

SCIENCE IDEAS CURRICULUM FRAMEWORK: PHYSICS (K-8)

Note: The following represents the results of a hierarchical conceptual analysis of Florida K-8 Big Ideas in Physics. In doing so, a perspective was adopted that represented the conceptual framework for physics in high school and introductory physics classes. Following this perspective, the core concepts and associated sub-concepts in physics were identified for grades K-8 in order to insure sound learning progressions from K-5 to 6-8. And, finally, this conceptual structure was applied and elaborated as necessary to provide Science IDEAS teachers with a grade-articulated curricular framework for physics instruction in grades K-5.

Core Concepts in Physics: Grade K-8 (Florida Standards- Big Ideas 10-13)

1. Energy is the ability to cause change; it exists in many forms and changes forms.
 - 1-1. Mechanical (kinetic and potential), thermal, light, sound, chemical, nuclear, electrical-- basics of how each works.
 - 1-2. Conservation/transfer of energy and many everyday examples thereof.
 - 1-3. Closed, open, and isolated systems.
 - 1-4. Waves: transfer of energy with or w/o transfer of matter
 - 1-5. Waves can travel through matter (mechanical and electromagnetic waves) or through vacuum (electromagnetic only).
 - 1-6. Wavelength, frequency, amplitude, wave speed
 - 1-7. Medium through which a wave travels changes many of its characteristics.
2. Thermal energy: conduction, convection, radiation
3. Light spectrum
 - 3-1. Inverse relationship between energy and wavelength
 - 3-2. Light: reflection, refraction, absorption
4. Electrical
5. Motion
 - 5-1. All motion is relative to the frame of reference, most motion is imperceptible.
 - 5-2. Magnitude and direction.
 - 5-3. Displacement as opposed to distance traveled, velocity, acceleration, momentum.
6. Forces
 - 6-1. Balanced and unbalanced forces.
 - 6-2. Newton's 3 Laws.
 - 6-3. Friction, pressure, tension, electromagnetic force, gravitational force.

Core Concepts in Physics by Grade Level: K-8 (Florida Standards- Big Ideas 10-13)

Grade K

- 1-1 Vibration creates sound= SC.K.P.10.1
- 1-2. Many different things electricity does in our homes (added)
- 3. Colors of visible light (added)
- 5-1. Fast vs. slow vs. not moving = SC.K.P.12.1
- 5-2. How fast vs. which way (added).
- 6. Pushes and pulls change motion of objects = SC.K.P.13.1

Grade 1

- 3. Combinations of colors of visible light (added).
- 5-2. How far vs. which way (added)
- 5-3. Types of motion=SC.1.P.12.1
- 6-2. The greater a push or a pull, the greater the change in motion=SC.1.P.13.1
- 6-3 Friction (added)
- 6-3. Permanent magnets (added)

Grade 2

- 1-2 Everyday examples of energy transformations (added)
- 6. A force = a push or a pull = SC.2.P.13.1 and SC.2.P.13.2
- 6-1. The greater the force the greater the change in motion = SC.2.P.13.1 and SC.2.P.13.2
- 6-3. Gravitational force SC.2.P.13.3

Grade 3

- 1 Energy = the ability to cause motion or create change =SC.3.P.10.2
- 1-1. Everyday forms of energy such as light, heat, sound, electrical and energy of motion = SC.3.1.10.1
- 1-1. Kinetic energy is the energy of motion (added)
- 1-1. Potential energy is the energy due to position (added)
- 1-1. Kinetic $\leftarrow \rightarrow$ potential (added)
- 1-2 Light $\leftarrow \rightarrow$ heat =SC.3.P.11.1
- 1-2. Friction \rightarrow heat = SC.3.P.11.2
- 3-2 Light travels in a straight line until it is reflected, refracted, or absorbed = SC.3.P.10.3 and SC.3.P.10.4

Grade 4

1. All everyday objects have the ability to cause motion and/or create change and therefore have many different forms of energy. = SC.4.P.10.1 and SC.4.P.10.2
- 1-1 Pitch depends on how fast or slow the object vibrates = SC.4.P.10.3
- 1-2 Wind and hydropower = SC.4.P.10.4
2. Adding or removing heat causes temperature changes =SC.4.P.11.1
2. Heat conductors and insulators = SC.4.P.11.2
5. Motion = change of position, possibly a change of direction = SC.4.P.12.1
- 5-1. Speed of motion vs. a frame of reference (added)
- 5-3. Speed is distance per time =SC.4.P.12.2
- 5-3. Displacement vs. distance travelled (added)
- 5-3 Momentum (added)

Grade 5

- 1 Energy = the ability to cause motion or create change =SC.5.P.10.2
- 1-1. Everyday forms of energy such as light, heat, sound, electrical and energy of motion = SC.5.P.10.1
- 1-2 Electrical energy → heat, light, sound, motion = SC.5.P.10.4
4. Attraction/repulsion of electrically charged objects =SC.5.P.10.3
4. Electrical circuits =SC.5.P.11.1
4. Conductors and insulators of electricity =SC.P.P.11.2
6. Identify everyday examples of forces = SC.5.P.13.1
- 6-1. If a force was applied but the motion did not change, there must be an equal and opposite balancing force =SC. 5.P.13.4
- 6-2. The greater the applied force, the greater the change in motion = SC.5.P.13.2
- 6-2. Change caused by a given force is inversely proportional to the object's mass = SC.5.P.13.3

Grade 6

- 1-1 The light spectrum: light is different types of energy waves (added)
- 1-2 Law of conservation of energy = SC.6.P.11.1
- 1-5 Electromagnetic and light waves can travel through vacuum or through a medium (added)
- 3 Electromagnetic radiation (added)
- 3-1 Inverse relationship between energy and wavelength (added)
- 5-3. Constant and changing speeds, acceleration, deceleration = SC.6.P.12.1
6. Contact forces vs. forces acting at a distance = SC.6.P.13.1
- 6-1. Applied unbalanced force will change speed and/or direction of motion = SC.P.6.13.3

- 6-1. Balanced forces results in no change in motion (added)
- 6-1. Resistance forces (e.g. strength of a wall, chair or floor). (added)
- 6-2. In a frictionless environment, an object will continue doing what it was doing unless an additional force is applied. (added)
- 6-3. Gravitational force acts between all objects, is proportional to mass and inversely proportional to distance = SC.6.P.13.2

Grade 7

- 1-1. Heat is imperceptible motion of particles that spreads until it is even with its surroundings. (added)
- 1-2. Conservation and transformation of energy =SC.7.P.11.2 and SC.7.P.11.3
- 1-4 Transfer of energy with a transfer of matter (e.g. ocean waves) (added)
- 1-4 Transfer of energy without a transfer of matter (e.g. a jump rope, light traveling through space). (added)
- 1-5 Mechanical waves such as sound or ocean waves need a medium to travel through. (added)
- 1-7. Medium through which a wave travels changes many of its characteristics = SC.7.P.10.3
- 2. Temperature vs. heat energy(added)
- 2. Heat flow → temperature changes and changes of state = SC.7.P. 11.1 and SC.7.P.11.4
- 3. Spectrum of sunlight = SC.7.P.10.1
- 3-2. Reflection, refraction, absorption = SC.7.P.10.2
- 5-1. Most motion is ongoing and imperceptible (added)

Grade 8

- 1-1. Chemical or bond energy keeps atoms together and is released when they break apart (added)
- 1-1. Nuclear energy keeps nuclei of atoms together and is released when they break apart (added)
- 1-1. Electrical energy is the movement of electrons that came off their atoms (added).
- 1-2 Chemical → electrical (added)
- 1-2 Chemical → motion (added)
- 1-2 Chemical → heat (added)
- 1-2 Light → chemical (added)
- 1-3 Open systems (e.g. cellular and organismal homeostasis, ecosystems) (added)
- 1-3 Closed systems (e.g. closed vs. open electrical circuits) (added)
- 1-3 Isolated systems (always imperfect, but e.g. a space capsule) (added)

6-3. Electricity = movement of electrons (added)