YOSEMITE HIGH SCHOOL
50200 ROAD 427 - OAKHURST, CA 93644
(559) 683-4667

COURSE TITLE: *PHYSICS*
DEPARTMENT: *SCIENCE*

REQUIREMENT SATISFIED:			
High School:	*X*	*Model Curriculum Standards:*	*X*
State College:	*X*	*Frameworks:*	*X*
UC Approved:	*X*		

GRADE LEVEL: *11-12* *LENGTH OF COURSE: 1 Year* *CREDITS: 10*

PREREQUISITE: *Successful completion of, or be concurrently enrolled in, Algebra 2. Student must have strong algebra skills, work well in labs, be personally responsible, and highly motivated.*

TEXTBOOKS: *Physics: Problems & Principles, Zitzewitz*

COURSE DESCRIPTION:

Physics is a lecture/lab course with a strong emphasis on the scientific method utilizing a mathematical approach. The course covers fundamental mathematics and measurement, mechanics, concepts of energy, wave theory, optics, electricity, magnetism, and modern physics. This course fulfills the UC requirement for Lab Science.

COURSE OUTLINE/ALIGNMENT TO CALIFORNIA STATE STANDARDS AND EXPECTED SCHOOLWIDE LEARNING RESULTS:

Assignment Course Content/Objectives:	*Standards Addressed:*	*ESLRS:*
Fundamental Mathematics and Measurement		*1,3,4*
a) Scientific notation	*Review*	
b) Trigonometry of right triangles		
c) Metric units		
d) Significant digits		
Motion in a Straight Line		*1,3,4*
a) Average and instantaneous speed	*1a, 1b,*	
b) Uniform acceleration	*1c, 1e,*	
c) Acceleration due to gravity	*1f*	
d) Graphical analysis of motion		
Vectors		*1,3,4*
a) Graphical method of addition	*1k*	
b) Equilibrium and equilibrant	*1j*	
c) Perpendicular and non-perpendicular components	*1j*	
Dynamics		*1,3,4*
a) Forces	*1c*	
b) Newton's lst and 2nd laws	*1b, 1c, 1d*	
c) Weight and mass	*1e*	

COURSE OUTLINE/ALIGNMENT TO CALIFORNIA STATE STANDARDS AND EXPECTED SCHOOLWIDE LEARNING RESULTS: (Continued)

Assignment Course Content/Objectives:	*Standards Addressed:*	*ESLRS:*
Momentum and Its Conservation		*1,3,4*
a) Newton's 3rd law	*1d, 2d*	
b) Law of conservation and momentum	*1e*	
Motion in Two Dimensions		*1,3,4*
a) Projectiles	*1i*	
b) Uniform circular motion	*1g*	
c) Satellites	*1f*	
Gravitation		*1,3,4*
a) Kepler's Law	*1l, 1f*	
b) Uniform gravitation	*1d*	
Work and Power	*1k*	*1,3,4*
Energy and Its Conservation		*1,3,4*
a) Potential and Kinetic Energy	*2a, 2b*	
b) Conservation of matter and energy	*2c*	
c) Elastic collisions	*2g*	
Heat		*1,3,4*
a) Temperature vs. heat	*3c*	
b) 1st and 2nd laws of Thermodynamics	*3b, 3d, 3e*	
c) Specific heat	*3c*	
d) Mechanical equivalent of heat	*3a*	
Kinetic Theory		*1,3,4*
a) Assumptions	*2a*	
b) Effects		
Waves and the Transfer of Energy		*1,3,4*
a) Rules	*4a*	
b) Types	*4b*	
c) Behavior at boundaries	*4f*	
The Nature of Light		*1,3,4*
a) Transmission and absorption	*4e*	
b) Waves vs. particles	*4a*	
c) Law of Reflection	*4f*	
d) Refraction		
e) Diffraction		
Mirrors and Lenses		*1,3,4*
a) Plane		
b) Concave and convex mirrors		
c) Concave and convex lenses		
d) Optical devices		
Origin of Light		*1,3,4*
a) Exitation of atoms		
b) Fluorescence and phosphorescence		
c) Emission and absorption spectra		
d) Lasers		

COURSE OUTLINE/ALIGNMENT TO CALIFORNIA STATE STANDARDS AND EXPECTED SCHOOLWIDE LEARNING RESULTS: (Continued)

Assignment Course Content/Objectives:	*Standards Addressed:*	*ESLRS:*
Static Electricity		*1,3,4*
a) Changing bodies electrically	*5e*	
b) Electric field intensity	*5e, 5l*	
Electric Currents		*1,3,4*
a) Potential difference	*5a*	
b) Circuits	*5b, 5c, 5d*	
c) Ammeters and voltmeters	*5a*	
The Magnetic Field		*1,3,4*
a) General properties of magnets	*5f*	
b) Theory of magnetism	*5g*	
c) Magnetic force	*5j*	
d) Electric motors and meters		
e) Electromagnetic induction		
f) Electromagnetic field application		
Nuclear Physics		*1,3,4*
a) Quantum Theory		
b) The Atom		
c) The Nucleus		
Theory of Relativity		*1,3,4*

DISTRICT/STATE CONTENT STANDARDS ADDRESSED:

Science: Physics (Grades 9-12):

Motion & Forces

1. Newton's laws predict the motion of most objects. As a basis for understanding this concept, students know:

a. How to solve problems involving constant speed and average speed.

b. When forces are balanced, no acceleration occurs, and thus an object continues to move at a constant speed or stays at rest (Newton's First Law).

c. How to apply the law F=ma to solve one-dimensional motion problems involving constant forces (Newton's Second Law).

d. When one object exerts a force on a second object, the second object always exerts a force of equal magnitude and opposite direction (Newton's Third Law).

e. The relationship between the universal law of gravitation and the effect of gravity on an object at the surface of the Earth.

f. Applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (for example, the Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).

g. Circular motion requires application of a constant force directed toward the center of the circle.

h. Newton's Laws are not exact but they provide very good approximations unless an object is moving close to the speed of light or is small enough that the quantum effects are important.

i. How to solve two-dimensional trajectory problems.

j. How to resolve two-dimensional vectors into their components and calculate the magnitude and direction of a vector from its components.

k. How to solve two-dimensional problems involving balanced forces (statics).

l. How to solve problems in circular motion, using the formular for centripetal acceleration in the following form: a=v2/r.

m. How to solve problems involving the forces between two electric charges at a distance (Coulomb's Law) or the forces between two masses at a distance (Universal gravitation).

Conservation of Energy and Momentum

2. The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept, students know:

a. How to calculate kinetic energy using the formula E=(1/2)mv2.

b. How to calculate changes in gravitational potential energy near the Earth using the formula (change in potential energy)=mgh (change in the elevation).

c. How to solve problems involving conservation of energy in simple systems such as falling objects.

d. How to calculate momentum as product mv.

e. Momentum is a separately conserved quantity, different from energy.

f. An unbalanced force on an object produces a change in it momentum.

g. How to solve problems involving elastic and inelastic collisions in one dimension using the principles of conservation of momentum and energy.

h. How to solve problems involving conservation of energy in simple systems with the various sources of potential energy such as capacitors and springs.

Heat & Thermodynamics

3. Energy cannot be created or destroyed although in many processes, energy is transferred to the environment as heat. As a basis for understanding this concept, students know:

a. Heat flow and work are two forms of energy transfer between systems.

b. The work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a low temperature (First Law of Thermodynamics) and that this is an example of the law of conservation of energy.

c. Thermal energy (commonly called heat) consists of random motion and the vibrations and rotations of atoms and molecules. The higher the temperature, the greater the atomic or molecular motion.

d. Most processes tend to decrease the order of a system over time, and energy levels are eventually distributed uniformly.

e. Entropy is a quantity that measures the order or disorder of a system, and is larger for a more disordered system.

f. The statement "entropy tends to increase" is a law of statistical probability that governs all closed systems (Second law of Thermodynamics).

g. How to solve problems involving heat flow, work, and efficiency in a heat engine and know that all real engines have some heat flow out.

Waves

4. Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept, students know:

a. Waves carry energy from one place to another.

b. How to identify transverse and longitudinal waves in mechanical media such as springs, ropes, and the Earth (seismic waves).

c. How to solve problems involving wavelength, frequency, and wave speed.

d. Sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.

e. Radio waves, light and x-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in vacuum is approximately 3x10 8 m/s (186,000 miles/second).

f. How to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.

Electronic and Magnetic Phenomena

5. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept, students know:

a. How to predict the voltage or current in simple direct current electric circuits constructed from batteries, wires, resistors, and capacitors.

b. How to solve problems involving Ohm's law.

c. Any resistive element in a DC circuit dissipates energy which heats the resistor. Students can calculate the power (rate of energy dissipation) in any resistive circuit element by using the formula: Power=(potential difference IR) times (current 1)=12R.

d. The properties of transistors and their role in electric circuits.

e. Charged particles are sources of electric fields and experience forces due to the electric fields from other

f. Magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and experience forces due to magnet fields of other sources.

g. How to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.

h. Changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.

i. Plasmas, the fourth state of matter, contain ions and/or free electrons and conduct electricity.

j. Electric and magnetic fields contain energy and act as vector force fields.

k. The force on a charged particle in an electric field is qE, where E is the electric field at the position of the particle and q is the charge of the particle.

l. How to calculate the electric field resulting from a point charge.

m. Static electric fields have as their source some arrangement of electric charges.

n. The force on a moving particle (with charge q0 in a magnetic field is qvB sin (a) where a is the angle between v and B (v and B are the magnitudes of vectors v and B, respectively), and students use the right-hand rule to find the direction of the force.

o. How to apply the concepts of electrical and gravitational potential energy to solve problems involving conservation of energy.

OUTCOMES:
Students will demonstrate:

1. *An ability to perform kinematics problems using a calculator.*
2. *An understanding of using metrics, sci notation, and rounding.*
3. *Proper use of scientific notation and exponents.*
4. *Graphical and trigonometric solutions to vector problems.*
5. *Solving right and non-right angle vector problems.*
6. *Solutions to force, balanced force problems.*
7. *An ability to solve half and full projectile problems.*
8. *An understanding of Newton's three laws.*
9. *The relationship between Newton' 2^{nd} law and weight.*
10. *The difference between weight and mass.*
11. *An understanding of momentum as a motion quantifier.*
12. *Solutions to centripetal force calculations.*
13. *Understanding of orbits related to centripetal force.*
14. *Newtonian uniform gravitational theory.*
15. *That kinetic energy is the energy of motion.*
16. *That potential energy is the energy of storage or position.*
17. *That activation energy is just kinetic energy.*
18. *Understanding of the theory of conservation of energy.*
19. *A knowledge of the difference between inelastic and elastic collisions.*
20. *An understanding of the difference between temperature and heat.*
21. *A comprehension of the 1^{st} and 2^{nd} laws of thermodynamics.*
22. *How to do specific heat problems involving change in heat.*
23. *How to quantify heat of fusion and heat of vaporization problems.*
24. *A basic understanding of the kinetic theory of matter.*
25. *A knowledge of waves, their types, and their description.*
26. *That waves carry energy, have wavelength, frequency, speed, and amplitude.*
27. *An understanding of the law of reflection.*
28. *That waves may refract and diffract at boundaries in media.*
29. *An understanding of concave, flat and convex mirrors, and the images they reflect.*
30. *An understanding of flat planar, concave and convex lenses, and the images they transmit.*
31. *An ability to draw and calculate image distance, height, and focal length of a lens; and whether an image is real or virtual.*
32. *A basic understanding of Michelson's device in the solution of the speed of light at approx. $3x10^8$m/s.*
33. *A basic understanding of the dual wave and particle nature of light.*
34. *A knowledge of the terms opaque, translucent, and transparent.*
35. *The movement of loose electrons in materials causing static charge.*
36. *The nature of electrical fields and the forces they produce on charges.*
37. *An understanding that Voltage is the potential difference.*
38. *A basic understanding of the relationship of current, resistance, and voltage in Ohm's law.*
39. *How to use and read a multimeter.*
40. *How to put together a circuit in a series and parallel fashion.*
41. *A knowledge of how to solder a wire joint on a circuit board properly.*
42. *That semiconductors use positive and negative semiconductive materials to produce a 'go'-'no go' of electron movement through the component.*
43. *That magnets are produced due to the alignment of magnetic domains within the magnetic substance.*
44. *A basic understanding of the theory of magnetism.*
45. *An understanding of the forces produced by a magnetic field and how that force is used to do mechanical work and produce electricity.*
46. *The basic concept of atomic theory including the structure of an atom, including the nucleus and electron cloud.*
47. *The general concept of relativity and the relationship of space and time.*

INSTRUCTIONAL STRATEGIES:

Students learning will involve reading of the text, outlining techniques, note taking, classroom discussions, demonstrations, labs, video viewing, and class projects.

ASSESSMENT:

Student assessment will be done by observation by instructor of student participation, notebook assessment, writing assignments, worksheets, projects, lab write ups, group activities, chapter outlines, chapter review assignments, problem sheets, quizzes, tests, mid-term tests, and final tests.

1/86
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