K to 12 BASIC EDUCATION CURRICULUM
SENIOR HIGH SCHOOL – CORE SUBJECT

Grade: Grade 11/12
Core Subject Title: Physical Science

No. of Hours/Quarter: 40 hours/quarter
Prerequisite (if needed): None

Core Subject Description: Evolution of our understanding of matter, motion, electricity, magnetism, light, and the universe from ancient times to the present; applications of physics and chemistry concepts in contexts such as atmospheric phenomena, cosmology, astronomy, vision, medical instrumentation, space technology, drugs, sources of energy, pollution and recycling, fitness and health, and cosmetics.

CONTENT	CONTENT STANDARD (The learners demonstrate an understanding of...)	PERFORMANCE STANDARD (The learners...)	LEARNING COMPETENCIES (The learners...)	CODE
QUARTER 3				
How the elements found in the universe were formed	1. the formation of the elements during the Big Bang and during stellar evolution	make a creative representation of the historical development of the atom or the the chemical element in a timeline	1. give evidence for and explain the formation of the light elements in the Big Bang theory (3 hours)	**S11/12PS-IIIa-1**
	2. the distribution of the chemical elements and the isotopes in the universe		2. give evidence for and describe the formation of heavier elements during star formation and evolution	**S11/12PS-IIIa-2**
			3. write the nuclear fusion reactions that take place in stars, which lead to the formation of new elements	**S11/12PS-IIIa-3**
			4. describe how elements heavier than iron are formed	**S11/12PS-IIIa-b-4**
How the idea of the atom, along with the idea of the elements evolved	3. how the concept of the atom evolved from Ancient Greek to the present		5. describe the ideas of the Ancient Greeks on the atom	**S11/12PS-IIIa-b-5**

CONTENT	CONTENT STANDARD (The learners demonstrate an understanding of...)	PERFORMANCE STANDARD (The learners...)	LEARNING COMPETENCIES (The learners...)	CODE
	4. how the concept of the element evolved from Ancient Greek to the present		6. describe the ideas of the Ancient Greeks onthe elements (2 hours)	**S11/12PS-IIIa-b-6**
			7. describe the contributions of the alchemists to the science of chemistry	**S11/12PS-IIIb-7**
			8. point out the main ideas in the discovery of the structure of the atom and its subatomic particles (3 hours)	**S11/12PS-IIIb-8**
			9. cite the contributions of J.J. Thomson, Ernest Rutherford, Henry Moseley, and Niels Bohr to the understanding of the structure of the atom	**S11/12PS-IIIb-9**
			10. describe the nuclear model of the atom and the location of its major components (protons, neutrons, and electrons)	**S11/12PS-IIIb-10**
			11. explain how the concept of atomic number led to the synthesis of new elements in the laboratory	**S11/12PS-IIIb-11**

CONTENT	CONTENT STANDARD (The learners demonstrate an understanding of...)	PERFORMANCE STANDARD (The learners...)	LEARNING COMPETENCIES (The learners...)	CODE
			12. write the nuclear reactions involved in the synthesis of new elements	**S11/12PS-IIIb-12**
			13. cite the contribution of John Dalton toward the understanding of the concept of the chemical elements (1 hour)	**S11/12PS-IIIc-13**
			14. explain how Dalton's theory contributed to the discovery of other elements	**S11/12PS-IIIc-14**
How the properties of matter relate to their chemical structure	1. how the uses of different materials are related to their properties and structures 2. the relationship between the function and structure of biological macromolecules		1. determine if a molecule is polar or non polar given its structure (2 hours)	**S11/12PS-IIIc-15**
			2. relate the polarity of a molecule to its properties	**S11/12PS-IIIc-16**
			3. describe the general types of intermolecular forces (3 hours)	**S11/12PS-IIIc-d-17**
			4. give the type of intermolecular forces in the properties of substances (3 hours)	**S11/12PS-IIId-e-18**
			5. explain the effect of intermolecular forces on the properties of substances	**S11/12PS-IIId-e-19**
			6. explain how the uses of the following materials depend on	**S11/12PS-IIId-e-20**

CONTENT	CONTENT STANDARD (The learners demonstrate an understanding of...)	PERFORMANCE STANDARD (The learners...)	LEARNING COMPETENCIES (The learners...)	CODE
			their properties: a. medical implants, prosthesis b. sports equipment c. electronic devices d. construction supplies for buildings and furniture e. household gadgets	
			7. explain how the properties of the above materials are determined by their structure	**S11/12PS-IIId-e-21**
			8. explain how the structures of biological macromolecules such as carbohydrates, lipids, nucleic acid, and proteins determine their properties and functions (3 hours)	**S11/12PS-IIIe-22**
How chemical changes take place	1. the following aspects of chemical changes: a. how fast a reaction takes place b. how much reactants are needed and how much products are formed in a reaction c. how much energy is involved in a reaction 2. how energy is harnessed	make either a poster, a flyer, or a brochure on a product(such as fuels, household, or personal care products) indicating its uses, properties, mode of action, and precautions	1. use simple collision theory to explain the effects of concentration, temperature, and particle size on the rate of reaction 2. define catalyst and describe how it affects reaction rate (2 hours)	**S11/12PS-IIIf-23** **S11/12PS-IIIf-24**
			3. calculate the amount of substances used or produced in a chemical reaction (7 hours)	**S11/12PS-IIIf-h-25**

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			4. calculate percent yield of a reaction (1 hour)	**S11/12PS-IIIh-26**
			5. determine the limiting reactant in a reaction and calculate the amount of product formed (2 hours)	**S11/12PS-IIIh-27**
			6. recognize that energy is released or absorbed during a chemical reaction (1 hour)	**S11/12PS-IIIi-28**
			7. describe how energy is harnessed from different sources: a. fossil fuels b. biogas c. geothermal d. hydrothermal e. batteries f. solar cells g. biomass (2 hours)	**S11/12PS-IIIi-29**
How chemistry contributes to the understanding of household and personal care products	The properties and mode of action of the following consumer products: a. cleaning materials b. cosmetics		1. give common examples of cleaning materials for the house and for personal care	**S11/12PS-IIIi-j-30**
			2. from product labels, identify the active ingredient(s) of cleaning products used at home	**S11/12PS-IIIi-j-31**

CONTENT	CONTENT STANDARD (The learners demonstrate an understanding of...)	PERFORMANCE STANDARD (The learners...)	LEARNING COMPETENCIES (The learners...)	CODE
			3. give the use of the other ingredients in cleaning agents 4. give common examples of personal care products used to enhance the appearance of the human body 5. identify the major ingredients of cosmetics such as body lotion, skin whitener, deodorants, shaving cream, and and perfume 6. explain the precautionary measures indicated in various cleaning products and cosmetics (5 hours for competences 2-6)	**S11/12PS-IIIi-j-32** **S11/12PS-IIIi-j-33** **S11/12PS-IIIi-j-34** **S11/12PS-IIIi-j-35**
QUARTER 4				
How we come to realize that the Earth is not the center of the Universe.	1. Greek views of matter, motion, and the universe 2. competing models of the universe by Eudoxus, Aristotle, Aristarchus, Ptolemy, 3. Copernicus, Brahe, and Kepler 4. evidence that the Earth is not		1. explain what the Greeks considered to be the three types of terrestrial motion	**S11/12PS-IVa-36**
			2. explain what is meant by diurnal motion, annual motion, precession of the equinoxes	**S11/12PS-IVa-37**

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	the center of the universe		3. explain how the Greeks knew that the Earth is spherical	**S11/12PS-IVa-38**
			4. explain how Plato's problem of "Saving the Appearances" constrained Greek models of the Universe	**S11/12PS-IVa-39**
			5. compare and contrast the models/descriptions of the universe by Eudoxus, Aristotle, Aristarchus, Ptolemy, and Copernicus	**S11/12PS-IVa-40**
			6. cite examples of astronomical phenomena known to astronomers before the advent of telescopes	**S11/12PS-IVa-41**
			7. compare and contrast explanations and models of astronomical phenomena (Copernican, Ptolemaic, and Tychonic)	**S11/12PS-IVa-42**

CONTENT	**CONTENT STANDARD** (The learners demonstrate an understanding of...)	**PERFORMANCE STANDARD** (The learners...)	**LEARNING COMPETENCIES** (The learners...)	**CODE**
			8. explain how Galileo's astronomical discoveries and observations (lunar craters, phases of Venus, moons of Jupiter, sun spots, supernovas, the apparently identical size of stars as seen through the naked eye, and telescope observations) helped weaken the support for the Ptolemaic model.	**S11/12PS-IVb-43**
			9. explain how Brahe's innovations and extensive collection of data in observational astronomy paved the way for Kepler's discovery of his laws of planetary motion	**S11/12PS-IVb-44**
			10. apply Kepler's 3rd law of planetary motion to objects in the solar system	**S11/12PS-IVb-45**
Why we believe that the laws of physics are universal	1. Aristotelian vs. Galilean views of motion 2. how Galileo used his discoveries in mechanics (and astronomy) to address		1. compare and contrast the Aristotelian and Galilean conceptions of vertical motion, horizontal motion, and projectile motion.	**S11/12PS-IVc-46**

CONTENT	CONTENT STANDARD (The learners demonstrate an understanding of...)	PERFORMANCE STANDARD (The learners...)	LEARNING COMPETENCIES (The learners...)	CODE
	scientific objections to the Copernican model 3. Newton's Laws of Motion 4. Newton's Law of Universal Gravitation 5. mass, momentum, and energy conservation		2. explain how Galileo inferred that objects in vacuum fall with uniform acceleration, and that force is not necessary to sustain horizontal motion	**S11/12PS-IVc-47**
			3. explain how the position vs. time, and velocity vs. time graphs of constant velocity motion are different from those of constant acceleration motion	**S11/12PS-IVc-48**
			4. recognize that the everyday usage and the physics usage of the term "acceleration" differ: In physics an object that is slowing down, speeding up, or changing direction is said to be accelerating	**S11/12PS-IVc-49**
			5. explain each of Newton's three laws of motion	**S11/12PS-IVd-50**

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			6. explain the subtle distinction between Newton's 1st Law of Motion (or Law of Inertia) and Galileo's assertion that force is not necessary to sustain horizontal motion	**S11/12PS-IVd-51**
			7. use algebra, Newton's 2nd Law of Motion, and Newton's Law of Universal Gravitation to show that, in the absence of air resistance, objects close to the surface of the Earth fall with identical accelerations independent of their mass.	**S11/12PS-IVd-52**
			8. explain the statement "Newton's laws of motion are axioms while Kepler's laws of planetary motion are empirical laws."	**S11/12PS-IVe-53**
			9. explain the contributions of scientists to our understanding of mass, momentum, and energy conservation	**S11/12PS-IVe-54**

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			10. use the law of conservation of momentum to solve one-dimensional collision problems	**S11/12PS-IVe-55**
How light acts as a wave and a particle			1. describe what happens when light is reflected, refracted, transmitted, and absorbed	**S11/12PS-IVf-56**
			2. explain how Newton and Descartes described the emergence of light in various colors through prisms	**S11/12PS-IVf-57**
			3. cite examples of waves (e.g., water, stadium, sound, string, and light waves)	**S11/12PS-IVf-58**
			4. describe how the propagation of light, reflection, and refraction are explained by the wave model and the particle model of light	**S11/12PS-IVf-59**
			5. explain how the photon theory of light accounts for atomic spectra	**S11/12PS-IVf-60**

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			6. explain how the photon concept and the fact that the energy of a photon is directly proportional to its frequency can be used to explain why red light is used in photographic dark rooms, why we get easily sunburned in ultraviolet light but not in visible light, and how we see colors	**S11/12PS-IVf-61**
			7. apply the wavelength-speed-frequency relation	**S11/12PS-IVg-62**
			8. describe how Galileo and Roemer contributed to the eventual acceptance of the view that the speed of light is finite	**S11/12PS-IVg-63**
			9. cite experimental evidence showing that electrons can behave like waves	**S11/12PS-IVg-64**
			10. differentiate dispersion, scattering, interference, and diffraction	**S11/12PS-IVh-65**
			11. explain various light phenomena such as: a. your reflection on the concave and convex sides of a spoon looks different b. mirages	**S11/12PS-IVh-66**

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			c. light from a red laser passes more easily though red cellophane than green cellophane d. clothing of certain colors appear different in artificial light and in sunlight e. haloes, sundogs, primary rainbows, secondary rainbows, and supernumerary bows f. why clouds are usually white and rainclouds dark g. why the sky is blue and sunsets are reddish	
			12. explain the contributions of Franklin, Coulomb, Oersted, Ampere, Biot-Savart, Faraday, and Maxwell to our understanding of electricity and magnetism (3 hours)	**S11/12PS-IVi-67**
			13. describe how Hertz produced radio pulses	**S11/12PS-IVi-68**
How physics helps us understand the Cosmos	1. Relativity and the Big Bang 2. Planets in and beyond the Solar System		1. explain how special relativity resolved the conflict between Newtonian mechanics and Maxwell's electromagnetic theory (3 hours)	**S11/12PS-IVi-j-69**

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			2. explain the consequences of the postulates of Special Relativity (e.g., relativity of simultaneity, time dilation, length contraction, mass-energy equivalence, and cosmic speed limit)	**S11/12PS-IVi-j-70**
			3. explain the consequences of the postulates of General Relativity (e.g., correct predictions of shifts in the orbit of Mercury, gravitational bending of light, and black holes)	**S11/12PS-IVi-j-71**
			4. explain how the speeds and distances of far-off objects are estimated (e.g., Doppler effect and cosmic distance ladder) (2 hours)	**S11/12PS-IVj-72**
			5. explain how we know that we live in an expanding universe, which used to be hot and is approximately 14billion years old	**S11/12PS-IVj-73**
			6. explain how Doppler shifts and transits can be used to detect extra solar planets	**S11/12PS-IVj-74**
			7. explain why Pluto was once thought to be a planet but is no longer considered one	**S11/12PS-IVj-75**

Code Book Legend

Sample: S11/12PS-IIIa-1

LEGEND		SAMPLE	
First Entry	Learning Area and Strand/ Subject or Specialization	Science	**S11/12**
	Grade Level	Grade 11/12	
Uppercase Letters	Domain/Content/ Component/ Topic	Physical Science	**PS**
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