**2019-20 Honors Physical Science Objectives:**

**Physics with Earth Science (Semester 1)**

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| **1. NATURE OF SCIENCE**  The student will be able to: | Text Section | Key Concepts |
| 1. Measure length, volume, and mass with correct accuracy and precision using a variety of measuring devices. | 1.3 | Degree of Freedom, Significant Figures, Uncertainty, SI Units, Metric Prefixes (kilo, centi, milli), % error, Standard deviation |
| 2. Compare and contrast random errors and systematic errors, giving examples and how to prevent if possible. | 1.3 | Calibration |
| 3. Convert between measures (both US and metric) using dimensional analysis. | 1.3 |  |
| 4. Represent/interpret data using different graphical representations (i.e. graphs, tables, charts, etc.). | 1.4  Mark Schemes | Graph components (title, axis labels, uncertainty, units, trendline)  Table components (see above) |
| 5. Design and conduct a personal investigation. (Explained in the IB Mark Scheme. See Mark Scheme Rubric for more details.) | 1.2  Mark Schemes | Scientific process, Independent variable, Dependent variable, Controlled variable, Research question |
| 6. Explain the nature of science including key components of the scientific method. | Mark Schemes | Hypothesis, Theory, Law, Research |
| 7. Evaluate personal study skills and set measurable goals for their study habits. | Class text | Learner profile |

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| **2. MOTION AND FORCES**  The student will be able to: | Text Section | Key Concepts |
| 1. Describe motion both qualitatively and quantitatively with respect to distance/displacement, speed/velocity, and acceleration. | 11.1- 11.3 | Reference point, Scalar, Vector, Average, Instantaneous, Final, Initial, 1-Dimensional calcs, v=x/t, s=d/t, a=(vf-vi)/t |
| 2. Create and interpret position/time, velocity/time, and acceleration/time motion graphs of objects. | 11.1- 11.3 | Meaning of slope |
| 3. Apply Newton’s three laws of motion to solve real life problems. | 12.1- 12.3 | Force, Inertia, Balanced, Unbalanced, F=ma, Friction, Terminal velocity, Force Diagrams |
| 4. Apply the Law of Conservation of Momentum in a real life scenario. | 12.3 | Momentum (p), Impulse, p=mv, Imp=Δp=mΔv=F\*t, pi = pf , m1v1i + m2v2i = m1v1f + m2v2f |
| 5. Use Newton’s Universal Law of Gravitation to mathematically describe the force relationship between two masses. | 12.4 | Mass, Weight, F=G\*m1m2/r2, Fg = mg,  g=9.8 m/s2 |
| 6. Compare the theories of continental drift, sea-floor spreading and plate tectonics. | GS 17.1- 17. 4 | Alfred Wegener, Harry Hess, Mid-ocean ridge, Sonar |
| 7. Illustrate plate tectonics (types of plates, boundaries) by describing forces involved in driving plate movement and explain the implications to humans. | GS 17.1- 17.4 | Convection, Core, Mantle, Continental and Oceanic crust (age/composition), Transform, Convergent, Divergent, Subduction, Volcanism, Earthquakes, Tsunamis |

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| **3. ENERGY**  The student will be able to: | Text Section | Key Concepts |
| 1. Differentiate between kinetic and potential energies and describe the ways that energy can be stored. | 15.1 | Energy, Work, W=F\*x, KE = 1/2mv2,  GPE = mgh, Joule |
| 2. Examine the conservation and transformation of energy within systems. | 15.2 | Law of Conservation of Energy  Mechanical energy, GPE + KE = ME |
| 3. Compare and contrast the relationships between temperature, thermal energy, and heat. | 16.1 | Fahrenheit, Celsius, Kelvin |
| 4. Describe how thermal energy is transferred by conduction, convection and radiation. | 16.2 | Differential heating |
| 5. Identify internal and external sources of heat energy in Earth’s systems. | GS 12.1  GS 22.1 | Decay of radioisotopes |
| 6. Explain how ocean water circulation affects energy distribution in the earth’s system. | GS 15.2- 15.3 | Thermocline, Light absorption, Salinity, Density, Thermohaline, Conveyor belt |
| 7. Apply how differential heating of the earth’s surface & atmosphere drives convection within the earth’s system. | GS 11.1- 11.2 | Axis tilt, Pressure, Hadley Cell, Polar Cell, Ferrel Cell |
| 8. Summarize how heat energy transfer relates to the formation of winds & air masses. | GS 12.1-  12.2 | Coriolis, Trade winds, Westerlies, Maritime, Continental, Tropical, Polar |
| 9. Explain & analyze how air mass types affect weather and fronts. | GS 12.2- 12.4 | Cold front, Warm front, Occluded front, Stationary front |

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| **4. ATOMIC STRUCTURE & NUCLEAR REACTIONS**  The student will be able to: | Text Section | Key Concepts |
| 1. Describe the structure of the atom in terms of subatomic particles and their properties. | 4.2 | Protons/Neutrons/Electrons (Mass, Charge, Location), Ion |
| 2. Distinguish the uniqueness of atoms in terms of atomic number, mass number, and isotopes. | 4.2 | Atomic #, Mass #, Atomic mass, Isotope |
| 3. Describe the forces which bind the atom together. | 10.4,  12.4 | Strong force, Coulomb’s Law,  FC = Kq1q2/d2 |
| 4. Distinguish between fission, fusion and radioactive decay. | 10.1, 10.2, 10.4 | Alpha, Beta (+ and -), Gamma, E=mc2 |
| 5. Compare/contrast methods used to determine geologic time (relative dating, fossil record, absolute dating). | GS 21.2- 21.4 | Index fossil, Half life, Superposition, Cross-cutting relationships, Original horizontality |

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| **5. WAVES**  The student will be able to: | Text Section | Key Concepts |
| 1. Outline the properties of waves (i.e. velocity, wavelength, frequency, period, and amplitude) and describe their relationship. | 17.1- 17.2 | Velocity, wavelength (λ), frequency,  period (T), T=1/f, amplitude (A), v = λ\*f |
| 2. Describe the composition and production of electromagnetic waves. | 18.1 | Electric field, magnetic field |
| 3. Explain how technological devices use the principles of waves to transmit information and energy. |  | AM, FM, device ranges (remotes, CB’s, radio, wifi, 4G) |
| 4. Compare and contrast regions of the electromagnetic spectrum based on frequency, wavelength, and energy. | 18.2 | radio, micro, infrared, visible, ultraviolet, x-rays, gamma |
| 5. Define diffraction and interference and justify how they illustrate the wave nature of light. | 17.3 | Reflection, refraction, diffraction, interference, constructive, destructive |
| 6. Define the photoelectric effect and justify how it illustrates the particle nature of light. | 18.1 | Photon |
| 7. Explain how energy in waves can be converted into other forms of energy. | 18.2 | Kinetic, potential, chemical, sound, thermal, electromagnetic |

**2019-20 Honors Physical Science Objectives:**

**Chemistry (3rd Quarter)**

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| **6. ATOMS, BONDING, AND CHEMICAL REACTIONS**  The student will be able to: | Text Section | Key Concepts |
| 1. Explain how the atomic theory has evolved over time. | 4.1, 4.3 | Model, Democritus/Leucippus, Dalton, Thomson, Rutherford, Bohr, Electron Cloud Model |
| 2. Classify elements as metals, nonmetals, and metalloids based on their properties and position on the periodic table. | 5.1-5.3 | Mendeleev, Conductivity, Luster, Malleability |
| 3. Identify periods and families on the periodic table by name, common properties, and valence electrons. | 5.2-5.3 | Valence, Charge (oxidation #), Period, Family, Electronegativity, Atomic Radius, Ionization Energy, Dot Diagram |
| 4. Explain how ionic compounds are formed and predict their formulas. | 6.1 | Cation, Anion, Reduction, Oxidation |
| 5. Explain how covalent compounds are formed and draw their Lewis structures. | 6.2 | Polar bonds (electronegativity differences) |
| 6. Compare and contrast the physical & chemical properties of ionic and covalent compounds. | 6.1-6.2 | Melting point, Solubility, State at room temperature, Conductivity |
| 7. Balance a chemical equation using atom counts and coefficients. | 7.1 | Law of conservation of matter |
| 8. Identify the types of common chemical reactions. | 7.2 | Synthesis, Decomposition, Single Replacement, Double Replacement, Combustion |
| 9. Outline factors which affect the rate of chemical reactions. | 7.4 | Surface area, Temperature, Concentration, Catalyst |

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| **7. KINETIC MOLECULAR THEORY AND MATTER** | Text Section | Key Concepts |
| 1. Describe particle arrangement and particle motion in the four states of matter. | 3.1-3.3 | Intermolecular Attraction |
| 2. Illustrate the effect of pressure and temperature on state of matter using a phase diagram. | 3.3 | Boiling/vaporization, Evaporation, Condensation, Melting, Freezing, Sublimation, Deposition, Pressure |
| 3. Describe the relationship between temperature and state of matter using a heating curve. | 3.3  7.3 | Specific Heat, Q = mcΔT, Latent heat of fusion, Latent heat of vaporization,  Q = mL, Endothermic, Exothermic |
| 4. Demonstrate the relationships between pressure, moles, volume, and temperature of a confined gas. | 3.2 | Combined gas law, P1V1/T1=P2V2/T2  Ideal gas law, PV=nRT |
| 5. Distinguish between chemical and physical properties of matter. | 2.2-2.3 | Reactivity, Flammability, Melting Point, Boiling Point, Density |
| 6. Categorize substances as elements, compounds, mixtures and pure substances. | 2.1 | Heterogeneous, Homogeneous, Solution |

**2019-20 Honors Physical Science Objectives:**

**Earth Science (4th Quarter)**

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| **8. SYSTEMS OF THE EARTH**  The student will be able to: | Text  Pages | Key Concepts |
| 1. Describe & use evidence to explain how land, atmosphere, & oceans changed throughout Earth’s history. | GS 22.1- 22.3  15.1 | Cyanobacteria, Supercontinent, Differentiation, Outgassing, Meteoroid, Red bed |
| 2. Illustrate how the geosphere, hydrosphere, atmosphere, & biosphere interact on earth. | GS 1.1 | Biogeochemical cycles |
| 3. Outline the properties of water which make it unique and important to life on Earth. | GS  25.4 | Polarity, Heat capacity, Expansion upon freezing, Universal solvent |
| 4. Illustrate the movement of carbon, nitrogen, and water through earth’s spheres in terms of chemical and physical changes. | GS 9.1 | Reservoir, Mechanism, Evaporation, Transpiration, Condensation, Precipitation, Collection, Runoff, Percolation, Infiltration, Photosynthesis, Cellular Respiration, Nitrogen Fixation |
| 5. Describe natural causes/influences on global climate. | GS 14.1, 14.3 | Weather, Earth’s orbit, Axis tilt, Mountain ranges, Oceans, Differential heating (latitude), Greenhouse effect, Volcanism, Milankovitch cycles |
| 6. Investigate scientific evidence for atmospheric changes of specific greenhouse gases and evaluate the human impact on these processes. | GS 14.4 | Climate change, Sequestration |
| 7. Evaluate how changes to the oceans (natural and artificial) affect Earth’s spheres. | GS 15.2- 15.3 | Acidity, Salinity, Temperature |
| 8. Compare and contrast the pros and cons of renewable and nonrenewable energy sources. | 10.4, 15.3  GS 26.1- 26.2 | Coal, Oil, Natural Gas, Nuclear, Wind, Solar, Geothermal, Hydro (Dam/Tidal), Biomass, Nuclear vs chemical energy |
| 9. Develop a plan for both individuals and communities to conserve energy resources. | GS 26.3 | Carbon footprint |

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| **9. ASTRONOMY**  The student will be able to: | Text Pages | Key Concepts |
| 1. Explain the evolution of astronomical theories due to changing technologies and methods. | GS 28.1 | Hipparchus, Ptolemy, Copernicus, Brahe, Kepler, Galileo, Newton, Hubble, Penzias and Wilson  Geocentric, Heliocentric, Sextant, Parallax, Retrograde motion, Telescope (reflector/refractor, space/land- based, wavelengths), Spectroscopy, Space probes |
| 2. Explain the common terms and methods astronomers use to locate and study celestial objects in the sky. | GS 28.3 | Declination, Right Ascension, Ecliptic, Zenith, Altitude, Azimuth, Paths of celestial bodies, North star and Southern cross, constellations |
| 3. Describe the structural organization of the solar system. | GS 29.4 | Sun, Planets, Terrestrial, Jovian, Asteroid belt, Kuiper belt, Oort cloud, Comets, Meteoroids |
| 4. Explain each of Kepler’s Laws and apply them qualitatively. | GS  29.1 | Eccentricity, Semi-major axis |
| 5. Compare & contrast the properties of different stars. | GS 30.2- 30.3 | Magnitude, Temperature, Brightness, Luminosity, Mass, Composition, HR Diagram    b=L/(4πd2), λT=2.90\*10-3 m\*K |
| 6. Sequence & summarize the processes in the life cycle of the stars. | GS 30.3 | Nebula, Protostar, Main Sequence Star, Red Giant, Super Red Giants, White Dwarf, Black Dwarf, Red Dwarf, Neutron Star, Black Hole, Element formation |
| 7. Compare relative distances and sizes of astronomical entities. | GS 30.2 | Astronomical Unit, Light year, Parsec, Relative distances between/radius of: Planets, Stars, Galaxies, Universe |
| 8. Explain the Big Bang Theory & summarize supporting evidence. | GS 31.2- 31.3 | Steady State Theory, Hubble’s Constant, Redshift, Cosmic Microwave Background, Open/Closed/Flat Universe, Critical density |

Honors Physical Science 1st Semester Pacing

*Unit 1: Study Skills, Dimensional Analysis, Introduction to Mark Schemes (4 weeks)*

Week 1—Introduction, Expectations, Strengths/Goals, Study Skills, Safety, Accuracy & Precision

Week 2—Errors, Measurements, Significant Figures, Dimensional Analysis (Pink Packet) (Ch 1.3)

Week 3—Graphical Analysis and graphing, Scientific Process (Ch 1.4, 1.2)

Week 4—Mark Schemes: Exploration, Review, EXAM (Ch 1.2)

*Unit 2: Motion and Forces (4 weeks)*

Week 1—Review speed, velocity, etc., intro scalar vs vector, intro acceleration (Ch 11.1-3)

Week 2—Review Newton's laws, momentum, introduce concept of gravity (Ch 12.1-4)

Week 3—Review Plate tectonics and talk implications (GS Ch 17.1-4)

Week 4—Tie together, Review, EXAM

*Unit 3: Energy (4 weeks)*

Week 1—Intro to Kinetic and Potential and Conservation of Energy (Ch 15.1-2)

Week 2—Intro to temperature and heat (Ch 16.1), Review types of heat transfer (Ch 16.2)

Week 3—Intro heat transfer applications (ocean, atmosphere)

Week 4—Heat transfer applications, Review and EXAM

*Unit 4: Atomic Structure (3 weeks)*

Week 1—Review subatomic particles and associated terms, Nuclear forces (Ch 4.2-3)

Week 2—Fission/Fusion, Radioactivity (Ch 10.1-2, 4)

Week 3—Absolute age dating vs Relative age dating, fossils, Review, EXAM (GS Ch 21.2, 4)

*Unit 5: Waves (3 weeks)*

Week 1—Wave characteristics & properties (Ch 17.1-2)

Week 2—EM waves and technology, wave and particle behavior of light (Ch 21.1, 18.1-2)

Week 3—Conservation of energy, Review, EXAM (Ch 17.3)

Semester 1 Final Exam

Honors Physical Science Quarter 3

*Unit 6: Atoms, Bonding and Chemical Reaction (5 weeks)*

Week 1—Atomic Model, Intro to periodic table and periodicity (Ch 4.3, 5.2-3)

Week 2—Valence electrons and intro to bonding (Ch 6.1-2)

Week 3—Bonding and properties of compounds, Balancing Equations

Week 4—Introduction to chemical equations and reaction types (Ch 7.1-2)

Week 5— Factors which influence rates of chemical reactions (Ch 7.4), Review, EXAM 6

*Unit 7: Kinetic Molecular Theory and Matter (4 weeks)*

Week 1—Review KMT, phase diagrams, Heating curve intro & explanation (Ch 3.1, 3.3)

Week 2—Gas Laws (Ch 3.2)

Week 3—Classification of matter, Review, EXAM 7 (Ch 2.1-2.3)

Week 4—Review, Quarter 3 Final Exam

Honors Physical Science Quarter 4

*Unit 8: Systems of the Earth (4 weeks)*

Week 1—Overview of earth’s evolution (GS Ch 22.1-3), water’s unique properties (GS Ch 15.1)

Week 2— Biogeochemical cycles (GS Ch 1.1, 9.1), Natural global climate influences (GS Ch 14.1, 14.3)

Week 3—Climate change, artificial (human) impacts (GS Ch 14.4), changes in oceans (GS 15.2-3)

Week 4—Energy resources and energy conservation, EXAM (Ch 10.4, 15.3, GS 26.1-2)

*Unit 9: Astronomy (5 weeks)*

Week 1—Methods and technologies, astronomical terms (GS Ch 28.1, 29.1)

Week 2—Continue with astronomical terms, Solar system (GS Ch 29.4)

Week 3—Kepler’s Laws (GS Ch 29.1), Star Properties (GS Ch 30.2-3)

Week 4—Star Properties (GS Ch 30.2-3), Stellar Evolution (GS Ch 30.3)

Week 5—Universe, EXAM (GS Ch 31.2-3)

4th Quarter Final Exam