**Ohio's Learning Standards and Model Curriculum for Science Goals**

## Kindergarten

**K.PS.2: Some objects and materials can be made to vibrate to produce sound.**

Sound is produced by touching, blowing, or tapping objects. The sounds that are produced vary depending on the properties of objects. Sound is produced when objects vibrate.

**Future Application of Concepts**
**Grades 1-2:** Exploring sound provides an experiential basis for the concepts of motion and energy. A variety of motions is explored. Forces are needed to change the motion of objects.

**Grades 3-5:** Energy is introduced as something that can make things move or cause change. The concept of a medium for sound is introduced and disturbances in liquid and solid media are observed.

**Grades 6-8:** The wave nature of sound is introduced.

**Lesson 4:** The students will learn that sound is made of vibrations or sounds waves that we can hear. They will also understand that sound must travel through a medium as vibrations.

## Grade 1

**1.PS.2: Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.**

The position of an object can be described by locating it relative to another object or to the object's surroundings. An object is in motion when its position is changing.

The motion of an object can be affected by pushing or pulling. A push or pull is a force that can make an object move faster, slower or go in a different direction. Changes in motion are a result of changes in energy.

**Lesson 2:** The students will investigate and understand that moving objects exhibit different kinds of motion incorporating physical dimensions (left, right, forward, back, up and down. They will also gain an understanding of what motion is and how to put an object into motion.

## Grade 2

**2.PS.1: Forces change the motion of an object.**

Motion can increase, change direction, or stop depending on the force applied.

The change in motion of an object is related to the size of the force.

Some forces act without touching, such as using a magnet to move an object or objects falling to the ground.

**Lesson 2:** The students will investigate and understand that moving objects exhibit different kinds of motion incorporating physical dimensions (left, right, forward, back, up and down. They will also gain an understanding of what motion is and how to put an object into motion.

**Lesson 8:** The students will be guided towards an understanding regarding balanced and unbalanced forces through the study of Newton's Laws. They will also gain a more thorough understanding of Newton's Laws and determine how a change in mass of an object (a roller skate) effects a push or pull on the objects speed and or direction.

## Grade 3

**3.PS.3: Heat, electrical energy, light, sound, and magnetic energy are forms of energy.**

**Lesson 4:** The students will learn that sound is made of vibrations or sounds waves that we can hear. They will also understand that sound must travel through a medium as vibrations.

**Lesson 5:** The students will investigate and understand that different frequencies and wavelengths in the electromagnetic spectrum range from radio waves through visible light to gamma radiation. They will gain an understanding of what light truly is and how it travels.

## Grade 4

**4.PS.2: Energy can be transferred from one location to another or can be transformed from one form to another.**

**Lesson 9:** The students will gain an understanding of velocity, several types of motion, and how they relate to the speed of a hockey puck and a roller hockey ball.

**STEM in Sports: Basketball, Volleyball, Roller Skating and Roller Derby:**
The students will get an introduction into the physics of sports, The Law of Conservation, how energy converts while the ball is moving, while calculating averages and velocity.

## Grade 5

**5.PS.1: The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.**

Movement can be measured by speed. The speed of an object is calculated by determining the distance (d) traveled in a period of time (t).

Any change in speed or direction of an object requires a force and is affected by the mass of the object and the amount of force applied.

**5.PS.2: Light and sound are forms of energy that behave in predictable ways.**

Light travels and maintains its direction until it interacts with an object or moves from one medium to another and then it can be reflected, refracted or absorbed.

Sound is produced by vibrating objects and requires a medium through which to travel. The rate of vibration is related to the pitch of the sound.

**Lesson 4:** The students will learn that sound is made of vibrations, or sounds waves that we can hear. They will also understand that sound must travel through a medium as vibrations.

**Lesson 5:** The students will investigate and understand that different frequencies and wavelengths in the electromagnetic spectrum range from radio waves through visible light to gamma radiation. They will gain an understanding of what light truly is and how it travels.

**Lesson 7**
The students will engage in a math heavy lesson solving problems through statistics and logic. They will figure out a solution as to how many skates a roller rink may need to purchase through population and samples as scientists and engineers do to solve certain situations.

## Middle School:

**6.PS.3: There are two categories of energy: kinetic and potential.**

Objects and substances in motion have kinetic energy.

Objects and substances can have energy because of their position (potential energy).

**6.PS.4: An object's motion can be described by its speed and the direction in which it is moving.**

An object's position and speed can be measured and graphed as a function of time.

**Conservation of Mass and Energy**

This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, transformation, and transfer of energy.

**7.PS.3** Energy can be transformed or transferred but is never lost.

**7.PS.4** Energy can be transferred through a variety of ways.

**8.PS.2** Forces can act to change the motion of objects.

Describe the motion of an object based on multiple reference points.

Investigate the relationship between the type of surface and the effects of kinetic friction on moving objects (e.g., experiment with moving an object across various surfaces).

**Lesson 8**
The students will gain and understanding of Newton's Laws and determine how a change in mass of an object (a roller skate) effects a push or pull on the objects speed and or direction. They will also gain information on different forces including the role gravity plays. They will conduct an experiment pertaining to the amount of force needed when mass changes.

**Lesson 9:** The students will gain an understanding of velocity, several types of motion, and how they relate to the speed of a hockey puck and a roller hockey ball.

**STEM in Sports: Basketball, Volleyball, Roller Skating and Roller Derby:**
The students will get an introduction into the physics of sports, The Law of Conservation, how energy converts while the ball is moving, while calculating averages and velocity. They will also gain an understanding of how kinetic, potential and thermal energy work in sports.

## GOALS

Ohio's student-centered goals (Duschl et. al., 2007; Bell et. al. 2009) for science education include helping students:

1. Experience excitement, interest and motivation to learn about phenomena in the natural and physical world.

2. Come to generate, understand, remember and use concepts, explanations, arguments, models and facts related to science.

3. Manipulate, test, explore, predict, question, observe and make sense of the natural and physical world.

4. Reflect on science as a way of knowing; on processes, concepts and institutions of science; and on their own process of learning about phenomena.

5. Participate in scientific activities and learning practices with others, using scientific language and tools.

6. Think about themselves as science learners and develop an identity as someone who knows about, uses and sometimes contributes to science.