

# Science

## CHEMISTRY

### STANDARD 1

*The student understands and uses scientific concepts and principles.*

To meet this standard, the student will:

**Benchmark C.1.1:** Use properties to identify, describe, and categorize substances, materials, and objects  
**Indicators:**

- C.1.1.1 Describe objects using sensory terms and properties including shape, size, color, texture, and hardness
- C.1.1.2 Sort substances by measuring properties such as density, hardness, boiling and freezing points, solubility, conductivity, Ph, and melting points
- C.1.1.3 Examine properties of mixtures, solutions, acids, and bases
- C.1.1.4 Determine, and understand the importance of concentration of solutions
- C.1.1.5 Identify the phase of matter associated with a substance at a particular temperature
- C.1.1.6 Distinguish between ionic and covalent bonds, and metallic bonds
- C.1.1.7 Distinguish different types of chemical reactions including synthesis, decomposition, single and double replacement, neutralization, redox, exothermic, endothermic, spontaneous, and non-spontaneous
- C.1.1.8 Use molar mass, molar volume, and Avogadro's principle to investigate stoichiometric relationships
- C.1.1.9 Investigate the relationships among pressure, temperature, and volume for gases
- C.1.1.10 Determine electron configuration, notations, electron dot notation, and orbital notation
- C.1.1.11 Distinguish the different orbital shapes

**Benchmark C.1.2:** Identify, describe, and categorize objects and ideas based on their characteristics

**Indicators:**

N/A

**Benchmark C.1.3:** Measure properties and characteristics

**Indicators:**

- C.1.3.1 Use instruments to measure time, temperature, mass, weight, and volume
- C.1.3.2 Identify and manage sources of error and uncertainty
- C.1.3.3 Use estimation skills to check measurements
- C.1.3.4 Understand the goals of measurement and the usefulness of standard measurements

Key: 1, Discipline 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

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

**Indicators:**

- C.1.4.1 Understand and explain how the atomic structure of matter relates to observable properties of matter
- C.1.4.2 Distinguish among an element, a compound, and a mixture
- C.1.4.3 Distinguish between physical and chemical properties
- C.1.4.4 Recognize the usefulness of the periodic table as an organizational and informational tool
- C.1.4.5 Use the periodic table to investigate atomic number, atomic mass, isotopes, families, groups, series, periods, atomic and nuclear radii, electro negativity, electron configurations, and oxidation numbers
- C.1.4.6 Distinguish between physical changes and chemical changes
- C.1.4.7 Determine electron configuration, electron dot notation, and orbital notation and relate it to periodic table and properties

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

**Indicators:**

- C.1.5.1 Recognize and be able to explain physical and chemical equilibrium
- C.1.5.2 Know that matter and energy are conserved in physical and chemical changes
- C.1.5.3 Use the kinetic theory of matter to describe the differences between solids, liquids, and gases
- C.1.5.4 Recognize processes which transform one form of energy into another
- C.1.5.5 Understand how bonds store and release energy

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

**Indicators:**

- C.1.6.1 Evaluate various models of atomic structure and how technology relates to these views
- C.1.6.2 Construct molecular models and dynamic models of chemical reaction
- C.1.6.3 Recognize, interpret, and balance chemical equations
- C.1.6.4 Use mathematical models to make predictions about chemical reactions

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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 C.2.1: Plan and implement scientific investigations**

**Indicators:**

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

**Benchmark C.2.2: Think logically, analytically, and creatively**

**Indicators:**

- C.2.2.1 Approach questions and problems using several different strategies
- C.2.2.2 Distinguish between evidence, explanation, and opinion
- C.2.2.3 Make predictions and create explanations by drawing inferences and recognizing patterns and relationships (especially mathematical relationships)
- C.2.2.4 Reflect upon the thought process associated with a particular series of actions

**Benchmark C.2.3: Practice the principles of scientific inquiry**

**Indicators:**

- C.2.3.1 Recognize the role of science as a way of looking at the world
- C.2.3.2 Evaluate and modify processes of investigation
- C.2.3.4 Accurately record and report a series of observations
- C.2.3.5 Give proper credit to informative sources
- C.2.3.6 Explain the importance of openness, honesty, and skepticism in science
- C.2.3.7 Analyze information that is known and recognize what is still unknown or unanswered
- C.2.3.8 Recognize the logical process of basing conclusions on evidence
- C.2.3.9 Recognize that scientific knowledge is always changing
- C.2.3.10 Recognize that observations can be influenced by faulty procedures and by the beliefs of the observer
- C.2.3.11 Recognize that scientific understanding can come from unexpected results
- C.2.3.12 Analyze basic assumptions held by scientists

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

**Indicator:**

- C.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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## CHEMISTRY

### STANDARD 3

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

**To meet this standard, the student will:**

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

**Indicators:**

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

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

**Indicator:**

- C.3.2.1 Use scientific tools and methods to individually and collaboratively research, design, test, and compare alternative solutions to a problem

**Benchmark C.3.3: Evaluate solutions and consequences**

**Indicator:**

- C.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 C.4.1: Use listening, observing, and reading skills to obtain scientific information**

**Indicators:**

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

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

**Indicators:**

- C.4.2.1 Construct, interpret, and utilize line graphs and other graphical displays of information
- C.4.2.2 Write informative reports that make use of formulas, symbols, diagrams, tables, and graphs
- C.4.2.3 Recognize, use, and be able to explain common science terms

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

**Indicators:**

- C.4.3.1 Utilize computer software and hardware to conduct scientific research and investigations
- C.4.3.2 Recognize and interpret chemical equations
- C.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 C.5.1: Use mathematics to enhance scientific understanding**

**Indicator:**

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

**Benchmark C.5.2: Understand the relationship between science and technology**

**Indicators:**

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

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

**Benchmark C.5.3: Examine the relationship between science and history**

**Indicator:**

C.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 C.5.4: Examine the relationship among science, society, and the workplace**

**Indicators:**

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

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

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

**Indicator:**

C.6.1.1 Describe the role of chemicals in causing or curing disease

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

**Indicators:**

C.6.2.1 Understand the role of petroleum to build materials and to burn for energy

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

**Indicator:**

C.6.3.1 Conserve materials in lab and experience some aspects of pollution such as SO<sub>2</sub> from burning sulfur

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

**Indicator:**

C.6.4.1 Understand and demonstrate the need for honesty in preparing lab reports

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