Lenoir County Public Schools
Curriculum Pacing Guide
2006-2007 (Reviewed 2008)

**Subject:** **Physics Honors** **Grade Level:** **10-12** **$2^{nd}/4^{th}$** **9 weeks**

| **Time** (approx teaching days) | **Major Concepts** | **Objective / Pacing** | **Text / Support Materials** |
|---|---|---|---|
| **6** | Temperature<br>Heat<br>Internal energy<br>Thermal equilibrium<br>Law of conservation of energy<br>Specific heat capacity<br>Heat transfer<br>Latent heat | **Objectives**<br>6.01 Investigate and analyze energy changes and transfer mechanisms.<br>• Thermal energy<br>6.02 Analyze, evaluate, and apply the principle of conservation of energy.<br>**Questions addressed**<br>• What is temperature and how is it related to the kinetic and potential energies of a substance?<br>• What is thermal equilibrium?<br>• How is temperature measured?<br>• What is heat?<br>• In what units is heat measured? What other quantity uses the same units?<br>• What is specific heat capacity?<br>• What is calorimetry?<br>• What information can be obtained from the analysis of a cooling curve graph?<br>• Why is there no temperature during a phase change?<br>• What is the distinction between heat of fusion and heat of vaporization?<br>• What are the three primary mechanisms for heat transfer? | Chapter 10 – **Holt Physics** Text (pp. 358-385)<br>Video: **Conceptual Physics**: *Heat, Temperature, and Expansion*<br>Video: **Conceptual Physics**: *Heat Transfer*<br>Video: **Conceptual Physics**: *Heat Radiation*<br>Video: **Conceptual Physics**: *Heat: Change of Phase*<br>Video: **The Mechanical Universe**: *Temperature and Gas Laws*<br><br>Labs involving temperature probeware, cooling curves, and phase changes |

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|---|---|---|---|
| 5 | Hooke's law<br>Simple harmonic motion<br>Pendulum<br>Amplitude<br>Period<br>Frequency<br>Wavelength<br>Transverse wave<br>Longitudinal wave<br>Crest<br>Trough<br>Constructive interference<br>Destructive interference<br>Reflection<br>Standing waves<br>Node<br>Antinode | **Objectives**<br>6.01 Investigate and analyze energy storage and transfer mechanisms.<br>• Simple harmonic motion<br>7.01 Analyze, investigate, and evaluate the relationship among the following characteristics of waves.<br>• Wavelength<br>• Frequency<br>• Period<br>• Amplitude<br>7.02 Describe the behavior of waves in various media.<br>7.03 Analyze the behavior of waves at boundaries between media.<br>7.04 Analyze the relationships between the phenomenon of interference and the principle of superposition.<br>**Questions addressed**<br>• What is simple harmonic motion?<br>• What factors determine the period of a pendulum?<br>• What is amplitude?<br>• What is meant by the period for an oscillating object?<br>• In what units is frequency measured?<br>• What is the difference between transverse and longitudinal waves?<br>• How is the speed of a wave calculated?<br>• What is the principle of superposition?<br>• What is the difference between constructive and destructive interference?<br>• How are waves reflected at fixed boundaries?<br>• How are waves reflected at free boundaries?<br>• What is a standing wave?<br>• What is the difference between nodes and antinodes in a standing wave? | Chapter 12 – **Holt Physics** Text (pp. 438-467)<br>Video: **Conceptual Physics**: *Vibrations and Sound I*<br>Video: **The Mechanical Universe**: *Waves* |

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|---|---|---|---|
| 5 | Compression<br>Rarefaction<br>Pitch<br>Doppler effect<br>Sound intensity<br>Threshold of hearing<br>Threshold of pain<br>Decibel level<br>Forced vibration<br>Natural frequency<br>Resonance<br>Fundamental frequency<br>Harmonics<br>Sound quality<br>Timbre<br>Beats<br>Beat frequency | **Objectives**<br>7.01 Analyze, investigate, and evaluate the relationship among the characteristics of sound waves.<br>• Wavelength<br>• Frequency<br>• Period<br>• Amplitude<br>7.02 Describe the behavior of sound waves in various media.<br>7.05 Analyze the frequency and wavelength of sound produced by a moving source (the Doppler effect)<br>**Questions addressed**<br>• What do the compression and rarefaction of a longitudinal wave correspond to on a transverse wave?<br>• What is the pitch of a sound?<br>• On what factors does the speed of sound depend?<br>• What is the Doppler effect?<br>• How is the perceived frequency of a sound affected by the relative motions of the hearer and sound source?<br>• What is sound intensity?<br>• How is the relative intensity of sound measured?<br>• What is the frequency range of human hearing (audible spectrum)?<br>• What are the requirements for resonance to occur?<br>• How does the human ear transmit sound?<br>• What is the fundamental frequency of a vibrating string?<br>• How are harmonics related to the fundamental frequency?<br>• What differences are there in the harmonics produced by an open pipe and a closed pipe?<br>• What factors determine the sound quality (timbre) of a musical note?<br>• How are beats produced? How is beat frequency determined? | Chapter 13 – **Holt Physics** Text (pp. 480-505)<br>Video: **Conceptual Physics**: *Vibrations and Sound II*<br>Video: **The Mechanical Universe**: *Resonance* |

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|---|---|---|---|
| 5 | Electromagnetic wave<br>Diffuse reflection<br>Regular(specular) reflection<br>Law of reflection<br>Virtual image<br>Real image<br>Mirror equation<br>Magnification<br>Convex(diverging) mirror<br>Concave(converging) mirror<br>Plane(flat) mirror<br>Focal point<br>Radius of curvature<br>Reflecting telescope<br>Spherical aberration<br>Color<br>Primary color<br>Primary pigments<br>Light polarization | **Objectives**<br>7.01 Analyze, investigate, and evaluate the relationship among the characteristics of light waves.<br>• Wavelength<br>• Frequency<br>• Period<br>• Amplitude<br>7.03 Analyze the behavior of waves at boundaries between media.<br>7.06 Design and conduct investigations of optics (mirrors) and the law of reflection. **(HONORS)**<br>**Questions addressed**<br>• What are some characteristic features of electromagnetic waves?<br>• At what speed do all electromagnetic waves travel?<br>• How does the brightness of a light vary with its distance from the light source?<br>• What does the law of reflection state?<br>• What is the difference between a virtual image and a real image?<br>• What are the characteristics of an image produced by a plane(flat) mirror?<br>• What is the main difference between concave and convex mirrors?<br>• What is the mirror equation?<br>• How are the image distance, object distance, and focal length of a mirror related to the mirror equation?<br>• How is the magnification of a mirror determined?<br>• What is spherical aberration? How can it be eliminated?<br>• How do reflecting telescopes work?<br>• What are the three primary colors of light?<br>• What are complementary colors?<br>• What are the three primary pigments?<br>• Why can light be polarized while sound cannot be polarized? | Chapter 14 – **Holt Physics** Text (pp. 520-548)<br>Video: **Conceptual Physics**: *Light and Color*<br>Video: **The Mechanical Universe**: *The Michelson-Morley Experiment*<br><br>Optics lab activities (mirrors) |

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|---|---|---|---|
| 5 | Refraction<br>Index of refraction<br>Snell's law<br>Convex(converging) lens<br>Concave(diverging) lens<br>Focal length<br>Lens equation<br>Nearsightedness<br>Farsightedness<br>Compound microscope<br>Refracting telescope<br>Total internal reflection<br>Critical angle<br>Fiber optics<br>Mirages<br>Dispersion<br>Chromatic aberration | **Objectives**<br>7.01 Analyze, investigate, and evaluate the relationships among the characteristics of light waves.<br>• Wavelength<br>• Frequency<br>• Period<br>• Amplitude<br>7.03 Analyze the behavior of waves at boundaries between media.<br>7.06 Design and conduct investigations of optics (lenses) and the law of refraction (Snell's law). **(HONORS)**<br>**Questions addressed**<br>• When does refraction occur?<br>• How is the index of refraction of a substance determined?<br>• What does Snell's law determine?<br>• What is the main difference between convex and a concave lenses?<br>• How does the lens equation compare with the mirror equation?<br>• How is lens magnification determined?<br>• What differences are there between nearsightedness and farsightedness?<br>• How do compound microscopes and refracting telescopes use convex lenses to produce images?<br>• What is total internal reflection?<br>• What is the critical angle? How is it calculated?<br>• What are some advantages of fiber-optics communications?<br>• What causes a mirage?<br>• How does a prism separate light into the visible spectrum of colors?<br>• What is chromatic aberration? How can it be eliminated or reduced? | Chapter 15 – **Holt Physics** Text (pp. 562-585)<br>Video: **Conceptual Physics**: *Reflection and Refraction*<br>Video: **Conceptual Physics**: *Light Waves*<br>Video: **The Mechanical Universe**: *Optics*<br><br>Optics lab activities (lenses) |

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|---|---|---|---|
| **4** | Electric charge<br>Conservation of charge<br>Conductor<br>Insulator<br>Charging by contact<br>Charging by conduction<br>Charging by induction<br>Coulomb's law | **Objectives**<br>8.01 Analyze the nature of electrical charges.<br>• Investigate the electrical charging of objects due to transfer of charge.<br>• Investigate the conservation of electric charges.<br>• Analyze the relationships among force, charge, and distance summarized in Coulomb's law.<br>**Questions addressed**<br>• How do objects become electrically-charged?<br>• What do like-charged objects do when brought near each other?<br>• What do oppositely-charged objects do when brought near each other?<br>• What does the law of conservation of charge state?<br>• What was the significance of Millikan's oil drop experiment?<br>• What is the difference between conductors and insulators?<br>• What are semiconductors? What materials are most commonly used as semiconductors?<br>• What are the three methods by which an object can be charged? charging?<br>• What is charge polarization?<br>• What does Coulomb's law state?<br>• What is the relationship between the electrical force of attraction or repulsion and the distance between two charged bodies? | Chapter 17 – **Holt Physics**<br>(Sections 17.1 & 17.2 only!)<br>Text (pp. 628-642)<br>Video: **Conceptual Physics**:<br>*Electrostatics*<br>Video: **The Mechanical Universe**<br>*Static Electricity*<br><br>Electrostatic demonstrations |

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| **4** | Potential difference<br>Voltage<br>Electric current<br>Ampere<br>Conventional current<br>Drift velocity<br>Direct current<br>Alternating current<br>Electrical resistance<br>Ohm's law<br>Superconductors<br>Electric power<br>Electric energy<br>Kilowatt-hour | **Objectives**<br>8.02 Analyze and measure the relationship among potential difference, current, and resistance in a direct current circuit.<br>8.04 Analyze and measure the nature of power in an electrical circuit.<br>**Questions addressed**<br>• What is electric current?<br>• What is the SI unit of electric current?<br>• What is conventional current?<br>• What is drift velocity? How does it compare to the electric field velocity?<br>• What are some common devices used to convert other forms of energy into electrical energy?<br>• What are the distinctive features of the two types of electric current?<br>• How are resistance, potential difference, and current related in Ohm's law?<br>• What is the difference between ohmic materials and nonohmic materials?<br>• On what four factors does the resistance of a material depend?<br>• What are some uses for superconductors?<br>• How is electric power defined?<br>• How is electric energy converted into other forms of energy, including thermal energy?<br>• What unit is used by utility companies to measure the electrical energy consumed by their customers?<br>• How is electrical energy transmitted over long distances to minimize energy loss? | Chapter 19 – **Holt Physics** Text (pp. 694-713)<br>Video: **Conceptual Physics**: *Current Electricity* |

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| **4** | Schematic diagram<br>Electric circuit<br>Series circuit<br>Parallel circuit<br>Series-parallel combination circuit<br>Equivalent resistance<br>Electromotive force (emf) | **Objectives**<br>8.03 Analyze and measure the relationship among current, voltage, and resistance in circuits.<br>• Series<br>• Parallel<br>• Series-parallel combination<br>**Questions addressed**<br>• What are schematic diagrams?<br>• What are the essential components of all electric circuits?<br>• What is the difference between an open circuit and a closed circuit?<br>• What are the hazards of a short circuit?<br>• What is the emf of a circuit?<br>• How is the terminal voltage of a battery determined?<br>• What are the distinctive features of a series circuit?<br>• How is the equivalent resistance determined in a series circuit?<br>• What are the distinctive features of a parallel circuit?<br>• How is the equivalent resistance determined in a parallel circuit?<br>• How does overall circuit current compare to the current in each branch within a parallel circuit?<br>• What is the main difference between a series circuit and a parallel circuit?<br>• How do fuses and circuit breakers work to regulate current in a circuit?<br>• How can the equivalent resistance of a series-parallel combination circuit be determined?<br>• How are current and potential difference across components of a series-parallel combination circuit determined? | Chapter 20 – **Holt Physics** Text (pp. 730-751)<br>Video: **The Mechanical Universe:** *Electric Circuits* |

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| **3** | Nucleus<br>Isotopes<br>Energy-mass equation<br>Strong nuclear force<br>Electroweak force<br>Valley of stability<br>Binding energy<br>Nuclear decay<br>Alpha emission<br>Beta emission<br>Gamma emission<br>Decay series<br>Half-life<br>Nuclear fission<br>Nuclear fusion<br>Leptons<br>Hadrons<br>Quarks<br>Standard model | **Objectives**<br>6.06 Evaluate nuclear energy as a storage and transfer mechanism. **(HONORS)**<br>8.06 Analyze and mathematically describe relationships within modern and nuclear physics such as quantum theory, radioactivity, binding energy, nuclear decay, nuclear reactions, and the standard model of matter. **(HONORS)**<br>**Questions addressed**<br>• What does each variable in Einstein's mass-energy equation represent?<br>• What force holds the nucleus together?<br>• What subatomic particle is necessary to maintain nuclear stability?<br>• What is the binding energy of a nucleus? How is it determined?<br>• What are the characteristics of each of the three major types of radiation emitted by a radioactive material?<br>• What are the two possible types of beta decay? What particles are emitted in each case?<br>• What is a nuclear decay series?<br>• What does the decay constant indicate? How is it calculated?<br>• What is half-life? How is it calculated?<br>• What features distinguish nuclear fission from nuclear fusion?<br>• What are the components of a nuclear fission reactor?<br>• What function does the moderator play? What materials are suitable as moderators?<br>• What role do control rods play in a nuclear reactor? What materials are suitable for use as control rods?<br>• What are the four fundamental forces in nature?<br>• What are the two broad subcategories of subatomic particles? What distinguishes one from the other?<br>• What is the standard model of matter? What function does it serve in discussing the origins of the universe? | Chapter 25 – **Holt Physics** Text (pp. 896-925)<br>Video: **Conceptual Physics**: *Radioactivity*<br>Video: **Conceptual Physics**: *Fission and Fusion*<br>Video: **The Mechanical Universe:** *From Atoms to Quarks* |

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|---|---|---|---|
| **4** | All concepts covered in course (**except** for those objectives labeled as **HONORS**) | **North Carolina End-of-Course Test in Physics (Review and Test Administration)** | Test review materials (to include previous New York State Regents examinations and other useful sources) |