

# Missouri End-of-Course Assessment Achievement Level Descriptors

## Physical Science

### Achievement Levels

**Advanced:** Students performing at the Advanced level on the Missouri Physical Science End-of Course Assessment demonstrate a thorough understanding of the course-level expectations for Physical Science. In addition to demonstrating, understanding, and applying the skills at the Proficient level, students scoring at the Advanced level use a range of strategies.

**Proficient:** Students performing at the Proficient level on the Missouri Physical Science End-of Course Assessment demonstrate an understanding of the course-level expectations for Physical Science. In addition to demonstrating, understanding, and applying the skills at the Basic level, students scoring at the Proficient level use a range of strategies.

**Basic:** Students performing at the Basic level on the Missouri Physical Science End-of-Course Assessment demonstrate a partial understanding of the course-level expectations for Physical Science. In addition to demonstrating, understanding, and applying the skills at the Below Basic level, students scoring at the Basic level use some strategies.

**Below Basic:** Students performing at the Below Basic level on the Missouri Physical Science End-of-Course Assessment demonstrate a limited understanding of the course-level expectations for Physical Science. In addition to demonstrating these skills, students scoring at the Below Basic level use very few strategies and demonstrate a limited understanding of important Physical Science content and concepts.

## **Achievement Descriptors**

### **Advanced**

In addition to understanding and applying the skills at the Proficient level, students at this level:

- ✓ Predict the effect of a temperature change on the pressure, volume, and density of a liquid or gas
- ✓ Describe how valence electrons determine how atoms interact and may bond
- ✓ Compare and contrast the types of chemical bonds
- ✓ Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change as support for the Law of Conservation of Mass
- ✓ Describe how electromagnetic energy is transferred through space as electromagnetic waves of varying wavelength and frequency
- ✓ Describe how changes in the nucleus of an atom during a nuclear reaction result in emission of radiation
- ✓ Classify the different ways to store energy and describe the transfer of energy as it changes from kinetic to potential, while the total amount of energy remains constant, within a system
- ✓ Interpret graphic displays of an object's motion in terms of speed, velocity, and acceleration using dimensional analysis
- ✓ Compare and describe the gravitational forces between two objects in terms of their masses and the distances between them
- ✓ Explain how the efficiency of a mechanical system can be expressed as a ratio of work output to work input
- ✓ Identify information that the electromagnetic spectrum provides about the stars and the universe
- ✓ Explain that the total momentum remains constant within a system

## Proficient

In addition to understanding and applying the skills at the Basic level, students at this level:

- ✓ Compare the densities of regular and irregular objects using their respective measures of volume and mass
- ✓ Describe power in terms of work and time
- ✓ Compare and contrast the properties of acidic and basic solutions
- ✓ Predict the effect of pressure changes on the properties of a material
- ✓ Classify a substance as being made up of one kind of atom or a compound when given the structural and molecular formula for the substance
- ✓ Identify pure substances by their physical and chemical properties
- ✓ Using the Kinetic Theory model, explain the changes that occur in the distance between atoms/molecules and temperature of a substance as energy is absorbed or released
- ✓ Calculate the number of protons, neutrons, and electrons of an element given its mass number and atomic number
- ✓ Contrast various types of chemical bonds
- ✓ Explain the structure of the periodic table in terms of the elements with common properties
- ✓ Predict the chemical reactivity of elements using the Periodic Table
- ✓ Compare the mass of the reactants to the mass of the products in a physical change as support for the Law of Conservation of Mass
- ✓ Differentiate among thermal energy, heat, and temperature
- ✓ Interpret examples of heat transfer as convection, conduction, or radiation
- ✓ Identify and evaluate advantages/disadvantages of using various sources of energy for human activity
- ✓ Relate kinetic energy to an object's mass and its velocity
- ✓ Compare the efficiency of two systems
- ✓ Relate an object's gravitational potential energy to its weight and height relative to the surface of the Earth
- ✓ Describe the effect of work on an object's kinetic and potential energy
- ✓ Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms
- ✓ Identify the role of nuclear energy as it serves as a source of energy for the Earth, stars, and human activity
- ✓ Describe weight in terms of the force of a planet's or moon's gravity acting on a given mass
- ✓ Compare the momentum of two objects in terms of mass and velocity
- ✓ Compare the gravitational forces between two objects in terms of their masses and the distances between them
- ✓ Describe the transfer of energy as it changes from kinetic to potential, while the total amount of energy remains constant, within a system
- ✓ Analyze the velocity of two objects in terms of distance and time
- ✓ Identify forces acting on a falling object and how those forces affect the rate of acceleration
- ✓ Analyze and determine the effect of the sum of the forces acting on an object using a force diagram
- ✓ Measure and analyze graphically an object's motion in terms of speed, velocity, and acceleration
- ✓ Determine the effect on acceleration using information about net force and mass
- ✓ Describe and analyze the relationships among force, distance, and work

## Basic

In addition to understanding and applying the skills at the Below Basic level, students at this level:

- ✓ Identify pure substances by their physical properties
- ✓ Distinguish between physical and chemical changes in matter
- ✓ Identify acidic and basic solutions based on the pH scale
- ✓ Predict the effect of a temperature change on the properties of a material
- ✓ Describe the atom as having a dense, positive nucleus surrounded by a cloud of negative electrons
- ✓ Describe the information provided by the atomic number and the mass number
- ✓ Explain the relationship between kinetic energy and temperature
- ✓ Differentiate between the properties and examples of conductors and insulators
- ✓ Describe sources and common uses of different forms of energy
- ✓ Identify advantages/disadvantages of using various sources of energy for human activity
- ✓ Identify stars as producers of electromagnetic energy
- ✓ Classify examples of heat transfer as convection, conduction, or radiation
- ✓ Distinguish between examples of kinetic and potential energy within a system
- ✓ Describe the effect of work on an object's potential energy
- ✓ Measure and analyze an object's motion in terms of speed and velocity
- ✓ Describe the relationship between applied net force and the distance an object moves
- ✓ Compare and describe the gravitational forces between two objects in terms of the distances between them
- ✓ Recognize the difference between weight and mass
- ✓ Identify and describe balanced and unbalanced forces acting on an object
- ✓ Recognize all free falling bodies accelerate at the same rate due to gravity regardless of their mass
- ✓ Recognize that inertia is a property of matter that can be described as an object's tendency to resist a change in motion

## Below Basic

Students at this level:

- ✓ Classify a substance as being made up of one kind of atom when given the structural formula for the substance
- ✓ Compare the common properties of metals and nonmetals
- ✓ Using the Kinetic Theory model, explain the particle motion during phase changes
- ✓ Describe the information provided by the atomic number
- ✓ Classify elements as metals and nonmetals according to their location on the Periodic Table
- ✓ Differentiate between examples of conductors and insulators
- ✓ Classify examples of heat transfer as conduction or radiation
- ✓ Describe an object's motion in terms of speed and velocity
- ✓ Describe gravity as an attractive force among all objects
- ✓ Compare the gravitational forces between two objects in terms of the distances between them
- ✓ Identify forces acting on an object