المدرسة الأمريكية الدولية
American International School

HIGH SCHOOL

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

SCIENCE SCOPE AND SEQUENCE
CHEMISTRY AND ADVANCED CHEMISTRY
AY 26-27

STRAND	STANDARDS/SKILLS (Common Core)	9th	10th	11th/12th
Matter and Its Interactions (HS-PS1)	**HS-PS1-1.** *Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.*		*Students use the periodic table to determine the typical reactivity of an atom.*	*Students will use the periodic table to explain why carbon forms four bonds and predict molecular formulas and structures of simple hydrocarbons.*
	HS-PS1-2. *Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.*		*Students identify the products and reactants, including their chemical formulas and the arrangement of their outermost (valence) electrons.*	*Students will use particle models, periodic trends, and IMFs to explain deviation of real gases from ideal behaviour*
	HS-PS1-3. *Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles*		*Students describe the measurable properties (e.g., melting point, boiling point) of a substance and the strength of the electrical forces between the particles of the substance*	*Students will explain how the arrangement in (s), (l), (g) account for observable properties (such as boiling point, melting point, vapor pressure, compressibility)* *Students will compare how different solutes dissolve in solvents, and use particle interactions to explain differences in solubility, conductivity and concentration.* *Students will illustrate how structures such as linear, branched and cyclic influences properties of organic substances.*

	HS-PS1-4. *Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.*		*Students identify bonds that are broken during the course of the reaction and the bonds that are formed during the course of the reaction.*	*Students will explain overall reaction enthalpy in terms of bond breaking and formation and classify them as endothermic and exothermic processes respectively. Students will illustrate how a catalyst lowers the activation energy and influences the energy profile of a reaction.*
	HS-PS1-5. *Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.*		*Students construct an explanation that includes the idea that as the kinetic energy of colliding particles increases and the number of collisions increases, the reaction rate increases. In addition, students will identify that increase in concentration and Temperature will increase the rate of a reaction.*	*Students will analyze reaction rates using collision theory and KMT, and quantitatively evaluate the effects of temperature, concentration, catalysts, and surface area on reaction rate by interpreting data and constructing rate laws.*
	HS-PS1-6. *Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*		*Students identify and describe* potential changes in a component of the given chemical reaction system that will increase the amounts of particular species at equilibrium*	*Students will apply the gas laws to predict and explain changes in pressure, temperature, volume, and amount of substance, affect a gas system and use this knowledge to discuss optimization of reaction system involving gases.* *Students will use Le Chatellier's principle and equilibrium constants to predict changes and shifts in reactions, proposing strategies to optimize product yield in equilibrium system.*
	HS-PS1-7. *Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.*		*Students use stoichiometric calculations to show that the number of atoms or number of moles is unchanged after a chemical reaction where a specific mass of reactant is converted to product.*	*Students will construct explanations to balance redox equations, demonstrating how electron transfer conserves charges in a chemical reaction along conservation of mass and atoms.*

	HS-PS1-8. *Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay*		*Students Identify an element by the number of protons.*	
Motion and Stability: Forces and Interactions (HS-PS2)	**HS-PS2-4.** *Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.*		*Students will be responsible to understand coulomb's law of attraction.*	
	HS-PS2-6.*Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*		*Student will be visualizing the molecular level using simulation*	*Students will be able to communicate about how the molecular structure and IMFs influence the functions of materials in everyday life, as well as how molecular level structures of solute and solvent influences the design of solutions and mixtures (e.g. sports drinks, antifreeze, pharmaceuticals…)*
Energy (HS-PS3)	**HS-PS3-1.** *Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.*			*Students will calculate enthalpy changes for reactions and processes using calorimetry data and energy conservation principles*
	HS-PS3-2. *Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects)*			*Students will explain electrochemical processes and connect the movement of electrons to forces and energy transfer in systems (e.g. common real world electrolysis applications)*
	HS-PS3-4. *Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).*			*Students will explain how energy transfer between substances of different temperatures lead to thermal equilibrium*
	HS-PS3-5. *Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction*		*Students identify the nature of the interaction (electric or magnetic) between the two objects*	

Waves and Their Applications in Technologies for Information Transfer (HS-PS4)	**HS-PS4-1.** *Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.*		*Students identify and describe Mathematical values for frequency, wavelength, and speed of waves traveling in various specified media*	
	HS-PS4-3. *Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other*		*Students identify the given evidence to be evaluated, including the following phenomena: i. Interference behavior by electromagnetic radiation; and ii. The photoelectric effect*	
	HS-PS4-4. *Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.*		*Students determine the validity and reliability of the sources of the claims.*	