Advanced Physical Science *(Master)*

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September
Unit 1: Chapter 1-3 Forces and Motion

Content	Skills	Learning Targets	Standards	Assessment	Resources & Technology
CEQ WHAT MAKES A GOOD EXPERIMENTAL DESIGN? HOW IS MOTION DESCRIBED AND MEASURED IN PHYSICS? HOW DO WE USE WAVES AND PARTICLES TO EXPLAIN ENERGY TRANSFERS? HOW CAN WORK DONE CAUSE ENERGY TO CHANGE FORMS? WHAT ARE THE COSTS AND BENEFITS OF USING VARIOUS FORMS OF ENERGY? WHAT ARE THE STEPS INVOLVED IN SOLVING	1. Measure and convert metric length, mass, volume, and density 2. Find the resultant of 2 displacement vectors 3. Measure and calculate instantaneous and average speed and velocity 4. Measure and calculate average acceleration 5. Solve free fall problems for final velocity and hang time. 6. Identify variables that contribute to air resistance 7. Describe and apply Newton's 3 laws of motion 8. Solve problems using the Law of Conservation of Energy and Momentum	1. I can measure and convert between units in the metric system for length, mass, volume, and density. 2. I can explain the difference between vectors and scalar quantities and add displacement vectors. 3. I can calculate instantaneous and average speed and velocity. 4. I can calculate average acceleration. 5. I can solve free fall problems for how fast and how far. 6. I can explain which	9.1.1 9.1.2 9.1.3 9.2.2 9.2.3	*Tower Fan Contest* Metric Golf Metric Measurement Lab 1A part 7-10 Speed & Measuring Lab 1B Energy and Change 2A Inertia 2B Newton's 2nd Law Hair Lab Mass and Weight Force and Motion Quiz Lab 3A Conservation of Energy Lab 3B Conservation of Momentum	CPO Science *Physics a First Course* Chapters 1-3. CPO Investigations Manual and energy track Data Studio Software and Pasco Interface Metric measurement tools. Key Vocabulary: experiment dependent speed mass hypothesis velocity inertia newton slope force free fall weight acceleration net force terminal speed gravity energy

A PHYSICS PROBLEM? UEQ ● *What should be considered when making scientific measurements?* ● *How do graphs help us describe the motion of an object?* ● *What considerations should be taken when designing an experiment?* ● *How do Newtons laws explain the differences between constant and changing velocity motion?* ● In the absence of air resistance, why do all objects fall with the same acceleration? ● Why is momentum conserved in collisions between objects?		of Newtons 3 laws of motion relate to an object in a system. 7. I can draw free body diagrams for an object acted on by multiple forces. 8. I solve problems using conservation laws.		CA=Force and MotionTest	work conservation momentum inelastic collision elastic collision potential energy kinetic energy impulse joule

Measurement and Motion Forces and Motion Relative motion and measurement Speed (calculation) Instantaneous speed Average speed Velocity (calculation) Constant velocity Changing velocity (calculation) Free fall (calculation) How fast How far Air resistance Laws of Motion Newton's first law of motion Newton's second law (calc) Newton's third law of motion Law of Conservation of Energy & Momentum Momentum (calculation) Impulse Conservation of momentum Elastic and inelastic collisions					

Momentum vectors Potential energy (GPE calculation) Kinetic energy (calculation) Conservation of energy					

October

Content	Skills	Learning Targets	Standards	Assessment	Resources & Technology
UEQ ● *How are free body diagrams useful in analyzing stationary and moving objects?* ● *How are work, energy, and power related?* ● *How does energy conservation help us make predictions about the motion of objects?* ● *How does friction affect*	Energy and Systems 1. Use Free Body Diagrams to calculate the net force on an object. 2. Calculate the work done by a force on an object. 3. Explain how simple machines give us a mechanical advantage. 4. Calculate the efficiency of a machine 5. Use the work energy theorem to relate work to changes in potential or kinetic energy 6. Use Conservation of Energy to describe how potential energy changes to kinetic. 7. Describe the effect of friction on Mechanical energy. 8. Calculate power as the rate at which work is done 9. Calculate and balance torques 10. Eplain the path of a projectile	Energy and Systems 1. I can find net force by drawing free body diagrams 2. I can calculate work done by a force on an object 3. I can explain how each of the six simple machines make work easier. 4. I can compare input and output distances and forces to find the mechanical advantage and efficiency of a machine. 5. I can use work done on an object to calculate change in kinetic energy in the absence of	9.2.4	Lab 4A (Simple Machines) Bike Gear Ratios Project Lab 4B (Work Energy) Golf Ball Lab (Conservation of Energy) Horse Power Lab (Power) Hooke's Law Lab (Springs) Quiz Machines Work and Energy Lab 5B (Friction) Lab 6A (Projectile Motion) Lab 6B (Inclined Planes) CA=Test	CPO Science *Physics a First Course* Chapters 4-6. CPO Investigations Manual CPO energy track, Spring Scales, Pulleys, Cars, Projectile Launchers, and Photogates Golf Balls, Rubber Bands, and Springs Data Studio Software and Pasco Interface Metric measurement tools. Key Vocabulary: mechanical advantage machine input arm horsepower work flucrum output

the motion of an object? ● *How do machines make work easier* ● *What variables affect the rotational motion of an object?* ● *Distinguish between horizontal and vertical projectile motion* ● *Explain the variables that affect the amount of centripetal force needed for circular motion* Energy in Systems Free Body Diagrams Net Force Frictional Force Work Mechanical Advantage Simple Machines (6) Efficiency		friction. 6. I can use energy conservation to calculate speed at the bottom of a hill. 7. I can predict the energy lost as work is done by nonconservative forces 8. I can calculate power and horsepower of a moving object. 9. I can balance torques about a fulcrum. 10. I can describe horizontal and vertical motion of a projectile.		CA=Trebuchet Design and Testing	power hooke's law component normal force torque resultant rotational equilibrium free body diagram centripetal force range center of gravity parabola projectile trajectory

Potential Energy Kinetic Energy Work Energy Theorem Conservation of Energy Power Torque and Rotational Motion Projectile Motion Trajectory					

November

Content	Skills	Learning Targets	Standards	Assessment	Resources & Technology
UEQ: ● *How is heat transferred between objects?* ● *What are the differences between heat and temperature?* ● *What happens to heat and temperature during phase changes?*	Matter and Energy 1. Compare Kelvin, Celsius, and Fahrenheit scales of temperature 2. Explain why temperature doesn't change during a phase change of a substance, even though heat is being added. 3. Explain how heat it transferred by	Matter and Energy 1. I can switch between Kelvin, Celsius, and Fahrenheit scales of temperature 2. I can explain why temperature doesn't change during a phase change of a substance, even though heat is	9.2.1	Matter and Energy Lab 7A (temp and heat) Lab 7B (phase changes) SH Lab (specific heat) Heat and Temp Quiz Plop Plop Lab (density of gases) Archimedes Lab (buoyancy)	Matter and Energy CPO Science Chapter 7-9 CPO Investigations Manual CPO atom game and periodic table Bunsen Burners, thermometers, styrofoam cups, balances, and glassware *Key Vocabulary:* Heat Internal Energy Temperature

• *What is the structure of an atom and what forces exist within the atom?* • What are the physical properties of matter? • *Why do objects float or sink in fluids?* • *What are some practical applications of fluid mechanics?* Matter and Energy Internal Energy, Heat, & Temperature Kelvin, Celcius, and Fahrenheit Scales Phase Changes Convection, Conduction, Radiation Fluids Pressure Density Archimedes' Principle Pascal's Principle Bernoulli's Principle	convection, conduction, and radiation. 4. Explain how arrangements of atoms affects their physical properties. 5. Explain how fluid forces are used in fluid mechanics. 6. Identify and describe the particles found in the atom 7. Determine the name, symbol, number of protons, electrons, neutrons, atomic number, and mass number of an isotope. Energy and Change 1. analyze the costs and benefits of different methods of energy production. 2. explain how the size of atoms and the number of nucleons relate to the binding energy of the atom.	being added or removed. 3. I can explain whether heat is transferred by convection, conduction, or radiation in a thermal exchange. 4. I can explain how arrangements of atoms affects their physical properties. 5. I can explain how fluid forces are used in fluid mechanics. 6. I can identify and describe the particles found in the atom 7. I can determine the name, symbol, number of protons, electrons, neutrons, atomic number, and mass number of an isotope. Energy and Change		Lab 8B (Motion of Fluids) Surface Tension Balances 9A (atomic structure) Lab 9B (quantum theory) CA=Matter and Energy Test Energy and Change Alternative Energy Research Lab 10A (energy) Lab 11A (chemical change) Lab 11B (nuclear) Lab 12 A (relativity) Lab 12B (relativity) CA=Energy and Change Test	Celsius Fahrenheit Kelvin Absolute zero Phases of matter Melting Freezing Vaporization Evaporation Boiling Condensation Sublimation Convection Conduction Radiation viscosity pascal elastic pressure archimedes' principle Boyle's Law stress density tensile strength buoyancy Charles' Law Periodic Table atomic number energy level electron groups nucleus spectral lines

Atomic # Protons Electrons Mass # Neutrons Periodic Table Electron Energy Levels UEQ: ● What are the costs and benfits to alternative mehthods of energy production ● Why do nuclear reactions occur and why is energy given off? ● How are fission and fusion different? Energy and Change Alternative Energy Research Project Fuel Source Power Plant Location How energy is	3. use the idea that small amounts of matter are transformed into large amounts of energy in nuclear reactions to compare fission and fusion in terms of beginning and end products and the amount of energy released. 4. explain transmutation of atoms through alpha, beta, and gamma decay. 5. explain how the size of atoms and the number of nucleons relate to the binding energy of the atom. 6. compare fission and fusion in terms of beginning and ending products and the amount of energy released. 7. explain how matter is converted to energy using Einstein's equation. 8. explain the consistency	1. I can analyze the costs and benefits of different methods of energy production. 2. I can explain how the size of atoms and the number of nucleons relate to the binding energy of the atom. 3. I can use the idea that small amounts of matter are transformed into large amounts of energy in nuclear reactions to compare fission and fusion in terms of beginning and end products and the amount of energy released. 4. I can explain transmutation of atoms through alpha, beta, and gamma decay. 5. I can explain how the size of atoms and the number of nucleons relate to the binding energy of the atom.			isotopes Energy and Change CPO Science Chapter 10-12 CPO Investigations Manual CPO atom game and periodic table, portable computer lab Key Vocabulary: Chemical Energy Nuclear Energy Mechanical Energy Electrical Energy Watt Joule Ion Reaction Chain Reaction Covalent Ionic Half-Life Decay (Alpha, Beta, Gamma) Product Reactant Speed of Light Reference Frame Black Hole relativity time dialation

generated Consumer Cost Environmental Impacts Power Plant Cost Benefits and Disadvantages Changes in Matter Parts of the atom Radioactivity around you Types of radiation Radioactive decay Transmutation of elements Carbon dating	of the speed of light leads to relativity of space and time.	6. I can compare fission and fusion in terms of beginning and ending products and the amount of energy released. 7. I can explain how matter is converted to energy using Einstein's equation. 8. I can explain the consistency of the speed of light leads to relativity of space and time.			

December

Content	Skills	Learning Targets	Standards	Assessment	Resources & Technology
UEQ: How does an object become charged? Why do charges move? How are voltage, current, and resistance related? How are series and parallel circuits different	Electrical Systems 1. Identify the 2 types of charge and the particles responsible 2. Predict the behavior of charged objects when placed near other charged or neutral objects 3. Explain how to charge	Electrical Systems 1. I can identify the 2 types of charge and the particles responsible. 2. I can predict the behavior of charged objects when placed near other charged or neutral objects 3. I can explain how to		Electrical Systems Student Static Demos Static Electricity *Quiz* Battery Lab Lab 13A (electircity) Lab 13B (ohms law)	Electrical Systems CPO Physics a First Course Ch: 13-15 CPO Investigations Manual CPO circuit board Wire, van de graf, multimeters, static electricity demos, and

Electrical Systems Electric Circuits Current and Voltage Resistance and Ohm's Law Series Circuits Parallel Circuits Electric Power, AC, and DC Electricity Electric Charge and Current Electric Current, Resistance, and Voltage Capacitors	objects by friction and induction. 4. Use Ohm's law to calculate the current, voltage, or resistance of a circuit. 5. Compare the equivalent resistance of resistors connected in series and parallel. 6. Given the Wattage of a device and the time of operation calculate the Energy used in kWh. 7. Explain how capacitors store charge and are used in circuits.	charge objects by friction and induction. 4. I can use Ohm's law to calculate the current, voltage, or resistance of a circuit. 5. I can compare the equivalent resistance of resistors connected in series and parallel. 6. Given the Wattage of a device and the time of operation i can calculate the Energy used in kWh. 7. I can explain how capacitors store charge and are used in circuits.		14A (circuits) 14B (power) Electric Circuit Project Lab 15B (charge) Cost of Electricity Lab CA=Electrical Systems Test	capacitors *Key Vocabulary:* static electricity charge neutral friction induction electroscope conductor insulator polarization Van de Graff generator voltage electrical potential potential difference circuit series circuit parallel circuit open circuit closed circuit short circuit schematic diagram resistance current alternating current direct current Ohm's Law battery Capacitor

January

Content	Skills	Learning Targets	Standards	Assessment	Resources & Technology
UEQ: ● How is magnetism different than electricity? ● How is magnetism related to electricity? ● What are the conditions needed for electromagnetic induction? ● Why do power companies use alternating current? ● How are field and contact forces different Electricity and Magnetism Magnetism Electromagnets Motors	Electricity and Magnetism 1) Draw the magnetic field around a bar magnet 2) Predict attraction and repulsion of magnetis 3) List the variables that affect the strength of an electromagnet 4) Identify several devices that use electromagnetism 5) List the variables that affect electromagnetic induction 6) Calculate the input or output voltage of a transformer 7) Explain why power companies step up and down voltage for transmission 8) Rank the four naturally occuring field forces in order of strength and compare their properties	Electricity and Magnetism 1) I can draw the magnetic field around a bar magnet 2) I can predict attraction and repulsion of magnets 3) I can list the variables that affect the strength of an electromagnet 4) I can identify several devices that use electromagnetism 5) I can list the variables that affect electromagnetic induction 6) I can calculate the input or output voltage of a transformer 7) I can explain why power companies step up and down voltage for transmission		Electricity and Magnetism Lab 16A (magnetism) Building Speakers EM Induction Lab 17B Mag Lev Train Magnetism Quiz Inverse Square Law Electric Field CA= Electricity and Magnetism Test	Electricity and Magnetism CPO Physics a First Course Ch16-18 CPO Investigations Manual CPO circuit board, rip cord generator Wire, magnets, compasses, multimeters, motor and speaker supplies. *Key Vocabulary:* electromagnet right hand rule compass gauss magnetic field domain declination poles ferromagnetic generator motor armature brushes induction transformer rotor

Speakers Electromagnetic Induction Generators Transformers Fields		8) I can rank the four naturally occuring field forces in order of strength and compare their properties			solenoid commutator coil force field inverse square law gravitational field test charge electric field Shielding

February

Content	Skills	Learning Targets	Standards	Assessment	Resources & Technology
UEQ: ● *How does simple harmonic motion relate to wave behavior?* ● What are the properties of waves? ● *How does sound show wave properties?* ● *How are wave properties used to explain the transfer of energy?*	Vibrations Waves and Sound 1. Identify the frequency and amplitude of an object in simple harmonic motion. 2. Calculate the speed of a wave given the frequency and wavelength. 3. Describe how vibrations set up transverse and longitudinal waves	Vibrations Waves and Sound 1. I can identify the frequency and amplitude of an object in simple harmonic motion. 2. I can calculate the speed of a wave given the frequency and wavelength. 3. I can describe how vibrations set up transverse and longitudinal		Vibrations Waves and Sound 19A (harmonic motion) 19B (natural frequency) Lab 20A (waves) Lab 20B (standing waves and resonance) Speed of Sound Lab Lab 21A (Sound) Waves Quiz Sound presentations Sound Quiz	Vibrations Waves and Sound Waves CPO Science Chapters 19-21 CPO Lab Equipment, resonance tubes, and decibel meter *Key Vocabulary* Simple harmonic motion Frequency

Vibrations, Waves, and Sound Pendulums Wave Speed, Wavelength, Frequency Parts of a Wave Transverse and Longitudinal Waves Standing Waves Sound Waves Resonance Interference Reflection Refraction Diffraction Doppler Effect Electromagnetic Waves Color Polarization Wave Particle Duality Speed of sound Pitch Decibels Beats	in various mediums. 4. Explain how wave properties such as interference, resonance, refraction, and reflection affect waves. 5. Explain how sound displays the properties of waves. 6. Calculate the speed of sound 7. Explain the cause of resonance and standing waves, and beats.	waves in various mediums. 4. I can explain how wave properties such as interference, resonance, refraction, and reflection affect waves. 5. I can explain how sound displays the properties of waves. 6. I can calculate the speed of sound 7. I can explain how standing waves set up in strings and air columns 8. I can explain why objects resonate 9. I can calculate beat frequency		CA=Vibrations, Waves, and Sound Test	Hertz Amplitude Period Wavelength Transverse wave Crest Trough Longitudinal wave Compression Rarefaction Interference Natural frequency Resonance Refraction Reflection Incident

					Diffraction Absorption Pitch Decibels Fundamental Harmonic Standing wave Node Antinode Medium Doppler effect

March

Content	Skills	Learning Targets	Standards	Assessment	Resources & Technology
UEQ: • How does light show both wave and particle behavior	Light and Optics 1. Describe the properties and uses of forms of electromagnetic	Light and Optics 1. I can describe the properties and uses of forms of electromagnetic		Light and Optics Lab 22A (light and color) Lab 22B	Light and Optics CPO Science Chapters 22-24 CPO Invstigations Manual CPO Light and Optics Kit Concave and Convex

• How are different forms of light used? • How can reflection and refraction be used in optical devices to form images? • How is light different from sound? Light and Optics a. Properties of Light b. Vision and Color c. Using Color d. The Electromagnetic Spectrum e. Interference, Diffraction, and Polarization f. Photons	radiation from radio through gamma radiation. 2. Compare the wave and particle model in explaining properties of light. 3. Use properties of light including reflection, refraction, interference, and the Doppler Effect to explain phenomena and make predictions. 4. Explain how optical devices such as mirrors and lenses use reflection and refraction to create images 5. Explain how total internal reflection is used in fiber optics 6. Explain the cause of diffraction and how it is related to the wavelength of light.	radiation from radio through gamma radiation. 2. I can compare the wave and particle model in explaining properties of light. 3. I can use properties of light including reflection, refraction, interference, and the Doppler Effect to explain phenomena and make predictions. 4. I can explain how optical devices such as mirrors and lenses use reflection and refraction to create images 5. I can explain how total internal reflection is used in fiber optics 6. I can explain the cause of diffraction and how it is related to		(reflection and refraction) Seeing Around Corners Lab 23A (optics) Lab 23B (optics) *Quiz on Light and Refraction* Lab 24A (wavelength of light) Lab 24B (waves and photons) *Quiz on EM Waves* Burning Time vs Paper Color Challenge CA=Light and Optics Test	Mirrors and Lenses Laser Diffraction Gratings Key Vocabulary: Electromagnetic wave Electromagnetic spectrum Photon Polarization Dispersion Convex lens/mirror Concave lens/mirror Converging Diverging Real image Virtual image Additive primary colors Subtractive primary colors

	7. Use the speed of light to calculate frequency or wavelength 8. Explain how primary colors of light are mixed to create other colors	the wavelength of light. 7. I can use the speed of light to calculate frequency or wavelength 8. I can explain how primary colors of light are mixed to create other colors			Incandescence Fluorescence Total internal reflection