



Standards Overview

Shanghai American School

Science



Grade 6

Define Scientific Facts, Concepts

Standard I Define scientific facts, concepts, and terminology
Electricity and Magnetism

- 6EM-1.1 Identify the names, locations, and charges of the major subatomic particles (protons, neutrons, and electrons) [11]
- 6EM-1.2 Identify the interaction of like and unlike charges (magnetic poles, subatomic particles, static electric charges) [9]
- 6EM-1.3 Demonstrate ways in which charges can be transferred (friction, induction, conduction) [9]
- 6EM-1.4 Demonstrate an understanding of the relationship among current, resistance, and voltage [4]
- 6EM-1.5 Identify the parts of an electrical circuit (energy source, conductor, and load) [9]
- 6EM-1.6 Identify practical uses of transferring electrical energy into other forms of energy (to

Grade 7

Define Scientific Facts, Concepts

Standard I Define scientific facts, concepts, and terminology
Human Body

- 7HB-1.1 Describe the main functions of the following systems: skeletal, muscular, digestive, circulatory, respiratory, and nervous [25]
- 7HB-1.2 Identify the locations and functions of the major organs of the skeletal, muscular, digestive, circulatory, respiratory, and nervous systems [25]

Cells

- 7CE-1.1 Recognize that organisms are made of cells working together as tissues, tissues working together as organs, organs working together as systems, and systems working together as organisms [7]
- 7CE-1.2 State the cell theory and describe its development [7]
- 7CE-1.3 Describe the function of the cell's organelles including the cell membrane, nucleus, cytoplasm, and chloroplast [9]

Grade 8

Define Scientific Facts, Concepts

Standard I Define scientific facts, concepts, and terminology

Astronomy

- 8AS-1.1 Describe the relationships between Earth, Moon and Sun such as seasons, eclipses, lunar phases, tides and Earth's calendar. [9]
- 8AS-1.2 Identify and describe the different structures in the universe such as stars, planets, comets and meteors [8]
- 8AS-1.3 Describe the scientific evidence for the existence of the universe as we know it (Big Bang Theory) [10]
- 8AS-1.4 Describe how different lenses and mirrors are used in telescopes [9]
- 8AS-1.5 Describe man's efforts to explore space (Sputnik, Apollo, unmanned probes, the space shuttle) [4]

Genetics and Heredity

- 8GH-1.1 Describe how information is passed from cell to cell, and from organism to organism using mitosis, meiosis, DNA, chromosomes and sex cells [10]
- 8GH-1.2 Describe the cell cycle and describe how mitosis is a part of it [10]
- 8GH-1.3 Illustrate and describe the events in mitosis using the following terms: chromatid and chromosome [9]
- 8GH-1.4 Describe meiosis in simple terms of meiosis I and meiosis II [6]
- 8GH-1.5 Describe the role of genetics in natural selection, evolution and

Grade 9

HS Biology

Standard I Defines scientific facts, concepts, and terminology

- 1. Describe the basic functions and uses of the compound light microscope and electron microscope [3]
- 2. Identify the basic structure of the cell wall, cell membrane, nucleus, ribosome, cytoplasm, mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, vacuole, chloroplasts, cilia, and flagella using diagrams [8]
- 3. Describe the basic function of the cell wall, cell membrane, nucleus, ribosome, cytoplasm, mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, vacuole, chloroplasts, cilia, and flagella [7]
- 4. Discuss the differences of specialized cells (skin cell vs. muscle cell vs. nerve cell) and how these specialized cells function together to make up tissues, organs, organ systems, and complex organisms [9]
- 5. Identify the structures of basic organic molecules (e.g., lipids, proteins, carbohydrates, nucleic acids) [8]

Grade 10

HS Biology

Standard I Define scientific facts, concepts, and terminology
DNA Structure and Replication

- 1. Recognize the historical contributions that scientists have made to the discovery of the structure and function of DNA [7]
- 2. Describe the structure of DNA using the following terms: sugarphosphate backbone, nitrogenous base, nucleotide, antiparallel [9]
- 3. Describe the nitrogenous base pairing of DNA and RNA using the following terms: hydrogen bonds, purines, pyrimidines, complementary base pairs, adenine, guanine, cytosine, thymine and uracil [9]
- 4. Order the steps of DNA replication [6]

Protein Synthesis

- 5. Examine the roles of proteins in organisms [6]
- 6. Describe the process of transcription in protein synthesis using the following terms: RNA nucleotides (uracil), RNA polymerase, introns, exons, DNA triplet code, mRNA, codons, 5 cap, poly-A tail [6]
- 7. Describe the process of translation in protein synthesis using the following terms: ribosome, mRNA, rRNA, tRNA, codon, anticodon, peptide bond, dehydration synthesis (condensation), amino acid, and protein [6]
- 8. Differentiate

IB

IB Biology

Standard I Defines scientific facts, concepts, and terminology
Standard II Applies, analyzes and evaluates scientific facts and concepts

Topic 1: Statistical analysis

- Application of various statistical tools

Topic 2: Cells

- 2.1 Cell theory
- 2.2 Prokaryotic cells
- 2.3 Eukaryotic cells
- 2.4 Membranes
- 2.5 Cell division

Topic 3: The chemistry of life

- 3.1 Chemical elements and water
- 3.2 Carbohydrates, lipids and proteins
- 3.3 DNA structure
- 3.4 DNA replication
- 3.5 Transcription and translation
- 3.6 Enzymes
- 3.7 Cell respiration
- 3.8 Photosynthesis

Topic 4: Genetics

- 4.1 Chromosomes, genes, alleles and mutations
- 4.2 Meiosis
- 4.3 Theoretical genetics
- 4.4 Genetic engineering and biotechnology [1]

Topic 5: Ecology and evolution

- 5.1 Communities and ecosystems
- 5.2 The greenhouse effect
- 5.3 Populations
- 5.4 Evolution [3]
- 5.5 Classification

Topic 6: Human health and physiology

- 6.1 Digestion [3]
- 6.2 The transport system [3]
- 6.3 Defence against infectious

<p>produce heat, light, sound, and motion [9]</p> <p>6EM-1.7 Summarize the relationship between electricity and magnetism (flowing electricity creates a magnetic field; moving magnets create electrical flow) [9]</p> <p>6EM-1.8 Identify characteristics of insulators and conductors (sample materials, degree to which electrons are bound to the atoms of those materials) [5]</p>	<p>7CE-1.4 Describe the movement of particles in and out of cells using the processes of diffusion and osmosis [7]</p> <p>7CE-1.5 Describe the basic processes of photosynthesis and cellular respiration and their importance to life [7]</p>	<p>extinction [9]</p> <p>8GH-1.6 Describe recent advances in genetics such as cloning, stem cells, and genetic engineering [6]</p>	<p>6. Describe how the body breaks down organic polymers through enzymes in the digestive system and describe how cells are able to synthesize organic polymers from monomers (dehydration synthesis and hydrolysis) [10]</p> <p>7. Describe the structure and function of the cells, tissues, and organs of the digestive system, respiratory system and circulatory system [14]</p>	<p>8. Differentiate between the roles of mRNA, tRNA, and rRNA in protein synthesis [6]</p> <p>9. Identify the nature of each of the four levels of protein structure and describe how various intermolecular interactions (e.g. disulfide bridges, hydrogen bonds, polar/non-polar interactions, ionic bonds) contribute to the folding of the polypeptide chain [5]</p> <p>10. Identify the roles of the endoplasmic reticulum and the Golgi apparatus in protein synthesis [4]</p>	<p>disease</p> <p>6.4 Gas exchange [3]</p> <p>6.5 Nerves, hormones and homeostasis [3]</p> <p>6.6 Reproduction</p>
Microorganisms and Diseases					
	<p>7MD-1.1 Describe the basic characteristics of bacteria, viruses and protists [11]</p> <p>7MD-1.2 Describe and give examples of infectious diseases and how they can be prevented and treated [5]</p> <p>7MD-1.3 Discuss how infectious diseases are transmitted and describe the precautions that should be taken to prevent their spread [7]</p>				
Forces and Motion					
<p>6FM-1.1 Define the terms force, motion, friction, inertia, speed, and velocity [12]</p> <p>6FM-1.2 Calculate average speed by taking measurements of distance and time [8]</p> <p>6FM-1.3 Identify the points at which an object has the most potential and/or kinetic energy [6]</p>					
Plants and Animals					
<p>6PA-1.1 List the characteristics of living things: they are made of cells, are made of similar chemicals, use energy, grow and develop, respond to stimuli, and reproduce [15]</p> <p>6PA-1.2 Differentiate</p>	<p>7WS-1.1 Demonstrate (e.g., using probes) that there are variations in sound among instruments and voices</p> <p>7WS-1.2 Identify the parts of the ear and describe how the brain perceives sound</p>				
Waves and Sound					
	<p>7DE-1.1 Identify the existence of tectonic plates and investigate the forces that cause their movement [9]</p>				
Dynamic Earth					
		<p>8CH-1.1 Describe the current model of the atom in terms of the nucleus, protons, neutrons, electrons and energy levels.</p> <p>8CH-1.2 Be able to identify, place and write the chemical symbols of all atoms 1-20 and some common compounds.</p> <p>8CH-1.3 Be able to draw and write the electronic configuration of atoms of elements 1-20 using the basic energy levels (excluding s, p, d, f orbitals)</p> <p>8CH-1.4 Identify acids and bases using different methods such as pH scale and chemical reactions.</p>			
Chemistry					
Environmental Science					
		<p>8ES-1.1 Describe the way an ecosystem is able to perpetuate itself (energy flow, recycling of matter) [9]</p> <p>8ES-1.2 Explain how biotic and abiotic factors influence the size of a population using words such as competition, disease, limiting factors [10]</p> <p>8ES-1.3 Describe the different levels of organization within an ecosystem: organism, species, population, community, ecosystem. Describe causes and effects of global environmental issues such as endangered species, exotic species, extinction, pollution and global warming [9]</p> <p>8ES-1.4 Identify renewable and non-renewable resources such as fossil fuels, metals, solar energy, wind energy and geothermal energy [7]</p>			
Genetics and Evolution					
		<p>8GE-1.1 Describe how information is passed from cell to cell, and from organism to organism using mitosis, meiosis, DNA, chromosomes and sex</p>			
Standard II Applies, analyzes and evaluates scientific facts and concepts					
Mitosis/Meiosis					
Additional Higher Level					
Topic 7: Nucleic acids and proteins					
Topic 8: Cell respiration and photosynthesis					
Topic 9: Plant science					
Topic 10: Genetics					
Topic 11: Human health and physiology					
Option A: Human nutrition and health					
Option B: Physiology of exercise					
Option C: Cells and energy					

<p>between plants and animals on the basis of cellular structure (cell membrane, chloroplasts) and means of obtaining food (internal production vs. external consumption) [9]</p> <ul style="list-style-type: none"> 6PA-1.3 Identify the anatomy and function of various parts of vascular plants (root, stem, leaf, and flower) [13] 6PA-1.4 Discover the various stages in the life cycle of a flowering plant (seed, germination, emergence of cotyledon, growth spurt, pollination, and seed production) [11] 6PA-1.5 Identify major taxonomic groups (5 vertebrate classes, 9 invertebrate phyla, monocots, dicots, angiosperms, gymnosperms) [23] 	<ul style="list-style-type: none"> 7DE-1.2 Describe the effects of volcanic and earthquake activity on the surface of the earth [9] 7DE-1.3 Identify and describe transverse, longitudinal and surface waves 7DE-1.4 Define wavelength, frequency, amplitude, and velocity of waves 	<p>cells</p> <ul style="list-style-type: none"> 8GE-1.2Describe the cell cycle and describe how mitosis is a part of it 8GE-1.3Describe meiosis in simple terms of meiosis I and meiosis II 8GE-1.4Describe the role of genetics in natural selection, evolution and extinction 8GE-1.5Describe recent advances in genetics such as cloning, stem cells, and genetic engineering 	<p>chemical energy for the cell through the processes of cellular respiration and photosynthesis (use balanced equations in describing the processes of cellular respiration and photosynthesis and identify the reactants and products in the equations) [9]</p> <ul style="list-style-type: none"> 5. Compare and contrast the processes of cellular respiration and photosynthesis [8] 6. Explain how the nucleus, cytoplasm, ribosome, endoplasmic reticulum, and Golgi apparatus contribute to the process of protein synthesis (show how these organelles work together in making and transporting a protein within the cell without covering the structure of DNA, codons, anticodons, etc.) [7] 7. Investigate and compare the properties of acids, bases, and indicators [3] 8. Discover how pH affects the effectiveness of an enzyme [6] 9. Explain how diffusion plays a major role in the transportation of substances through the cell membrane and in the digestive system, respiratory system, and circulatory system [14] 10. Examine how the digestive system, respiratory system, and circulatory system function 	<p>Human Genetics</p> <ul style="list-style-type: none"> 17. Describe Mendel's experimental work which led to defining his laws of dominance, segregation, and independent assortment [8] 18. Describe the effects that genes have on the physical characteristics of an organism using the following terms: homozygous, heterozygous, allele, dominant allele, recessive allele, phenotype and genotype [9] 19. Differentiate between codominance and incomplete dominance and state examples of each [6] 20. Describe ABO blood groups as an example of codominance and multiple alleles [6] 21. Differentiate between sex-linked traits and sex-influenced traits and state examples of each [6] 22. Describe the following chromosome mutations and their effects: deletion, inversion, translocation, addition, and non-disjunction [6] 23. Describe gene mutations and their effects using the following terms: point mutation, frameshift mutation, insertion, deletion, and substitution [6] 24. Construct Punnett grids for monohybrid and dihybrid crosses [9] 25. Identify chromosome mutations and the sex of individuals using karyotypes [8] 26. Construct a pedigree based on anecdotal information [7] 	<ul style="list-style-type: none"> C2 Enzymes C3 Cell respiration C4 Photosynthesis <p>Option D: Evolution Core (SL and HL)</p> <ul style="list-style-type: none"> D1 Origin of life on Earth D2 Species and speciation D3 Human evolution <p>Extension (HL only)</p> <ul style="list-style-type: none"> D4 The Hardy–Weinberg principle D5 Phylogeny and systematics <p>Option E: Neurobiology and behaviour Core (SL and HL)</p> <ul style="list-style-type: none"> E1 Stimulus and response E2 Perception of stimuli E3 Innate and learned behaviour E4 Neurotransmitters and synapses <p>Extension (HL only)</p> <ul style="list-style-type: none"> E5 The human brain E6 Further studies of behaviour <p>Option F: Microbes and biotechnology Core (SL and HL)</p> <ul style="list-style-type: none"> F1 Diversity of microbes F2 Microbes and the environment F3 Microbes and biotechnology F4 Microbes and food production <p>Extension (HL only)</p> <ul style="list-style-type: none"> F5 Metabolism of microbes F6 Microbes and disease <p>Option G: Ecology and conservation Core (SL and HL)</p> <ul style="list-style-type: none"> G1 Community ecology G2 Ecosystems and biomes G3 Impacts of humans on ecosystems <p>Extension (HL only)</p> <ul style="list-style-type: none"> G4 Conservation of biodiversity G5 Population ecology <p>Standard III Constructs research questions, hypotheses, and plans experimental procedures</p> <ul style="list-style-type: none"> 1 Defining the
<p>Weather and Climate</p> <ul style="list-style-type: none"> 6WC-1.1 Describe the components and interactions of the water cycle (evaporation, condensation, precipitation, transpiration, and runoff) [27] 6WC-1.2 Describe the basic composition, properties, and structure of the atmosphere (the range and distribution of temperature and pressure in the troposphere and 	<p>Matter</p> <ul style="list-style-type: none"> 7MA-1.1 Describe, compare, and measure objects based on common physical and chemical properties including: states of matter, mass, volume, density, temperature, boiling point, and melting point [46] 7MA-1.2 Describe and measure properties of matter such as temperature, mass, and volume before and after a physical or chemical change [31] 7MA-1.3 Identify and describe the phases of matter [19] 	<p>Forces and Motion</p> <ul style="list-style-type: none"> 8FE-1.1Calculate and describe different types of motion (velocity and acceleration) [10] 8FE-1.2Describe the effects of balanced and unbalanced forces on an object's motion [10] 8FE-1.3Recognize and manipulate simple machines [6] 8FE-1.4Describe how Newton's laws influence everyday life [7] 	<p>Evolution</p>		

- stratosphere)
[21]
- 6WC-1.3
Observe, measure, and record changes in weather conditions (humidity, temperature, air pressure, cloud type, wind, precipitation)
[10]
- 6WC-1.4
Explain how atmospheric circulation is driven by the sun (transfer of energy by radiation, convection, conduction)
[13]

together in order to provide cells in humans with essential nutrients needed for life (oxygen gas, proteins, carbohydrates, lipids, nucleic acids)
[13]

- 11. Examine how the respiratory system and circulatory system function together in order to get rid of carbon dioxide waste
[13]

Standard III Constructs research questions, hypotheses, and plans experimental procedures

- 1. Identify questions for investigation
[11]
- 2. Develop predictions based on background knowledge and/or research and can be addressed through scientific investigations
[8]
- 3. Design and conducts scientific investigations
[6]
- 4. Select appropriate tools, technologies and techniques for gathering, analyzing and interpreting data
[7]

Standard IV Collects, records and organizes data

- 1. Record the appropriate qualitative and/or quantitative raw data
[8]
- 2. Record raw data clearly
[10]
- 3. Use appropriate numerical representation in data (for example

- 27. Explain how the processes of meiosis and mutation enhance genetic variability in a population
[6]

- 28. Explain how the processes of genetic mutation, natural selection, and adaptation leads to organisms well suited for survival in a particular environment
[7]

- 29. Describe how Darwin's findings from his voyage supports the current body of evidence for evolution: fossil record, biogeography, anatomy (i.e., homologous structures, embryology) and molecular biology
[5]

Standard II Applies analyzes and evaluates scientific facts and concepts DNA Structure and Replication

- 1. Demonstrate the molecular interactions that define the primary structure of DNA by creating a model
[9]
- 2. Compare and contrast DNA and RNA
[5]
- 3. Explain both the polarity and antiparallel nature of DNA as a molecule and how these impact the replication of DNA
[6]
- 4. Explain the role of the enzymes; helicase, primase, DNA polymerase, and ligase in the process of DNA replication
[7]

Protein Synthesis

- 5. Predict what will happen to a protein if various point mutations occur during transcription
[4]
- 6. Summarize the events that occur in protein synthesis from transcription to secretion of proteins from the cell
[5]
- 7. Given any nucleotide sequence

- 1. Defining the problem and selecting variables
- 2. Controlling variables
- 3. Developing a method for collection of data

Standard IV Collects, records and organizes data

- 1. Recording raw data
- 2. Presenting processed data

Standard V Analyzes and interprets collected data

- 1. Processing raw data

Standard VI Draws conclusions and evaluates procedures and hypotheses

- 1) Concluding
- 2) Evaluating procedures
- 3) Improving the investigations

Standard VII Effectively manipulates equipment and utilizes technology

- 1. Following instructions
- 2. Carrying out techniques
- 3. Working safely

making tables using Word and Excel)
[6]

Standard V Analyzes and interprets collected data

- 1. Use appropriate tools and techniques to analyze data (for example plotting graphs using Excel)
[7]
- 2. Determine direct and indirect relationships among data using best fit lines
[6]
- 3. Communicate analyzed data such as constructing graphs using Excel, charts and mathematical calculations appropriately
[6]

Standard VI Draws conclusions and evaluates procedures and hypotheses

- 1. Draw conclusions from analyzed data and as appropriate compares with hypothesis
[9]
- 2. Evaluate the procedure by identifying strengths and weakness
[7]
- 3. Recognize alternative explanations and develops questions for further investigation
[7]

Standard VII Effectively manipulates equipment and utilizes technology

- 1. Demonstrate the use of equipment and materials appropriately
[9]
- 2. Use materials and equipment safely
[8]
- 3. Use

(DNA or RNA), order the proper sequence of amino acids in a protein using a codon chart
[5]

- 8. Evaluate the role of DNA in protein synthesis, cell reproduction, genetics, and evolution
[6]

Mitosis/Meiosis

- 10. Analyze the role that meiosis plays in maintaining organisms' genetic variability
[7]
- 11. Evaluate the process of crossing over and its implications in terms of genetic variability
[6]
- 12. Compare and contrast the phases of mitosis and meiosis
[6]
- 13. Examine cells undergoing mitosis on microscope slides and identify the phases of each cell based the orientation of the structures observed
[6]

Human Genetics

- 14. Explain how Mendel's laws of segregation and independent assortment relate to meiosis
[7]
- 15. Calculate and predict the phenotypic and genotypic ratios of offspring of monohybrid and dihybrid crosses involving unlinked autosomal genes, sex-linked genes, codominant alleles, and alleles that display incomplete dominance
[10]
- 16. Deduce the pattern of inheritance (sex-linked/autosomal, dominant/recessive), as well as the genotypes and phenotypes of individuals in pedigree charts
[9]
- 17. Discover the cause of various human genetic disorders in terms of the specific chromosomal or

technology
tools to
enhance
learning,
increase
productivity and
promote
creativity
[10]

point mutations
responsible for the
resulting symptoms
[8]

Evolution

- 18. Discover how adaptations may occur as the result of an allele frequency increasing in a population's gene pool over a number of generations
[8]
- 19. Explore how natural selection leads to the increased reproduction of individuals with favorable inheritable variations
[7]

Standard III Collects, records and organizes data

- 1. Records the appropriate qualitative and/or quantitative raw data
[11]
- 2. Records raw data clearly
[9]
- 3. Uses appropriate numerical representation in data (for example units, significant figures, tallies, uncertainties in data)
[11]

Standard IV Analyzes and interprets collected data

- 1. Uses appropriate tools and techniques to analyze data
[10]
- 2. Determine the connections and relationships among data
[10]
- 3. Communicates analyzed data such as graphs, charts and mathematical calculations appropriately
[11]

Standard V Draws conclusions and evaluates procedures and hypotheses

- 1. Draws conclusions from analyzed data and as appropriate compares with hypothesis
[11]
- 2. Evaluates the procedure by identifying strengths and weakness

[11]

- 3. Recognizes alternative explanations and develops questions for further investigation [7]

Standard VI Effectively manipulates equipment and utilizes technology

- 1. Demonstrates the use of equipment and materials appropriately [8]
- 2. Uses materials and equipment safely [8]
- 3. Uses technology tools to enhance learning, increase productivity and promote creativity [8]

Applies, Analyze, Evaluate Standard II Applies, analyzes, and evaluates scientific facts and concepts Electricity and Magnetism

- 6EM-2.1 Identify element names, symbols, atomic mass, and atomic number using the periodic table
- 6EM-2.2 Analyze the impact of the factors that affect the resistance to electrical current (material, temperature, length, thickness) [11]
- 6EM-2.3 Design a combination circuit using both parallel and series circuits in order to accomplish a wiring task [10]
- 6EM-2.4 Compare magnetic and non-magnetic materials with respect to their domain alignment [8]

Applies, Analyze, Evaluate Standard II Applies, analyzes and evaluates scientific facts and concepts Human Body

- 7HB-2.1 Demonstrate the interdependent nature of the skeletal, muscular, digestive, circulatory, respiratory and nervous systems

Cells

- 7CE-2.1 Explain that the cell is the basic unit of life and carries out all of life's functions
- 7CE-2.2 Describe the relationship between breathing and respiration
- 7CE-2.3 Make connections between organelles and basic life processes such as photosynthesis, respiration, diffusion and osmosis
- 7CE-2.4 Compare the structure and function of plant cells and animal cells

Applies, Analyze, Evaluate Standard II Applies analyzes and evaluates scientific facts and concepts

Astronomy

- 8AS-2.1 Identify how relationships between Earth, Moon and Sun affect human life [6]
- 8AS-2.2 Compare the temperature and composition of stars during their life-cycle [4]
- 8AS-2.3 Explain and demonstrate how the light behaves in the equipment used to study the universe [6]
- 8AS-2.4 Design, construct and modify a balloon rocket [6]

Chemistry

- 8CH-2.1 Classify (Demonstrate?) matter in terms of atoms, elements, molecules, compounds and mixtures
- 8CH-2.2 Use the periodic table as a resource to identify basic physical and chemical properties of the elements including valence electrons, non-metal, metal, metalloid, and family characteristics
- 8CH-2.3 Test the pH of substances and identify them as acid, base or neutral

Environmental Science

- 8ES-2.1 Analyze the

HS Chemistry Standard I Defines scientific facts, concepts, and terminology Atomic Theory

- 1. Describe how elements are characterized by the nature of their particles [7]
- 2. Identify materials as elements, molecules, compounds or mixtures and how they are represented in chemical equations [7]
- 3. Draw proper Bohr-Rutherford diagrams for elements one to twenty [3]
- 4. Draw the Lewis structures for elements one to twenty and use them in simple Lewis diagrams [1]
- 5. Describe the model of the atom: the subatomic particles, their locations, arrangement, and influence on oxidation state [5]

Bonding and Reactions

- 6. Identify

HS Chemistry Standard I Defines scientific facts, concepts, and terminology Atomic Theory

- 1. Describe the arrangement of elements in the periodic table in order of increasing atomic number, groups (valence electrons) and periods (energy levels) [2]
- 2. Identify and give the historical names of the elements in groups in 1 to 8 [2]
- 3. Describe the electron configuration of atoms and ions for elements 1 to 20 using main energy levels and s, p, d, f notation [2]
- 4. Deduce the formula and name of compounds involving monatomic and polyatomic ions [1]
- 5. State the position of protons, neutrons and electrons in the atom and their relative charges [2]
- 6. Define mass number, atomic number and isotope [2]
- 7. Draw Bohr Rutherford diagrams for the first 20 elements [2]
- 8. State the names and symbols for the seven diatomic

IB Chemistry Standard I Defines scientific facts, concepts, and terminology Standard II Applies, analyzes and evaluates scientific facts and concepts Topic 1: Quantitative chemistry

- 1.1 The mole concept and Avogadro's constant
- 1.2 Formulas
- 1.3 Chemical equations
- 1.4 Mass and gaseous volume relationships in chemical reactions
- 1.5 Solutions

Topic 2: Atomic structure

- 2.1 The atom
- 2.2 The mass spectrometer
- 2.3 Electron arrangement

Topic 3: Periodicity

- 3.1 The periodic table
- 3.2 Physical properties
- 3.3 Chemical properties

Topic 4: Bonding

- 4.1 Ionic bonding
- 4.2 Covalent bonding
- 4.3 Intermolecular forces
- 4.4 Metallic bonding
- 4.5 Physical properties

Topic 5: Energetics

<ul style="list-style-type: none"> 6EM-2.5 Apply Ohm's Law to find current, voltage, and resistance in an electrical circuit [5] 6EM-2.6 Analyze the impact of the removal of a load (e.g., light bulb) on other loads in a combination circuit [5] 	Microorganisms and Diseases <ul style="list-style-type: none"> 7MD-2.1 Compare and contrast bacteria and viruses 7MD-2.2 Compare the effectiveness of various chemical agents such as antiseptics, disinfectants and antibiotics in controlling the growth of bacteria 7MD-2.3 Evaluate the impact of pathogens on the human population 	<p>interactions of organisms in food chains and food webs (producer/consumer, predator/prey, parasite/host, symbiosis, scavenger, herbivore, carnivore, omnivore, decomposer) [11]</p> <ul style="list-style-type: none"> 8ES-2.2 Evaluate the effect of unsustainable exploitation at any level of an ecosystem (fishing, forestry, poaching) Analyze the impact of the human population on Earth (renewable and non-renewable resources, pollution) [9] 8ES-2.3 Analyze the impact of the human population on Earth (renewable and non-renewable resources, pollution) 	<p>compounds as ionic or covalent via their constituent parts or physical properties [7]</p> <ul style="list-style-type: none"> 7. Describe the importance of the Law of Conservation of Mass and its relationship to balancing chemical reactions [7] 8. Identify upon inspection of the chemical equation: synthesis, decomposition, single and double displacement, and combustion of hydrocarbons reactions [1] 9. Define the term aqueous and describe the nature of the ions in an aqueous solution [5] 10. Insert acid-base benchmarks here.....these are attempting to become part of the grade 9 course to remove pressure on the grade 9 biology - Definitions of: brønsted-lowry? Arrhenius? - pH scale basics: relative hydronium and hydroxide concentrations [5] 11. Describe using the molecular kinetic theory, the structure and properties of various states of matter and how they are represented in chemical equations [5] 12. Describe the relationship between temperature, volume and pressure in terms of the 	<p>periodic elements [2]</p> <ul style="list-style-type: none"> 9. Distinguish between an element, compound, molecule and ion [2] 10. Distinguish between precision and accuracy [4] 11. Define Avogadro's number, molar mass, relative atomic mass, relative molecular mass 12. Describe the ionic bond as the result of electron transfer leading to the attraction between oppositely charged ions [2] 13. Describe the covalent bond as the result of electron sharing [2] 14. Identify the functional groups of common biological molecules [2] 15. Define and describe periodic trends (periods and groups) in electro negativity [2] 	<ul style="list-style-type: none"> 5.1 Exothermic and endothermic reactions 5.2 Calculation of enthalpy changes 5.3 Hess's law 5.4 Bond enthalpies
Forces and Motion <ul style="list-style-type: none"> 6FM-2.1 Predict the motion of an object exposed to forces from multiple directions [4] 	Waves and Sound <ul style="list-style-type: none"> 7WS-2.1 Relate the wave properties of amplitude and frequency to our perception of sound 7WS-2.2 Explain why there are variations in sound among instruments and voice 	Genetics and Evolution <ul style="list-style-type: none"> 8GE-2.1 Compare and contrast mitosis and meiosis using the following terms: purpose, number of divisions, number of cells produced number of chromosomes, genetic variability [9] 8GE-2.2 Examine cells undergoing mitosis on microscope slides the phases of each cell. [6] 8GE-2.3 Analyze (e.g. through debates) high-profile/current/disputed issues in genetics/science [9] 	Measurement <ul style="list-style-type: none"> 10. Distinguish between precision and accuracy [4] 	Mole Concept <ul style="list-style-type: none"> 11. Define Avogadro's number, molar mass, relative atomic mass, relative molecular mass 	Topic 6: Kinetics <ul style="list-style-type: none"> 6.1 Rates of reaction 6.2 Collision theory
Plants and Animals <ul style="list-style-type: none"> 6PA-2.1 Classify organisms into taxonomic groups on the basis of selected characteristics (body plans, external features, digestive structures, vascular systems in plants, specialized internal structures) [17] 	Dynamic Earth <ul style="list-style-type: none"> 7DE-2.1 Explain how earth's internal structure causes the dynamic nature of the surface of the earth 7DE-2.2 Explain the distribution and causes of earthquakes and volcanoes. 7DE-2.3 Explain the relationships among earthquakes, volcanoes, mid-ocean ridges, and deep sea trenches using the theory of plate tectonics 7DE-2.4 Locate the epicenter of an earthquake using knowledge of P waves and S waves 7DE-2.5 Compare and contrast the damage caused 	Forces and Motion <ul style="list-style-type: none"> 8FM-2.1 Draw, interpret and analyze motion graphs [4] 8FM-2.2 Solve problems involving simple machines (force, work, power, distance, mechanical advantage) [10] 8FM-2.3 Compare, contrast, builds and modifies simple machines [4] 	Bonding <ul style="list-style-type: none"> 12. Describe the ionic bond as the result of electron transfer leading to the attraction between oppositely charged ions [2] 13. Describe the covalent bond as the result of electron sharing [2] 14. Identify the functional groups of common biological molecules [2] 15. Define and describe periodic trends (periods and groups) in electro negativity [2] 	Topic 7: Equilibrium <ul style="list-style-type: none"> 7.1 Dynamic equilibrium 7.2 The position of equilibrium 	Topic 8: Acids and bases <ul style="list-style-type: none"> 8.1 Theories of acids and bases 8.2 Properties of acids and bases 8.3 Strong and weak acids and bases 8.4 The pH scale
Weather and Climate <ul style="list-style-type: none"> 6WC-2.1 Predict weather based on recent data (reports of humidity, temperature, air pressure, cloud type, wind, and precipitation) [8] 			Standard II Applies analyzes and evaluates scientific facts and concepts. Atomic Theory <ul style="list-style-type: none"> 1. Predict the pattern in the arrangement of elements on the periodic table and their chemical reactivity from their electron configuration [2] 2. Calculate non integer atomic masses from the relative abundance of isotopes [2] 3. Calculate the number of protons, electrons and neutrons in atoms and ions from the mass number, atomic number and charge [2] 4. Infer the name of an element and its group number from Bohr- Rutherford 	Topic 9: Oxidation and reduction <ul style="list-style-type: none"> 9.1 Introduction to oxidation and reduction 9.2 Redox equations 9.3 Reactivity 9.4 Voltaic cells 9.5 Electrolytic cells 	Topic 10: Organic chemistry <ul style="list-style-type: none"> 10.1 Introduction 10.2 Alkanes 10.3 Alkenes 10.4 Alcohols 10.5 Halogenoalkanes 10.6 Reaction pathways
		Gases <ul style="list-style-type: none"> 11. Describe using the molecular kinetic theory, the structure and properties of various states of matter and how they are represented in chemical equations [5] 12. Describe the relationship between temperature, volume and pressure in terms of the 		Topic 11: Measurement and data processing <ul style="list-style-type: none"> 11.1 Uncertainty and error in measurement 11.2 Uncertainties in calculated results 11.3 Graphical techniques 	Additional Higher Level Topic 12: Atomic structure <ul style="list-style-type: none"> 12.1 Electron configuration
				Topic 13: Periodicity <ul style="list-style-type: none"> 13.1 Trends across period 13.2 First-row d-block elements 	Topic 14: Bonding <ul style="list-style-type: none"> 14.1 Shapes of

<p>by P, S and Surface waves on man-made structures</p> <ul style="list-style-type: none"> 7DE-2.6 Relate the density of a material with the waves speed as it passes through the material 		<p>gas laws: Boyles, Charles, Gay Lussac and Combined Gas Law and predict the change in one variable given a change in another [3]</p>	<p>diagrams [2]</p>	<p>molecules and ions</p> <ul style="list-style-type: none"> 14.2 Hybridization 14.3 Delocalization of electrons
<p>Matter</p>		<p>Standard II Applies, analyzes and evaluates scientific facts and concepts Atomic Theory</p>	<p>Mole Concept</p>	<p>Topic 15: Energetics</p>
<ul style="list-style-type: none"> 7MA-2.1 Classify objects based on common physical and chemical properties, including: phases of matter, mass, volume, density, boiling point, melting point 7MA-2.2 Compare and contrast the observable properties of matter including their phases, masses, volumes and densities. 7MA-2.3 Investigate and compare the properties and behavior of matter in its solid, liquid and gaseous states 7MA-2.4 Explain the increase in the atomic mass and atomic number of elements across the periods in the periodic table (e.g., as one moves across the periods, the atomic number and mass increase because of the addition of protons and neutrons) 7MA-2.5 Use the periodic table as a resource to identify the phases of matter of elements at room temperature. 		<ul style="list-style-type: none"> 1. Write the symbol formulae for ionic and covalent compounds including polyatomic containing ionic compounds (Q – do we want to include ionic compound naming beyond the 20 element limit and introduce the use of roman numerals for ambiguous naming? Or leave to the grade 10 course where it is more clear to students WHY.....) [5] 2. Predict oxidation states of elements based on their position in the periodic table, difference in the number of protons and electrons and how they behave in chemical reactions [7] 3. Deduce the formula and name of compounds involving monatomic and polyatomic ions (cross reference to grade 10) [5] 	<ul style="list-style-type: none"> 5. Calculate the mass of one mole of a species [1] 6. Calculate the number of atoms, ions and molecules in a species using Avogadro's number [2] 7. Solve calculations involving: a) Amount of a substance, mass and molar mass ($n = m \div M$) b) Amount of a substance, concentration and volume ($c = n \div v$) c) dilutions ($c_i \times v_i = c_f \times v_f$) [3] 8. Identify the mole ratios of any two species in a balanced chemical equation; use balanced chemical equations to obtain information about the amount of reactants and products [2] <p>Bonding</p> <ul style="list-style-type: none"> 9. Predict whether a compound will or ionic or covalent from its position on the periodic table and why inert gases generally do not form compounds [2] 10. Deduce the Lewis structures for simple molecules and polyatomic ions [2] 11. Distinguish between polar and non-polar molecules using water and chlorine as examples [2] 12. Explain how the polarity of water relates to the solubility of some solutes [2] 13. Describe the intermolecular force (hydrogen bond) between two water molecules and its affect on the physical properties of boiling point and density [2] 14. Explain the difference between adhesion and cohesion with respect to water [1] 	<ul style="list-style-type: none"> 15.1 Standard enthalpy changes of reaction 15.2 Born-Haber cycle 15.3 Entropy 15.4 Spontaneity <p>Topic 16: Kinetics</p> <ul style="list-style-type: none"> 16.1 Rate expression 16.2 Reaction mechanism 16.3 Activation energy <p>Topic 17: Equilibrium</p> <ul style="list-style-type: none"> 17.1 Liquid-vapour equilibrium 17.2 The equilibrium law <p>Topic 18: Acids and bases</p> <ul style="list-style-type: none"> 18.1 Calculations involving acids and bases 18.2 Buffer solutions 18.3 Salt hydrolysis 18.4 Acid-base titrations 18.5 Indicators <p>Topic 19: Oxidation and reduction</p> <ul style="list-style-type: none"> 19.1 Standard electrode potentials 19.2 Electrolysis <p>Topic 20: Organic chemistry</p> <ul style="list-style-type: none"> 20.1 Introduction 20.2 Nucleophilic substitution reactions 20.3 Elimination reactions 20.4 Condensation reactions 20.5 Reaction pathways 20.6 Stereoisomerism <p>Options SL and HL Students at SL study the core of these options and students at HL study the whole option (that is, the core and the extension material). Option A: Modern analytical chemistry Core (SL and HL)</p> <ul style="list-style-type: none"> A1 Analytical techniques A2 Principles of spectroscopy A3 Infrared (IR) spectroscopy
	<p>Bonding and Reactions</p>	<ul style="list-style-type: none"> 4. Balance chemical equations using the correct coefficients [3] 5. Predict compound formula for the products of: 		

single and double displacement reactions, synthesis and decomposition and combustion of hydrocarbons [1]			
<ul style="list-style-type: none"> 6. Translate a balanced chemical reaction into a balanced ionic and/or net ionic equation (where applicable) [1] 7. Insert acid-base benchmarks here.....these are attempting to become part of the grade 9 course to remove pressure on the grade 9 biology - Definitions of: bronsted-lowry? Arrhenius? - pH scale basics: relative hydronium and hydroxide concentrations [5] 			
Gases			
<ul style="list-style-type: none"> 8. Apply the following gas laws: Boyle's; Charles' and Gay-Lussac to various situations involving the variables of temperature, pressure and volume [5] 9. Calculate pressure, volume or temperature from data provided using the gas laws (No $PV=nRT$ absence of moles concept) [5] 			
Standard III Constructs research questions, hypotheses, and plans experimental procedures			
<ul style="list-style-type: none"> 1. Identifies questions for investigation [5] 2. Develops predictions based on background knowledge and/or research 			
	Standard III Constructs research questions, hypotheses and plans experimental procedures		<ul style="list-style-type: none"> A4 Mass spectrometry A5 Nuclear magnetic resonance (NMR) spectroscopy A6 Atomic absorption (AA) spectroscopy A7 Chromatography
	<ul style="list-style-type: none"> 1. Identifies questions for investigation 2. Develops predictions based on background knowledge and/or research and can be addressed through scientific Investigations 3. Designs and conducts scientific investigations 4. Selects appropriate tools, technologies and techniques for gathering, analyzing and interpreting data 		Extension (HL only) <ul style="list-style-type: none"> A8 Visible and ultraviolet (UV-Vis) spectroscopy A9 Nuclear magnetic resonance (NMR) spectroscopy A10 Chromatography
	Standard IV Collects, records and organizes data		Option B: Human biochemistry Core (SL and HL)
	<ul style="list-style-type: none"> 1. Records the appropriate qualitative and/or quantitative raw data [3] 2. Records raw data clearly [3] 3. Uses appropriate numerical representation in data; this includes: a) Fundamental units b) Accepted SI format c) Scientific notation d) Correct number of significant figures e) Uncertainty inherent in measuring devices used in laboratory work f) Units conversions (for example mL to L) [4] 		<ul style="list-style-type: none"> B1 Energy B2 Proteins B3 Carbohydrates B4 Lipids B5 Micronutrients and macronutrients B6 Hormones
		Extension (HL only)	<ul style="list-style-type: none"> B7 Enzymes B8 Nucleic acids B9 Respiration
		Option C: Chemistry in industry and technology Core (SL and HL)	<ul style="list-style-type: none"> C1 Iron, steel and aluminium C2 The oil industry C3 Addition polymers C4 Catalysts C5 Fuel cells and rechargeable batteries C6 Liquid crystals C7 Nanotechnology
		Extension (HL only)	<ul style="list-style-type: none"> C8 Condensation polymers C9 Mechanisms in the organic chemicals industry C10 Silicon and photovoltaic cells C11 Liquid crystals C12 The chlor-alkali industry
	Standard V Analyzes and interprets collected data		Option D: Medicines and drugs Core (SL and HL)
	<ul style="list-style-type: none"> 1. Uses appropriate tools and techniques to analyze data [3] 2. Determine the connections and relationships among data [4] 3. Communicates analyzed data such as graphs, charts and mathematical calculations appropriately [6] 		<ul style="list-style-type: none"> D1 Pharmaceutical products D2 Antacids D3 Analgesics D4 Depressants D5 Stimulants D6 Antibacterials D7 Antivirals
	Standard VI Draws conclusions and evaluates procedures and hypotheses		Extension (HL only)

and/or research and can be addressed through scientific investigations [7]

- 3. Designs and conducts scientific investigations [3]
- 4. Selects appropriate tools, technologies and techniques for gathering, analyzing and interpreting data [3]

Standard IV Constructs research questions, hypotheses, and plans experimental procedures

- 1. Records the appropriate qualitative and/or quantitative raw data [17]
- 2. Records raw data clearly [11]
- 3. Uses appropriate numerical representation in data; calculate values from measurements using the correct number of significant figures [15]

Standard V Analyzes and interprets collected data

- 1. Uses appropriate tools and techniques to analyze data [11]
- 2. Determine the connections and relationships among data [13]
- 3. Communicates analyzed data such as graphs, charts and mathematical calculations appropriately [5]

Standard VI Draws conclusions and evaluates procedures and hypotheses

- 1. Draws conclusions from analyzed data and as appropriate compares with hypothesis [1]
- 2. Evaluates the procedure by identifying strengths and weakness
- 3. Recognizes alternative explanations and develops questions for further investigation

Standard VII Effectively manipulates equipment and utilizes technology

- 1. Demonstrates the use of equipment and materials appropriately [2]
- 2. Uses materials and equipment safely [2]
- 3. Uses technology tools to enhance learning, increase productivity and promote creativity [4]

- D8 Drug action
- D9 Drug design
- D10 Mind-altering drugs

Option E: Environmental chemistry Core (SL and HL)

- E1 Air pollution
- E2 Acid deposition
- E3 Greenhouse effect
- E4 Ozone depletion
- E5 Dissolved oxygen in water
- E6 Water treatment
- E7 Soil
- E8 Waste

Extension (HL only)

- E9 Ozone depletion
- E10 Smog
- E11 Acid deposition
- E12 Water and soil

Option F: Food chemistry Core (SL and HL)

- F1 Food groups
- F2 Fats and oils
- F3 Shelf life
- F4 Colour
- F5 Genetically modified foods
- F6 Texture

Extension (HL only)

- F7 Oxidative rancidity (auto-oxidation)
- F8 Antioxidants
- F9 Stereochemistry in food
- F10 Chemical structure and colour

Option G: Further organic chemistry Core (SL and HL)

- G1 Electrophilic addition reactions
- G2 Nucleophilic addition reactions
- G3 Elimination reactions
- G4 Addition-elimination reactions
- G5 Arenes
- G6 Organometallic chemistry
- G7 Reaction pathways
- G8 Acid-base reactions

Extension (HL only)

- G9 Addition-elimination reactions
- G10 Electrophilic substitution reactions
- G11 Reaction pathways

Standard III Constructs research questions,

			<ul style="list-style-type: none">1. Draws conclusions from analyzed data and as appropriate compares with hypothesis [9]2. Evaluates the procedure by identifying strengths and weakness [5]3. Recognizes alternative explanations and develops questions for further investigation [9]				<p>hypotheses, and plans experimental procedures</p> <ul style="list-style-type: none">1. Defining the problem and selecting variables2. Controlling variables3. Developing a method for collection of data
			<p>Standard VII Effectively manipulates equipment and utilizes technology</p> <ul style="list-style-type: none">1. Demonstrates the use of equipment and materials appropriately [11]2. Uses materials and equipment safely [9]3. Uses technology tools to enhance learning, increase productivity and promote creativity [5]				<p>Standard IV Collects, records and organizes data</p> <ul style="list-style-type: none">1. Recording raw data2. Presenting processed data <p>Standard V Analyzes and interprets collected data</p> <ul style="list-style-type: none">1. Processing raw data <p>Standard VI Draws conclusions and evaluates procedures and hypotheses</p> <ul style="list-style-type: none">1) Concluding2) Evaluating procedures3) Improving the investigations <p>Standard VII Effectively manipulates equipment and utilizes technology</p> <ul style="list-style-type: none">1. Following instructions2. Carrying out techniques3. Working safely
<p>Constructs research questions</p> <p>Standard III Constructs research questions, hypotheses, and plans experimental procedures</p> <ul style="list-style-type: none">1. Identify questions for investigation [4]2. Develop predictions based on background knowledge and/or research and can be addressed through scientific investigations [2]3. Design and conducts scientific investigations	<p>Constructs research questions</p> <p>Standard III Constructs research questions, hypotheses, and plans experimental procedures</p> <ul style="list-style-type: none">1. Identify questions for investigation [13]2. Develop predictions based on background knowledge and/or research and can be addressed through scientific investigations [15]3. Design and conducts scientific investigations	<p>Constructs research questions</p> <p>Standard III Constructs research questions, hypotheses, and plans experimental procedures</p> <ul style="list-style-type: none">1. Identify questions for investigation [7]2. Develop predictions based on background knowledge and/or research and can be addressed through scientific investigations [15]3. Design and conducts scientific investigations [11]4. Select appropriate tools, technologies and techniques for gathering, analyzing and interpreting data [10]	<p>HS Physics</p> <p>Standard I Defines scientific facts, concepts, and terminology</p> <p>Waves</p> <ul style="list-style-type: none">1. Identify the characteristics of the electromagnetic (E&M) spectrum [3]2. Identify how waves transfer energy without transferring matter [5]3. Define wavelength, frequency, amplitude and velocity [5]4. Illustrate the application of the Doppler Effect to wave phenomena [1] <p>Sound</p>	<p>HS Physics</p> <p>Standard I Defines scientific facts, concepts, and terminology</p> <p>Vectors and Scalars</p> <ul style="list-style-type: none">1. Distinguish between vector and scalar quantities; give examples of each [6]2. Draw arrows of appropriate length and direction to represent vector quantities [8]3. State vector quantities in terms of magnitude and direction or by the components along chosen axis [6] <p>Mechanics</p> <ul style="list-style-type: none">4. Define displacement, velocity, speed and acceleration	<p>IB Environmental Systems & Societies</p> <p>Standard I Defines scientific facts, concepts, and terminology / Standard II Applies, analyzes and evaluates scientific facts and concepts</p> <p>Topic 1: Systems and models</p> <ul style="list-style-type: none">Systems and models <p>Topic 2: The ecosystem</p> <ul style="list-style-type: none">2.1 Structure2.2 Measuring abiotic components of the system2.3 Measuring biotic components of the system2.4 Biomes2.5 Function2.6 Changes2.7 Measuring changes in the system		

<ul style="list-style-type: none"> 4. Select appropriate tools, technologies and techniques for gathering, analyzing and interpreting data [2] 	<ul style="list-style-type: none"> 4. Select appropriate tools, technologies and techniques for gathering, analyzing and interpreting data [8] 		
		<ul style="list-style-type: none"> 5. Identify the parts of the ear and describe how the brain perceives sound [3] 6. Illustrate the application of the Doppler Effect to sound [3] 	<p>(quantities should be identified as scalar or vector quantities) [10]</p> <ul style="list-style-type: none"> 5. Describe the effects of air resistance on falling objects, including "terminal velocity" [6]
			<p>Topic 3: Human population, carrying capacity and resource use</p> <ul style="list-style-type: none"> 3.1 Population dynamics 3.2 Resources—natural capital 3.3 Energy resources 3.4 The soil system 3.5 Food resources 3.6 Water resources 3.7 Limits to growth 3.8 Environmental demands of human populations
		<p>Forces Dynamics</p> <ul style="list-style-type: none"> 6. State Newton's 1st, 2nd and 3rd Law of motion [4] 7. State the conditions for translational equilibrium [6] 8. Describe examples of Newton's 1st Law [4] 9. Discuss examples of Newton's 3rd Law [4] 	
			<p>Topic 4: Conservation and biodiversity</p> <ul style="list-style-type: none"> 4.1 Biodiversity in ecosystems 4.2 Evaluating biodiversity and vulnerability 4.3 Conservation of biodiversity
		<p>Electricity</p> <ul style="list-style-type: none"> 10. Define work and energy in relation to the moving electron [2] 11. State that there are two types of electric charge [2] 12. State and apply the concept of conservation of charge [2] 13. Describe and explain the properties of conductors and insulators [2] 14. Describe the use of a gold leaf electroscope [2] 15. State Coulomb's Law qualitatively [2] 16. Define electric potential energy difference [2] 17. Define electric potential difference [2] 18. Describe a simple model of electrical conduction in a metal [2] 19. Define electric current [4] 20. Define the concept of resistance and state the variable that influences its magnitude [4] 21. State Ohm's Law [4] 22. Draw simple circuit diagrams 	<p>Topic 5: Pollution management</p> <ul style="list-style-type: none"> 5.1 Nature of pollution 5.2 Detection and monitoring of pollution 5.3 Approaches to pollution management 5.4 Eutrophication 5.5 Solid domestic waste 5.6 Depletion of stratospheric ozone 5.7 Urban air pollution 5.8 Acid deposition
			<p>Topic 6: The issue of global warming</p> <ul style="list-style-type: none"> Global warming
			<p>Topic 7: Environmental value systems</p> <ul style="list-style-type: none"> Environmental value systems
			<p>Standard III Constructs research questions, hypotheses, and plans experimental procedures</p> <ul style="list-style-type: none"> 1. Defining the problem and selecting variables 2. Controlling variables 3. Developing a method for collection of data
			<p>Standard IV Collects, records and organizes data</p> <ul style="list-style-type: none"> 1. Recording raw data 2. Presenting
		<p>Light</p> <ul style="list-style-type: none"> 7. Describe how diffraction demonstrates that light is wave [2] 8. Illustrate the application of the Doppler Effect to light [2] 9. Identify different techniques used in determining the speed of light, for example Galileo, Roemer and Michelson [1] 10. Distinguish between specular and diffuse reflection [2] 11. Locate the images formed by plane mirrors [2] 12. Describe the properties and uses of spherical mirrors [2] 13. Determine the locations and sizes of spherical mirror images [2] 14. Describe how real and virtual images are formed by single convex and concave lenses [4] 15. Locate images formed by concave and convex lenses using ray tracing [4] 16. Describe how the eye focuses light to form an image [4] 17. Describe the optical systems in some common optical 	

	spec- instruments [2]	[4]	processed data
		<ul style="list-style-type: none">• 23. Describe the use of ammeters and voltmeters (including the ability to describe and draw the correct positioning of ideal ammeters and voltmeters in a circuit) [4]	Standard V Analyzes and interprets collected data <ul style="list-style-type: none">• 1. Processing raw data
Standard II Applies, analyzes and evaluates scientific facts and concepts Waves	<ul style="list-style-type: none">• 1. Distinguish between the different types of the electromagnetic radiation and their uses [3]• 2. Compare simple harmonic motion and the motion of a pendulum [2]• 3. Contrast transverse and longitudinal waves [4]• 4. Relate wave speed, wavelength and frequency [4]• 5. Apply the principles of superposition, diffraction, interference refraction and reflection to waves [4]	Magnetism (if time permits) <ul style="list-style-type: none">• 24. Draw patterns of magnetic field lines of an isolated bar magnet [4]• 25. Draw the magnetic field pattern of the earth [4]	Standard VI Draws conclusions and evaluates procedures and hypotheses <ul style="list-style-type: none">• 1) Concluding• 2) Evaluating procedures• 3) Improving the investigations
		Standard II Applies, analyzes and evaluates scientific facts and concepts Vectors and Scalars <ul style="list-style-type: none">• 1. Add vector quantities by the graphical method [6]• 2. Resolve vectors into perpendicular components along chosen axis [6]• 3. Interpret the physical meaning of vector components (force components along and perpendicular to inclined plane and along suspended cables) [6]• 4. Add two or more vectors by the method of components [6]	Standard VII Effectively manipulates equipment and utilizes technology <ul style="list-style-type: none">• 1. Following instructions• 2. Carrying out techniques• 3. Working safely
Sound	<ul style="list-style-type: none">• 6. Demonstrate the properties that sound shares with other waves [5]• 7. Relate the physical properties of sound waves to hear and our perception of sound [4]• 8. Demonstrate an understanding of forces vibration and resonance, especially as applied to air columns and strings [4]• 9. Explain why there are variations in sound among instruments and voices [5]	Mechanics <ul style="list-style-type: none">• 5. Draw and analyze displacement-time graphs and velocity-time graphs [8]• 6. Analyze and calculate the slopes of displacement-time and velocitytime graphs and the areas under the velocity versus time graph [10]• 7. Determine the acceleration due to gravity using a ticker timer [6]	
		Forces Dynamics <ul style="list-style-type: none">• 8. Identify the forces acting on an object and draw free-body diagrams	
Light	<ul style="list-style-type: none">• 10. Compare and contrast the ray and the		

- wave model of light
[4]

 - 11. Solve problems involving the speed of light
[4]
 - 12. Predict the effects of combining colors of light and mixing pigments
[2]
 - 13. Explain the phenomenon of the polarization of light
[2]
 - 14. Explain the Law of Reflection
[2]
 - 15. Explain how concave and convex mirrors form images
[2]
- representing the forces acting on both stationary and moving objects (both at constant velocities and accelerations)
[4]

 - 9. Resolve force vectors into perpendicular components along chosen axis
[4]
 - 10. Determine the resultant force in different situations
[4]
 - 11. Solve problems involving translational equilibrium
[4]
 - 12. Solve problems using Newton's 2nd Law
[4]

Electricity

- 13. Compare Ohmic and non-Ohmic behavior
[4]
- 14. Derive and apply expressions for electrical power dissipation in resistors
[4]
- 15. Derive and apply the equations for equivalent resistance of resistors in series and parallel
[4]
- 16. Solve problems involving series and parallel circuits (including the calculation of voltage and current across resistors in both parallel and series circuits)
[4]

Standard III
Constructs research questions, hypotheses, and plans experimental procedures

- 1. Identifies questions for investigation
[4]
- 2. Develops predictions based on background knowledge and/or research and can be addressed through scientific investigations
[4]
- 3. Designs and conducts scientific investigations
[2]
- 4. Selects appropriate tools,

Standard III Constructs research questions, hypotheses and plans experimental procedures

- 1. Identifies questions for investigation
[6]
- 2. Develops predictions based on background knowledge and/or research and can be addressed through scientific investigations
[10]
- 3. Designs and conducts scientific investigations
[6]
- 4. Selects appropriate tools, technologies and techniques for gathering, analyzing

technologies,
and techniques
for gathering,
analyzing and
interpreting
data
[3]

and interpreting
data
[10]

**Standard IV Collects,
records and organizes
data**

**Standard IV Collects,
records and organizes
data**

- 1. Records the appropriate qualitative and/or quantitative raw data [4]
- 2. Records raw data clearly [4]
- 3. Uses appropriate numerical representation in data (for example, units, significant figures, tallies, uncertainties in data) [4]

- 1. Records the appropriate qualitative and/or quantitative raw data [10]
- 2. Records raw data clearly [10]
- 3. Uses appropriate numerical representation in data; for example units, significant figures, tallies, uncertainties in data [10]

**Standard V Analyzes and
interprets collected data**

**Standard V Analyzes
and interprets
collected data**

- 1. Uses appropriate tools and techniques to analyze data [5]
- 2. Determine the connections and relationships among data [7]
- 3. Communicates analyzed data such as graphs, charts and mathematical calculations appropriately [6]

- 1. Uses appropriate tools and techniques to analyze data [10]
- 2. Determine the connections and relationships among data [10]
- 3. Communicates analyzed data such as graphs, charts and mathematical calculations appropriately [10]

**Standard VI Draws
conclusions and evaluates
procedures and
hypotheses**

**Standard VI Draws
conclusions and
evaluates procedures
and hypotheses**

- 1. Draws conclusions from analyzed data and as appropriate compares with hypothesis [5]
- 2. Evaluates the procedure by identifying strengths and weakness [4]
- 3. Recognizes alternative explanations and develops questions for further

- 1. Draws conclusions from analyzed data and as appropriate compares with hypothesis [10]
- 2. Evaluates the procedure by identifying strengths and weakness [10]
- 3. Recognizes alternative explanations and develops questions for further investigation [10]

**Standard VII Effectively
manipulates equipment
and utilizes technology**

- 1. Demonstrates the use of equipment and materials appropriately [10]
- 2. Uses materials and equipment safely [10]
- 3. Uses technology tools to enhance

Further
investigation
[3]

learning, increase
productivity and
promote creativity
[10]

**Standard VII
Effectively
manipulates
equipment and
utilizes technology**

- 1. Demonstrates the use of equipment and materials appropriately [7]
- 2. Uses materials and equipment safely [7]
- 3. Uses technology tools to enhance learning, increase productivity and promote creativity [7]

**Collects,
records &
organizes data**

Standard IV Collects, records and organizes data

- 1. Record the appropriate qualitative and/or quantitative raw data [6]
- 2. Record raw data clearly [6]
- 3. Use appropriate numerical representation in data [6]

**Collects,
records &
organizes data**

Standard IV Collects, records and organizes data

- 1. Record the appropriate qualitative and/or quantitative raw data [21]
- 2. Record raw data clearly [21]
- 3. Use appropriate numerical representation in data [21]

**Collects, records &
organizes data**

Standard IV Collects, records and organizes data

- 1. Record the appropriate qualitative and/or quantitative raw data [13]
- 2. Record raw data clearly [10]
- 3. Use appropriate numerical representation in data [7]

IB Physics

Standard I Defines scientific facts, concepts, and terminology / Standard II Applies, analyzes and evaluates scientific facts and concepts

Topic 1: Physics and physical measurement

- 1.1 The realm of physics [1]
- 1.2 Measurement and uncertainties
- 1.3 Vectors and scalars

Topic 2 : Mechanics

- 2.1 Kinematics
- 2.2 Forces and dynamics
- 2.3 Work, energy and power
- 2.4 Uniform circular motion

Topic 3 : Thermal physics

- 3.1 Thermal concepts
- 3.2 Thermal properties of matter

Topic 4: Oscillations and waves

- 4.1 Kinematics of simple harmonic motion (SHM)
- 4.2 Energy changes during simple harmonic motion (SHM)
- 4.3 Forced oscillations and resonance
- 4.4 Wave

- characteristics
- 4.5 Wave properties

Topic 5: Electric currents

- 5.1 Electric potential difference, current and resistance
- 5.2 Electric circuits

Topic 6: Fields and forces

- 6.1 Gravitational force and field
- 6.2 Electric force and field
- 6.3 Magnetic force and field

Topic 7: Atomic and nuclear physics

- 7.1 The atom
- 7.2 Radioactive decay
- 7.3 Nuclear reactions, fission and fusion

Topic 8: Energy, power and climate change

- 8.1 Energy degradation and power generation
- 8.2 World energy sources
- 8.3 Fossil fuel power production
- 8.4 Non-fossil fuel power production
- 8.5 Greenhouse effect
- 8.6 Global warming

**Additional Higher Level
Topic 9: Motion in fields**

- 9.1 Projectile motion
- 9.2 Gravitational field, potential and energy
- 9.3 Electric field, potential and energy
- 9.4 Orbital motion

Topic 10: Thermal physics

- 10.1 Thermodynamics
- 10.2 Processes
- 10.3 Second law of thermodynamics and entropy

Topic 11: Wave phenomena

- 11.1 Standing (stationary) waves
- 11.2 Doppler effect
- 11.3 Diffraction
- 11.4 Resolution
- 11.5 Polarization

**Topic 12:
Electromagnetic induction**

- 12.1 Induced electromotive force (emf)
- 12.2 Alternating current
- 12.3 Transmission of electrical power

Topic 13: Quantum physics and nuclear physics

- 13.1 Quantum physics
- 13.2 Nuclear physics

Topic 14: Digital technology

- 14.1 Analogue and digital signals
- 14.2 Data capture; digital imaging using charge-coupled devices (CCDs)

Options SL
These options are available at SL only.
Option A: Sight and wave phenomena

- A1 The eye and sight
- A2 Standing (stationary) waves
- A3 Doppler effect
- A4 Diffraction
- A5 Resolution
- A6 Polarization

Option B: Quantum physics and nuclear physics

- B1 Quantum physics
- B2 Nuclear physics

Option C: Digital technology

- C1 Analogue and digital signals
- C2 Data capture; digital imaging using charge-coupled devices (CCDs)
- C3 Electronics
- C4 The mobile phone system

Option D: Relativity and particle physics

- D1 Introduction to relativity
- D2 Concepts and postulates of special relativity
- D3 Relativistic kinematics
- D4 Particles and interactions
- D5 Quarks

Options SL and HL
SL students study the core of these options, and HL students study the whole option (that is, the core and the

extension material).
Option E: Astrophysics
Core (SL and HL)

- E1 Introduction to the universe
- E2 Stellar radiation and stellar types
- E3 Stellar distances
- E4 Cosmology

Extension (HL only)

- E5 Stellar processes and stellar evolution
- E6 Galaxies and the expanding universe

Option F:
Communications
Core (SL and HL)

- F1 Radio communication
- F2 Digital signals
- F3 Optic fibre transmission
- F4 Channels of communication

Extension (HL only)

- F5 Electronics
- F6 The mobile phone system

Option G:
Electromagnetic waves
Core (SL and HL)

- G1 Nature of EM waves and light sources
- G2 Optical instruments
- G3 Two-source interference of waves
- G4 Diffraction grating

Extension (HL only)

- G5 X-rays
- G6 Thin-film interference

Options HL
These options are available at HL only.
Option H: Relativity

- H1 Introduction to relativity
- H2 Concepts and postulates of special relativity
- H3 Relativistic kinematics
- H4 Some consequences of special relativity
- H5 Evidence to support special relativity
- H6 Relativistic momentum and energy
- H7 General relativity
- H8 Evidence to support general relativity

Option I: Medical physics

- I1 The ear and hearing
- I2 Medical imaging
- I3 Radiation in medicine

Option J: Particle physics

- J1 Particles and interactions
- J2 Particle accelerators and detectors
- J3 Quarks
- J4 Leptons and the standard model
- J5 Experimental evidence for the quark and standard models
- J6 Cosmology and strings

Standard III Constructs research questions, hypotheses, and plans experimental procedures

- 1. Defining the problem and selecting variables
- 2. Controlling variables
- 3. Developing a method for collection of data

Standard IV Collects, records and organizes data

- 1. Recording raw data
- 2. Presenting processed data

Standard V Analyzes and interprets collected data

- 1. Processing raw data

Standard VI Draws conclusions and evaluates procedures and hypotheses

- 1) Concluding
- 2) Evaluating procedures
- 3) Improving the investigations

Standard VII Effectively manipulates equipment and utilizes technology

- 1. Following instructions
- 2. Carrying out techniques
- 3. Working safely

Analyzes &interprets collected data

Standard V Analyzes and interprets collected data

- 1. Use appropriate

Analyzes &interprets collected data

Standard V Analyzes and interprets collected data

- 1. Use appropriate

Analyzes &interprets collected data

Standard V Analyzes and interprets collected data

- 1. Use appropriate tools and techniques to analyze data

- tools and techniques to analyze data
[4]

 - 2. Determine direct and indirect relationships among
[2]
 - 3. Communicate analyzed data
[4]
- tools and techniques to analyze data
[19]

 - 2. Determine direct and indirect relationships among data
[9]
 - 3. Communicate analyzed data such as constructing graphs using Excel, charts and mathematical calculations appropriately
[15]
- [12]

 - 2. Determine direct and indirect relationships among data
[17]
 - 3. Communicate analyzed data such as constructing graphs using Excel, charts and mathematical calculations appropriately
[10]

Draws conclusions/ Evaluates

Standard VI Draws conclusions and evaluates procedures and hypotheses

- 1. Draw conclusions from analyzed data and as appropriate compares with hypothesis
[4]
- 2. Evaluate the procedure by identifying strengths and weakness
[2]
- 3. Recognize alternative explanations and develops questions for further investigation
[4]

Draws conclusions/ Evaluates

Standard VI Draws conclusions and evaluates procedures and hypotheses

- 1. Draw conclusions from analyzed data and as appropriate compares with hypothesis
[19]
- 2. Evaluate the procedure by identifying strengths and weakness
[12]
- 3. Recognize alternative explanations and develops questions for further investigation
[7]

Draws conclusions/ Evaluates

Standard VI Draws conclusions and evaluates procedures and hypotheses

- 1. Draw conclusions from analyzed data and as appropriate compares with hypothesis
[17]
- 2. Evaluate the procedure by identifying strengths and weakness
[11]
- 3. Recognize alternative explanations and develops questions for further investigation
[11]

Utilizes Technology

Standard VII Effectively manipulates equipment and utilizes technology

- 1. Demonstrate the use of equipment and materials appropriately
[10]
- 2. Use materials and equipment safely
[10]
- 3. Use technology tools to enhance learning, increase productivity

Utilizes Technology

Standard VII Effectively manipulates equipment and utilizes technology

- 1. Demonstrate the use of equipment and materials appropriately
[16]
- 2. Use materials and equipment safely
[16]
- 3. Use technology tools to enhance learning, increase productivity and promote

Utilizes Technology

Standard VII Effectively manipulates equipment and utilizes technology

- 1. Demonstrate the use of equipment and materials appropriately
[11]
- 2. Use materials and equipment safely
[7]
- 3. Use technology tools to enhance learning, increase productivity and promote creativity
[8]

and promote
creativity
[6]

creativity
[18]

Atlas Curriculum Mapping, Version 6.9.2
© Copyright 2009, Rubicon