# Kentucky Department of Education - Course Standards

## Course Standards

**Course Code: 304821**

**Course Name: Physics I**

**Grade Level: 9-12**

Course standards documents are designed to show how specific standards align to courses. For instructional planning and assessment, please access the complete *Kentucky Academic Standards for Science* for the full scope of what students should know and be able to do.

## Upon course completion students should be able to:

| Std. # | Standard Text |
|---|---|
| HS-PS1-8 | **Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.**<br>Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.<br>Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays. |
| HS-PS2-1 | **Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.**<br>Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object sliding down a ramp, or a moving object being pulled by a constant force.<br>Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds. |
| HS-PS2-2 | **Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.**<br>Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.<br>Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension. |
| HS-PS2-3 | **Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. ***<br>Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.<br>Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations. |

| Std. # | Standard Text |
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| HS-PS2-4 | **Use mathematical representations of Newton's law of gravitation and Coulomb's law to describe and predict the gravitational and electrostatic forces between objects.**<br>Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields.<br>Assessment Boundary: Assessment is limited to systems with two objects. |
| HS-PS2-5 | **Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.**<br>Clarification Statement: None provided.<br>Assessment Boundary: Assessment is limited to designing and conducting investigations with provided materials and tools. |
| HS-PS2-6 | **Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. ***<br>Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.<br>Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials. |
| HS-PS3-1 | **Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.**<br>Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions modeled in common phenomena.<br>Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields. |
| HS-PS3-2 | **Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative position of particles (objects).**<br>Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.<br>Assessment Boundary: None provided. |
| HS-PS3-3 | **Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. ***<br>Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency. |

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| | Assessment Boundary: Assessment for quantitative evaluations is limited to total output for a given input. Assessment is limited to devices constructed with materials provided to students. |
| HS-PS3-4 | **Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).**<br>Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.<br>Assessment Boundary: Assessment is limited to investigations based on materials and tools provided to students. |
| HS-PS3-5 | **Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.**<br>Clarification Statement: Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.<br>Assessment Boundary: Assessment is limited to systems containing two objects. |
| HS-PS4-1 | **Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.**<br>Clarification Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the earth.<br>Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively. |
| HS-PS4-2 | **Evaluate questions about the advantages of using digital transmission and storage of information.**<br>Clarification Statement: Examples of advantages could include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Disadvantages could include issues of easy deletion, security, and theft.<br>Assessment Boundary: None provided. |
| HS-PS4-3 | **Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.**<br>Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect.<br>Assessment Boundary: Assessment does not include using quantum theory. |
| HS-PS4-4 | **Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.** |

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| | Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.<br>Assessment Boundary: Assessment is limited to qualitative descriptions. |
| HS-PS4-5 | **Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. ***<br>Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology.<br>Assessment Boundary: Assessments are limited to qualitative information. Assessments do not include band theory. |
| HS-ETS1-1 | **Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. *** |
| HS-ETS1-2 | **Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. *** |
| HS-ETS1-3 | **Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. *** |
| HS-ETS1-4 | **Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. *** |

Standards marked with an asterisk (*) integrate traditional science content with engineering.