EL DORADO UNION HIGH SCHOOL DISTRICT
Educational Services

Course of Study Information Page

Course Title: Physics A (#328)	
Rationale: After high school the top 25% of students are university bound, the bottom 25% move into service or vocational jobs, and the middle 50% have little or no direction. It is this "middle" student population that is lacking our attention. Physics A is a course designed to prepare that middle 50% of students more effectively for technical careers. The rapid changes in modern technology require training that is applicable to more than a single job. Technicians must understand the mechanical, fluid, electrical, and thermal principles on which modern equipment operates. If a technician understands the principles on which their current work is based, they can apply those principles to new situations.	
Course Description: Year one of a two year course that is both academically rigorous and practical for students planning technical careers. Topics include force, energy, electricity, and optics and the mathematics required to support these concepts.	
Length of Course:	One Year
Grade Level:	Grades 10-12
Credit: Number of units: 5 per semester ☒ Meets graduation requirements ☒ Request for UC "a-f" requirements ☒ College Prep ☒ Elective ❒ Vocational	
Prerequisites:	Algebra A minimum, Algebra 1 suggested
Department(s):	Science
District Sites:	EDHS
Board of Trustees Adoption Date:	February 14, 1995
Textbook(s)/Instructional Materials:	*Principles of Technology* (teacher's guide only), 1987, 1990, Center of Occupational Research and Development, Waco, Texas
Date Adopted by the Board of Trustees:	May 23, 1995

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Course Goals:	Principles of Technology is based on the Unified Technical Concepts course developed by the Center for Occupational Research and Development, Waco, Texas. Each of the 14 units deals with one principle as it applies in the four energy systems; mechanical, fluid, thermal, and electrical that make up both simple and complex technological devices and equipment. The units also cover the mathematics needed to understand and apply the principles. The units will be presented over two years.
Student Performance Objectives:	Please see attached sheet.
Instructional Units:	The following chart shows the sequence for the two year program: First Year Units — Second Year Units Force — Momentum Work — Waves and vibrations Rate — Energy Converters Resistance — Transducers Energy — Radiation Power — Optical Systems Force Transformers — Time Constants

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UNIT #1: Work

OBJECTIVES The student will:	ACTIVITIES
1. Describe work in mechanical, fluid and electrical systems.	1. The unit begins with an overview of the 3 systems with work as the unifying concept.
2. Describe how work in mechanical, fluid and electrical systems involves the presence of force and movement.	2. In the laboratory, we investigate how work is done by a pulley system, a hydraulic ram, and an electric motor.
3. Identify correct SI and English units for work on mechanical, fluid and electrical systems.	3. Calculations are done in units of Joules, ft-lbs, N/m^2, lbs./in^2, Voltage x coulombs, Amperes, etc.
4. Identify the effects of work done in mechanical, fluid, and electrical systems.	4. Laboratory measurement of systems in motion, doing work.
5. Measure work in mechanical, fluid, and electrical systems.	

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UNIT # 2: Resistance

OBJECTIVES The student will:	ACTIVITIES
1. Describe how resistance affects mechanical, fluid, electrical, and thermal systems.	1. The unit begins with an overview of resistance in mechanical, fluid, electrical and thermal systems.
2. Explain how resistance in each energy system relates to the unifying principle of a "force" divided by a rate.	2. In the laboratory, friction, (mechanical resistance) viscosity, (fluid friction) electrical resistance and thermal conductivity are investigated.
3. Identify correct SI and English units for resistance in each energy system.	3. The mathematical expressions necessary to the study of resistance are covered in lecture/discussion and guided practice.
4. Identify the positive and negative effects of resistance in each energy system.	4. Measurements of the resistance to the flow of energy are made on working systems.
5. Identify workplace applications where technicians measure or control resistance.	
6. Measure resistance in mechanical, fluid, electrical and thermal energy systems.	

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UNIT # 3: Force Transformers

OBJECTIVES The student will:	ACTIVITIES
1. Describe force transformers in general. Describe force transformers in mechanical, fluid and electrical systems.	1. The unit begins with an overview of force transformers in mechanical, fluid and electrical systems.
2. Explain why force transformers form a unifying principle in mechanical, fluid, and electrical systems.	2. In the laboratory, we investigate mechanical advantage in mechanical and fluid systems and the function of a transformer in electrical systems.
3. List examples of force transformers in mechanical, fluid, and electrical systems.	3. The mathematical calculations of mechanical advantage and the efficiencies of machine and electrical systems are discussed and reinforced by guided practice and lab work.
	4. Laboratory measurement of the change in force and efficiencies of working systems.

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UNIT # 4: Rate

OBJECTIVES The student will:	ACTIVITIES
1. Describe rate in terms of mechanical, fluid, electrical and thermal systems.	1. The unit begins with an overview of rate in mechanical, fluid, electrical and thermal systems.
2. Identify appropriate SI and English units for rate in all four energy systems.	2. In the laboratory, translational mechanical rate is measured and angular rate is measured with a stroboscope. Techniques for measuring the rates in fluid and gas systems are employed and an oscilloscope is used to measure frequency and voltage in electrical systems.
3. Measure rate in mechanical, fluid, electrical and thermal systems.	3. Mathematical calculations are used to solve problems involving rate in the four energy systems.
4. Identify workplace applications where rate is measured and or controlled.	

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UNIT # 5: Force

OBJECTIVES The student will:	ACTIVITIES
1. Apply the concept force in terms of linear displacement (translational) and angular displacement (torque).	1. The unit begins with an overview of force in mechanical, fluid, electrical and thermal systems.
2. Give examples of complex technological devices where force must be controlled, measured or applied.	2. In the laboratory, we investigate torque, translational drive systems, force in hydraulic and pneumatic systems, and voltage in electrical systems.
3. Describe what force, pressure, voltage and temperature difference have in common.	3. Mathematical representation of force (vectors) are described and conceptually developed in the lab and by guided practice.
4. Predict what happens to an object when forces on it are balanced and when forces on it are unbalanced.	4. The mathematics of calculating torque, force, pressure, temperature conversions and voltage are covered in lecture and reinforced in lab.
5. Measure force in mechanical, fluid, electrical, and thermal systems.	5. Laboratory measurement of force analogues in working systems.
6. List occupations that require technicians to measure, control, or otherwise deal with force in complex devices.	

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UNIT # 6: Power

OBJECTIVES The student will:	ACTIVITIES
1. Describe what is meant by power in general and relate that concept to mechanical, fluid, electrical and thermal systems.	1. The unit begins with an overview of power in mechanical, fluid, electrical and thermal systems.
2. Explain how thermal power and thermal rate are the same.	2. In the laboratory, we measure translational and rotational mechanical power, power in hydraulic and pneumatic systems, and power in electrical systems.
3. Explain how power in each energy system relates to the unifying principle of work divided by time.	3. Guided practice in problem solving in the calculation of power in mechanical, fluid and electrical systems.
4. Explain why power also can be described in terms of a "force" multiplied by a rate for mechanical, fluid and electrical systems.	4. Research project in which the student chooses a vocation which involves the production of power or the management of power and produces a paper which is presented to the class.
5. Identify technical workplace applications where technicians measure or control power.	

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UNIT # 7: Energy

OBJECTIVES The student will:	ACTIVITIES
1. Describe the nature of energy in mechanical, fluid, electrical and thermal systems.	1. The unit begins with an overview of mechanical, fluid, electrical and thermal systems with energy as the unifying concept.
2. Describe what's meant by "potential energy."	2. In the laboratory, the potential energy of a rotating flywheel, (mechanical) compressed gasses, (fluids) capacitors, (electrical) and the mechanical equivalent of heat are studied.
3. Describe what's meant by "kinetic energy."	3. Mathematical equivalences for energy and work are used to solve problems.
4. Describe the relationship between potential energy, kinetic energy and heat energy in the conservation of energy law.	4. Laboratory investigations of the control systems for energy systems.
5. Describe the relationship between work and energy.	
6. Identify appropriate SI and English units for energy in each system.	
7. Measure energy in each system.	
8. Identify workplace applications where technicians measure or control energy.	