

Active Physics Correlation to California's Science Framework

Grades 9-12 Physics Content Standards "Standards without asterisks represent those that all students are expected to achieve in the course of their studies. Standards with asterisks represent those that all students should have the opportunity to learn."	Communication			Home			Medicine			Predictions			Sports			Transportation		
	C1	C2	C3	H1	H2	H3	M1	M2	M3	P1	P2	P3	S1	S2	S3	T1	T2	T3
Chapter																		
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Motion and 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.											X		O			O		X
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).											O			O			O	
c. how to apply the law $F=ma$ to solve one-dimensional motion problems involving constant forces (Newton's Second Law).											O			O			O	X
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).											O			O				
e. the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of the Earth.												O			X			X

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g. how to solve problems involving elastic and inelastic collisions in one dimension using the principles of conservation of momentum and energy.												O				O	X			
h.* how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs.																				

Heat and 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.				X																
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 lower 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.																				

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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.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>									<input type="radio"/>						
b. how to identify transverse and longitudinal waves in mechanical media such as springs, ropes, and the Earth (seismic waves).	<input type="radio"/>											<input type="radio"/>						
c. how to solve problems involving wavelength, frequency, and wave speed.	<input type="radio"/>		<input type="radio"/>				<input checked="" type="radio"/>											

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d. sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.	O						X											
e. radio waves, light and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in vacuum is approximately 3×10^8 m/s (186,000 miles/second).			O															O
f. how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.	O		O						O			O						

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.					X													
b. how to solve problems involving Ohm's law.					X													

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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 $Power = (potential\ difference\ IR) \times (current\ I) = I^2R$.					X													
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 charges.						X												
f. magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and experience forces due to magnetic fields of other sources.		O				O												
g. how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.		X				X												
h. changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.		O				O												
i. plasmas, the fourth state of matter, contain ions and/or free electrons and conduct electricity.																		

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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 q) 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 this force.																			
o.* how to apply the concepts of electrical and gravitational potential energy to solve problems involving conservation of energy.																			