



### COURSE OVERVIEW

Chemistry is an experimental science that combines academic study and the acquisition of practical and investigational skills, and is suited to students who have an enquiring mind and want to better understand the nature of the living and physical world, who would enjoy developing their experimental and investigative skills and who are logical and analytical thinkers. Students who enjoy exploring the moral, social and ethical responsibilities of science and scientists are developed throughout the course.

At the centre of the chemistry course will be an emphasis on the nature of science. The teaching and learning approach promotes an understanding of how scientists justify knowledge claims and an understanding of the scientific world view. Through experience, knowledge and reflection the student will become trained to approach uncertainty scientifically and will develop aspects of the learner profile

### LEARNING OUTCOMES

Through studying chemistry students should become aware of how scientists work and communicate with each other. While the scientific method may take on a wide variety of forms, it is the emphasis on a practical approach through experimental work that characterizes these subjects.

The aims enable students, through the overarching theme of the Nature of science, to:

1. appreciate scientific study and creativity within a global context through stimulating and challenging opportunities
2. acquire a body of knowledge, methods and techniques that characterize science and technology
3. apply and use a body of knowledge, methods and techniques that characterize science and technology
4. develop an ability to analyse, evaluate and synthesize scientific information
5. develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities
6. develop experimental and investigative scientific skills including the use of current technologies
7. develop and apply 21st century communication skills in the study of science
8. become critically aware, as global citizens, of the ethical implications of using science and technology
9. develop an appreciation of the possibilities and limitations of science and technology
10. develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge.

### UNIT OVERVIEWS

#### Unit 1 – Stoichiometry

**Approximate Length:** 8 weeks

**Unit description:** This unit focuses on the mathematics of chemistry and determining reacting amounts.

**Key concepts:** Physical and chemical properties depend on the ways in which different atoms combine.

**Learning outcomes:**

- Introduction to the particulate nature of matter and chemical change
- The mole concept
- Reacting masses and volumes

#### Unit 2 – Atomic Theory (plus Unit 12 HL only)

**Approximate Length:** 4 weeks

**Unit description:** This unit focuses on the nature of the atom and how knowledge of the structure developed over time.

**Key concepts:** The mass of an atom is concentrated in its minute, positively charged nucleus.

**Learning outcomes:**

- The nuclear atom
- Electronic configuration
- HL Electrons in atoms

#### Unit 3 – Periodicity (plus Unit 13 HL only)

**Approximate Length:** 3 weeks

**Unit Description:** This unit focuses on the periodic table and organization of the elements.

**Key concepts:** The arrangement of elements in the periodic table helps to predict their electron configuration.

**Learning outcomes:**

- The Periodic Table
- Periodic trends
- HL First row d-block elements
- HL Coloured complexes

**Unit 4 – Chemical Bonding & Structure (plus Unit 14 HL only)****Approximate Length:** 6 weeks**Unit Description:** This unit focuses on how atoms combine to make structure and what their physical properties tell us about their structure.**Key concepts:** Lewis (electron dot) structures show the electron domains in the valence shell and are used to predict molecular shape.**Learning outcomes:**

- Ionic bonding & structure
- Covalent bonding
- Covalent structures
- Intermolecular Forces
- Metallic Bonding
- HL Covalent bonding & electron domain & molecular geometries
- HL Hybridization

**Unit 5 – Energetics/Thermochemistry (plus Unit 15 HL only)****Approximate Length:** 4 weeks**Unit Description:** This unit focuses on the energy of chemical reactions.**Key concepts:** The enthalpy changes from chemical reactions can be calculated from their effect on the temperature of their surroundings.**Learning outcomes:**

- Measuring energy changes
- Hess's Law
- Bond enthalpies
- HL Energy cycles
- HL Entropy & spontaneity

**Unit 6 – Chemical Kinetics (plus Unit 16 HL only)****Approximate Length:** 4 weeks**Unit Description:** This unit focuses on the speed of chemical reactions.**Key concepts:** The greater the probability that molecules will collide with sufficient energy and proper orientation, the higher the rate of reaction.**Learning outcomes:**

- Collision theory & rates of reaction
- HL Rate expression & reaction mechanism
- HL Activation energy

**Unit 7 – Equilibrium (plus Unit 17 HL only)****Approximate Length:** 4 weeks**Unit Description:** This unit focuses on reversible reactions and applying this knowledge to industrial systems.**Key concepts:** Many reactions are reversible. These reactions will reach a state of equilibrium when the rates of the forward and reverse reaction are equal. The position of equilibrium can be controlled by changing the conditions.**Learning outcomes:**

- Equilibrium
- HL The equilibrium law

**Unit 8 – Acids & Bases (plus Unit 18 HL only)****Approximate Length:** 6 weeks**Unit Description:** This unit focuses on acids and bases, development of our understanding of them and their real world application.**Key concepts:** The characterization of an acid depends on empirical evidence such as the production of gases in reactions with metals, the colour changes of indicators or the release of heat in reactions with metal oxides and hydroxides.**Learning outcomes:**

- Theories of acids & bases
- Properties of acids & bases
- The pH scale

- Strong & weak acids & bases
- Acid deposition
- HL Lewis acids & bases
- HL Calculations involving acids & bases
- HL pH curves

**Unit 9– Redox Processes (plus Unit 19 HL only)****Approximate Length:** 6 weeks**Unit Description:** This unit focuses on how we define reduction and oxidation and apply this knowledge to metal extraction and use.**Key concepts:** Redox (reduction–oxidation) reactions play a key role in many chemical and biochemical processes.**Learning outcomes:**

- Oxidation & reduction
- Electrochemical cells
- HL Electrochemical cells

**Unit 10 – Organics (plus Unit 20 HL only)****Approximate Length:** 8 weeks**Unit Description:** This unit focuses on carbon containing molecules with a strong focus on homologous series and global warming.**Key concepts:** Organic chemistry focuses on the chemistry of compounds containing carbon.**Learning outcomes:**

- Fundamentals of organic chemistry
- Functional group chemistry
- HL Types of organic reactions
- HL Synthetic routes
- HL Stereoisomerism

**Unit 11– Measurement & Data Processing (plus Unit 21 HL only)****Approximate Length:** throughout the course**Unit Description:** This unit focuses on skills and mathematical calculations required for Internal Assessment. Also physical testing of organic molecules rather than chemical and how to combine the 2 methods to determine structure..**Key concepts:** All measurement has a limit of precision and accuracy, and this must be taken into account when evaluating experimental results.**Learning outcomes:**

- Uncertainties & errors in measurements & results
- Graphical techniques
- Spectroscopic identification of organic compounds
- HL Spectroscopic identification of organic compounds

**Option Topic – B Biochemistry****Approximate Length:** 8 weeks**Unit Description:** This unit focuses on the chemistry of living things.**Key concepts:** Our increasing knowledge of biochemistry has led to several environmental problems, while also helping to solve others**Learning outcomes:**

- Introduction to biochemistry
- Proteins & enzymes
- Lipids
- Carbohydrates
- Vitamins
- Biochemistry & the environment
- HL Proteins & enzymes
- HL Nucleic acids
- HL Biological pigments
- HL Stereochemistry in biomolecules

**ASSESSMENT**

The assessment objectives for chemistry reflect those parts of the aims that will be formally assessed either internally or externally. These assessments will centre upon the nature of science. It is the intention of these courses that students are able to fulfill the following assessment objectives:

1. Demonstrate knowledge and understanding of:
  - a. facts, concepts, and terminology
  - b. methodologies and techniques

- c. communicating scientific information.
2. Apply:
  - a. facts, concepts, and terminology
  - b. methodologies and techniques
  - c. methods of communicating scientific information.
3. Formulate, analyse and evaluate:
  - a. hypotheses, research questions and predictions
  - b. methodologies and techniques
  - c. primary and secondary data
  - d. scientific explanations.
4. Demonstrate the appropriate research, experimental, and personal skills necessary to carry out insightful and ethical investigations.

Students will be evaluated using formative and summative assessments.

Formative assessment is used to inform both teaching and learning. It is concerned with providing accurate and helpful feedback to students and teachers on the kind of learning taking place and the nature of students' strengths and weaknesses in order to help develop students' understanding and capabilities. Formative assessment can also help to improve teaching quality, as it can provide information to monitor progress towards meeting the course aims and objectives. Formative assessments will take many forms with the goal of scaffolding the knowledge, skills and the critical thinking required to successfully complete summative assessments.

Summative assessment gives an overview of previous learning and is concerned with measuring student achievement. All summative assessments will be graded on the 1-7 IB scale. All reports will reflect the IB 1-7 grading scale and will be based the best-fit approach to assessment. The Internal Assessment [IA] task will be one major investigation or scientific exploration and will be worth 20% of the overall assessment. There will also be 3 internal examinations in June of DP1 and January for DP1 and DP2. Paper 1 will consist of multiple choice questions, Paper 2 structured longer answer questions and Paper 3 will be the Options and data analysis examination.

Grade Boundaries for each summative will be published to students by the teacher after the summative assessments are graded.

#### Paper 1

This paper is made up of objective questions (multiple choice) and there is no calculator or data booklet allowed. Students answer in pencil on the answer grid provided. It has a weighting of 20% of the final IB grade.

**Duration:** Paper 1 consists of 30 multiple choice questions and is 45 mins for SL and consists of 40 multiple choice questions for HL and is 1 hour.

#### Paper 2

This paper is made up of structured questions and a calculator and data booklet are allowed. Students write on the examination paper in black or blue ink. It has a weighting of 36%(HL) or 40% (SL) of the final IB grade for Biology.

**Duration:** Paper 2 is 1 hr 15 mins for SL and consists of 50 marks and for HL and is 2 hr 15 mins long & consists of 90 marks.

#### Paper 3

This paper is made up of structured questions based on the Option B Biochemistry and section A consists of data analysis questions. A calculator and data booklet are allowed. It has a weighting of 20% (SL) or 24%(HL) of the final IB grade for Biology.

**Duration:** Paper 3 is 1 hr for SL and consists of 35 marks and for HL and is 1 hr 15 mins long and consists of 45 marks.

#### Internal Assessment (IA)

All students will design, and perform an individual investigation as a part of their Chemistry coursework. They will demonstrate knowledge and understanding of scientific methodologies and terminology. They will apply facts, concepts and techniques for communicating scientific information. They will formulate, analyze and evaluate their own work. They will demonstrate the appropriate research, experimental, and personal skills to carry out an insightful investigation. The IA has a weighting of 20% of the final IB grade for Chemistry.

#### Course Requirements

Scientific calculator (no graphing calculators)

Textbooks are available from the TRC. All students should have a Cambridge textbook and also a Pearsons SL or HL textbook for reference. Oxford revision books will be provided which the students may keep and therefore write on/highlight, etc. Kognity (the online textbook) will be used extensively to set reading assignments and formative tasks throughout the course.

Chemistry Data Booklet

Lab instructions booklet

Syllabus reference and past paper questions booklet to be brought to every lesson

Chemistry ASA will be offered in Grades 11 & 12 in term 2 and 3

**Group 4 Project**

There is a compulsory Group 4 project where all students studying science will work together collaboratively. All DP Chemistry students must participate in this collaborative project as part of the syllabus. Participation at GWA consists of learning the Experimental Sciences from new perspectives in a real-life setting. There will be an **off campus** trip during November of Grade 11.

The Group 4 Project is assessed internally by a Digital Story Submission by each group in November.

**Course Grade Descriptors**

While we will look carefully at the grades students have achieved on the various assessments, ultimately, quarterly grades as well as predicted grades will be based on the following grade descriptors.

**Grade 7**

Displays comprehensive knowledge of factual information in the syllabus and a thorough command of concepts and principles. Selects and applies relevant information, concepts and principles in a wide variety of contexts. Analyses and evaluates quantitative and/or qualitative data thoroughly. Constructs detailed explanations of complex phenomena and makes appropriate predictions. Solves most quantitative and/or qualitative problems proficiently. Communicates logically and concisely using appropriate terminology and conventions. Shows insight or originality.

Demonstrates personal skills, perseverance and responsibility in a wide variety of investigative activities in a very consistent manner. Works very well within a team and approaches investigations in an ethical manner, paying full attention to environmental impact. Displays competence in a wide range of investigative techniques, pays considerable attention to safety, and is fully capable of working independently.

**Grade 6**

Displays very broad knowledge of factual information in the syllabus and a thorough understanding of concepts and principles. Selects and applies relevant information, concepts and principles in most contexts. Analyses and evaluates quantitative and/or qualitative data with a high level of competence. Constructs explanations of complex phenomena and makes appropriate predictions. Solves basic or familiar problems and most new or difficult quantitative and/or qualitative problems. Communicates effectively using appropriate terminology and conventions. Shows occasional insight or originality.

Demonstrates personal skills, perseverance and responsibility in a wide variety of investigative activities in a very consistent manner. Works well within a team and approaches investigations in an ethical manner, paying due attention to environmental impact. Displays competence in a wide range of investigative techniques, pays due attention to safety and is generally capable of working independently.

**Grade 5**

Displays broad knowledge of factual information in the syllabus. Shows sound understanding of most concepts and principles and applies them in some contexts. Analyses and evaluates quantitative and/or qualitative data competently. Constructs explanations of simple phenomena. Solves most basic or familiar problems and some new or difficult quantitative and/or qualitative problems. Communicates clearly with little or no irrelevant material.

Demonstrates personal skills, perseverance and responsibility in a variety of investigative activities in a fairly consistent manner. Generally works well within a team and approaches investigations in an ethical manner, paying attention to environmental impact. Displays competence in a range of investigative techniques, pays attention to safety and is sometimes capable of working independently.

**Grade 4**

Displays reasonable knowledge of factual information in the syllabus, though possibly with some gaps. Shows adequate comprehension of most basic concepts and principles but with limited ability to apply them. Demonstrates some analysis or evaluation of quantitative or qualitative data. Solves some basic or routine problems but shows limited ability to deal with new or difficult situations. Communicates adequately although responses may lack clarity and include some repetitive or irrelevant material.

Demonstrates personal skills, perseverance and responsibility in a variety of investigative activities, although displays some inconsistency. Works within a team and generally approaches investigations in an ethical manner, with some attention to environmental impact. Displays competence in a range of investigative techniques, pays some attention to safety although requires some close supervision.

## STUDENTS RESPONSIBILITIES

**Academic Honesty****Protocol For In-School Malpractice**

The following steps will be followed in cases of malpractice:

1. Teachers will advise students of suspicion of misconduct
2. A record of the incident will be forwarded to the Diploma Programme Coordinator
3. The Diploma Programme Coordinator will discuss the incident with the teacher
4. The Diploma Programme Coordinator will interview the student involved
5. The Diploma Programme Coordinator will action appropriate disciplinary measures commensurate to the offense making note of the incident in the SIS which will in turn prompt a communication with parents.

**Malpractice on Assessments to be Submitted to the IB**

According to the Academic Honesty (2009) document, in cases of malpractice on assessments or exam that are intended for submission to the IB, the following protocol has been put in place.

Once a candidate has submitted his or her work to a teacher (or the coordinator) for external or internal assessment together with the coversheet signed (or authenticated electronically) to the effect that it is the final version of the work, neither the work nor the coversheet can be retracted by the candidate. If the candidate is subsequently suspected of plagiarism or collusion, it is no defense to claim that the incorrect version of the work was submitted for assessment.

After a candidate has signed and dated the coversheet (or authenticated electronically) to the effect that his or her work is authentic and constitutes the final version of that work, the candidate's teacher (or supervisor in the case of an extended essay) must also sign and date the coversheet to the effect that to the best of his or her knowledge it is the authentic work of the candidate. Any suspicion of malpractice that arises after the candidate has signed the coversheet must be reported to the coordinator help desk at IB Cardiff for investigation. However, if there is no tangible evidence of malpractice (such as the source of plagiarism) the candidate must be given the benefit of any doubt and the coversheet must be signed by the teacher/supervisor. It is not acceptable for the teacher to:

- delete the declaration and then sign the coversheet
- submit the work for assessment without his or her signature
- sign the declaration and then write comments on the work or coversheet that raise doubts about the work's authenticity.
- In the above circumstances the IB will not accept the work for assessment (or moderation) unless confirmation is received from the school that the candidate's work is authentic.

If a teacher is unwilling to sign a coversheet owing to a suspicion of malpractice, the matter must be resolved within the school. The coordinator has the option of informing the coordinator help desk that the work will not be submitted on behalf of the candidate (resulting in no grade being awarded for the subject or diploma requirement).

**Malpractice in Testing Situations:**

Students may not:

- take unauthorized material into an examination room (see below)
- leave and/or access unauthorized material in a bathroom/restroom that may be visited during a test
- pass on information to another student about the content of an examination, this includes facilitating the exchange information between other students in any way
- steal examination papers
- using an unauthorized calculator during an examination

Students must not have unauthorized material (for example, own rough paper, notes, a mobile/cell phone or an electronic device other than a permitted calculator) in their possession during a testing situation. "In their possession" may be taken to mean on the person of the student, in the student's immediate proximity (such as on the floor or desk) or placed somewhere (such as a bathroom/restroom) for access during the test. It is very important to note that guilt will be confirmed by the school administration regardless of whether this material is used, was or was not intended for use or contains information relevant or potentially relevant to the test. The actual possession of unauthorized material constitutes malpractice; the school administration is not required to establish whether the student used or intended to use the material. No leniency is shown to a candidate who claims that they were unaware the material was in their possession.

**Late Assessment Policy**Late Assessments:

Should a student not complete a summative assessment on time (this includes summative drafts) teachers will:

- Speak with the student to find out why the assessment has not been submitted.
- An email home will be sent to parents detailing the missed assessment and the student will be asked to stay in school until it is completed.
- If the assessment is pending, once received, they log the infraction in the “reward and conduct” tab in iSAMS regarding the tardiness of the assessment.
- If a student does not attend after school to work on the assessment, the teacher will confer with the student and, if necessary, refer the incident to the Grade Leader. The Grade Leader will discuss the situation with the student to see if support is required or consequences need to be imposed. The Grade Leader will subsequently record the incident in iSAMS. Further incidents of truancy will be escalated to the Secondary School Administration.
- If there is a second incident of a late submission of an assessment, the teacher will report it in an email to the Grade Leader who may contact parents for a meeting where you may be included. The Grade Leader will record their actions in iSAMS.
- Further incidents of late assessments will be reported to Grade Leaders who will forward the incident(s) to the Secondary School administration who, if warranted, will initiate an in-school suspension where students will complete the assessment until it is completed to standard. A record of the suspension will be recorded in iSAMS and prompt a communication with parents.
- Any subsequent incidents of late assessments will necessitate a parent meeting with a member of the Secondary School Administration to determine the best way forward.

Tests Absenteeism

- In cases where students are not in school on a test day, a communication from parents will be required.
- The student will need to present their teacher with a doctor’s note upon their return to class if the test is to be administered with no consequence.
- Should an authorized absence not be received, the student may not be permitted to write the test and an “NA” representing an “incomplete” will appear on the next quarterly report.
- If this incident reoccurs, the issue will be escalated to the Head of Senior School and will receive a ‘O’.
- Aside from school activities, all test absences will be recorded in iSAMS by the teacher with a note in the “record description” whether the test absence was authorized or not. The Grade Level Leader may follow-up with the student, if necessary.

**Teacher Assessment Commitments****All teachers will:**

- Provide feedback on all formative assessments within one calendar week of receipt.
- Post on Managebac any formative assessment (including homework) no later than 5:00PM the day it is assigned. If the formative assessment is not posted by this time there is no expectation that the assessment will be completed for the next day.
- Discuss with students prior to posting summative assessments and provide at least one calendar week lead time for students to prepare. Summative assessments will be posted on Managebac at least one week in advance of the due date.
- Work collaboratively with their teacher colleagues and coordinator to work toward the goal of students having no more than 2 summative assessments on a given day.
- Return summative assessments to students with feedback no later than three calendar weeks after the due date.
- Update Managebac immediately upon completion of marking/feedback.
- Communicate, in a timely fashion, with colleagues and administration about students who are turning in late formative and summative tasks in order to implement late assessment procedures, as outlined in the Assessment Policy. Late assessment procedures are outlined below.
- Communicate with parents when assignments/assessments are not turned in on the due date and clearly articulate the next steps for the student.