage 2 units at levels 4 to 6; and Stage 3 units at levels 6 to 8.

Unit pairs are designed around the essential content areas which increase in complexity from one unit pair to the next. Each unit allows students to achieve all five course outcomes.

For students intending to sit an external examination in Chemistry, it is expected they will have completed either 2ACHE/2BCHE or 3ACHE/3BCHE as their final pair of units.

Unit 1ACHE
The focus for this unit is **chemistry and me.** This unit is designed to build on informal understandings of chemistry students have already acquired through using different materials, tools and products in their lives, and through everyday chemical reactions such as cooking, decomposition and rusting.

Unit 1BCHE
The focus for this unit is **chemistry in my community.** In this unit students build on their understandings through contexts that relate to the local environment such as air and water pollution and treatment, conservation and recycling.

Unit 2ACHE
The focus for this unit is **chemistry in and around the home.** In this unit, students develop more formal understandings of chemical structure, change and language within familiar contexts.

Unit 2BCHE
The focus for this unit is **chemistry and the environment.** In this unit students develop formal understandings of acids and bases, oxidation and reduction, and organic chemistry through environmental contexts.

Unit 3ACHE
The focus for this unit is **chemistry and living.** Students develop relationships between concepts, models and principles in contexts that relate chemistry to society.

Unit 3BCHE
The focus for this unit is **chemistry and modern lifestyles.** In this unit students develop understandings of complex models that underlie the study of medicines, biochemistry, drugs and plastics through further study of equilibrium, oxidation and reduction, and organic chemistry.

Examination details

External assessment is a requirement for students aspiring to university selection. Students need to complete at least two units from 2A–3B to be eligible to sit the WACE exam.

The total examination length is 3 hours and 10 minutes. It will assess Outcomes 1, 2, 3, 4 and 5 of the course. Where possible, examination items will be set in suitable contexts.

There will be two booklets available: one for students who have completed units 2ACHE and 2BCHE only, and one for students who have completed units 3ACHE and 3BCHE.