

Science

PHYSICS

STANDARD 1

The student understands and uses scientific concepts and principles.

To meet this standard, the student will:

Benchmark P.1.1: Use properties to identify, describe, and categorize substances, materials, and objects

Indicators:

- P.1.1.1 Accurately predict what materials are good conductors of heat and electricity and be able to test those predictions
- P.1.1.2 Observe, analyze, and predict properties of one-dimensional motion including position, distance, average speed, and change of speed
- P.1.1.3 Distinguish between familiar forms of energy including heat, electrical, light, and mechanical (potential and kinetic)

Benchmark P.1.2: Identify, describe, and categorize living (and non-living) things based on their characteristics

Indicators:

- P.1.2.1 Identify characteristics of wave phenomena such as period, wavelength, frequency, amplitude, and phase
- P.1.2.2 Identify key properties and applications of various regions of the electromagnetic spectrum
- P.1.2.3 Identify characteristics and effects of fields

Benchmark P.1.3: Measure properties and characteristics

Indicators:

- P.1.3.1 Understand the goals of measurement and the usefulness of standard measurements
- P.1.3.2 Use instruments to measure time, temperature, length, mass, weight, and volume
- P.1.3.3 Calculate density and rates of change
- P.1.3.4 Identify and manage sources of error and uncertainty
- P.1.3.5 Use estimation skills to check measurements
- P.1.3.6 Understand the goals of measurement and the usefulness of standard measurements

Benchmark P.1.4: Recognize the components, structure, and organization of systems and the interconnections within and among them

Indicators:

- P.1.4.1 Understand what factors limit the size of living and non-living systems, including the relationship between volume and surface area
- P.1.4.2 Understand and explain how the atomic structure of matter relates to observable properties of matter
- P.1.4.3 Review the elements needed to form a complete circuit
- P.1.4.4 Demonstrate that electrical energy can be transformed into light, heat, or sound

Key: 1, Discipline 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

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Benchmark P.1.5: Understand that interactions within and among systems cause changes in matter and energy

Indicators:

- P.1.5.1 Use the particle theory to describe the differences between solids, liquids, and gases
- P.1.5.2 Solve problems involving conservation of energy in simple systems
- P.1.5.3 Investigate the interactions among volume, pressure, and temperature of gases
- P.1.5.4 Understand the interaction among heat, temperature, molecular motion, and phase change
- P.1.5.5 Describe forms of heat transfer (conduction, convection, and radiation)
- P.1.5.6 Recognize processes which transform one form of energy into another
- P.1.5.7 Investigate Ohm's law and the interaction of the different elements in series, parallel, and combined circuits
- P.1.5.8 Explain the ideas of transformation and the principles of conservation, especially conservation of matter, mass, energy, momentum, and charge
- P.1.5.9 Explain various ways that light can interact with matter (transmission, absorption, reflection)
- P.1.5.10 Explain how the pitch of a sound can be varied
- P.1.5.11 Review the ideas that forces have a size and a direction and that they can change the state of motion of an object
- P.1.5.12 Investigate the forces and phenomena that result from static electricity and magnetism
- P.1.5.13 Recognize that momentum is a separately conserved quantity different from energy
- P.1.5.14 Research the scientific, technological, and mathematical knowledge and training requirements in career fields
- P.1.5.15 Identify an educational pathway which meets personal interests, aspirations, and abilities

Benchmark P.1.6: Construct and use models to predict, test, and understand scientific phenomena

Indicators:

- P.1.6.1 Evaluate various models of electrical flow or atomic structure
- P.1.6.2 Construct and analyze diagrams of electrical circuits
- P.1.6.3 Construct and interpret ray diagrams
- P.1.6.4 Recognize the usefulness and limitations of models and theories as scientific representations of reality
- P.1.6.5 Use mathematical models to make predictions about observed phenomena

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STANDARD 2

The student conducts scientific investigations to expand understanding of the natural world.

To meet this standard, the student will:

Benchmark P.2.1: Plan and implement scientific investigations

Indicators:

- P.2.1.1 Distinguish between an observation and an inference
- P.2.1.2 Draw inferences based on observations
- P.2.1.3 Develop questions and testable hypotheses in response to observations
- P.2.1.4 Use appropriate tools to collect data and test a hypothesis
- P.2.1.5 Plan and conduct a controlled experiment, individually and collaboratively
- P.2.1.6 Develop and communicate descriptions, results, explanations, conclusions, and models from evidence
- P.2.1.7 Understand and follow proper safety procedures
- P.2.1.8 Identify and communicate sources of unavoidable experimental error

Benchmark P.2.2: Think logically, analytically, and creatively

Indicators:

- P.2.2.1 Formulate explanations by using logic and evidence
- P.2.2.2 Approach questions and problems using several different strategies
- P.2.2.3 Distinguish between evidence, explanation, and opinion
- P.2.2.4 Make predictions and create explanations by drawing inferences and recognizing patterns and relationships (especially mathematical relationships)
- P.2.2.5 Describe the thought process associated with a particular series of actions
- P.2.2.6 Analyze situations and solve problems that require combining and applying concepts from more than one area of science

Benchmark P.2.3: Practice the principles of scientific inquiry

Indicators:

- P.2.3.1 Recognize the role of science as a way of looking at the world
- P.2.3.2 Evaluate and modify processes of investigation
- P.2.3.3 Analyze a set of knowledge and recognize what is still unknown or unanswered
- P.2.3.4 Recognize the logical process of basing conclusions on evidence
- P.2.3.5 Recognize that scientific knowledge is always changing
- P.2.3.6 Recognize that observations can be influenced by faulty procedures and by the beliefs of the observer
- P.2.3.7 Recognize that scientific understanding can come from unexpected results
- P.2.3.8 Analyze basic assumptions held by scientists

Key: 1, Discipline 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

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Benchmark P.2.4: Understand the relationship between evidence and scientific explanation

Indicator:

- P.2.4.1 Understand that the process of science results from inventive acts of imagination, intelligence and logical inquiry which meet certain criteria of testability, consistency and rules of evidence

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STANDARD 3

The student applies science knowledge and skills to solve problems and meet challenges.

To meet this standard, the student will:

Benchmark P.3.1: Identify problems and challenges in which science knowledge and skills can be applied

Indicators:

- P.3.1.1 Analyze a relevant problem or challenge which is related to science or technology
- P.3.1.2 Identify the components of the problem and criteria of a suitable solution

Benchmark P.3.2: Research, design, and test a variety of ways to address problems and/or challenges

Indicators:

- P.3.2.1 Use scientific tools and methods to individually and collaboratively research, design, test, and compare alternative solutions to a problem
- P.3.2.2 Conduct risk-benefit analyses, investigate trade-offs and constraints, and make predictions about the consequences of implementing various solutions to a problem

Benchmark P.3.3: Evaluate solutions and consequences

Indicator:

- P.3.3.1 Develop a written report which completely describes the problem-solving process

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STANDARD 4

The student uses effective communication skills and tools to build and demonstrate understanding of science.

To meet this standard, the student will:

Benchmark P.4.1: Use listening, observing, and reading skills to obtain scientific information

Indicators:

- P.4.1.1 Practice listening to and paraphrasing someone describe his/her own observations
- P.4.1.2 Read, understand, and summarize informative text

Benchmark P.4.2: Use writing and speaking skills to organize and express science ideas

Indicators:

- P.4.2.1 Construct, interpret, and utilize line graphs and other graphical displays of information
- P.4.2.3 Write informative reports that make use of formulas, symbols, diagrams, tables, and graphs
- P.4.2.4 Recognize, use, and be able to explain common science terms

Benchmark P.4.3: Use effective communication strategies and tools to prepare and present science information

Indicators:

- P.4.3.1 Utilize computer software and hardware to produce science products and conduct scientific research and investigations
- P.4.3.2 Recognize and interpret chemical equations
- P.4.3.3 Clearly present information as evidence to support a conclusion

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STANDARD 5

The student understands how science knowledge and skills are connected to other subject areas and real-life situations.

To meet this standard, the student will:

Benchmark P.5.1: Use mathematics to enhance scientific understanding

Indicator:

P.5.1.1 Use statistical methods and estimation skills to make predictions and describe and analyze results

Benchmark P.5.2: Understand the relationship between science and technology

Indicators:

P.5.2.1 Describe workplace situations which utilize scientific inquiry and technological design processes

P.5.2.2 Explain the interdependence of science, technology, and public awareness

Benchmark P.5.3: Examine the relationship between science and history

Indicator:

P.5.3.1 Research and describe how individual contributions, various tools and techniques, and different historical periods and events have influenced the development of science

Benchmark P.5.4: Examine the relationship among science, society, and the workplace

Indicators:

P.5.4.1 Describe how the scientific enterprise is influenced by societal, environmental, economic, political, and ethical considerations

P.5.4.2 Explain how the actions of humans can affect the environment and the supply of resources

P.5.4.3 Recognize and explain some short-term and long-term consequences of science and technology

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STANDARD 6

The student understands how science knowledge carries with it responsibility for its application.

To meet this standard, the student will:

Benchmark P.6.1: Understand how science contributes to the treatment of diseases in the maintenance of a healthy lifestyle (Personal and Community Health)

Indicators:

N/A

Benchmark P.6.2: Understands how the use of resources affects population growth and the global environment (Population)

Indicator:

P.6.2.1 Explain how societal and political policy is shaped by dependence upon natural resources

Benchmark P.6.3: Understand the importance of maintaining resources and environmental quality (Environmental Quality/Resources)

Indicator:

P.6.3.1 Recognize the limitations of our natural resources as being exhaustible, and the dangers in depleting natural resources

Benchmark P.6.4: Understand the ethical issues inherent in scientific research (Ethics)

Indicators:

P.6.4.1 Accurately record and report a series of observations

P.6.4.2 Give proper credit to informative sources

P.6.4.3 Explain the importance of openness, honesty, and skepticism in science

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