Calvary Chapel Christian School

CURRICULUM GUIDE

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 1: Units • Scientific Notation • Significant Digits The student will: • Express the three fundamental quantities of length, mass, and time using the metric system or System Inernationale (SI) • Express computational results using Greek prefixes. • Carry out mathematical operations using scientific notation. • Explain the need for significant digits. • Explain rules for determining significant digits. **Lesson 2: Estimating with Scientific Notation• Precision of a Calculation • Unit Conversions** The student will: • Perform order-of-magnitude calculations, approximations, and guesstimates. • Understand the rules for handling significant digits and how to handle them when performing calculations. • Understand how to convert units. **Lesson 3: Vectors and Scalars** The student will: • Define scalar quantity and site examples. • Define vector quantity and site examples. • Define vector sum and resultant of two or more vectors.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 2.1 Measurement **Evaluation Techniques** Homework Lab Quiz Lessons 1-4	*Physics An Incremental Development* <u>Student Text</u> Pages 1-18 <u>Lab Manual</u> Pages 3-4 Demonstration materials	Perfect and just measurements. Deut 25:15 Various units of measurement in the Bible: Cubit, Homer, Ephah, etc. Just weights and measures. Lev 19:35, Deut 25:13-15 God measure the heavens with the span of His hand. Isa 40:12, 48:13 Jesus as a problem solver in the feeding of the 5000. Matt 6:36-44 As Christians we should always looked to the Lord to give us direction in our lives. Prov 3:6 Prov. 11:5 Saul's Conversion to Paul. Phil 3:5-8	1 3, 4, 5 2

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Lesson 3: Vectors and Scalars (continued) • Use the Tip-to-Tail Method to find the resultant of vectors. • Determine the x and y-components of a given vector by graphical methods. • Calculate x and y-components of a vector. • Calculate the magnitude and the direction of a vector when its rectangular components are given. **Lesson 4: Reference Frames • Average Speed and Velocity • Mass and Weight • Density** The student will: • Locate points, express angles, express rotation sense, and express distances in Frame of Reference—the Cartesian coordinate system. • Distinguish between displacement and distance and speed and velocity. • Calculate displacement, distance, speed, and velocity. • Demonstrate by definition and example ad understanding of the distinction between mass and weight. • Write the value of the acceleration due to gravity in metric units. • Define the unit of force, Newton. • Define density and solve problems using density.					

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Lesson 5: Vector Equations • Forces in Equilibrium The student will: • Define equilibrium. • Define equilibrant. • State the conditions necessary for equilibrium. • Demonstrate an understanding of Static Equilibrium • Solve vector equations in tension problems. **Lesson 6: Structure of Matter • Temperature** The student will: • In terms of structure, distinguish the differences between solids, liquids, gases, and plasma. • Understand the difference between elements, compounds, and mixtures. • Distinguish between protons, neutrons, and electrons. • Describe the composition of an atom of any particular element in terms of the subatomic particles. • Know the difference between an atom, an ion, and a molecule. • Define Brownian movement. • State the Kinetic Molecular Theory. • Demonstrate and understanding of the difference between a specific temperature and temperature interval.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 3-1 Uniform Motion **Evaluation Techniques** Homework Lab Test Lessons 1-8	*Physics* *An Incremental Development* Student Text Pages 24-41 Lab Manual Pages 11-14 Demonstration materials	Christians should be moving on a path toward sanctification. Ultimate fulfillment is when we enter into His presence. I John 3:2-5 We will be changed in a twinkling of an eye. 1 Cor 15:52 The Lord commanded Ezekiel to go into the flatlands that lie between the Tigris and Euphrates Rivers. Eze 3:22,23 In 2 Cor 4:17, Paul compares the weight of the world to the greater weight of glory in heaven. One of the influences (force) in our lives is your friends. Good friends improve our character. Prov 27:17	1 3, 4, 5 2

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Lesson 6: Structure of Matter • Temperature (continued) • Demonstrate working skill with the Celsius, Fahrenheit, Kelvin, and Rankine temperature scales and the inner conversion between them **Lesson 7: Linear Motion and Average Velocity • Average Acceleration** The student will: • Relate average speed to distance traveled and time elapsed to solve problems involving such parameters. • Define average velocity and solve problems using definition. • Define acceleration and suggest means for measuring it. • Define average acceleration and solve problems using definition. **Lesson 8: Friction** The student will: • Discuss the forces of kinetic and static friction and suggest a means of measuring them. • Define the coefficient of friction. • Calculate the normal force. • Calculate the friction force. • Solve problems involving friction for unknown forces or coefficient of friction.				God created and sustains the universe through His Son Jesus Christ. Jesus manifests the Godhead in creation. All praise and honor must be directed to Him. Neh 9:6, Col 1:17 God created all matter. Gen 1:1	

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Lesson 9: Torque The student will: • Clearly demonstrate an understanding of torque and apply this understanding to various applications. • State whether the resulting torque is positive or negative by convention when a force is applied to an extended body pivoted at some point. • Calculate the resultant torque about any point given the magnitude and the position of the forces applied to an extended body. **Lesson 10: Motion Graphs** The student will: • On a Position vs. Time graph determine the average velocity between two points. • Recognize that the slope of a straight line on a Position vs. Time graph is the velocity. • Recognize that the area under the curve on a Position vs. Time graph is the displacement traveled. • Calculate the velocity and displacement given the Position vs. Time graph. • On a Velocity vs. Time graph determine the average acceleration between two points. • Recognize that the slope of a straight line on a Velocity vs. Time graph is the acceleration. • Calculate the acceleration on a Velocity vs. Time graph.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 4.1 Accelerated Motion **Evaluation Techniques** Homework Lab Quiz Lessons 9-12	*Physics* *An Incremental Development* Student Text Pages 42-68 Lab Manual Pages 15-18 Demonstration materials	Why were the Jewish religious leaders perplexed about how to answer the anticipated question from Jesus about John the Baptist? Mark 11:31 Why do we call upon the Lord and not do what he commands? Luke 6:46 For every action there is an equal and opposite reaction. Hos 4:6 Because they had rejected God, God had rejected them The omnipotence of God. Jer 32:17	1 3, 4, 5 2

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Lesson 11: Galileo • Newton The student will: • Demonstrate an understanding of Newton's First Law of Motion. • State specific examples to illustrate an understanding of Newton's Third Law of Motion. • Demonstrate an understanding of Newton's Second Law of Motion. • Relate Newton's First and Second Laws to kinematics. • Solve Newton's Second Law problems by setting the resultant force equal to the total mass times the acceleration and solve for the unknown parameters. **Lesson 12: Work, Power, and Energy** The student will: • Define physical work. • State the conditions necessary for the performance of physical work. • Define the joule as work or energy unit. • Write a mathematical statement for calculating the work done by a given force and demonstrate that the equation is dimensionally correct. • Recognize that the area beneath a Force vs. Distance curve is work done over the distance interval. • Understand the relationship between work, energy, and power. • Define and unit of watt for power. • Demonstrate by example an understanding of the concept of power.				The omnipotence of God. Jer 32:17 1 Cor 1:23-25 We are all born with talents and abilities that represent a potential for doing good, but this potential must be trained and taught. Common sense says we should cooperate with those teaching us, but "The sluggard is wiser in his own conceit than seven men that can render a reason." Prov 26:16 We have a potential to sin so be careful less we fall. 1 Cor 10:12	

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Lesson 13: Instantaneous Velocity • Instantaneous Acceleration The student will: • Define Instantaneous Velocity. • Calculate the Instantaneous Velocity on a Position vs. Time graph by approximating the slope at that point. • Distinguish between average velocity and instantaneous velocity. • Define Instantaneous Acceleration. • Calculate the Instantaneous Acceleration on a Velocity vs. Time graph by approximating the slope at that point. • Distinguish between average acceleration and instantaneous acceleration.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 5.1 Newton's Second Law Lab 5.2 Friction	*Physics* *An Incremental Development* Student Text Pages 69-93 Lab Manual Pages 25-32 Demonstration materials	Some people think that living a godly life would be an unbearable burden. This is only apparent weight, however, Jesus declared "My yoke is easy, and my burden is light." Matt 11:30	1 3, 4, 5
Lesson 14: Free Body Diagrams • Elevator Problems The student will: • Draw a free-body diagram representing all forces acting on an object that is in static equilibrium. • Draw a free-body diagram representing all forces acting on an object that is in translational equilibrium. • Analyze the motion of an accelerating elevator.		**Evaluation Techniques** Homework Labs Test Lessons 9-16			2
Lesson 15: Static Equilibrium • Beam Problems The student will: • Define Static Equilibrium. • Solve Beam problems using condition of equilibrium for unknown forces					

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Lesson 16: Simple Machines • Efficiency The student will: • State the six types of simple machines. • Recognize that machines do not change the work required but only reduce the effort force and increase the effort distance. • Determine the mechanical advantage of a pulley. • Calculate the effort force given the load and mechanical advantage. • Define mechanical efficiency. • Calculate the work output given the mechanical efficiency and the work input.					

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Lesson 17: Sliding Block Problems The student will: • Develop equations involving a sliding block with friction. • Calculate either P, μ_k, w, F_N, or θ for a sliding block problem. **Lesson 18: Bodies in Equilibrium** The student will: • Apply the condition of equilibrium to write two equations involving components of given vectors along the x-axis and the y-axis of a frame of reference. • Solve simultaneous equations derived from the condition of equilibrium for unknown forces. • Draw a free-body diagram for a body of a system of bodies in motion with a constant acceleration. **Lesson 19: Constant Acceleration** The student will: • Write three general kinematic equations that involve the parameters distance, initial velocity, final velocity, acceleration, and time. • Use the kinematic equations to solve motion at constant acceleration problems. **Lesson 20: Heat • Specific Heat** The student will: • Understand that heat is an energy form. • Represent the heat gained or lost in a given process in terms of calories, joules, or BTUs.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 10.1 Pulleys **Evaluation Techniques** Homework Lab Quiz Lessons 17-20	*Physics* *An Incremental Development* Student Text Pages 94-119 Lab Manual Pages 63-64 Demonstration materials	The elements will melt with fervent heat. 2 Pet 3:10	1 3, 4, 5 2

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Lesson 20: Heat • Specific Heat (continued) • Give two or more examples illustrating the distinction between quantity of heat and temperature of a material. • Demonstrate by example and by experiment an understanding of specific heat and the distinction from heat capacity. • Explain practical advantages or disadvantages of metals with large specific heat capacities. • Apply the Law of Conservation of Energy to a given process to determine unknown parameters such as mass, specific heat, or temperature.					

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Lesson 21: Momentum The student will: • Define impulse and momentum. • Derive an equation illustrating the relationship of a change in momentum to the impulse. • Recognize that the area beneath a Force vs. Time curve is impulse and that impulse is the change in momentum. **Lesson 22: The Derivative • The Area Under a Curve** The student will: • Define the derivative of a function. • Use the summation and power rules of differentiation to find the derivatives of a polynomial function of t. • Recognize that the derivative of the position function with time is the velocity. • Calculate the velocity at any time using the derivative. • Define the second derivative. • Recognize that the second derivative of the position function with time or the first derivative of the velocity with time is the acceleration. • Calculate the acceleration at any time using the second derivative. • Define the Integral. • Use the summation and power rules of integration to find the integrals of a polynomial function of t.	8 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 6.1 Addition of Forces Lab 12.1 Specific Heat **Evaluation Techniques** Homework Labs Test Lessons 17-24 Midterm Lessons 1-24	*Physics* *An Incremental Development* Student Text Pages 120-146 Lab Manual Pages 33-36 Pages 75-78 Demonstration materials	God sustains us in the presence of opposing forces. Psalm 55 Do not have a hard heart, but let God teach you through His Word, both studied and preached. Heb 4:2	1 3, 4, 5 2

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Lesson 22: The Derivative • The Area Under a Curve (continued) • Recognize that the definite integral of the velocity function is the area under the curve which it the displacement. • Calculate the displacement between two points in time given the velocity function and using definite integrals. **Lesson 23: Center of Mass** The student will: • Understand the distinction between the center of mass and center of a system. • Calculate the location of the center of mass in simple systems. **Lesson 24: Free Falling Bodies** The student will: • Describe the behavior of an object in free fall when neglecting air resistance. • Recognize that the equations of kinematics directly apply to bodies in free fall. • Use the quadratic equation to determine the time it takes a body with an initial velocity to reach the ground and explain the meaning of the extraneous solution. • Calculate the position and velocity at specific times for a body dropped from rest, projected vertically downward, and projected vertically upwards with some initial velocity.					

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Lesson 25: Radian Measure • Angular Speed and Acceleration The student will: • Define and illustrate the degree, the radian, and the revolution as angular measure and convert between them. • State angular kinematics concepts in linear kinematics terms and expressions. • Define angular velocity and angular acceleration and describe procedures for measuring and expressing them. **Lesson 26: Fluid Pressure • Weight, Density, and Pressure • Fluids at Rest • Pascal's Principle** The student will: • Define the properties of fluids. • Distinguish between mass density, weight density, and specific gravity. • Calculate the pressure from a column of liquid. • Understand that only the depth of the liquid determines the pressure and not the shape of the container holding the liquid. • Understand that at a given depth the pressure is the same in all directions. • Define the concept of pressure and that of absolute pressure. • State and apply Pascal's Principle.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 8.1 Kepler's Laws **Evaluation Techniques** Homework Lab Quiz Lessons 25-28	*Physics* *An Incremental Development* Student Text Pages 147-178 Lab Manual Pages 49-54 Supplemental Text *Physics* *Principals and Problems* Pages 157-163 (Kepler's Laws and Cavendish equation) Add homework problems from this text. Demonstration materials	The children of Israel wandered in the Sinai for 40 years because of lack of faith. Num 14:33 Circular motions of the heavens. Job 38:31-32 The earth is a sphere. Isa 40:22	1 3, 4, 5 2

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Lesson 27: Inclined Plane The student will: • Analyze the motion of a body accelerating on an inclined plane with friction. • Calculate acceleration down the plane with and without friction. • Calculate normal force. • Draw vector diagram. **Lesson 28: Gravitational Theory** The student will: • Use Newton's Law of Gravitation to derive the acceleration due to gravity on the surface of the earth and for the surfaces of other planets when the radii and the masses of the planets are given. • Use Newton's Universal Law and Newton's Second Law of Motion to express weight for any location in the universe. • Determine mass from weight or weight from mass where a value for the acceleration due to gravity is known. • Describe an experiment that would measure the Universal Gravitational Constant. • Determine the acceleration due to gravity for various positions on the surface and above the surface of the earth. • State Kepler's Three Laws of Planetary Motion. • Use Kepler's Third Law to relate the radius of an orbit to its period.					

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Lesson 29: Gravitational Potential Energy • Kinetic Energy • Conservation of Mechanical Energy The student will: • Define potential energy. • Define gravitational potential energy. • Write an equation that will determine the gravitational potential energy of a known mass or weight relative to a given location is space. • Define kinetic energy. • Calculate the kinetic energy of a body when its mass or weight is given. • State and write the Law of Conservation of Mechanical Energy. **Lesson 30: Conservation of Momentum** The student will: • Distinguish by definition between elastic, inelastic, and completely inelastic collisions. • Relate energy changes in elastic and completely inelastic collisions. • Understand that momentum and kinetic energy are conserved in an elastic collision. • Apply the Law of conservation of Linear Momentum to problems involving colliding bodies. • Use energy and momentum principles to discuss what occurs after an elastic collision.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 9.1 Conservation of Momentum Roller Coaster Lab (handout) **Evaluation Techniques** Homework Labs Test Lessons 25-32	*Physics An Incremental Development* Student Text Pages 179-210 Lab Manual Pages 55-58 Demonstration materials	God conserves and preserves His creation through His power. Gen 2:1-2 Though God may work in different ways His character never Changes. Himself – Psa 102:26 His glory – Psa 104:31 His mercy – Psa 106:1 His goodness – Psa 52:1 His peace – Psa 72:7 His truth – Psa 117:2 His righteousness – Psa 113:3 His name – Psa 135:13 No amount of good works can an unbeliever do to escape God's judgments. John 3:18	1 3, 4, 5 2

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Lesson 30: Conservation of Momentum (continued) • Predict the velocities of two colliding bodies after impact when the masses and initial velocities are given. • Apply the Law of Conservation to solve recoil problems. • Predict the scattering angles after a two-dimensional elastic collision. **Lesson 31: Snell's Law** The student will: • Define index of refraction. • Understand the relationships between index of refraction and Snell's Law • Calculate speed of light in different media. • Calculate refracted angle using Snell's Law. **Lesson 32: Ideal Gases • Using the Gas Law** The student will: • Distinguish between an ideal gas and a real gas, giving reasons why some gases closely approximate the ideal condition. • Demonstrate by example an understanding of (1) Boyle's Law, (2) Charles' Law, (3) Gay-Lussac's Law, (4) Avogadro's Law, (5) the Combined Gas Law and (6) the Ideal Gas Law					

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Lesson 33: Two-Body Tension Problem The student will: • Determine the tension and acceleration on an Atwood machine. • Determine the tension and acceleration of two bodies, one on a frictionless table top and the other hanging from an ideal pulley. • Determine the tension and acceleration of two bodies, one on a frictionless inclined plane and the other hanging from and ideal pulley. **Lesson 34: Color • Wavelengths** The student will: • Explain what color is, how it is produced, and how colors are combined to product other colors. • Describe the regions to the electromagnetic spectrum, place them in proper relationship to each other according to frequency or wavelength, identify the origin of each region, and give at least one natural and one artificial source for each. • Identify and describe the sources of visible light. • Discuss the experimental history that lead to an accurate determination of the speed of light. • Define and compare the various methods of measuring illumination. • Calculate unknown luminous intensity from photometer data.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 17.2 Snell's Law Lab 13.1 Archimedes' Principle **Evaluation Techniques** Homework Labs Quiz Lessons 33-36	*Physics* *An Incremental Development* Student Text Pages 211-239 Lab Manual Pages 117-120 Pages 79-80 Supplemental Text *Physics* *Principals and Problems* Pages 329-345 (Luminous Intensity and Color) Add homework problems from this text. Demonstration materials	The source of spiritual light is Jesus Christ. 2 Cor 4:6 The shining of Moses' face. Ex 33 Become an expert at comparing light sources. Gal 5:22-23 2 Cor 11:14	1 3, 4, 5 2

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Lesson 35: Circular Motion I The student will: • Show that all circular motion equations are dimensionally correct. • Write three circular motion equations that involve the parameters angel, initial angular velocity, final angular velocity, angular acceleration, and time. • Use the circular motion equations to solve motion at constant angular acceleration problems. • Develop equations to relate linear motion to circular motion for a rolling object. • State the conditions that are necessary for uniform circular motion. **Lesson 36: Archimedes' Principle** The student will: • State Archimedes' Principle and its relation to buoyancy. • Calculate buoyancy force given the volume or percent volume of a floating object. • Calculate the tension in a tethered buoy submerged in a liquid.					

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Lesson 37: Electric Charge • Electric Current • Voltage • Ohm's Law • Resistivity The student will: • Discuss the nature of electrical charge. • Understand charge quantization. • Recognize that all charges are multiple of the fundamental unit of charge, e. • Demonstrate that charge is conserved. • Define the ampere as the unit of electrical current. • Distinguish between conventional flow and electron flow. • Define emf and it role in DC electrical theory. • Define voltage or potential difference. • State Ohm's Law for electrical components. • Define the unit of resistance, the ohm. • Determine the potential drop across a resistance carrying a given current. • Define the factors that determine the resistance of a given wire. • Calculate the resistance of a wire given its resistivity, length, and radius. **Lesson 38: Pressure and Volume • Temperature and Kinetic Energy** The student will: • Explain Boyle's and Charles's Law in terms of the Kinetic Theory of Gases.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 22.1 Ohm's Law Lab 14.1 Ripple Tank Waves **Evaluation Techniques** Homework Labs Test Lessons 33-40	*Physics An Incremental Development* Student Text Pages 240-269 Lab Manual Pages 149-152 Pages 81-86 Demonstration materials	Do not resist the ordinance of God. Rom 13:2 Resist the Devil. James 4:7 God will give us a mouth and wisdom, which all our adversaries will not be able to resist. Luke 21:15 Jesus is our solid foundation. The Church Matt 16:18 Wise man builds his house on the rocks. Matt 7:25 The Spirit of God flows out of us like a river. John 7:38 Rev 22:1	1 3, 4, 5 2

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Lesson 39: Liquids and Solids • Phase Changes The student will: • Describe the changes that take place during phase changes in terms of atomic and molecular structure of matter. • Apply the Law of Conservation of Energy to a given process that includes the latent heat of fusion or vaporization. **Lesson 40: Wave Motion • Sound Waves** The student will: • Distinguish between the physiological and physical definitions of sound. • Compute the velocity of sound in air at a given temperature. • State ways of approximating the speed of sound in liquids and gases knowing the speed of sound in air.					

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Lesson 41: Hooke's Law • Elastic Potential The student will: • State and give a mathematical equation for Hooke's Law. • Explain the meaning of the negative sign in the equation expressing Hooke's Law. • Calculate Elastic Potential Energy. **Lesson 42: Electric Power • Sign Conventions** The student will: • Relate the voltage drop across a resistor carrying a current to its energy loss. • Define the watt as the unit of electrical power. • Determine the power loss across a given current carrying resistance. • Define the sing conventions of the flow of conventional current to the polarity signs on a resistor. **Lesson 43: Tension Problems with Friction** The student will: • Solve two-body tension problems to include friction. **Lesson 44: Mechanical Waves • Superposition Principle • Wave Reflections • Speed Along a String** The student will: • Understand the principles of reflection, refraction, dispersion, and diffraction as they relate to mechanical waves. • Use the superposition principle and determine the resultant wave when two waves merge. • Calculate the speed along a string.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 22.1 Ohm's Law Lab 14.1 Ripple Tank Waves **Evaluation Techniques** Homework Labs Quiz Lessons 41-44	*Physics* *An Incremental Development* Student Text Pages 270-299 Lab Manual Pages 149-152 Pages 81-86 Demonstration materials	Endure temptations. James 1:12 Constructive wave interference. Acts 27:41	1 3, 4, 5 2

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Lesson 45: Projectile Motion • Motion of Center of Mass The student will: • Discuss the trajectory of a projectile in the earth's gravitational field. • Illustrate graphically how the motion of a horizontally projected baseball compares with that of a baseball dropped from rest. • Illustrate with diagrams how the vertical motion of a baseball thrown at any angle is similar to the motion of a baseball thrown vertically. • Predict the position and velocity of a projectile as a function of time when the projection angle and initial speed are given. • Predict the range, maximum altitude, and time of flight for a given projectile when the initial speed and the angle of projection are given. • Illustrate an understanding of relative motion in one and two dimensions **Lesson 46: Circular Motion II** The student will: • Define centripetal acceleration. • Calculate centripetal acceleration using the radius and linear or angular velocity. • Understand how acceleration is possible without a change in speed. • Apply centripetal force and gravitation to satellites.	9 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 7.1 Projectile Motion **Evaluation Techniques** Homework Lab Test Lessons 41-48 Final Test Lesson 1-48	*Physics* *An Incremental Development* Student Text Pages 300-334 Lab Manual Pages 41-44 Supplemental Text *Physics* *Principals and Problems* Pages 164-166 (Satellite Problems) Add homework problems from this text. Demonstration materials	Jonathan shoots an arrow to warn David of King Saul's decision concerning him. 1 Sam 20:18-23	1 3, 4, 5 2

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Lesson 47: Kirchhoff's Laws The student will: • Write and apply Kirchhoff's Rules for electrical networks in the determination of unknown currents. **Lesson 48: Conservative Forces • A Third Equation for Uniform Motion • Kinetic Energy Defined • Dot Product** The student will: • Discuss the meaning of the *expression conservative force*. • Understand the significance of a conservative force. • Understand that the gravitational field is a conservative field. • Understand that the spring force is a conservative force. • Understand that friction is not a conservative force. • Discuss the Work-Energy Theorem and express it as a mathematical statement. • Demonstrate by example and by experiment the relationship between the performance of work and the corresponding change in kinetic energy. • Define Dot Product. • Calculate work when the direction of force and the direction of motion are not the same.					

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Lesson 49: Circuit Analysis I The student will: • Calculate voltage drops for resistor hooked in series. **Lesson 50: Vibrating Systems** The student will: • Describe simple harmonic motion (SHM) through examples. • Define the parameters of SHM. • Describe the relationships between force and displacement in simple harmonic motion. • Describe and illustrate how the magnitude and direction of velocity varies as a function of time in SHM. • Calculate the frequency or period when the position and acceleration of an object at any instant during SHM are given. **Lesson 51: Circular Motion III** The student will: • Define centrifugal force. • Apply understandings of centrifugal force to examples of motion in a vertical circle. • Calculate tension in cables involving circular motion. **Lesson 52: Plane Mirrors • Concave Parabolic Mirrors.** The student will: • Describe the characteristics of plane mirrors. • Demonstrate an understanding of the nature of the images formed by plane mirrors.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Marble Launcher Lab (handout) **Evaluation Techniques** Homework Lab Quiz Lessons 49-52	*Physics* *An Incremental Development* <u>Student Text</u> Pages 335-353 Demonstration materials	The Lord is my light. Psa 27:1 Jesus is the light of the world. John 8:12 The Word is a lamp. Psa 119:105 We are children of the light. 1 Thes 5:5 We should shine as lights. Phil 2:15 God can see into our hearts. Psa 26:2 Be attracted to the light. John 3:20-21	1 3, 4, 5 2

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Lesson 52: Plane Mirrors • Concave Parabolic Mirrors (continued) • Distinguish between virtual and real images. • Distinguish between plane mirrors and spherical mirrors. • Understand the characteristics of a converging mirror. • Describe the images formed by a converging mirror. • Use ray-tracing techniques to construct images formed by a converging mirror. • Define the focal length of a spherical mirror.					

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Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 53: Equivalent Resistance The student will: • Calculate the resistance across a bank of resistors in series, parallel, and combined. • Define and describe voltage, current, and equivalent resistance for resistors connected in series, parallel, and combined. • State Ohm's Law for an entire electrical circuit and apply it to the solution of electrical problems involving the total resistance of the circuit. • Calculate the total resistance of an entire DC circuit. • Compute power loss in a DC circuit. **Lesson 54: Rotational Inertia** The student will: • Define the moment of inertia of a body. • Define the rotational inertia of point masses rotating about a fixed point. • State mathematically Newton's Second Law of Motion as it relates to rotational accelerations. • Calculate torque or angular acceleration for point mass inertia problems. **Lesson 55: Circular Unbanked Tracks • Two Parallel Resistors** The student will: • Calculate the coefficient of kinetic friction for a body that is moving in circular motion on an unbanked track. • Use simplified formula for finding parallel resistance for a pair of resistors.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 17.1 Reflection **Evaluation Techniques** Homework Lab Test Lessons 49-56	*Physics* *An Incremental Development* Student Text Pages 354-392 Lab Manual Pages 111-116 Demonstration materials	The Holy Spirit for power. John 7:38 Act 2:2-4 John 4:14	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 56: Ideal Fluids • Flow Rate • Continuity Equation The student will: • Distinguish between laminar and turbulent flow. • Discuss limitation of an ideal fluid. • Define volumetric flow rate. • Calculate volumetric flow rate given the cross sectional area and the velocity of the fluid. • Define continuity for fluid flow. • Using the Continuity equation, calculate the velocity of the fluid at various points along a pipe with varying diameter.					

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 57: Convex Mirrors The student will: • Understand the characteristics of a diverging mirror. • Describe the images formed by a diverging mirror. • Use ray-tracing techniques to construct images formed by a diverging mirror. **Lesson 58: Moment of Inertia • Exponential Equations** The student will: • Calculate the moment of inertia for disks, rings, solid spheres, hollow spheres, long thin rods rotating about its center, and long thin rods rotating about its end. • Solve mathematically Newton's Second Law of Motion as it relates to rotational accelerations of various shapes above. • Describe the shape of an exponential growth curve (positive exponent). • Describe the shape of an exponential decay curve (negative exponent). • Define time constant. • Solve an exponential equation for final voltage for a discharge of a capacitor given the time. **Lesson 59: Capacitors • *RC* Circuits I** The student will: • Discuss the effects of size and the shape of a conductor on its ability to store charge. • Derive a relationship between applied voltage, capacitance, and total charge.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 23.1 Series Resistance Lab 23.2 Parallel Resistance **Evaluation Techniques** Homework Labs Quiz Lessons 57-60	*Physics* *An Incremental Development* Student Text Pages 393-424 Lab Manual Pages 157-166 Demonstration materials	God gave each of us a certain measure of faith; use what you have! Rom 12:3 God gave us the capacity to love one another. John 13:34, 1 John 2:7, 2 John 5 What is the temperature of your spiritual life? Rev 3:15:16 Be equally yoked, II Cor 6:14 All phase of water are shown in the Bible. Job 35:27-32 Job 36:6	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 59: Capacitors • *RC* Circuits I (continued) • Write the exponential equation for the voltage across a discharging capacitor. • Draw the exponential curve for the voltage across a discharging capacitor. • Write the exponential equation for the current through a discharging capacitor. • Draw the exponential curve for the current through a discharging capacitor. • Understand that the voltage of a capacitor cannot change instantaneous with time. **Lesson 60: Thermal Expansion • Phase Changes for Water** The student will: • Predict the change in length of a metal rod of known length and material as the rod is heated through a known temperature range. • Develop a method to determine a relationship for the change in area of a sheet of material as it is heated or cooled over a given temperature range. • Predict the volume overflow when a container of known volume and material filled with a given liquid is heated over a given temperature interval. • Describe the phase changes for water.					

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 61: Bernoulli's Equation The student will: • Understand Bernoulli's Equation and its application to ideal fluids. • Demonstrate an understanding of the workings of an air foil. **Lesson 62: Rotational Kinetic Energy • Angular Momentum** The student will: • Describe how the moment of inertia and angular speed of a body determine the rotational kinetic energy. • Apply the Law of Conservation of Mechanical Energy to rotating and to rolling bodies. • Define rotational work and rotational power using torque and derive equations for computation in applied situations. • Define angular momentum and give at least two examples illustrating application. **Lesson 63: Simple Harmonic Motion • Conservation of Angular Momentum** The student will: • Write the equation for the motion of a mass oscillating on a spring. • Calculate the period or frequency of a mass-spring system. • Understand the change of energy from kinetic to spring potential energy for a mass-spring system. • State and apply the Law of Conservation of Angular Momentum.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 21.1 The Capacitor **Evaluation Techniques** Homework Lab Test Lessons 57-64	*Physics An Incremental Development* Student Text Pages 425-455 Lab Manual Pages 145-148 Demonstration materials	The flood that was upon the earth. Gen 7:17-20 Peer Pressure Job 2:9 The protection from floods of evil promised. Isa 59:19 The Lord has power to change time. .2 Kings 20:10-11 Periodic character of the seasons. Gen 8:22 Everything has a season. Eccl 3:1-8	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 64: Banked Tracks The student will: • Calculate the horizontal component of centripetal force for a body moving in a circular path. • Calculate the vertical component for a body moving in a circular path. • Calculate the angle necessary to bank the track to make the force direct perpendicular to the track's surface. • Calculate the magnitude of the normal force for a body on a banked track. • Determine the tension in a cable with a mass being swung in circular motion.					

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 65: Inertia Combinations • Pulleys with Mass The student will: • Develop three simultaneous equations to solve for the tension and acceleration of bodies where inertia is not neglected. • Solve two-body tension problems to involve pulleys with mass **Lesson 66: Work and Energy • Heat Transfer • First Law of Thermodynamics** The student will: • Discuss the significance of Joule's experiment. • Demonstrate by two examples in each case the application of heat transfer by radiation, conduction, and convection currents. • Define a *thermodynamic system*. • Give two examples in which the internal energy of a system can be changed. • State the First Law of Thermodynamics, give two examples in which the low is demonstrated, and represent the first law mathematically. • Define and give illustrated examples of each of the following thermodynamic processes: (a) adiabatic, (b) isochoric, (c) isothermal, and (d) isobaric.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Hooke's Law Lab (handout) **Evaluation Techniques** Homework Lab Quiz Lessons 65-68	*Physics* *An Incremental Development* Student Text Pages 456-485 Demonstration materials	Help your Christian brothers and sisters to radiate Christ by noticing and commending their Christian virtues—not for their glory but for Christ's. Philem. 5-6 The rainbow reminds us of God's promise not to destroy the earth again with a flood. Gen 9:12,13 Total mass & energy remained constant since the sixth day of creation. Gen 2:2-3 First Law Gen 2:1-2, Neh 9:6, Exo 20:11, Exo 31:17	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 67: Prisms • Total Internal Reflection The student will: • Discuss the separation of light using a prism. • Define total internal reflection. • Discuss how a prism could be used as a plane mirror. • Calculate the critical angle given the indices of refraction for two adjacent materials with light passing through them. **Lesson 68: Capacitor Energy • *RC* Circuits II** The student will: • Define and calculate the energy of a charged capacitor. • Write the exponential equation for the voltage across a charging capacitor. • Draw the exponential curve for the voltage across a charging capacitor. • Write the exponential equation for the current through a charging capacitor. • Draw the exponential curve for the current through a charging capacitor.					

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 69: Converging Lenses • Diverging Lenses The student will: • Distinguish between converging and diverging lenses. • Understand the characteristics of converging and diverging lenses. • Describe the images formed by converging and diverging lenses. • Use ray-tracing techniques to construct images formed by lenses. • Define the focal length for a lens. **Lesson 70: Fundamental Forces • Static Charge • Induced Charge** The student will: • State the four fundamental forces: (a) electrical force, (b) gravitational force, (c) strong nuclear force, and (d) weak nuclear force. • Distinguish between an insulator and a conductor. • Define static charge. • Explain how to charge a body by induction. **Lesson 71: The Simple Pendulum • The Physical Pendulum** The student will: • Understand that the period of a pendulum is only a function of its length and g. • Determine the period and total energy of a simple pendulum undergoing SHM. • Determine the period of a physical pendulum.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 20.1 Investigating Static Electricity **Evaluation Techniques** Homework Lab Test Lessons 65-72	*Physics An Incremental Development* Student Text Pages 486-517 Lab Manual Pages 139-144 Demonstration materials	Use a spiritual telescope. Job 36:3	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 72: Sinusoidal Motion • Circuit Analysis II The student will: • Define amplitude. • Define phase angle. • Write the sinusoidal motion equation for an object moving in SHM relating amplitude, frequency or angular velocity, and phase angle. • Write and apply Kirchhoff's rules for electrical networks in the determination of unknown currents. • Analyze multiloop circuits using Ohm's Law and Kirchhoff's Rules. • Solve three simultaneous equations to solve multiloop circuits.					

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 73: Traveling Waves • Doppler Effect The student will: • Describe and illustrate transverse and longitudinal wave motion. • Describe, relate, and illustrate the meaning of frequency speed, and wavelength as they apply to wave motion. • Understand the mathematics of traveling waves. • Use the Doppler Effect to predict the apparent change in sound frequency that occurs as a result of relative motion between a source and an observer. **Lesson 74: Heat Engines • Second Law of Thermodynamics** The student will: • Explain the operation and the limitations of the efficiency of a heat engine. • Determine the efficiency of a heat engine in terms of heat input and heat output. • Determine the efficiency of a heat engine in terms of input temperature and output temperature. • Understand that the Carnot efficiency is the maximum possible efficiency for a heat engine. • State the Plank statement of the Second Law of Thermodynamics.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 18.1 Concave and Convex Mirrors **Evaluation Techniques** Homework Lab Quiz Lessons 73-76 Midterm Lessons 49-76	*Physics* *An Incremental Development* Student Text Pages 518-543 Lab Manual Pages 121-124 Demonstration materials	Second Law Eccl 3:20, Isa 51:6 Magnify the Lord with a song of thanksgiving. Psa 69:30 Magnify God work. Job 36:24 Our sin nature is an aberration in mankind. Rely on the Holy Spirit as a "corrective lens" to permit us to shine forth undistorted. Acts 1:8 The greatest heat engine that affects us is the interactions in the atmosphere that cause weather. Eccles. 1:5-7 Does the Bible predict uniformitarianism? 2 Pet 3:3-4	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 75: Mirror-Thin Lens Equations The student will: • Use the Mirror-Thin Lens Equation to solve problems. • Calculate the magnification of a spherical mirror or lens. • Understand the sing convention for the Mirror-Thin Lens Equation. **Lesson 76: Coulomb's Law** The student will: • Write Coulomb's Law and express it in terms of an equation. • Apply Coulomb's Law to problems involving systems of point charges. • Solve electrostatic force vector problems.				Electrostatic charges attract or repel each other with incredible force. However, this force diminishes with distance. How close is your walk with the Lord? James 4:8 Isa 29:13	

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 77: Equivalent Capacitance The student will: • Calculate the equivalent capacitance of a number of capacitors arranged in (1) series, (2) parallel, and (3) series and parallel combination. **Lesson 78: Resonance Frequency • Standing Waves • Beat Frequencies** The student will: • Define resonance. • Define fundamental frequency. • Define nodes and antinodes. • Draw standing wave patterns for resonators and stringed instruments. • Define pitch, intensity and quality. • Distinguish between harmonics and overtones as they apply to a vibrating system. • Understand resonance in stringed instruments. • Calculate the resonance frequency for a stringed instrument given its length. • Understand resonance in open and closed resonators. • Calculate the resonance frequency for an open and closed resonator given its length. • Give examples of open and closed resonators. • Understand the mathematics of standing waves. • Discuss the origin and significance of beats.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 18.2 Concave and Convex Lenses **Evaluation Techniques** Homework Lab Test Lessons 73-80	*Physics* *An Incremental Development* Student Text Pages 544-581 Lab Manual Pages 125-130 Supplemental Text *Physics* *Principals and Problems* Pages 314-318 (Resonator Problems) Add homework problems from this text. Supplemental Text *Physics* Pages 548-569 (Voltage Potential Problems) Add homework problems from this text. Demonstration materials	The second coming of the Son of man will be like lightning. Matt 24:27 Do not store anger. Eph 4:31-32	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 79: Thermodynamic States • The Carnot Cycle The student will: • Differentiate between state and phase. • Define state variable. • Understand thermodynamic equilibrium. • Differentiate between reversible and irreversible processes. • Explain the significance of a PV diagram in describing (a) adiabatic, (b) isochoric, (c) isothermal, and (d) isobaric thermodynamic processes. • Understand the four steps involved in the Carnot Cycle. • Draw a PV diagram demonstrating the Carnot Cycle labeling all steps. • Understand that the work for each step of the cycle is the area under the curve. • Understand that the net work is the area enclosed by the cycle. • Calculate work as PΔV. **Lesson 80: Electric Fields • Electron Volts** The student will: • Define the electric field in terms of an isolated point charge. • Show how the electric field is similar to a gravitational field. • Calculate the magnitude and direction of the force that would act on a test charge placed at a given point in an electric field. • Calculate the electric field of a system of charge distributions. • Discuss the motion of a charged particle in a uniform electric field.					

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 80: Electric Fields • Electron Volts (continued) • Distinguish by definition and example between potential energy, electric potential, and electric potential difference. • Distinguish between positive and negative work. • Compute the potential energy of a known charge at a given distance from another known charge and state whether the potential energy is positive or negative. • Determine the electric potential at any point due to a charge of known magnitude. • Calculate the electric potential at a point in the neighborhood of a number of isolated charges. • Find the force that would be exerted on a given charge placed between two opposite charged parallel plates of known separation and potential difference. • Draw electric field lines around a charged particle. • Define the electron volt, eV, and be able to express energy in terms of this unit.					

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Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 81: The Otto Cycle • The Refrigerator The student will: • Understand the four steps involved in the Otto Cycle. • Draw a PV diagram demonstrating the Otto Cycle labeling all steps. • Understand the operation of a refrigerator. • Understand how to draw the refrigerator as a heat engine in reverse. • State the Clausius statement of the Second Law of Thermodynamics. **Lesson 82: Magnetic Fields** The student will: • Define the tesla. • Write the basic law of magnetic force and apply it to physical situations. • Define permeability. • Calculate the magnetic field strength for a current flowing though a wire and the radius from the wire. • Draw the direction of the magnetic field using the right-hand rule. • Use the right-hand rule to determine the north pole of an electromagnet. • Use the right-hand rule in determining the direction of magnetic forces on a positive particle. • Explain the magnetic field in terms of the force acting on a charged particle. • Discuss the motion in circular orbits of charged particles in a uniform magnetic field. • Define magnetic flux giving its units.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 15.2 Resonance in an Open Tube **Evaluation Techniques** Homework Lab Quiz Lessons 81-84	*Physics* *An Incremental Development* Student Text Pages 582-612 Lab Manual Pages 95-98 Demonstration materials	A compass always seeks a magnetic north. Are you continuously seeking Christ? John 12:32 Are you seeking Christ with all your heart are you just giving lip service? Matt 15:8 It is God who chose you, not the other way around. John 6:44 The corruption of the world is an inevitable end to all natural processes. If God were not to intervene, the universe would succumb to this principle. Those who are saved will escape this judgment. 2 Pet 1:4	1 3, 4, 5 2

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Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 83: Entropy The student will: • State the Second Law of Thermodynamics. • Define the entropy of a system. • Calculate the change in entropy for isothermal processes. **Lesson 84: Dielectrics • Ammeters and Voltmeters** The student will: • Define the dielectric strength of a material and describe the part it plays in limiting the charge that can be placed on a conductor. • Calculate the capacitance of a parallel-plate capacitor when the area of the plate is given and they are separated by a medium of known dielectric strength. • Define permittivity and give examples illustrating its effect on a capacitor. • Understand the theory, operation, and use of the ammeter, voltmeter, and galvanometer in DC circuits.					

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Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 85: DC Motors • DC Generators • Inductance The student will: • Explain how induced emfs are created by changing magnetic flux through a single loop. • Predict the polarity of an induced emf. • Describe ways in which magnetic flux can change. • Discuss induced emf and current. • Write Faraday's Law of Induction and apply it to induced emf through a loop. • State Lenz's Law and use it to determine the direction of an induced current. • Describe the main components of a DC generator. • Explain how back emf reduces the net voltage delivered by a generator. • Define Inductance. **Lesson 86: Magnets • Self-Inductance • Mutual Inductance • Bar Magnets** The student will: • Discuss the field lines of a magnet. • Discuss the basic features and properties of the earth's magnetic field. • Explain how to determine the direction of a magnetic field using a compass. • Define self and mutual inductance. • Define the time constant for an inductor and resistor. • Write the exponential equation for the current through an energized or denergized inductor.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 24.1 The Nature of Magnetism **Evaluation Techniques** Homework Lab Test Lessons 81-88	*Physics* *An Incremental Development* Student Text Pages 613-645 Lab Manual Pages 167-170 Demonstration materials	Shield yourself from the counsel of evil people. I Kings 12:8 Psa 1:1 Group as Christians. Matt 18:20	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 86: Magnets • Self-Inductance • Mutual Inductance • Bar Magnets (continued) • Draw the exponential curve for the current through an energized or denergized inductor. • Write the exponential equation for the voltage across an energized or denergized inductor. • Draw the exponential curve for the voltage through an energized or denergized inductor. • Understand that the current through an inductor cannot change instantaneous with time. • Determine secondary voltage and current given the number of primary and secondary turns in a transformer. **Lesson 87: Carnot Efficiency** The student will: • Prove using heat engine diagrams that Carnot efficiency is the maximum efficiency for a heat engine. • Show that an engine with a greater efficiency violates the Plank's and Clausius' Statements of the Second Law of Thermodynamics. **Lesson 88: Alternating Voltage and Current • Transformers** The student will: • Describe the main components of an AC generator. • Write the equation for an AC voltage. • Discuss the advantage of using a transformer.					

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 89: Richter Scale • Decibels The student will: • Understand the energy levels for an earthquake are logarithmic. • Discuss the Richter scale. • Calculate the magnitude of an earthquake on a Richter scale given the relative intensities of the earthquakes. • Relate the energy of a sound wave to its intensity. • Calculate the intensity level in decibels for a sound wave whose intensity is given in watts per square meter. • Define loudness. • Calculate the loudness for a sound wave. **Lesson 90: Electromagnetic Radiation** The student will: • Differentiate between radio, TV, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays as forms of electromagnetic radiations. • Discuss Maxwell's Equations. **Lesson 91: Speed of Light • Polarization • Wave Theory • Thin-Film Interference** The student will: • Calculate the speed of light from toothed-gear problems. • Use Huygen's Principle to explain diffraction and refraction. • Discuss Young's experiment and its significances. • Explain how the phenomena of diffraction and interference demonstrate the wave nature of light.	5 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 15.1 The Sound Level of a Portable Radio or Tape Player **Evaluation Techniques** Homework Lab Quiz Lessons 89-92	*Physics* *An Incremental Development* Student Text Pages 646-683 Lab Manual Pages 91-94 Supplemental Text *Physics* *Principals and Problems* Pages 392-403 (Single & Double Slit Problems and Diffraction Gratings) Add homework problems from this text. Demonstration materials	Do our work survive God's "polarizing filter"? 1 Cor 3:11-15 God answers are faster than we imagine. Isa 65:24	1 3, 4, 5 2

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Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 91: Speed of Light • Polarization • Wave Theory • Thin-Film Interference (continued) • Give graphic examples of constructive and destructive interference. • Discuss single-slit and double slit diffraction. • Explain how diffraction gratings are used in spectroscopy. • Describe how thin films produce colorful displays. • Understand the interference pattern produced by light reflecting off the two surfaces of a thin film. • Discuss Newton's rings and explain how they are formed. • Derive the diffraction-grating equation. • Apply the diffraction-grating equation to solve problems involving diffraction gratings. • Describe the phenomenon of polarization. **Lesson 92: Viscous Fluids • Surface Tension • Elastic Properties of Solids** The student will: • Discuss surface tension and viscosity. • Write Poiseuille's equation and give several examples. • Understand the effect of friction on fluid flow through a horizontal pipe of circular section. • Calculate stress and strain. • Use Young's modulus to calculate the change in length in a rod under stress.					

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Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 93: The Postulates of Special Relativity The student will: • Recognize the limitations to Newtonian mechanics. • Understand Einstein's special theory of relativity. • State Postulate 1: The laws of physics are the same in every inertial frame of reference. • State Postulate 2: The observed speed of light it the same for all observers. **Lesson 94: The Michelson-Morley Experiment • The Interferometer • The Lorentz Transformation** The student will: • Understand the conclusion to the Michelson-Morley experiment. • Explain how an interferometer works and how it was used in the Michelson-Morley experiment. • Understand the Lorentz Transformation was an attempt to solve the Michelson-Morley Equations. **Lesson 95: Special Relativity • Simultaneity • Time Dilation** The student will: • Understand that because there is no absolute frame of reference, neither observation from any observer is preferred over the other.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 16.2 Polarized Light **Evaluation Techniques** Homework Lab Test Lessons 89-96	*Physics An Incremental Development* Student Text Pages 684-717 Lab Manual Pages 107-110 Demonstration materials	God's thoughts are higher than our thoughts. Isa 55:8-9	1 3, 4, 5 2

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Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 95: Special Relativity • Simultaneity • Time Dilation (continued) • Understand that by knowing the relative velocity of our reference frame and the observer's reference frame allows one to predict what an observer in a different reference frame will see. • Understand the difference between local and distant simultaneity. • Understand that the proper time is the shortest time interval that is possible for any observer to measure. • Calculate relativistic time. **Lesson 96: Length Contraction • Relativistic Momentum • Relativistic Addition of Velocities** The student will: • Calculate relativistic lengths. • Calculate relativistic mass. • Calculate relativistic momentum. • Understand that the speed of any mass cannot exceed the speed of light. • Calculate relativistic addition of velocities.					

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Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 97: The Atom • The Photon • The Hydrogen Atom • Electron Clouds The student will: • Discuss the fundamental particles of an atom. • Discuss the Millikan Oil-Drop Experiment and its importance in modern physics. • Use the Planck equation to calculate the energies associated with frequency and wavelength of light. • Discuss the role of photons as energy carriers. • Sketch diagrams for the Lyman, Balmer, Pashcen, Brackett, and Pfund Series. • Demonstrate with appropriate diagrams an understanding of emission spectra. • Calculate the energy emitted per photon per Bohr orbit quantum jump. **Lesson 98: Radioactivity • The Electromagnetic Spectrum • Half-life** The student will: • Distinguish the various forms of radiation. • Balance equations for radioactive decays. • Calculate radioactive decay problems given a nucleotides half-life. • Distinguish between fission and fusion. **Lesson 99: Blackbody Radiation • Photoelectric Effect** The student will: • Define blackbody radiation. • Describe the photoelectric effect.	6 days	Read and discuss material in text. Demonstrations. Homework Section Reviews and Chapter Review Questions Lab 27.1 Planck's Constant **Evaluation Techniques** Homework Lab Test Lessons 97-100	*Physics An Incremental Development* Student Text Pages 718-760 Lab Manual Pages 191-194 Demonstration materials	Strong Nuclear Force. 2 Pet 3:10 The Bible makes it clear that life on earth will not be accidentally wiped out because of a nuclear war. Rev 20:7-9 Man has the responsibility to take care of the earth. Gen 1:28 Radioactive Carbon Dating. The splitting of Israel into two separate kingdoms. 1 Kings 12:20	1 3, 4, 5 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Lesson 99: Blackbody Radiation • Photoelectric Effect (continued) • Use Einstein photoelectric equation to calculate classical velocities of photoelectrons. • Relate the photoelectric effect to stopping potential and threshold frequency. **Lesson 100: Early Quantum Physics** The student will: • Discuss the Thomson and Rutherford atomic models. • Discuss the Rutherford scattering experiment. • Discuss the importance of the Compton Effect. • Write Bohr's First Postulate and use it to verify standing de Broglie waves. • Write and illustrate the meaning of Bohr's Second Postulate. • Discuss the de Broglie hypothesis and state circumstances under which the wave nature of matter is observed. • Calculate the wavelengths of matter waves. • Discuss the Einstein mass-energy relationship and use it to calculate the energy released in mass-to-energy conversions.	10 days	**Evaluation Techniques** Practice Tests Final Lessons 49-100		Study! 2 Tim 2:15	1, 2

Course Outline: 11TH – 12th Grade AP Physics

Unit Content and Objectives	Time	Methods, Activities, and Evaluation	Books and Materials	Biblical Integration	ESLR#
Review and AP Exam Practice The student will: • Take an entire exam and perform as well as possible. • Understand how the exam is graded, and realize that no student is expected to know all of the answers. • Realize that in Free-Response section, students are given choices of problems to answer. • Realize that students are given partial credit for what they have correct about the working of each problem. • Understand how important it is to write legibly and show work in an organized fashion.					