oak meadow
INDEPENDENT LEARNING SINCE 1975

Physics

This course combines traditional physics instruction with modern quantum theories of the nature of the universe. The subject is taught at an introductory level, which will allow the average student to grasp the concepts of Newton's laws, statics, dynamics, thermodynamics, optics, DC circuits, waves, electromagnetics, and special relativity.

Prerequisite: Algebra II.

The following books are needed for this course:

Oak Meadow Physics Syllabus
Physics (Saxon)
Coming of Age in the Milky Way (Harper)

Outline of the physics syllabus:

Lesson 1:	The Power of the Word and the Importance of the Story: Creation
Lesson 2:	Ancient Cosmological Thought
Lessons 3-4:	The Discovery of the Earth and the Sun
Lessons 5-6:	Galileo and an Introduction to Force
Lessons 7-8:	Heat and Energy
Lessons 9-10:	Newton's Forces
Lessons 11-12:	The Sun and Simple Machines
Lessons 13-14:	Celestial Space and Heat
Lessons 15-16:	The Meaning of Light and Higher Mathematics
Lessons 17-18:	More About Gravitation and Light
Lessons 19-20:	Heat, Time, and Thermodynamics
Lessons 21-22:	Waves, Stars, and Atomic Theory
Lessons 23-24:	Circular Motion, Harmonic Motion, and Gases and Fluids
Lessons 25-26:	Electricity
Lessons 27-28:	Magnetism, Radioactivity, and the Special Theory of Relativity
Lessons 29-30:	More Relativity
Lessons 31-32:	Quantum Physics and Symmetry
Lessons 33-34:	The Story of Creation and the Origin of the Universe
Lessons 35-36:	Mind, Matter, and Mystery

Physics~~~~~~~~~~~~~~~~~~~~~~~~~~~~Lessons 21-22

WAVES, STARS AND ATOMIC THEORY

PART ONE

Read: Timothy Ferris, *Coming of Age in the Milky Way*, Chapter 14, "The Evolution of Atoms and Stars," pages 255-282.

Answer the following questions:

1. In 1911 Rutherford, Geiger and Mardsen shot alpha particles of helium nuclei at thin foils of different metals, and found that while most passed through the foils, a few bounced back.

   a) What was the conclusion as to why this happens?

   b) Why then are heavy elements heavier than light elements?

2. Noels Bohr established that an *electron shell*, which consists of many different orbits of different electrons, surrounds the protons in an atom's nucleus. Explain what occurs between these orbits that allows a *spectroscopist* to know what type of chemical elements make up the stars.

3. What were the first *computers*?

4. What is the *Coulomb barrier*? What allows it to be breached and for nuclear fusion to power the stars?

5. While nuclear fusion powers both the sun and thermonuclear weapons, the sun is not a bomb. Why does a chain reaction in the sun normally not result in further ones occurring as they do in a bomb?

6. The lowest mass of a star is about 1 per cent the mass of our sun and the largest stars are about 60 times its size. What would happen if it were smaller? What would happen if it were bigger?

7. In terms of matter, what is the "primary" business of stars?

8. How did Paul Merril's discovery of technetium-99 in S stars show stars could build elements heavier than iron?

9. What is the cosmic element *abundance curve*?

10. 96% of all visible matter in the universe is composed of what two elements?

11. Explain the origins of the gold and silver that exists on Earth.

12. How do we know that the stars at a galactic center of a galaxy are older than the stars in the spiral arms?

PART TWO

Read and Study: Saxon, *Physics*, Lesson 34, pages 219-222; Lesson 40, pages 264-267; Lesson 44, pages 293-297; Lesson 73, pages 518-522; Lesson 78, pages 552-558.

Answer the following questions:

1. Explain how the white light from the sun causes a red fire engine to look red.

2. Explain the difference between *additive* primary colors and *subtractive* primary colors.

3. Draw two pictures of waves, one from a top view and one from a side view. In each, show the locations of the crests and the troughs of the wave.

4. Explain what happens to the frequency, the wavelength and the speed of light as it passes through air and then through water.

5. What is a sound wave? On what two variables does the speed of sound depend?

6. On what properties does the speed of a wave along a string depend?

7. Why does a boat whistle sound different when it is stationary, when the boat is moving towards you, and when it is moving away from you?

8. Explain what is meant by a *resonance frequency*.

9. What is *damping*? Explain why all real-world systems have damping.

10. In a pendulum clock, what keeps the clock moving at a constant speed?

11. All of the strings of a guitar are the same length. If the guitar is "in tune" why does each string sound a different note?

PART THREE

In your Saxon Home Study Packet, do problem 6 in Test 9, problem 10 in Test 10, problem 6 in Test 19, and problem 8 in Test 20. Be sure to show all your work and computations.