

Course Title	Title	Course Code	Code
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**Newport-Mesa Unified School District
Office of Secondary Curriculum and Instruction
High School Course of Study**

Department	Science	Course Title	IB Chemistry HL		
Course Code		Grade Level(s)	11, 12	Course Length	2 years
Credits/Semester	4	Required for Graduation?		Elective Credit?	
Prerequisites	Concurrent enrollment in Algebra 2 (yr 1) and Trig or Precalc (year 2), recommendation from Biology teacher				
Community College Articulation?		Name of College			
UC/CSU Articulation?	Yes	Name of University	UC/USC		
Meets UC/CSU "a-g" Requirement?	Yes	Meets NCAA Requirement?	Yes	Weighted Course Credit?	

COURSE DESCRIPTION

The IB Chemistry course will be a two year course which meets the HL requirements. The primary goal of this course will be to produce students who are clear, logical thinkers, students who understand the scientific method and who are able to apply the principles of the scientific method to the study of chemistry. Students will acquire a thorough knowledge of the topics of the course, they will be able to use this knowledge to inform and enhance their thinking, to help them develop a balanced and open-minded view of not only the particular science studied, but of the world in general. Through student-oriented inquiry they will acquire skills in designing studies, collecting data carefully, taking precise measurements, and evaluating data objectively. Since science is by definition a universal discipline, students will develop a global view of acquiring knowledge and at the same time develop an appreciation for cultural differences and their influences on scientific inquiry.

The course will be taught with an emphasis on hands-on scientific inquiry. There will be frequent labs, and lectures will be kept to an essential minimum. The inquiry method will prevail, and there will be frequent Socratic seminars. There is a natural fit for a science class like this and the Theory of knowledge class. Even in science, knowledge is not acquired strictly through reasoning; language, emotion, and personal perception all play a part in how humans and human societies "understand" scientific discovery.

One of the guiding principles of the course will be a close attention to the moral and ethical implications of scientific inquiry. Every step of a lab or a research project, from the design of the study, the data gathering, through to the interpretation of the results will be held up to established ethical standards. Students will see the interconnectedness of chemistry and the other sciences, mathematics, and the social sciences. IB Chemistry HL students will appreciate the role chemistry has played in history, and how it's on-going discoveries impact the modern world. As internationally-minded thinkers, they will appreciate and be sensitive to the impact of advances in chemistry on various world cultures.

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Students will be presented international issues and be encouraged to explore possible solutions and find links to science: whether it be Biology, Chemistry or Physics. Students will keep on top of international science findings by investigating international science website feeds such as LiveScience.com. The intriguing stories will stimulate inquiry and invite discussion, internal reflection and be open to discussion in class and a collaborative online forum.

Students will be asked to focus on the Theory of Knowledge with regards to their exploration. In their online journal or blog, they will be required to ask themselves:

- “How do they know?”
- “What is the power or value of gaining this knowledge?”
- “What are the consequences?”
- “How do your personal experiences affect your observations or the direction of your exploration?”

Students will explore the ways of knowing: logic, sensory perception, revelation, faith, memory, consensus, authority, intuition, and self-awareness. They will explore the four supposed truth tests: coherence, correspondence, pragmatism, and consensus. The class will refer to the IBO Chemistry Guide First Examinations Guide 2009 to cover outlined TOK and AIMS.

It is the ultimate goal of the course that students emerge as true scientists, clear thinking, open-minded scholars who are able to become passionate about a subject while maintaining a balanced objectivity, scholars who are concerned about the ethical implications of their work. Finally, graduates of this course should be able to clearly communicate their ideas and discoveries to others while always maintaining an openness to valid criticism.

GOALS: (Expected performance outcomes for students)

Mastery of all standards identified as high and medium frequency standards on the California Standards Tests, with a concerted effort to encourage mastery of low frequency standards as well. (For subjects without board adopted and approved state standards list in bullet form the goals of your department's course of study.)

California Content Standards

This course meets all CA state standards for this course

Evaluation

Student achievement will be measured using multiple assessment tools, included but not limited to:

benchmark test results, final exams, end-of-unit tests, quizzes, homework, classwork, notebooks, portfolios, authentic performance assessments, and written assessments using the district's rubric. District-wide benchmark assessments will be assessed using the following chart:

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Performance Standards - Benchmark Assessments				
Far Below Basic = F	Below Basic = D	Basic = C	Proficient = B	Advanced Proficient = A

I. Scientific Measurement and Methods (2 hours)

- a. Safety in the Lab
 - Scientific Method
 - i. Formulating a hypothesis
 - ii. Designing an experiment to test a hypothesis
 - iii. Controls and variable
 - iv. Collection and recording of data
 - v. Evaluation of results
- b. Accuracy, Precision and Significant Figures (2 hours and practiced throughout the year)

Labs and Assessments

- Students will design, perform and write up an experiment analyzing the accuracy of their glassware
- Propose a theory for why ice melts more slowly in salt water than distilled water. Design, perform and write up an experiment to test their theory.

II. Quantitative Chemistry (9 hours)

- a. Moles, Molarity and Empirical Formula
- b. Review the Atomic Theory
- c. Mole Concept and Avogadro's constant
- d. Empirical and Molecular formula determination
- e. Solutions, concentration and molarity

Labs and Assessments

- Answer questions that distinguish the different isotopes of an element and the relationships between the subatomic particles
- Answer questions related to subatomic particles, atoms, molecules, moles and masses
- In a lab, determine the empirical formula for MgO
- In a lab, determine the empirical formula for the oxide in Potassium Nitrate
- Write an IB format test which involves both multiple choice and short answer critical thinking questions

III. Atomic Theory and Chemical Bonding (7 hours)

- a. Electron arrangement in atoms
- b. Classes of compounds and their properties
- c. Ionic bond
 - i. Prediction of charge
 - ii. Prediction of formula
 - iii. Nomenclature
- d. Covalent Bond

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- i. Electron dot diagrams
 - ii. Electronegativity and polar bonds
- e. Ionic bonds involving polyatomic ions
 - i. Prediction of charge
 - ii. Prediction of formula
 - iii. Nomenclature

Labs and Assessments

- In a lab, use spectrosopes to observe and compare the light spectrum of various elements such as hydrogen and neon gas. Interpret this observation as evidence for electron energy levels in the atom.
- In a lab activity, students will compare the melting points, solubility and conductivity of ionic and covalent compounds.
- Write an IB format test which involves multiple choice and short answers on covalent compounds, ionic compounds, ionization energies and electron arrangement.

IV. Types of Chemical Reactions (15 hours)

- a. Chemical equations to represent reactions
 - i. Balancing chemical equations
 - ii. Law of conservation of mass
- b. Acid/Base reactions
 - i. Properties of acids and bases
 - ii. Acid + base reaction
 - iii. Acid + carbonate reaction
- c. Oxidation/reduction reactions
 - i. Spontaneous and non spontaneous redox reactions
 - ii. Net ionic equations
 - iii. Assigning oxidation numbers
- d. Precipitation reactions
 - i. Net ionic equations
 - ii. Solubility rules

Labs and Assessments

- Design and conduct an experiment to determine the order of an electrochemical series
- Design and conduct an experiment to determine the factors that affect the corrosion of iron
- Perform test with precipitation reactions to determine the identity of four unknown solutions
- Write an IB format test which involves multiple choice and short answers on but not limited to reactivity, reaction types, and solubility.

V. Stoichiometry- Mole and Chemical Equations (15 hours)

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- a. Mass/mole relationships in chemical reactions
- b. Limiting reagent and reagent in excess
- c. Experimental vs. theoretical yields
- d. Titration

Labs and Assessments

- Design and conduct an experiment to produce saltpeter, KNO_3 , from stoichiometric amounts of K_2CO_3 and $\text{Ca}(\text{NO}_3)_2$ and determine theoretical and percent yields.
- Titration of HCl and NaOH to monitor the stoichiometry
- Use redox titration with KMnO_4 to determine the amount of iron (II) sulfate in an iron supplement tablet
 - Students will need to standardize the potassium permanganate with oxalic acid as a primary standard and conduct an error analysis with their experimental data and the company's advertised value.
- Write an IB format test which involves short answers on mathematical analysis.

VI. Physical and Chemical Periodicity (5 hours)

- a. Periodicity of physical and atomic properties
- b. Chemical nature of elements in the same group
- c. Metallic to non metallic switch within a period

Labs and Assessments

- Design and implement a lab to view the characteristic reactions between Silver nitrate and silver chloride, bromide (might not be obtainable according to state laws) and iodide.
- Write an IB format test which involves short answers on but not limited to chemical periodicity and physical characteristics.

VII. Heats of Reactions (10 hours)

- a. Exothermic and endothermic reactions
- b. Calculation of enthalpy change
- c. Hess' law
- d. Bond enthalpies

Labs and Assessments

- Perform lab activity which involves the reaction of copper (II) silver chloride and aluminum. Students can investigate the relationship between the amount of limiting reagent and the amount of heat flow.
- Students will design and perform an experiment illustrating Hess' Law.
- Write an IB format test which involves multiple choice, short answers and critical thinking questions on Hess Law, heat flow, system and surroundings.

VIII. States of Matter (5 hours)

- a. States of matter and kinetic theory of matter
- b. Ideal gas law and corresponding equations

Labs and Assessments

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- Determine the identity of an unknown metal through stoichiometric relations of the amount of gas produced when the metal is reacted with excess acid solution.
- Write an IB format test which involves multiple choice and short answers on but not limited to mathematical interpretations of the gas law, kinetic theory and the three states of matter.

IX. Molecular Shape, Polarity and Intermolecular Forces (5 hours)

- Hydrocarbons and Functional groups including haloalkanes and alcohol
 - Nomenclature
 - Homologous series
 - Full and condensed structural formulae isomers
 - Physical properties
- Molecular geometry and VSEPR theory
- Intermolecular forces and relation to physical properties
- Inter-particle forces and relation to physical properties

Labs and Assessments

- Investigate the solubility of iodine in water versus other solvents such as hexane and alcohols.
- Write an IB format test which involves multiple choice and short answers on different bond types, intermolecular forces, and polarity trends.
- *Formal Lab Practicals will be turned in during the third week of March*

X. Kinetics (5 hours)

- Measurement of a rate of reaction
- Collision theory and factors that affect rate of reaction
- Rate expression
 - Order of reaction and rate constant
 - Reaction half-lives
- Reaction mechanism rate determining step
 - Activated complex
- HL** Collision theory
 - Maxwell-Boltzman energy distribution curve
- HL** Activation Energy
 - Homogeneous and heterogeneous catalyst

Labs and Assessments

- Design and implement to determine the rate law for the iodine clock reaction
- Design and implement an experiment to show the effect of surface area on the rate of reaction between Mg and HCl.
- Design an experiment to determine factors that influence the rate of oxygen gas and the decomposition of hydrogen peroxide

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- Write an IB format test which involves multiple choice and short answer questions on reaction time, the affects on the reaction if the concentration in reagents is increased or there is a temperature change
- Write an IB format test which involves short answers on but not limited to the rate of reactions and the effects of catalysts on reactions.

XI. Equilibrium (4 Hours)

- Conditions for dynamic equilibrium
- Factors that affect the position of equilibrium
- Equilibrium constant calculations
- Phase equilibrium
- Vapor Pressure
- Application of Equilibrium –acid and base chemistry
 - Bronsted-Lowry acids and bases
 - Strong and weak acids and bases
 - The pH scale
 - Acid and Base calculations and equilibrium constants
 - Salts as acids and bases
 - Buffer solutions – acid-base titrations and the use of indicators

Labs and Assessments

- Design and implement a lab to answer the question, can water boil below 100 degrees Celsius
- Write an IB format test which involves short answers on but not limited to balanced acid-base reactions, rate of reactions, and K_a

Remainder of the year will be used to address class needs for Group 4 project, subject matter, etc.)

This course meets all CA state standards for this course

Textbook/Publisher used in course: Pearson Baccalaureate: Standard Level Chemistry for the IB Diploma (Pearson International Baccalaureate Diploma: International Editions)

Pearson Baccalaureate: High Level Level Chemistry for the IB Diploma (Pearson International Baccalaureate Diploma: International Editions)

Oxford IB Diploma Chemistry Course Companion by Geoffrey Neuss

Oxford IB Study Guides Chemistry for IB Diploma by Geoffrey Neuss