

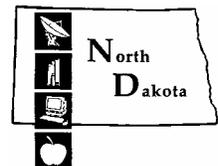
North Dakota Standards and Benchmarks

Achievement Standards

Science

November 2002

**North Dakota Department of Public Instruction
Dr. Wayne G. Sanstead, State Superintendent
600 E Boulevard Avenue, Dept. 201
Bismarck, North Dakota 58505-0440
www.dpi.state.nd.us**



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PROJECT DIRECTOR

Clarence A. Bina, Ph.D.

School Improvement, Assistant Director
North Dakota Department of Public Instruction
600 East Boulevard Avenue - 9th Floor
Bismarck, North Dakota 58505-0440
Phone: 701-326-2098
Email: cbina@mail.dpi.state.nd.us

CONSULTANT

Carolyn R. Brauner, Ph.D.

Educational Consulting
2115 2nd Place NE, Jamestown, ND 58401
Phone: 701-252-5289
Email: cbrauner@jc.edu

North Dakota Science Achievement Standards Writing Team

(This team also revised some of the ©2001 N.D. Science Content Standards upon review during their writing of the N.D. Science Achievement Standards.)

Carol Beaton, M.S.
Fargo South High School
Fargo

John Brauner, Ph.D.
Jamestown College
Jamestown

Mike Burton
Discovery Jr. High
Fargo

Rita Charlebois, M.Ed.
Bismarck Public
Mandan

Maxine Foss
Leeds Public School
Leeds

Mary Gleason
Dakota Prairie High School
Petersburg

Mark Gonzalez, Ph.D.
North Dakota Geological Survey
Bismarck

Gary Jackson, M.Ed.
Valley
Hoople/Crystal

Michelle Keller, M.Ed.
Bisbee-Egeland High
Bisbee

Mary Kester
Burlington/Des Lacs Elementary at United #7
Burlington

Cy Kotaska
Sawyer Public
Sawyer

Judith Krueger
Enderlin Public
Enderlin

Ila LaChapelle
Walhalla High School
Walhalla

Robbi Jo Morgan
Roosevelt School
Minot

Sheryl Nesseth, M.Ed.
Century Elementary
Grand Forks

Susan Syverson
Washington Elementary
Jamestown

Pamela Thompson, M.Ed.
West Fargo High
Fargo

Elizabeth (Betty) Ussatis, M.Ed.
Washington Elementary
Valley City

Rae Ann Vandrovec
St. John's Academy
Jamestown

Mike Watterson, M.Ed.
Valley City Junior High
Valley City

TABLE OF CONTENTS

North Dakota Science Achievement Standards Writing Team	iii
Preface.....	v
Grade 4 Content Standards, Benchmarks, Achievement Levels	
Standard 1: Unifying Concepts	1
Standard 2: Science Inquiry.....	2
Standard 3: Physical Science	3
Standard 4: Life Science.....	4
Standard 5: Earth and Space Science.....	5
Standard 6: Science and Technology	6
Standard 7: Science and Other Areas	7
Standard 8: History and Nature of Science.....	8
Grade 8 Content Standards, Benchmarks, Achievement Levels	
Standard 1: Unifying Concepts	9
Standard 2: Science Inquiry.....	10
Standard 3: Physical Science	12
Standard 4: Life Science.....	13
Standard 5: Earth and Space Science.....	14
Standard 6: Science and Technology	16
Standard 7: Science and Other Areas	17
Standard 8: History and Nature of Science.....	18
Grade 12 Content Standards, Benchmarks, Achievement Levels	
Standard 1: Unifying Concepts	19
Standard 2: Science Inquiry.....	20
Standard 3: Physical Science	23
Standard 4: Life Science.....	25
Standard 5: Earth and Space Science.....	26
Standard 6: Science and Technology	27
Standard 7: Science and Other Areas	28
Standard 8: History and Nature of Science.....	30
References.....	31
Glossary.....	33

Preface

This document is a companion to the ***North Dakota Standards and Benchmarks: Content Standards - Science*** (2002). It provides descriptions in rubric form for levels of student achievement in relation to the state content standards and benchmarks for science.

These achievement levels are intended as a guide to:

- help teachers and administrators understand the expected student achievement of the content standards in science,
- assist science instruction; curriculum and assessment planners, designers, and writers,
- measure growth over time, and
- communicate with students, parents, school board members, and others about students' achievement of science.

The achievement levels defined in this document are written as expectations for students when they complete grades 4, 8, and 12. This document is designed for use by all educators in grades K-12. **The higher number achievement level assumes achievement of the lower levels.** The achievement levels for any standard assume increases in detail and knowledge as the grade levels rise. Therefore, the achievement levels expectation sometimes may appear similar across the grade levels.

The components of the document include:

- **Content Standards** – a description of what students should know and be able to do within a particular discipline or content domain.
- **Benchmarks** – A translation of a standard into what students should understand and be able to do at developmentally appropriate levels (of grade groupings K-4, 5-8, 9-12).
 - The Benchmarks do not describe in detail what students should know. Reference should be made to the **Examples of Specific Knowledge** section in the *North Dakota Standards and Benchmarks: Content Standards-Science* document. *The National Science Education Standards* (1996) and the *Benchmarks for Science Literacy* (1993)(from Project 2061) provide explanations of the specific knowledge and skills.

- **Achievement Levels** – Labels for the level of student performance in a content area that convey in a general manner the degree of student achievement in the content area, e.g. advanced proficiency, proficient, partially proficient, novice. Statements in rubric form describe the levels of student achievement for each benchmark from the state content standards for science.
 - **Level 4 Advanced Proficiency**
 - Demonstrates exemplary performance; *exceeds* the State standard
 - Advanced, outstanding, clear/dynamic; performance demonstrates thorough understanding.
 - **Level 3 Proficient ***
 - Demonstrates solid performance; *meets* the State standard
 - Good, acceptable, adequate; a complete and accurate understanding.
 - **Level 2 Partially Proficient**
 - Performance is emerging or developing toward the State standard.
 - Basic, attempted, inadequate; demonstrated incomplete understanding.
 - **Level 1 Novice**
 - Attempt made, but there are serious errors
 - Student is unable to do the task, complete the assignment or show comprehension of the activity.

*Level 3 **Proficient** describes what North Dakota educators hold to be the standard, a high yet achievable performance that can be expected of most students.

Grade 4 North Dakota Science Achievement Levels

Standard 1: Unifying Concepts

Students understand unifying concepts and processes of science.

4.1.1 Understand that a system is made up of parts that work together

Level 4: The student demonstrates that a system is made up of parts that work together.

Level 3: The student explains that a system is made up of parts that work together.

Level 2: The student identifies that a system is made up of parts that work together.

Level 1: The student is unable to identify that a system is made up of parts that work together.

4.1.2 Understand that models help explain objects and ideas

Level 4: The student creates a model to help explain an object or idea.

Level 3: The student demonstrates that a model helps explain objects and ideas.

Level 2: The student shows a model with limited explanation of objects and ideas.

Level 1: The student shows a model without relating it to objects and ideas.

4.1.3 Understand that changes might occur in properties of materials and in position and motion of objects

Level 4: The student demonstrates changes in properties of materials and in position and motion of objects.

Level 3: The student explains that changes might occur in properties of materials and in position and motion of objects.

Level 2: The student explains with inaccuracies that changes might occur in properties of materials and in position and motion of objects.

Level 1: The student is unable to explain that changes might occur in properties of materials and in position and motion of objects.

4.1.4 Understand that change might occur in order to maintain balance in a system

Level 4: The student demonstrates that change might occur in order to maintain balance in a system.

Level 3: The student explains that change might occur in order to maintain balance in a system.

Level 2: The student explains with inaccuracies that change might occur in order to maintain balance in a system.

Level 1: The student is unable to identify that change might occur in order to maintain balance in a system.

4.1.5 Understand relations between form and function

Level 4: The student demonstrates relations between form and function.

Level 3: The student describes relations between form and function.

Level 2: The student partially describes relations between form and function.

Level 1: The student is unable to describe relations between form and function.

Standard 2: Science Inquiry

Students use the process of science inquiry.

4.2.1 Use and integrate the science processes of observing, questioning, hypothesizing, and reflecting to investigate their world

Level 4: The student draws conclusions using and integrating the science processes of observing, questioning, hypothesizing, and reflecting to investigate their world.

Level 3: The student uses and integrates the science processes of observing, questioning, hypothesizing, and reflecting to investigate their world.

Level 2: The student uses but does not integrate the science processes of observing, questioning, hypothesizing, and reflecting to investigate their world.

Level 1: The student is unable to use and integrate the science processes of observing, questioning, hypothesizing, and reflecting to investigate their world.

4.2.2 Use simple scientific tools to gather information

Level 4: The student selects and uses appropriate simple scientific tools to gather information.

Level 3: The student uses simple scientific tools to gather information.

Level 2: The student has limited success using simple scientific tools to gather information.

Level 1: The student is unable to use simple scientific tools to gather information

4.2.3 Plan and conduct controlled investigations

Level 4: The student plans and conducts a controlled investigation testing more than one aspect of the variable.

Level 3: The student plans and conducts a controlled investigation.

Level 2: The student conducts a controlled investigation.

Level 1: The student is unable to plan or conduct a controlled investigation.

4.2.4 Keep records of their investigations and share their results with others as scientists do

Level 4: The student keeps records, draws conclusions, and shares the results of their investigations with others as scientists do.

Level 3: The student keeps records of their investigations and shares their results with others as scientists do.

Level 2: The student keeps inaccurate records of their investigations but is able to share their results with others.

Level 1: The student is unable to keep records of their investigations and is unable to share their results with others.

4.2.5 Review scientific investigations done by others as scientists do

Level 4: The student reviews and duplicates scientific investigations done by others as scientists do.

Level 3: The student reviews scientific investigations done by others as scientists do.

Level 2: The student recognizes that scientific investigations are reviewed by others.

Level 1: The student does not recognize that scientific investigations are reviewed by others.

Standard 3: Physical Science

Students understand the basic concepts and principals of physical science.

4.3.1 Know properties of objects and materials

Level 4: The student analyzes properties of objects and materials and states examples.

Level 3: The student identifies properties of objects and materials.

Level 2: The student identifies with some inaccuracies properties of objects and materials.

Level 1: The student identifies few or no properties of objects and materials.

4.3.2 Know that position and motion of objects can be described and changed

Level 4: The student demonstrates that the position and motion of objects can be described and changed.

Level 3: The student states that the position and motion of objects can be described and changed.

Level 2: The student states with some inaccuracies that the position and motion of objects can be described and changed.

Level 1: The student states with many inaccuracies that the position and motion of objects can be described and changed.

4.3.3 Know characteristics of light, heat, electricity, and magnetism

Level 4: The student describes the characteristics of light, heat, electricity, and magnetism.

Level 3: The student identifies the characteristics of light, heat, electricity, and magnetism.

Level 2: The student identifies with some inaccuracies the characteristics of light, heat, electricity, and magnetism.

Level 1: The student identifies with many inaccuracies the characteristics of light, heat, electricity, and magnetism.

Standard 4: Life Science

Students understand the basic concepts and principles of life science

4.4.1 *Understand the characteristics of organisms*

Level 4: The student compares and contrasts the characteristics of organisms.

Level 3: The student explains the characteristics of organisms.

Level 2: The student lists the characteristics of organisms.

Level 1: The student lists with inaccuracies the characteristics of organisms.

4.4.2 *Know the characteristics of the life cycle of organisms*

Level 4: The student differentiates among the characteristics of the life cycle of organism.

Level 3: The student describes the characteristics of the life cycle of organisms.

Level 2: The student describes with inaccuracies the characteristics of the life cycle of organisms.

Level 1: The student is unable to describe the characteristics of the life cycle of organisms.

4.4.3 *Understand relations between organisms and environment*

Level 4: The student analyzes relations between organisms and environment.

Level 3: The student explains relations between organisms and environment.

Level 2: The student identifies relations between organisms and environment.

Level 1: The student identifies with inaccuracies relations between organisms and environment.

4.4.4 *Know that changes in life forms have occurred over time*

Level 4: The student gives examples with supporting details that changes in life forms have occurred over time.

Level 3: The student identifies that changes in life forms have occurred over time.

Level 2: The student identifies with inaccuracies that changes in life forms have occurred over time.

Level 1: The student is unable to identify that changes in life forms have occurred over time.

Standard 5: Earth and Space Science

Students understand the basic concepts and principles of earth and space science.

4.5.1 Know the properties and uses of earth materials

Level 4: The student compares and contrasts the properties and uses of earth materials.

Level 3: The student identifies the properties and uses of earth materials.

Level 2: The student identifies with inaccuracies the properties and uses of earth materials.

Level 1: The student identifies with many inaccuracies the properties and uses of earth materials.

4.5.2 Know the names and basic characteristics of celestial objects

Level 4: The student states the names and describes the basic characteristics of celestial objects.

Level 3: The student states the names and basic characteristics of celestial objects.

Level 2: The student states with inaccuracies the names and basic characteristics of celestial objects.

Level 1: The student states with many inaccuracies the names and basic characteristics of celestial objects.

4.5.3 Know ways that changes occur in Earth's surface and atmosphere

Level 4: The student demonstrates ways that changes occur in Earth's surface and atmosphere.

Level 3: The student describes ways that changes occur in Earth's surface and atmosphere.

Level 2: The student describes with inaccuracies ways that changes occur in Earth's surface and atmosphere.

Level 1: The student describes with many inaccuracies ways that changes occur in Earth's surface and atmosphere.

Standard 6: Science and Technology

Students understand relations between science and technology.

4.6.1 Know the various forms that technology can take

- Level 4: The student evaluates the various forms that technology can take.
- Level 3: The student illustrates the various forms that technology can take.
- Level 2: The student lists some of the various forms that technology can take.
- Level 1: The student lists few or none of the various forms that technology can take.

4.6.2 Distinguish how natural objects differ from those made by humans

- Level 4: The student compares and contrasts natural objects to those made by humans and evaluates their use.
- Level 3: The student compares and contrasts natural objects to those made by humans.
- Level 2: The student compares and contrasts with inaccuracies natural objects to those made by humans.
- Level 1: The student is unable to compare and contrast natural objects to those made by humans

4.6.3 Design technological solutions to a problem

- Level 4: The student creates, evaluates, and justifies a technological solution to a problem.
- Level 3: The student creates a model of a technological solution to a problem.
- Level 2: The student creates a model that offers no technological solution to a problem.
- Level 1: The student is unable to create a model of a technological solution to a problem.

4.6.3 Understand concepts and applications of science and technology

- Level 4: The student explains concepts and applications of science and technology and evaluates their use.
- Level 3: The student explains concepts and applications of science and technology.
- Level 2: The student explains with inaccuracies concepts and applications of science and technology.
- Level 1: The student is unable to explain concepts and applications of science and technology.

Standard 7: Science and other Areas

Students understand relations between science and personal, social, and environmental issues.

4.7.1 *Know basic concepts of personal health*

- Level 4: The student applies basic concepts of personal health.
- Level 3: The student illustrates basic concepts of personal health.
- Level 2: The student identifies some basic concepts of personal health.
- Level 1: The student is unable to identify basic concepts of personal health.

4.7.2 *Understands characteristics of and changes in populations of organisms*

- Level 4: The student explains characteristics of and changes in populations of organisms.
- Level 3: The student distinguishes characteristics of and changes in populations of organisms.
- Level 2: The student distinguishes with inaccuracies characteristics of and changes in populations of organisms.
- Level 1: The student is unable to distinguish characteristics of and changes in populations of organisms.

4.7.3 *Understand how different types of resources affect our lives*

- Level 4: The student evaluates how different types of resources affect our lives.
- Level 3: The student describes how different types of resources affect our lives.
- Level 2: The student names resources but is unable to tell how different types of resources affect our lives.
- Level 1: The student is unable to name resources that affect our lives.

4.7.4 *Understand how changes in environments affect populations of organisms*

- Level 4: The student interprets how changes in environments affect populations of organisms.
- Level 3: The student explains how changes in environments affect populations of organisms.
- Level 2: The student gives examples of changes in environments but is unable to tell how the changes affect populations of organisms.
- Level 1: The student identifies changes in environments but is unable to tell how the changes affect populations or organisms.

4.7.5 *Understand how culture influences the way people relate to science*

- Level 4: The student evaluates how culture influences the way people relate to science.
- Level 3: The student describes how culture influences the way people relate to science.
- Level 2: The student identifies how culture influences the way people relate to science.
- Level 1: The student has little or no recognition of how culture influences the way people relate to science.

Standard 8: History and Nature of Science

Students understand the history and nature of science.

4.8.1 *Understand how people have used science throughout time*

Level 4: The student questions and justifies how people have used science throughout time.

Level 3: The student demonstrates how people have used science throughout time.

Level 2: The student identifies how people have used science throughout time.

Level 1: The student has limited success identifying how people have used science throughout time.

4.8.2 *Know basic beliefs and attitudes that scientists share*

Level 4: The student summarizes basic beliefs and attitudes that scientists share.

Level 3: The student states basic beliefs and attitudes that scientists share.

Level 2: The student states with inaccuracies basic beliefs and attitudes that scientists share.

Level 1: The student is unable to state basic beliefs and attitudes that scientists share.

4.8.3 *Understand the role of individuals and cultures in contributing to science*

Level 4: The student explains the role of individuals and cultures in contributing to science.

Level 3: The student identifies the role of individuals and cultures in contributing to science.

Level 2: The student identifies the role of individuals in contributing to science.

Level 1: The student is unable to identify the role of individuals and cultures in contributing to science.

Grade 8 North Dakota Science Achievement Levels

Standard 1: Unifying Concepts

Students understand unifying concepts and processes of science.

8.1.1 *Understand the structure and organization of systems*

Level 4: The student explains the structure and organization of systems.
Level 3: The student describes the structure and organization of systems.
Level 2: The student recognizes the structure and organization of systems.
Level 1: The student has little or no recognition of the structure and organization of systems.

8.1.2 *Understand how models can be used to explain scientific principles*

Level 4: The student demonstrates how models can be used to explain scientific principles.
Level 3: The student describes how models can be used to explain scientific principles.
Level 2: The student recognizes how models can be used to explain scientific principles.
Level 1: The student has little or no recognition of how models can be used to explain scientific principles.

8.1.3 *Understand how patterns of change and constancy apply to various systems*

Level 4: The student demonstrates how patterns of change and constancy apply to various systems.
Level 3: The student describes how patterns of change and constancy apply to various systems.
Level 2: The student identifies with inaccuracies how patterns of change and constancy apply to various systems.
Level 1: The student is unable to identify how patterns of change and constancy apply to various systems.

8.1.4 *Understand how change affects systems in equilibrium*

Level 4: The student analyzes and predicts how change may affect systems in equilibrium.
Level 3: The student explains how change affects systems in equilibrium.
Level 2: The student recognizes how change affects systems in equilibrium.
Level 1: The student has little or no recognition of how change affects systems in equilibrium.

8.1.5 *Understand relations between form and function*

Level 4: The student analyzes and gives examples of relations between form and function.
Level 3: The student describes relations between form and function.
Level 2: The student identifies relations between form and function.
Level 1: The student has little or no recognition of relations between form and function.

Standard 2: Science Inquiry

Students use the process of science inquiry.

8.2.1	<i>Understand how questions that can be answered by scientific inquiry differ from those that can not</i>
	Level 4: The student demonstrates how questions that can be answered by scientific inquiry differ from those that can not. Level 3: The student explains how questions that can be answered by scientific inquiry differ from those that can not. Level 2: The student recognizes how questions that can be answered by scientific inquiry differ from those that can not. Level 1: The student is unable to recognize how questions that can be answered by scientific inquiry differ from those that can not.
8.2.2	<i>Design and carry out a scientific investigation</i>
	Level 4: The student evaluates the design and methodology of a scientific investigation. Level 3: The student designs and carries out a scientific investigation. Level 2: The student cannot design but can carry out a procedure for a scientific investigation. Level 1: The student is unable to design or carry out a scientific investigation.
8.2.3	<i>Use appropriate technology and techniques to gather and interpret data</i>
	Level 4: The student analyzes the appropriateness of different technologies and techniques to gather and interpret data. Level 3: The student uses appropriate technology and techniques to gather and interpret data. Level 2: The student uses appropriate technology and techniques to gather data but cannot interpret data. Level 1: The student is unable to use appropriate technology and techniques to gather data.
8.2.4	<i>Use acquired data to develop descriptions, explanations, predictions, and models</i>
	Level 4: The student justifies use of acquired data to develop descriptions, explanations, predictions, and models. Level 3: The student uses acquired data to develop descriptions, explanations, predictions, and models. Level 2: The student misuses acquired data to develop flawed descriptions, explanations, predictions or models. Level 1: The student is unable to use the acquired data to develop descriptions, explanations, predictions or models.
8.2.5	<i>Use acquired data and critical analysis to formulate conclusions</i>
	Level 4: The student justifies use of acquired data and critical analysis to formulate conclusions. Level 3: The student uses acquired data and critical analysis to formulate conclusions. Level 2: The student misuses acquired data and critical analysis to formulate conclusions. Level 1: The student is unable to use acquired data and critical analysis to formulate conclusions.

8.2.6 *Understand that alternative explanations and procedures in scientific inquiry may exist*

Level 4: The student analyzes and evaluates alternative explanations and procedures in scientific inquiry.

Level 3: The student demonstrates that alternative explanations and procedures in scientific inquiry may exist.

Level 2: The student recognizes that alternative explanations and procedures in scientific inquiry may exist.

Level 1: The student is unable to recognize that alternative explanations and procedures in scientific inquiry may exist.

8.2.7 *Communicate the aspects of a scientific investigation in a variety of ways*

Level 4: The student selects and utilizes the most appropriate ways to communicate the aspects of a scientific investigation.

Level 3: The student communicates the aspects of a scientific investigation in a variety of ways.

Level 2: The student communicates the aspects of a scientific investigation in a single way.

Level 1: The student is unable to communicate the aspects of a scientific investigation.

8.2.8 *Use mathematics in the process of scientific inquiry*

Level 4: The student defends their use of mathematics in the process of scientific inquiry.

Level 3: The student uses mathematics in the process of scientific inquiry.

Level 2: The student misuses mathematics in the process of scientific inquiry.

Level 1: The student is unable to use mathematics in the process of scientific inquiry.

Standard 3: Physical Science

Students understand the basic concepts and principles of physical science.

8.3.1 *Understand properties of matter and their relation to physical and chemical changes in matter*

Level 4: The student compares categories of matter and explains relations of properties of matter to physical and chemical change.

Level 3: The student identifies common properties of matter and describes relations of properties to physical and chemical change.

Level 2: The student identifies some properties of matter, distinguishes between physical and chemical change, but cannot describe their relation.

Level 1: The student has difficulty identifying properties of matter and cannot state their relation to physical and chemical change.

8.3.2 *Understand relations between force and motion*

Level 4: The student analyzes and predicts relations between force and motion.

Level 3: The student identifies various forces and demonstrates their relation to motion.

Level 2: The student defines force and motion, however, has difficulty determining relations between force and motion.

Level 1: The student has little or no recognition of relations between force and motion.

8.3.3 *Know the characteristics of various forms of energy and the principles governing energy transformation and transfer*

Level 4: The student compares characteristics of various forms of energy and gives examples that illustrate the principles governing energy transformation and transfer.

Level 3: The student describes the characteristics of various forms of energy and identifies the principles of energy transformation and transfer.

Level 2: The student identifies some characteristics of various forms of energy and some of the principles governing energy transformation and transfer.

Level 1: The student is unable to identify any of the characteristics of various forms of energy and the principles governing energy transformation and transfer.

Standard 4: Life Science

Students understand the basic concepts and principles of life and science.

8.4.1 *Understand relations between structure and function in living systems*

Level 4: The student interprets and gives examples of relations between structure and function in living things.

Level 3: The student describes relations between structure and function in living things.

Level 2: The student identifies relations between structure and function in living things.

Level 1: The student has little or no recognition of relations between structure and function in living things.

8.4.2 *Understand the basic principles governing genetics and reproduction*

Level 4: The student describes and analyzes the basic principles governing genetics and reproduction.

Level 3: The student explains the basic principles governing genetics and reproduction.

Level 2: The student identifies the basic principles governing genetics and reproduction.

Level 1: The student has difficulty identifying the basic principles governing genetics and reproduction.

8.4.3 *Understand regulation in and behavior of organisms*

Level 4: The student justifies the role of regulation in and behavior of organisms.

Level 3: The student describes and gives examples of regulation in and behavior of organisms.

Level 2: The student can give some examples of regulation in and behavior of organisms.

Level 1: The student has little or no recognition of regulation in and behavior of organisms.

8.4.4 *Understand the interactions of populations in ecosystems*

Level 4: The student analyzes the interactions of populations in ecosystems.

Level 3: The student describes the interactions of populations in ecosystems.

Level 2: The student identifies the interactions of populations in ecosystems.

Level 1: The student has little or no recognition of the interactions of populations in ecosystems.

8.4.5 *Understand the cause and significance of diversity and adaptations of organisms*

Level 4: The student examines and assesses the cause and significance of diversity and adaptations of organisms.

Level 3: The student explains the cause and significance of diversity and adaptations of organisms.

Level 2: The student identifies some of the causes and significances of diversity and adaptations of organisms.

Level 1: The student recognizes the diversity and adaptations of organisms but has little recognition of the cause and significance.

Standard 5: Earth and Space Science

Students understand the basic concepts and principles of earth and space science.

8.5.1	<i>Understand the structure and processes of Earth</i>
	Level 4: The student describes and relates the structure to the processes of Earth. Level 3: The student explains the structure and processes of Earth. Level 2: The student lists and defines the structure and processes of Earth. Level 1: The student has difficulty listing and defining the structure and processes of Earth.
8.5.2	<i>Understand landforms and the processes that change the surface of Earth</i>
	Level 4: The student connects landforms with the processes that change the surface of Earth. Level 3: The student identifies and describes landforms and the processes that change the surface of Earth. Level 2: The student identifies some landforms and the processes that change the surface of Earth. Level 1: The student has difficulty identifying landforms and the processes that change the surface of Earth.
8.5.3	<i>Understand the types of evidence used to reconstruct the history of Earth and the evolution of life</i>
	Level 4: The student explains the types of evidence used to reconstruct the history of Earth and the evolution of life. Level 3: The student points out the types of evidence used to reconstruct the history of Earth and the evolution of life. Level 2: The student lists some types of evidence used to reconstruct the history of Earth and the evolution of life. Level 1: The student is unable to list the types of evidence used to reconstruct the history of Earth and the evolution of life.
8.5.4	<i>Understand the structure and processes of Earth's atmosphere</i>
	Level 4: The student describes relations occurring within the structure and processes of Earth's atmosphere. Level 3: The student explains the structure and processes of Earth's atmosphere. Level 2: The student lists and defines the structure and processes of Earth's atmosphere. Level 1: The student has difficulty listing and defining the structure and processes of Earth's atmosphere.
8.5.5	<i>Understand the structure and processes of the oceans</i>
	Level 4: The student describes relations occurring within the structure and processes of the oceans. Level 3: The student explains the structure and processes of the oceans. Level 2: The student lists and defines the structure and processes of the oceans. Level 1: The student has difficulty listing and defining the structure and processes of the oceans.

8.5.6 *Understand the Theory of Plate Tectonics*

Level 4: The student employs the Theory of Plate Tectonics to explain the resulting phenomena.

Level 3: The student summarizes the Theory of Plate Tectonics.

Level 2: The student states the Theory of Plate Tectonics.

Level 1: The student is unable to state the Theory of Plate Tectonics.

8.5.7 *Understand the structure and features of our solar system and the universe and the relations between them*

Level 4: The student analyzes the structure and features of our solar system and the universe and the relations between them.

Level 3: The student explains the structure and features of our solar system and the universe and the relations between them.

Level 2: The student identifies some of the structure and features of our solar system and the universe and the relations between them.

Level 1: The student has difficulty identifying any structure and features of our solar system and the universe and the relations between them.

Standard 6: Science and Technology

Students understand relations between science and technology.

8.6.1 *Design a solution, using science and technology, to a problem related to human needs or wants*

Level 4: The student, using science and technology, designs, presents, and defends a solution to a problem related to human needs or wants.

Level 3: The student designs a solution, using science and technology, to a problem related to human needs or wants.

Level 2: The student attempts, with partial success, to design a solution, using science and technology, to a problem related to human needs or wants.

Level 1: The student is unable to design a solution to a problem related to human needs or wants.

8.6.2 *Understand how science and technology are similar and different*

Level 4: The student discriminates between science and technology and evaluates their proper application.

Level 3: The student explains how science and technology are similar and different.

Level 2: The student lists examples of science and technology.

Level 1: The student is unable to differentiate between science and technology

8.6.3 *Understand the limitations and possibility for unintended outcomes of technological solutions*

Level 4: The student assesses the limitations and possibility for unintended outcomes of technological solutions.

Level 3: The student describes the limitations and possibility for unintended outcomes of technology solutions

Level 2: The student recognizes limitations and possibility for unintended outcomes of technological solutions.

Level 1: The student is unable to recognize limitations and possibility for unintended outcomes of technological solutions.

Standard 7: Science and Other Areas

Students understand relations between science and personal, social, and environmental issues.

8.7.1 Understand how science influences personal health

Level 4: The student analyzes and predicts how science may influence personal health.

Level 3: The student explains how science influences personal health.

Level 2: The student recognizes and gives examples of how science influences personal health.

Level 1: The student has little or no recognition of how science influences personal health.

8.7.2 Understand how limiting factors affect populations, resources, and environments

Level 4: The student analyzes and predicts how limiting factors may affect populations, resources, and environments.

Level 3: The student explains how limiting factors affect populations, resources, and environments.

Level 2: The student recognizes and gives examples of how limiting factors affect populations, resources, and environments.

Level 1: The student has little or no recognition of how limiting factors affect populations, resources, and environments.

8.7.3 Understand the challenges presented to the individual and society by human-induced hazards

Level 4: The student analyzes and predicts how human-induced hazards may present challenges to the individual and society.

Level 3: The student explains how human-induced hazards present challenges to the individual and society.

Level 2: The student recognizes and gives examples of human-induced hazards that present challenges to the individual and society.

Level 1: The student has little or no recognition of how human-induced hazards present challenges to the individual and society.

8.7.4 Use a systematic approach to analyze risks and benefits

Level 4: The student uses more than one systematic approach to analyze risks and benefits.

Level 3: The student uses a systematic approach to analyze risks and benefits.

Level 2: The student uses a flawed approach to analyze risks and benefits.

Level 1: The student does not use a systematic approach to analyze risks and benefits.

8.7.5 Understand the limitations of science and technology in dealing with social issues

Level 4: The student analyzes the limitations of science and technology in dealing with social issues.

Level 3: The student explains the limitations of science and technology in dealing with social issues.

Level 2: The student recognizes and gives examples of the limitations of science and technology in dealing with social issues.

Level 1: The student has little or no recognition of the limitations of science and technology in dealing with social issues.

Standard 8: History and Nature of Science

Students understand the history of nature of science

8.8.1 *Understand how science is influenced by human qualities*

Level 4: The student explains how science can be influenced by human qualities.

Level 3: The student lists examples of how science is influenced by human qualities.

Level 2: The student recognizes that science is a human endeavor.

Level 1: The student has little or no recognition of how science is influenced by human qualities.

8.8.2 *Understand how scientists' beliefs and attitudes influence their work*

Level 4: The student explains how scientists' beliefs and attitudes influence their work.

Level 3: The student lists examples of how scientists' beliefs and attitudes influence their work.

Level 2: The student recognizes how scientists' beliefs and attitudes influence their work.

Level 1: The student has little or no recognition of how scientists' beliefs and attitudes influence their work.

8.8.3 *Understand how science has changed from a historical perspective*

Level 4: The student explains how science has changed from a historical perspective.

Level 3: The student lists examples of how science has changed from a historical perspective.

Level 2: The student recognizes how science has changed from a historical perspective.

Level 1: The student has little or no recognition of how science has changed from a historical perspective.

Grade 12 North Dakota Science Achievement Levels

Standard 1: UNIFYING CONCEPTS

Students understand unifying concepts and processes of science.

12.1.1 *Understand the structure, organization, and dynamics of systems*

Level 4: The student analyzes the components and interactions of a system.

Level 3: The student describes the structure, organization, and dynamics of systems.

Level 2: The student describes with inaccuracies the structure, organization, and dynamics of systems.

Level 1: The student is unable to describe the structure, organization, and dynamics of systems.

12.1.2 *Understand how scientists create and use models*

Level 4: The student proposes and/or uses a model in a scientific investigation.

Level 3: The student explains how scientists create and use models.

Level 2: The student explains with inaccuracies how scientists create and use models.

Level 1: The student is unable to explain how scientists create and use models.

12.1.3 *Understand concepts of constancy and change*

Level 4: The student models concepts of constancy and change.

Level 3: The student explains concepts of constancy and change.

Level 2: The student identifies concepts of constancy and change.

Level 1: The student is unable to identify concepts of constancy and change.

12.1.4 *Understand principles governing evolution and equilibrium within systems*

Level 4: The student investigates principles governing evolution and equilibrium within systems.

Level 3: The student explains principles governing evolution and equilibrium within systems.

Level 2: The student identifies principles governing evolution and equilibrium within systems.

Level 1: The student is unable to identify principles governing evolution and equilibrium within systems.

12.1.5 *Understand relations between form and function*

Level 4: The student uses form to predict function and uses function to predict form.

Level 3: The student illustrates relations between form and function.

Level 2: The student identifies relations between form and function.

Level 1: The student makes little connection between form and function.

Standard 2: SCIENCE INQUIRY

Students use the process of science inquiry.

12.2.1 *Identify problems, develop appropriate questions, and recognize relevant concepts that guide scientific investigations*

Level 4: The student can identify problems, develop appropriate questions, recognize relevant concepts that guide scientific investigations and formulate a testable hypothesis.

Level 3: The student identifies problems, develops appropriate questions, and recognizes relevant concepts that guide scientific investigations.

Level 2: The student, with inaccuracies, identifies problems, develops questions, and recognizes relevant concepts that guide scientific investigations.

Level 1: The student cannot identify problems, develop appropriate questions or recognize relevant concepts that guide scientific investigations.

12.2.2 *Design and conduct investigations in various ways to solve problems in a variety of forms*

Level 4: The student evaluates the design of an investigation and justifies modifications.

Level 3: The student designs and conducts investigations in various ways to solve problems in a variety of forms.

Level 2: The student cannot design but can conduct investigations in various ways to solve problems in a variety of forms.

Level 1: The student can neither design nor conduct investigations in various ways to solve problems in a variety of forms.

12.2.3 *Use appropriate measuring systems and tools*

Level 4: The student converts between measuring systems and uses appropriate tools.

Level 3: The student uses appropriate measuring systems and tools.

Level 2: The student can identify measuring systems and tools but cannot use them appropriately.

Level 1: The student cannot relate measuring systems to the appropriate tools.

12.2.4 *Collect, organize, analyze, and use data to solve problems*

Level 4: The student collects, organizes, analyzes, and uses data to solve problems and to generate questions for research.

Level 3: The student collects, organizes, analyzes and uses data to solve problems.

Level 2: The student collects and organizes but improperly analyzes or uses data to solve problems.

Level 1: The student collects but improperly organizes, analyzes, and uses data to solve problems.

12.2.5 *Formulate conclusions based upon experimental data*

Level 4: The student formulates conclusions and makes predictions based upon experimental data.

Level 3: The student formulates conclusions based upon experimental data.

Level 2: The student formulates inaccurate conclusions based upon experimental data.

Level 1: The student is unable to formulate conclusions based upon experimental data.

12.2.6 *Identify and analyze alternative explanations to scientific problems*

Level 4: The student generates and analyzes alternative explanations to scientific problems.

Level 3: The student identifies and analyzes alternative explanations to scientific problems.

Level 2: The student identifies but cannot analyze alternative explanations to scientific problems.

Level 1: The student can neither identify nor analyze alternative explanations to scientific problems.

12.2.7 *Use knowledge and skills from other academic disciplines to solve problems in science*

Level 4: The student develops novel approaches to problem solving in science by integrating knowledge and skills from other academic disciplines.

Level 3: The student integrates knowledge and skills from other academic disciplines to solve problems in science.

Level 2: The student inappropriately applies knowledge and skills from other academic disciplines to address problems in science.

Level 1: The student is unable to transfer knowledge and skills from other academic disciplines to address problems in science.

12.2.8 *Use various forms of communication to present results and explanations of scientific investigations*

Level 4: The student selects and uses appropriate forms of communication to present results and explanations of scientific investigations to a targeted audience.

Level 3: The student presents results and explanations of scientific investigations using various forms of communication.

Level 2: The student ineffectively communicates results and explanations of scientific investigations.

Level 1: The student is unable to communicate results and explanations of scientific investigations.

Standard 3: PHYSICAL SCIENCE

Students understand the basic concepts and principles of physical science.

12.3.1 *Understand the structure and behavior of atoms*

Level 4: The student interprets relations between the structure of atoms and their behavior.

Level 3: The student explains the structure of atoms.

Level 2: The student identifies the structure of atoms.

Level 1: The student identifies incompletely the structure.

12.3.2 *Understand the structure, composition, and properties of matter*

Level 4: The student analyzes how the structure and composition of matter relate to its properties and correctly identifies and represents matter by name and formula.

Level 3: The student describes the structure and composition of matter and identifies differences in its properties.

Level 2: The student describes some properties of matter and identifies with some inaccuracies differences in structure and composition of matter.

Level 1: The student identifies with difficulty the structure, composition and properties of matter.

12.3.3 *Understand the characteristics of chemical reactions*

Level 4: The student uses characteristics of chemical reactions to predict products of chemical reactions and to analyze associated energy changes.

Level 3: The student models and explains the characteristics of chemical reactions.

Level 2: The student models characteristics of chemical reactions with some inaccuracies.

Level 1: The student models with difficulty the characteristics of chemical reactions.

12.3.4 *Understand the principles and relations influencing forces and motion*

Level 4: The student analyzes and illustrates the principles and relations influencing forces and motion.

Level 3: The student explains the principles and relations influencing forces and motion.

Level 2: The student describes with some inaccuracies the principles and relations influencing forces and motion.

Level 1: The student has difficulty identifying the principles and relations influencing forces and motion.

12.3.5 *Understand the properties and behaviors of waves*

Level 4: The student interprets the properties and behaviors of waves as they relate to the natural world.

Level 3: The student describes the properties and behaviors of waves.

Level 2: The student partially describes properties and behaviors of waves.

Level 1: The student has difficulty identifying properties and behaviors of waves.

12.3.6 *Understand the Law of Conservation of Energy and its implications*

Level 4: The student thoroughly explains the Law of Conservation of Energy and its implications and generates examples illustrating energy transformations.

Level 3: The student explains the Law of Conservation of Energy and its implications.

Level 2: The student partially explains the Law of Conservation of Energy and its implications.

Level 1: The student cannot explain the Law of Conservation of Energy.

12.3.7 *Understand interactions of energy and matter*

Level 4: The student analyzes the changes brought about by the interaction of energy and matter.

Level 3: The student explains the interactions of energy and matter change.

Level 2: The student explains simple relations between energy and matter.

Level 1: The student has difficulty explaining simple relations between energy and matter.

Standard 4: LIFE SCIENCE

Students understand the basic concepts and principles of life science.

12.4.1	<p><i>Understand the structure and function of cells and their components</i></p> <p>Level 4: The student analyzes the structure and function of cells and their components. Level 3: The student identifies and explains the structure and function of cells and their components. Level 2: The student identifies some of the structures and/or functions of cells and their components. Level 1: The student has difficulty recognizing the structure and function of cells and their components.</p>
12.4.2	<p><i>Understand how systems and organisms develop through the differentiation of cells</i></p> <p>Level 4: The student compares and contrasts how systems and organisms develop through the differentiation of cells. Level 3: The student explains how systems and organisms develop through the differentiation of cells. Level 2: The student explains with some inaccuracies how systems and organisms develop through the differentiation of cells. Level 1: The student has difficulty relating the development of systems and organisms to the differentiation of cells.</p>
12.4.3	<p><i>Understand the molecular basis of heredity</i></p> <p>Level 4: The student applies the molecular basis of heredity to genetics. Level 3: The student explains the molecular basis of heredity. Level 2: The student identifies the molecular basis of heredity. Level 1: The student makes little connection between heredity and its molecular basis.</p>
12.4.4	<p><i>Understand the theory of biological evolution</i></p> <p>Level 4: The student relates the theory of biological evolution to the diversity of organisms. Level 3: The student explains the theory of biological evolution. Level 2: The student identifies some aspects of the theory of biological evolution. Level 1: The student has difficulty identifying key aspects of biological evolution.</p>
12.4.5	<p><i>Understand the interdependence of organisms and their environments</i></p> <p>Level 4: The student analyzes the interrelations and interdependencies within an ecosystem. Level 3: The student explains the interdependence of organisms and their environments. Level 2: The student identifies examples of interdependence of organisms and their environments. Level 1: The student makes few connections between organisms and their environments.</p>

12.4.6 *Understand the role of matter and energy in the organization of living systems*

Level 4: The student demonstrates the role of natural cycles in maintaining organization of living systems.

Level 3: The student explains the role of matter and energy in the organization of living systems.

Level 2: The student identifies examples of the role of matter and energy in the organization of living systems.

Level 1: The student makes few connections between matter, energy and organization in living systems.

Standard 5: EARTH AND SPACE SCIENCE

Students understand the basic concepts and principles of earth and space science.

12.5.1 Understand the origin and evolution of the earth system

Level 4: The student evaluates theories of the origin and evolution of the earth system.

Level 3: The student explains the origin and evolution of the earth system.

Level 2: The student describes with inaccuracies the origin and evolution of the earth system.

Level 1: The student describes with many inaccuracies the origin and evolution of the earth system.

12.5.2 Understand the origin and evolution of the universe

Level 4: The student evaluates theories of the origin and evolution of the universe.

Level 3: The student explains the origin and evolution of the universe.

Level 2: The student describes with inaccuracies the origin and evolution of the universe.

Level 1: The student describes with many inaccuracies the origin and evolution of the universe.

12.5.3 Understand the principles governing energy and its transfer in the earth system

Level 4: The student comprehensively relates the principles governing energy and its transfer to changes in the earth system.

Level 3: The student explains the principles governing energy and its transfer in the earth system.

Level 2: The student identifies principles governing energy and its transfer in the earth system.

Level 1: The student identifies few principles governing energy and its transfer in the earth system.

12.5.4 Understand the interactions among the geosphere, hydrosphere, atmosphere, and biosphere

Level 4: The student comprehensively illustrates the cyclic nature of interactions among the geosphere, hydrosphere, atmosphere and biosphere.

Level 3: The student formulates examples of interactions among the geosphere, hydrosphere, atmosphere, and biosphere.

Level 2: The student identifies examples of interactions among the geosphere, hydrosphere, atmosphere, and biosphere.

Level 1: The student identifies with inaccuracies examples of interactions among the geosphere, hydrosphere, atmosphere, and biosphere.

12.5.5 Understand the effects that geologic processes and human activities can have on the environment

Level 4: The student predicts and evaluates effects that geologic processes and human activities can have on the environment.

Level 3: The student describes effects that geologic processes and human activities can have on the environment.

Level 2: The student identifies effects that geologic processes and human activities can have on the environment.

Level 1: The student makes few connections between geologic processes and human activities and the environment.

Standard 6: SCIENCE AND TECHNOLOGY

Students understand relations between science and technology.

12.6.1 *Understand the role of technology in applying scientific knowledge to meet human needs and wants*

Level 4: The student evaluates the role of technology in applying scientific knowledge to meet human needs and wants.

Level 3: The student explains the role of technology in applying scientific knowledge to meet human needs and wants.

Level 2: The student identifies examples of the role of technology in applying scientific knowledge to meet human needs and wants.

Level 1: The student makes little connection between human needs and wants and the application of technology and scientific knowledge.

12.6.2 *Use technological design to solve a problem or to improve current technology*

Level 4: The student evaluates the effectiveness of technological design to solve a problem or to improve current technology.

Level 3: The student utilizes technological design to solve a problem or to improve current technology.

Level 2: The student uses available technology appropriately.

Level 1: The student attempts with limited success to use available technology.

12.6.3 *Understand how scientific and technological developments interact and produce consequences*

Level 4: The student demonstrates how scientific and technological developments interact and produce consequences.

Level 3: The student describes how scientific and technological developments interact and produce consequences.

Level 2: The student identifies how scientific and technological developments interact and produce consequences.

Level 1: The student is unable to relate the interaction of scientific and technological developments to consequences.

Standard 7: SCIENCE AND OTHER AREAS

Students understand relations between science and personal, social, and environmental issues.

12.7.1	<p><i>Understand relations between science and personal and community health issues</i></p> <p>Level 4: The student evaluates the effects of science on personal and community health issues. Level 3: The student describes relations between science and personal and community health issues. Level 2: The student recognizes that science relates to personal and community health issues. Level 1: The student makes little connection between science and personal and community health issues.</p>
12.7.2	<p><i>Understand the principles governing change and how change affects the environment and quality of life</i></p> <p>Level 4: The student uses principles governing change to predict how change may impact the environment and quality of life. Level 3: The student explains the principles governing change and how change affects the environment and quality of life. Level 2: The student explains with inaccuracies the principles governing change and how change affects the environment and quality of life. Level 1: The student makes little connection between principles governing change and how change affects the environment and quality of life.</p>
12.7.3	<p><i>Understand how natural resources are affected by social and environmental issues and variables</i></p> <p>Level 4: The student analyzes effects of social and environmental issues and variables on natural resources. Level 3: The student explains how natural resources are affected by social and environmental issues and variables. Level 2: The student explains with inaccuracies how natural resources are affected by social and environmental issues and variables. Level 1: The student makes little connection between social and environmental issues and their effects on natural resources.</p>
12.7.4	<p><i>Understand components of and issues affecting environmental quality</i></p> <p>Level 4: The student evaluates components of and issues affecting environmental quality. Level 3: The student explains components of and issues affecting environmental quality. Level 2: The student explains with inaccuracies components of and issues affecting environmental quality. Level 1: The student explains with many inaccuracies components of and issues affecting environmental quality.</p>

12.7.5 *Understand the role of science and technology in addressing local, national, and global challenges*

Level 4: The student analyzes the role of science and technology in addressing local, national, and global challenges.

Level 3: The student describes the role of science and technology in addressing local, national, and global challenges.

Level 2: The student describes with inaccuracies the role of science and technology in addressing local, national, and global challenges.

Level 1: The student describes with many inaccuracies the role of science and technology in addressing local, national, and global challenges.

12.7.6 *Understand how science and technology influence personal, industrial, and cultural decision-making*

Level 4: The student interprets the influence of science and technology on personal, industrial, and cultural decision-making.

Level 3: The student describes how science and technology influence personal, industrial, and cultural decision-making.

Level 2: The student describes with inaccuracies how science and technology influence personal, industrial, and cultural decision-making.

Level 1: The student makes little connection between science and technology and personal, industrial, and cultural decision-making.

Standard 8: HISTORY AND NATURE OF SCIENCE

Students understand the history and nature of science.

12.8.1	<i>Understand how cultural elements and intellectual perspectives have influenced the development of science throughout history</i>
<p>Level 4: The student illustrates how cultural elements and intellectual perspectives have influenced the development of science throughout history.</p> <p>Level 3: The student explains how cultural elements and intellectual perspectives have influenced the development of science throughout history.</p> <p>Level 2: The student explains with inaccuracies how cultural and intellectual perspectives have influenced the development of science throughout history.</p> <p>Level 1: The student makes little connection between cultural elements and intellectual perspectives and the development of science throughout history.</p>	
12.8.2	<i>Understand the nature of scientific knowledge</i>
<p>Level 4: The student evaluates characteristics of scientific knowledge.</p> <p>Level 3: The student explains the nature of scientific knowledge.</p> <p>Level 2: The student defines with inaccuracies the nature of scientific knowledge.</p> <p>Level 1: The student is unable to define the nature of scientific knowledge.</p>	
12.8.3	<i>Understand how human characteristics influence scientific advancement</i>
<p>Level 4: The student evaluates how human characteristics influence scientific advancement.</p> <p>Level 3: The student explains how human characteristics influence scientific advancement.</p> <p>Level 2: The student explains with inaccuracies how human characteristics influence scientific advancement.</p> <p>Level 1: The student is unable to explain how human characteristics influence scientific advancement.</p>	
12.8.4	<i>Understand the role of science and scientists in theoretical and applied situations</i>
<p>Level 4: The student explores the role of science and scientists in theoretical and applied situations.</p> <p>Level 3: The student describes the role of science and scientists in theoretical and applied situations.</p> <p>Level 2: The student describes with inaccuracies the role of science and scientists in theoretical and applied situations.</p> <p>Level 1: The student is unable to describe the role of science and scientists in theoretical and applied situations</p>	

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Glossary

The following definitions were used for these terms in this document to help clarify and distinguish the levels of understanding for the achievement levels.

Analyze: to examine critically, part by part (An analysis may require the synthesis of information to create an explanation or conclusion.) Ex: The student will analyze a pedigree to predict inheritance of a trait.

Apply: to put to use in a relevant way, e.g., to conduct an experiment or to give a verbal explanation that illustrates scientific concepts, principles, laws, or theories Ex: The student applies his knowledge of Newton's First Law of Motion to the need to use seat belts.

Describe: to give an oral or written account of (Written accounts may be expressed in such forms as words, a diagram, concept map, or illustration.) Ex: The student will describe the physical characteristics of a sedimentary rock such as sandstone, including its color; the size, shape, hardness, and mineralogy of particles; layering of particles; type of cement binding the particles, etc.

Evaluate: to judge the value of material (a statement, investigation, research report) for a given purpose; judgments are based on definite criteria

Explain: to make clear; to give the reason for; to account for Ex: The student explains why one does not find fossils in igneous rocks.

Identify: to label; to list; to match; to point out; to state

Models: structures that represent real objects Models take many forms, including physical objects, plans, mental constructs, mathematical equations, and computer simulations. (from National Research Council (1996), p.117)

Predict: the use of knowledge to identify and explain observations, or changes, in advance (from National Research Council, p.116) Ex: The student predicts how the rate of erosion might increase if the vegetation on a hillside is removed.)

Recognize: is aware of; acknowledges; takes notice of