Science Shepherd Homeschool Physics Curriculum

Scope & Sequence

Chapter 1 - Introduction

Goals

- Introduce the general study of physics.
- Learn about the scientific method.
- Introduce the importance of measurement to various aspects of data collection.
- Study measurement standardization, base units, derived units and prefixes as found in the International System of Measurement.
- Consider scientific notation as beneficial shorthand for the study of physics.
- Define accuracy and precision.

Chapter 2 - Matter Introduction and Solids

Goals

- Provide an overview of the three states of matter – solids, liquids and gases.
- Learn about atoms, the building blocks of matter.
- Review the basics of the Periodic Table of the Elements
    - The atomic number is the number of protons (and electrons) in an element's atom.
    - The number of neutrons = atomic mass – the number of protons.
- Introduce some of the physical properties of matter.
- Study solids, particularly density and elasticity.

Chapter 3 - Matter – Liquids and Gases

Goals

- Learn about standard temperature and pressure.
- Study atmospheric pressure.
- Introduce in detail some physical properties of liquids, including boiling point, density, buoyancy and Archimedes principle.
- Master the relationship between pressure and its effects on the physical properties of liquid and gas matter.
- Detail the physical properties of gas matter, including infiniteness, compressibility and lift.

Chapter 4 - Temperature and Heat

Goals

- Introduce kinetic energy and potential energy.
- Describe the kinetic theory of molecular/atomic motion and how it explains heat transfer.
- Study temperature and how it is measured.
- Learn about heat, heat transfer, how to measure it.
- Briefly explore specific heat and the equation $Q = m \cdot c \cdot \Delta T$

Chapter 5 - Mechanical Equilibrium

Goals

- Learn more about forces.
- Discuss the two types of mechanical equilibrium, static and dynamic.

Chapter 6 - Newton's First Law of Motion (and some gravity)

Goals

- Learn about Newton's first law of motion.
- Study inertia in its various forms.
- Find out that mass is a measure of inertia.
- Review static and dynamic equilibrium and how they relate to inertia.
- Discuss the difference between mass and weight (and learn more about gravity in the process).

Chapter 7 - Newton's Second Law of Motion

Goals

- Introduce Newton's second law of motion – the acceleration of an object is directly proportional to the force acting upon it and inversely proportional to the mass of the object.
- Dissect the vector force called acceleration.
- Discuss $a = F/m$, the relationship of acceleration (a) to mass (m) and force (F).
- Practice using the acceleration equation.
- Learn about gravity's acceleration.

Chapter 8 - Newton's Third Law of Motion

Goals

- Introduce Newton's 3rd law of motion – when object 1 exerts a force on object 2, object 2 exerts an equal and opposite force upon object 1. These "paired forces" are known as 3rd law force pairs.
- Learn how to properly identify 3rd law force pairs.
- Study force systems and force interactions relative to the 3rd law.
- Reveal how objects move in a world of "equal and opposite forces."

Chapter 9 - Waves

Goals

- Learn about waves – disturbances that travel through a medium as it transports energy from one place to another without transporting matter.
- Discover that waves are formed from vibrations of matter.
- Dissect the anatomy of a wave.
- Study various aspects of waves, such as wavelength and frequency, and how they are related.
- Review the two general types of waves – transverse and longitudinal – and how they are the same and different.

Chapter 10 - Sound

Goals

- Learn about sound sources and reinforce that sound travels by waves.
- Review the hearing mechanism of humans and how sound waves stimulate the hearing response.
- Study various properties of sound, including loudness, intensity, resonance and amplitude.
- Investigate the speed of sound and what influences it.

Chapter 11 - Light

Goals

- Review a short history of the physics of light.
- Learn about the electromagnetic and particle (photon) properties of light.
- Introduce the electromagnetic spectrum.
- Study the following properties of light: specular reflection, diffuse reflection (scatter), refraction, speed, transmission and absorption.

Chapter 12 - Color

Goals

- Study why we see color.
- Learn how our eyes function to process light energy and how the brain decodes electrical information sent to it from our eyes to determine color.
- Review a brief history of color physics, with attention to Isaac Newton's prism experiments.
- Dissect the differences between seeing the colors of opaque and transparent objects.
- Introduce the RGB color scheme.

Chapter 13 - Radioactive Physics

Goals

- Introduce new terms related to nuclear physics and radioactive elements.
- Learn what makes an atom's nucleus unstable (or "radioactive").
- Study the nuclear decay processes of alpha, beta and gamma radiation.
- Understand half-life and how it works.
- Discuss a couple of basic applications of nuclear physics in everyday life.

Chapter 14 - Physics...How?

Goals

- Very briefly review the history of science and scientists as related to biblical interpretation.
- Discuss various applications of physics that support God's creation of the universe and everything in it, just like he said he did in Genesis 1.