Curriculum Guide
High School
Physical Science

Philosophy Statement: Science for the Christian is the study of God's creation. The exploration of the creation should yield a direct appreciation for the creative work of God. All that can be known of God we know through the creation and science is the study of that work. Students will continually be called on to see the divine order of creation and its implications for other subjects and be stirred to think about the work of an infinitely loving, good God who has prepared a place for us to live temporally and eternally.

Course Objectives: Physical Science is designed to serve as a foundation for other high school courses, especially chemistry and physics. Physics units include Newton's 3 laws of motion, forces, scientific definitions of work and power, momentum, conservation and conversions of energy, relationships between electricity and magnetism, and wave phenomena and behavior (including characteristics and calculations) including electromagnetic and sound waves. Chemistry units include composition and classification of matter, history of atomic structure up to present day model, learning the periodic table to include, but not limited to: all chemical symbols, patterns, trends and isotopes, chemical bonding, compound naming, and chemical reactions.

Course Materials: It's Not Rocket Science Unit packets, computer to access online assignments and slideshows, experiments

Time Allotment: 45 minutes per day, 1 and ½ hour on block schedule days

Biblical Integration -

"In the beginning, God created the heavens and the earth." - Genesis 1:1

"Since what may be known about God is plain to them, because God has made it plain to them. For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that people are without excuse." -Romans 1: 19-20

"And God blessed them. And God said to them, "Be fruitful and multiply and fill the earth and subdue it, and have dominion over the fish of the sea and over the birds of the heavens and over every living thing that moves on the earth." - Genesis 1:28

Course Content:

1st Semester

Week 1: (Unit 1): Scientific Method

I can:

- Identify safe and unsafe behaviors in a given scenario.
- Identify and describe the use of lab equipment given a picture or actual piece of equipment.

Week 2: (Unit 1): Scientific Method

I can:

- Use an example to explain the difference between accuracy and precision.
- Calculate an average.

Week 3: (Unit 1): Scientific Method

I can:

- Given data, be able to determine if it is accurate, precise, or both.
- Convert temperature measurements into Celsius, Fahrenheit, or Kelvin.

Week 4: (Unit 1): Scientific Method

I can:

- Convert metric measurements.
- Make precise and accurate measurements with various lab equipment.

Week 5: (Unit 1): Scientific Method

I can:

- Use dimensional analysis to convert numbers into different units.
- Convert numbers in standard notation into scientific notation.

Week 6: (Unit 1): Scientific Method

I can:

- Convert numbers in scientific notation into standard notation.
- Make qualitative observations, quantitative observations, and inferences about a picture or scenario.

Week 7: (Unit 1): Scientific Method

I can:

- Given a sample experiment, be able to write a hypothesis and identify the independent variable, dependent variable, constants, control group, and experimental group(s).
- Explain the importance of both constants and a control group to an experiment.

Week 8: (Unit 2) Motion and Forces

I can:

- Describe the motion of objects depicted in graphs.
- Analyze and explain distance vs. time graphs.
- Analyze and explain velocity vs. time graphs.

Week 9: (Unit 2) Motion and Forces

I can:

- Rank objects based on amount of inertia.
- Rank objects based on amount of momentum.
- Given a scenario, identify and explain which law is at work.

Week 10: (Unit 2) Motion and Forces

I can:

- Find net force on an object based on a picture or diagram.
- Calculate weight of an object, given its mass.

Week 11: (Unit 3) Energy

*I can d*iscern if an object has kinetic or potential energy, based on a description.

Week 12: (Unit 3) Energy

I can given a picture or a description, explain the energy conversion occurring in an object.

Week 13: (Unit 3) Energy

I can identify materials as conductors or insulators.

Week 14: (Unit 3) Energy

I can explain how thermal energy is being transferred, if given a picture or a scenario.

Week 15: (Unit 3) Energy

I can use Newton's 2nd Law to complete work and power calculations.

Week 16: (Unit 4) Electricity and Magnetism

I can:

- Understand the structure of an atom in relation to how electricity works.
- Describe how charges are able to act at a distance.

Week 17: (Unit 4) Electricity and Magnetism

I can describe the motion of electrons in a current.

Week 18: (Unit 4) Electricity and Magnetism

I can perform calculations using Ohm's Law given a scenario or labeled picture.

Week 19: (Unit 4) Electricity and Magnetism

*I can i*Interpret circuit drawings and diagrams.

Week 20: (Unit 4) Electricity and Magnetism

I can:

- Explain why magnetic poles cannot be isolated.
- Relate the properties of magnets to Earth's magnetic field.

<u>2nd Semester</u>

Week 21: (Unit 5) Waves

I can:

- Convert between period and frequency, based on an understanding of the relationship between the two.

- Make calculations of wave speed, frequency and wavelength given a scenario or picture of a wave and use numbers in scientific notation.
- Differentiate between electromagnetic and mechanical waves. Include examples of each.
- Differentiate between transverse and longitudinal waves.
- Draw a transverse wave and label a crest, trough, wavelength, and amplitude.
- Draw a longitudinal wave and label a compression, rarefaction, and wavelength.
- Define amplitude and how it looks different on a transverse and a longitudinal wave.

Week 22: (Unit 5) Waves

I can:

- *Explain the two factors that affect wave speed and how these specifically affect sound waves and light waves differently.*
- *Explain the relationship between loudness, intensity, amplitude, and pitch in relation to sound waves.*
- *Perform calculations of wave speed, wavelength, frequency, and period.*
- *Given a picture or description, determine which wave behavior is occurring.*
- *List a real-world example of each of the six behaviors of waves listed above.*
- *Explain the Law of Reflection. Include a picture of it with the incident ray, reflected ray, angle of incidence, angle of reflection, and normal labeled.*
- *Explain how a prism works.*
- *Draw a picture to show the difference between constructive and destructive interference.*

Week 23: (Unit 5) Waves

I can:

- *Compare two waves and determine which has the greater wavelength, frequency, and/or energy based on where they fall on the electromagnetic spectrum.*
- *Understand the real-world connection between electromagnetic waves and the digital world we live in.*
- *Write out the electromagnetic spectrum and label the trend of wavelength, frequency, and energy along the spectrum.*
- *List two uses for each type of wave on the electromagnetic spectrum.*

Week 24: (Unit 6) Matter

I can:

- *Classify matter based on a picture, description, or real-world example.*
- *Differentiate between a homogeneous mixture and a heterogeneous mixture.*
- *Explain the difference between a compound and a mixture.*
- *Draw a flowchart to represent how matter can be classified.*
- *Given a scenario or description, classify a property or change as chemical or physical.*

Week 25: (Unit 6) Matter

I can:

- Calculate volume and density of regular and irregularly shaped objects.
- Explain the difference between physical and chemical properties, and list examples of each.
- Explain the difference between physical and chemical changes, and list examples of each.
- Cite evidence that a chemical change has occurred.

Week 26: (Unit 6) Matter

I can:

- List the principles of kinetic molecular theory.
- Explain the relationship between thermal energy, temperature, and kinetic energy.
- Given a description or picture, determine the state of matter.
- Explain the difference between solids, liquids, and gasses. Include volume, shape, and particle motion in your description.
- Draw and interpret heating curves.

Week 27: (Unit 6) Matter

I can:

- List real-world examples of where plasma can be found and what Bose-Einstein condensates are used for.
- Explain whether or not state change is physical or chemical.
- Create a diagram to show changing states of matter.

Week 28: (Unit 7) Atomic Structure

I can:

- Understand how scientific discoveries, like atomic structure, are based upon experimentation and build upon each other, which exemplifies the very nature of science.
- Draw a timeline of the discovery of the structure of the atom. Include date, name, and a brief summary of each discovery or model.
- Differentiate between the Bohr Model and the Electron Cloud Model.
- Summarize our current understanding of atomic structure. Include the two parts, where the three particles are located, and where the mass and volume in an atom mainly exist.

Week 29: (Unit 7) Atomic Structure

I can:

- Explain the three forces at work that hold an atom together.
- Use and interpret a periodic table to determine information about an element.

- Given an incomplete chart and a periodic table for reference, be able to fill in the element, atomic number, mass number, protons, neutrons, and electrons.
- Use a picture or description to determine the mass number of an isotope.
- Explain what it means for an atom to be electrically neutral.
- Explain what two isotopes of the same element have in common and what is different about them. Include when an isotope is considered to be the most stable.
- Use both hyphen and nuclear isotope notation.

Week 30: (Unit 7) Atomic Structure

I can:

- Use and interpret an element's location of the periodic table to answer questions about its structure.
- Identify elements given a description by applying knowledge of the periodic table.
- Explain the structure of the electron cloud. Include how many electrons are held on each level, where valence electrons are, and which electrons are the craziest.
- Explain why elements in the same group have similar properties.
- Describe the pattern/shared characteristics of elements in the same group vs. the same period.

Week 31: (Unit 7) Atomic Structure

I can:

- List the names and any special characteristics for groups 1, 2, 3, 3-12, 17, and 18.
- Differentiate between the characteristics of metals, nonmetals, and metalloids. Include their general location on the periodic table.
- Draw Bohr Models for the elements 1-20.
- Use the periodic table to determine the identity of groups or specific elements.

Week 32: (Unit 8) Bonding

I can:

- Interpret chemical formulas.
- Use an element's location on the periodic table to determine its oxidation number and bonding tendencies.
- Draw electron dot diagrams for individual elements, and to show ionic bond formation.
- Explain why elements form compounds, and what most elements need to achieve this. Include which elements do not tend to form compounds and why.
- Determine the number of atoms of each element in a compound.

Week 33: (Unit 8) Bonding

I can:

- Explain the difference between a cation and an anion, including how each are formed and an example of each.
- Given the name of an ionic compound, determine its chemical formula, including those that contain polyatomic ions and/or transition metals.
- Given the chemical formula for an ionic compound, determine its name, including those that contain polyatomic ions and/or transition metals.

Week 34: (Unit 8) Bonding

I can:

- Explain why an ionic bond forms, how it forms, the two parts that make it up, and the overall charge of the resulting compound.
- Classify a compound as ionic or covalent.
- Draw electron dot diagrams to show covalent bond formation.
- Given the name of a covalent compound, determine its chemical formula.
- Given the chemical formula for a covalent compound, determine its name.

Week 35: (Unit 8) Bonding

I can:

- Classify examples as atoms, ionic compounds, or molecules.
- Explain why a covalent bond forms, how it forms, and what types of elements form them.
- Describe the difference between single, double, and triple bonds.
- Differentiate between the properties of covalent compounds and ionic compounds.

Week 36: (Unit 9) Reactions

I can:

- *Identify if a chemical reaction has occurred based on a description or visual representation.*
- *Label and interpret chemical equations and their notation to explain what they tell you about a chemical reaction.*
- *Balance chemical equations with regards to the Law of Conservation of Mass.*
- *Given a written description of a reaction, determine the chemical equation.*
- *List examples of chemical changes.*

Week 37: (Unit 9) Reactions

I can:

- Explain the Law of Conservation of Mass and how it relates to the amount of reactants and products in a chemical reaction.

- Differentiate between numbers that can be changed to balance a chemical reaction and numbers that cannot be changed.
- Given a compound, determine the number of atoms of each element in it.
- List examples of evidence that a chemical reaction has occurred.
- Give an example of a natural resource that can be chemically changed to make a synthetic resource and describe its impact on society.
- Classify chemical reactions based on an equation or a description.
- Apply knowledge of chemical bonds and classification of reactions to predict the products that will result from a reaction.

Week 38: (Unit 9) Reactions

I can:

- Describe the characteristics of the five types of chemical reactions.
- Given a scenario or description, determine if a reaction is giving off or absorbing energy, and in what form.
- Given a scenario or description, determine what factors are impacting the rate of the reaction.
- Describe, in detail, five factors that affect the rate of chemical reactions.

Week 39: Review Week

Areas to Be Evaluated:

*Class work assignments
*Homework assignments
*Quizzes
*Tests
*Projects
*Participation in experiments