

**FUTURES HIGH SCHOOL  
CURRICULUM MAP FOR PHYSICS**

***If you don't know the destination, then any road will do."***

MONTH	CONTENT	POWER STANDARDS	ASSESSMENTS
<b>August/September</b>	<p><b>Text: <i>Conceptual Physics</i>, P.L. Hewitt, c. 2006 (Prentice-Hall)</b></p> <p><b>Linear Motion: (Ch 2)</b></p> <ul style="list-style-type: none"> <li>• speed, velocity, acceleration, free fall, graph of motion</li> </ul> <p><b>Projectile Motion: (Ch 3)</b></p> <ul style="list-style-type: none"> <li>• vectors and scalars, velocity vectors, components of vectors, projectile motion</li> </ul> <p><b>Newton's First Law of Motion - Inertia: (Ch 4)</b></p> <ul style="list-style-type: none"> <li>• Newton's Law of Inertia, mass – a measure of inertia, net force, equilibrium – when net force equals zero, vector addition of forces</li> </ul> <p><b>Newton's Second Law – Force and Acceleration: (Ch 5)</b></p> <ul style="list-style-type: none"> <li>• Force causes acceleration, mass resists acceleration, friction</li> </ul> <p><b>Newton's Third Law – Action and Reaction: (Ch 6)</b></p> <ul style="list-style-type: none"> <li>• Identifying action and reaction, action and reaction on different masses, action equals reaction, do action and reaction forces cancel?</li> </ul>	<p><b>Motion and Forces</b></p> <p><b>1. Newton's laws predict the motion of most objects. As a basis for understanding this concept:</b></p> <p><b>a:</b> <i>Student know</i> how to solve problems that involve constant speed and average speed</p> <p><b>b:</b> <i>Student know</i> that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's first law).</p> <p><b>c:</b> <i>Students know</i> how to apply the law <math>F = ma</math> to solve one-dimensional motion problems that involve constant force (Newton's second law).</p> <p><b>d:</b> <i>Students know</i> that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).</p> <p><b>e:</b> <i>Students know</i> the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of Earth.</p> <p><b>f:</b> <i>Students know</i> applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (e.g. Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).</p> <p><b>g:</b> <i>Students know</i> circular motion requires the application of a constant force directed toward the center of the circle.</p>	<ul style="list-style-type: none"> <li>• Next-Time Questions</li> <li>• Chapter Reviews</li> <li>• Lab Experiments and write-ups</li> <li>• Problem-Solving Exercises</li> <li>• Chapter Test</li> </ul>

	<p><b>Universal Gravitation: (Ch 12)</b></p> <ul style="list-style-type: none"> <li>• Newton’s law of gravitation, gravity and distance – the inverse-square law, universal gravitation</li> </ul> <p><b>Gravitational Interaction:(Ch 13)</b></p> <ul style="list-style-type: none"> <li>• Gravitational fields inside and outside a planet, weight and weightlessness, ocean tides</li> </ul> <p><b>Circular Motion: (Ch 9)</b></p> <ul style="list-style-type: none"> <li>• Rotational speed, centripetal force, centrifugal forces</li> </ul>		
<b>October</b>	<p><b>Momentum: (Ch 7)</b></p> <ul style="list-style-type: none"> <li>• Impulse change momentum, conservation of momentum, collisions, momentum vectors</li> </ul> <p><b>Energy: (Ch 8)</b></p> <ul style="list-style-type: none"> <li>• Work, power, mechanical energy, potential energy, kinetic energy, conservation of energy, machines, efficiency</li> </ul>	<p><b>Conservation of Energy and Momentum</b></p> <p><b>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:</b></p> <p><b>a.</b> <i>Students know</i> how to calculate kinetic energy by using the formula <math>E=(1/2)mv^2</math>.</p> <p><b>b.</b> <i>Students know</i> how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) = <math>mgh</math> (<math>h</math> is the change in elevation ).</p> <p><b>c.</b> <i>Students know</i> how to solve problems involving conservation of energy in simple systems, such as falling objects.</p> <p><b>d.</b> <i>Students know</i> how to calculate momentum as the product <math>mv</math>.</p> <p><b>g.</b> <i>Students know</i> how to solve problems involving elastic and inelastic collisions in one dimension by using the principles of conservation of momentum and energy.</p>	<ul style="list-style-type: none"> <li>• Next-Time Questions</li> <li>• Chapter Reviews</li> <li>• Lab Experiments and write-ups</li> <li>• Problem-Solving Exercises</li> <li>• Chapter Test</li> </ul>
<b>November</b>	<b>Center of Gravity: (Ch 10)</b>	<b>2e.</b> <i>Students know</i> momentum is a separately	<ul style="list-style-type: none"> <li>• Next-Time Questions</li> </ul>

	<ul style="list-style-type: none"> <li>Center of mass, locating center of gravity, stability</li> </ul> <p><b>Rotational Mechanics: (Ch 11)</b></p> <ul style="list-style-type: none"> <li>Torque, balanced torque, torque and center of gravity, rotational inertia, angular momentum, conservation of angular momentum</li> </ul>	<p>conserved quantity different from energy.</p> <p><b>2f.</b> <i>Students know</i> an unbalanced force on an object produces a change in its momentum</p>	<ul style="list-style-type: none"> <li>Chapter Reviews</li> <li>Lab Experiments and write-ups</li> <li>Problem-Solving Exercises</li> <li>Chapter Test</li> </ul>
<b>December</b>	<p><b>Temperature, Heat, and Expansion: (Ch 21)</b></p> <ul style="list-style-type: none"> <li>Temperature, heat, thermal equilibrium, internal energy, specific heat capacity, thermal expansion</li> </ul>	<p><b>Heat and Thermodynamics</b></p> <p><b>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:</b></p> <p><b>c.</b> <i>students know</i> the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as <i>thermal energy</i>. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that made up an object.</p>	<ul style="list-style-type: none"> <li>Next-Time Questions</li> <li>Chapter Reviews</li> <li>Lab Experiments and write-ups</li> <li>Problem-Solving Exercises</li> <li>Chapter Test</li> </ul>
<b>January</b>	<p><b>Heat Transfer: (Ch 22)</b></p> <ul style="list-style-type: none"> <li>Heat conduction, convection, radiation, Newton's law of cooling</li> </ul> <p><b>Change of Phase: (Ch 23)</b></p> <ul style="list-style-type: none"> <li>Evaporation, condensation, boiling, freezing, regelation, energy and changes of phase</li> </ul> <p><b>Thermodynamics: (Ch 24)</b></p> <ul style="list-style-type: none"> <li>Absolute zero, first law of thermodynamics, adiabatic processes, second law of thermodynamics, heat</li> </ul>	<p><b>3a.</b> <i>Students know</i> heat flow and work are two forms of energy transfer between systems.</p> <p><b>3b.</b> <i>Students know</i> that 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 heat flow out at a lower temperature (first law of thermodynamics) and that this an example of the law of conservation of energy.</p> <p><b>3d.</b> <i>Students know</i> that most processes tend to decrease the order of a system over time and that energy levels are eventually distributed uniformly.</p> <p><b>3e.</b> <i>Students know</i> that entropy is a quantity</p>	<ul style="list-style-type: none"> <li>Next-Time Questions</li> <li>Chapter Reviews</li> <li>Lab Experiments and write-ups</li> <li>Problem-Solving Exercises</li> <li>Chapter Test</li> </ul>

	engines and the second law, order tends to disorder, entropy	that measures the order or disorder of a system and that this quantity is larger for a more disordered system.	
<b>February</b>	<p><b>Vibrations and Waves: (Ch 25)</b></p> <ul style="list-style-type: none"> <li>Wave description, wave motion, wave speed, transverse waves, longitudinal waves, interference, standing waves, the Doppler effect</li> </ul> <p><b>Sound: (Ch 26)</b></p> <ul style="list-style-type: none"> <li>The origin of sound, media that transmit sound, speed of sound, forced vibration, natural frequency, resonance, interference, beats</li> </ul>	<p><b>Waves</b></p> <p><b>4. Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept:</b></p> <p><b>a.</b> <i>Students know</i> waves carry energy from one place to another.</p> <p><b>b.</b> <i>Students know</i> how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).</p> <p><b>c.</b> <i>Students know</i> how to solve problems involving wavelength, frequency, and wave speed.</p> <p><b>d.</b> <i>Students know</i> sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.</p>	<ul style="list-style-type: none"> <li>Next-Time Questions</li> <li>Chapter Reviews</li> <li>Lab Experiments and write-ups</li> <li>Problem-Solving Exercises</li> <li>Chapter Test</li> </ul>
<b>March</b>	<p><b>Light: (Ch 27)</b></p> <ul style="list-style-type: none"> <li>Speed of light, electromagnetic waves, polarization</li> </ul> <p><b>Reflection and Refraction: (Ch 28)</b></p> <p>The law of reflection,</p> <ul style="list-style-type: none"> <li>refraction, dispersion in a prism, total internal reflection</li> </ul> <p><b>Diffraction and Interference: (Ch 31)</b></p> <ul style="list-style-type: none"> <li>Huygen's principle, diffraction, interference</li> </ul>	<p><b>4e.</b> <i>Students know</i> radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately <math>3 \times 10^8</math> m/s (186,000 miles/second).</p> <p><b>4f.</b> <i>Students know</i> how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.</p>	<ul style="list-style-type: none"> <li>Next-Time Questions</li> <li>Chapter Reviews</li> <li>Lab Experiments and write-ups</li> <li>Problem-Solving Exercises</li> <li>Chapter Test</li> </ul>
<b>April</b>	<p><b>Electrostatics: (Ch 32)</b></p> <ul style="list-style-type: none"> <li>Electrical forces and charges,</li> </ul>	<p><b>Electric and Magnetic Phenomena</b></p> <p><b>5. Electric and magnetic phenomena are</b></p>	<ul style="list-style-type: none"> <li>Next-Time Questions</li> <li>Chapter Reviews</li> </ul>

	<p>conservation of charge, Coulomb's Law, conductors and insulators, charging by friction and contact, charging by induction, charging by polarization</p> <p><b>Electric Fields and Potential: (Ch 33)</b></p> <ul style="list-style-type: none"> <li>• Electric fields, electric potential energy, electric potential</li> </ul> <p><b>Electric Current: (Ch 34)</b></p> <ul style="list-style-type: none"> <li>• Voltage source, electric resistance, Ohm's Law, direct current and alternating current, electric power</li> </ul>	<p><b>related and have many practical applications. As a basis for understanding this concept:</b></p> <p><b>e.</b> <i>Students know</i> charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.</p> <p><b>a.</b> <i>Students know</i> how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.</p> <p><b>b.</b> <i>Students know</i> how to solve problems involving Ohm's law</p>	<ul style="list-style-type: none"> <li>• Lab Experiments and write-ups</li> <li>• Problem-Solving Exercises</li> <li>• Chapter Test</li> </ul>
<p><b>May</b></p>	<p><b>Electric Circuits: (Ch 35)</b></p> <ul style="list-style-type: none"> <li>• A battery and a bulb, series circuits, parallel circuits, combining resistors in a compound circuit, parallel circuit and overloading</li> </ul> <p><b>Magnetism: (Ch 36)</b></p> <ul style="list-style-type: none"> <li>• Magnetic fields, electric currents and magnetic fields, magnetic forces on moving charged particles and current-carrying wires</li> </ul> <p><b>Electromagnetic Induction: (Ch 37)</b></p> <ul style="list-style-type: none"> <li>• Faraday's Law, generators and alternating current, transformers, induction of electric and magnetic fields, electromagnetic waves</li> </ul>	<p><b>5c.</b> <i>Students know</i> any resistive elements 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 <math>\text{Power} = IR</math> (potential difference) <math>\times I</math> (current) <math>= I^2R</math>.</p> <p><b>5f.</b> <i>Students know</i> magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subjected to forces arising from the magnetic fields of other sources.</p> <p><b>5g.</b> <i>Students know</i> how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.</p> <p><b>5h.</b> <i>Students know</i> changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.</p>	<ul style="list-style-type: none"> <li>• Next-Time Questions</li> <li>• Chapter Reviews</li> <li>• Lab Experiments and write-ups</li> <li>• Problem-Solving Exercises</li> <li>• Chapter Test</li> </ul>

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