

## **Habits of Mind**

Standards: 5.1 (4) A, B, C

### **I. Macro statement:**

Science is not merely a collection of facts and theories but a process, a way of thinking about and investigating the world in which we live. Thus, the scientific enterprise demands using good habits of mind as a way of thinking.

### **II. Knowledge statement:**

In order to develop and demonstrate an understanding of science, students will apply the skills of inquiry within the content area. Students will employ standards 5.5, 5.6, 5.7, 5.8, 5.9, and 5.10 to demonstrate an understanding of the scientific process.

### **III. Skill statement:**

A. Skills that are used by students as they discover and explain the world in which they live may include: comprehension, application, analysis, synthesis and evaluation. (See Bloom's Taxonomy on page 60 for each of the above cognitive levels.)

#### **B. Habits of Mind**

1. Express a curiosity, skepticism, open-mindedness toward science.
2. Express curiosity as a testable question. A testable question is one that establishes conditions that are varied and can be tested.
3. Arrange and distribute objects, events, or information in groups according to some method or system.
4. Collect information about objects and events related to a specific situation and record them in some way such as in a journal, on a table, list, graph, etc.
5. Recognize that the results of scientific investigations are seldom exactly the same and that replication is often necessary.
6. Science places a high priority on communication and the exchange of information. Information can be exchanged through writing, speaking, listening, performing, illustrating, and viewing.

#### **C. Inquiry and Problem Solving**

1. Raise questions and be able to incorporate habits of mind as a component of problem solving, decision making, and inquiry.
2. Use specific tools and strategies that are appropriate for information gathering, problem solving, and decision making.
3. Analyze findings by determining patterns or relationships in data.

#### **D. Safety:**

1. Handle and treat materials and equipment safely and effectively.
2. Perform acts that replicate demonstrated symbols, patterns, and procedures.
3. Be aware of the fundamental principles covering eye safety and hygiene.

## **Science, Society and Technology**

Standards: 5.2 (4) A, B; 5.4 (4) A, B, C; 5.4 (2) B, C

### **I. Macro statement:**

Understand how people of various cultures have contributed to the advancement of science and technology, and how major discoveries and events have advanced science and technology.

### **II. Knowledge statement:**

In order to demonstrate an understanding of the relationship between science and society, the student must recognize cultural contributions and historical perspectives within the cultural area. Students will use standards 5.5, 5.6, 5.7, 5.8, 5.9, and 5.10 to demonstrate an understanding of the relationship between science and society.

### **III. Skill statement:**

- A. Skills that are used by students as they discover and explain the relationship between science and society may include: comprehension, application, analysis, synthesis and evaluation. (See Bloom's Taxonomy on page 60 for each of the above cognitive levels.)
- B. Recognize that scientific contributions throughout history have come from men and women of various cultures.
- C. Recognize the need to communicate about scientific contributions in a clear and concise manner.
- D. Technology can be described as using tools and techniques to solve problems.
  1. People have always made tools to extend their senses and to do things that they could not otherwise do.
  2. Tools are used for everyday purposes.
  3. Measuring tools such as equal arm balances, thermometers, rulers, timing devices, graduated cylinders, and measuring cups are used to gather information in order to design things that work properly.
  4. A bicycle is a system of parts that work together. The foot moves the pedal; the pedal moves the chain; the chain moves the wheel; and the wheel moves the bicycle.
- E. Through the design process, students can engage in problem solving related to a wide range of real world contexts.

- F. Underlying concepts to be employed in the design process include:
1. An understanding of systems, their interactions and possible system failure.
  2. Using the design process in the identification of a problem and the search for ideas.
  3. The communication of ideas in a clear and concise manner.
  4. Every good design may fail. Steps taken ahead of time can reduce the likelihood of failure.

## **Mathematical Applications**

Standards: 5.3 (4) A, B, C, D

### **I. Macro statement:**

Integrate mathematics as a tool for problem solving in science as a means of expressing scientific theories.

### **II. Knowledge statement:**

In order to demonstrate the relationship between science and mathematics, students must integrate mathematics within the context of the content area. Students will use standards 5.5, 5.6, 5.7, 5.8, 5.9, and 5.10 to demonstrate their understanding of mathematical applications.

### **III. Skill statement:**

- A. Use a variety of measuring instruments (i.e., metric rulers, thermometers, graduated cylinders, balance, clock).
- B. Emphasize using the appropriate units of measurement.
- C. Recognize and comprehend large and small physical quantities.
- D. Judge whether estimates, measurements, and computations are reasonable.
- E. Make quantitative observations by comparing to a conventional or non-conventional standard. For example, grams or pennies may be used for weight, centimeters or paper clips may be used for length, milliliters or paper cups may be used for volume.
- F. Analyze data by determining patterns or relationships in the data; data may be represented in the form of tables, graphs, diagrams, and concept maps.
- G. Read tables and graphs to represent and interpret data.

## Life Science

Standards: 5.5 (2) A, B, C; 5.5 (4) A, B, C

### **I. Macro statement:**

The study of life on Earth must include an understanding of diversity, complexity, and interdependence. Organisms evolve over time, reproduce, and adapt to their environment.

### **II. Knowledge statement:**

#### **A. Matter, Energy and Organization of Living Things**

1. In order to survive, most living things require air, food, water, and ways to dispose of wastes.
2. The Sun is the primary source of energy for all living things.
3. Animals are living things that eat plants for food. These animals may in turn become food for other animals. This sequence is called a food web.
4. Plants are living things that provide the basic food supply for animals because only plants can manufacture food by utilizing the Sun's energy.
5. The direction of arrows in a food chain illustration shows the flow of energy through the chain. An example of a food chain is:  
Sun-----Grass-----Rabbit-----Fox
6. The requirements for life are not the same for all living things.
  - a. Most plants need water, light, air, and nutrients to live.
  - b. Most animals need air, food, and water to live.
7. Plants and animals are composed of different parts, performing different functions, but working together for the well-being of the organism.
  - a. Examples of animal parts include but are not limited to:
    1. wings, feet, legs, and fins.
    2. beaks, mouths, teeth, jaws, and tongues.
    3. eyes, noses, ears, and skin.
    4. claws, shells, and colors of body coverings.
    5. feathers, fur, skin, and scales.
  - b. Examples of plant parts include but are not limited to:
    1. roots.
    2. stems.
    3. leaves.
    4. seeds.
8. The major systems of the human body include the nervous, skeletal, respiratory, digestive, muscular, reproductive, and circulatory systems.
  - a. Nervous
    1. **Parts:** brain and sense organs
    2. **Functions:** helps the body to react to changes in the environment
  - b. Skeletal
    1. **Parts:** bone
    2. **Function:** provides support and protection
  - c. Respiratory
    1. **Parts:** nose, windpipe, and lungs
    2. **Function:** transports air into and out of the body.

- d. Digestive
  - 1. **Parts:** mouth, tongue, teeth, esophagus, stomach, intestine
  - 2. **Function:** breaks down food to be used by the body
- e. Circulatory
  - 1. **Parts:** heart, blood, blood vessels
  - 2. **Function:** transports materials throughout the body

## **B. Diversity and Biological Evolution**

- 1. Based on observation, recognize that a vast diversity exists among plants and animals.
- 2. Recognize the similarities and differences within and between groups of living things.
- 3. Organisms can be grouped by using classification schemes.
  - a. Organisms can be assigned to a group according to observable characteristics.
    - 1. Plants and animals
    - 2. Animals with appendages, animals without appendages
    - 3. Plants with roots, plants without roots
  - b. Individual living things vary within species.
    - 1. Animals: although dogs of a given breed are similar, they vary somewhat in size, color, and shape from one individual to another.
    - 2. Plants: although leaves on the same kind of maple tree are similar, they vary somewhat in size, shape, and color from one leaf to another.

## **C. Reproduction and Heredity**

- 1. Living things reproduce and produce offspring that resemble their parents.
- 2. Each kind of plant or animal continues beyond the life of the individual because each kind is able to produce offspring.
  - a. Animals: an animal goes through a particular set of stages from young to adult. The adult gives rise to the young of the next generation.
  - b. The complete sequence of changes is called a life cycle. Examples include the following:
    - 1. Many insects go from egg to larva to pupa to adult.
    - 2. Frogs go from egg to tadpole to adult.
    - 3. Large animals change gradually in size from young to adult.
  - c. Plants: stages in the development of some plants include the seed, seedling, and mature plant.
    - 1. Each generation of flowering plants goes through changes from seed to mature plant. The mature plant gives rise to the seeds of the next generation. The completed sequence of changes in form is called a life cycle.
    - 2. A flower is a structure in a mature flowering plant that enables the offspring to be produced in the form of seeds.

### III. Skill statement:

In order to demonstrate an understanding of the characteristics of life, students must use the scientific skills delineated in standards 5.1, 5.2, 5.3, and 5.4.

## **Physical Science; Chemistry**

Standards: 5.6 (2) A, B; 5.6 (4) A, B

### I. Macro statement:

The study of chemistry includes an understanding of the structure and behavior of matter.

### II. Knowledge Statement:

#### A. Structure and Properties of Matter

1. Matter has many observable (physical) properties including, size, weight, shape, state, and color.
  - a. Properties of an object are determined by materials and conditions.
  - b. Properties of an object can depend upon the materials from which the object is made.
  - c. Different kinds of materials have different properties. For example:
    1. Weight
    2. Color
    3. Texture
    4. Hardness
    5. Luster
    6. Reflective (mirrors) to light, sound, and heat.
    7. Transparent to light.
    8. Produce a sound when struck, plucked, or vibrated.
2. Matter can be changed by heating or cooling.
  - a. Matter that is familiar to us can exist as a solid, liquid, or gas.
  - b. Objects interact with heat.
    1. Heating can make objects warmer. Removing heat can make objects cooler.
    2. Adding heat to a material can form liquids or gases from solids and form gases from liquids. Examples include: solids to liquids (melting ice) and liquids to gases (boiling water).
    3. Removing heat from a material can form liquids or solids from gases and form solids from liquids. Examples can include: gases to solids (formation of frost or snow), gases to liquids (condensation of water droplets on a liquids to solids (freezing water to form ice).
    4. When water goes from liquid matter to solid matter, mass is conserved.

#### B. Chemical Reactions

1. Chemical reactions take place when one or more substances change to form one or more new substances.
2. The new substances formed as a result of a chemical reaction have properties that are different when compared to the original substances.
3. Examples of chemical reactions include:
  - a. an iron nail rusting.
  - b. a piece of paper burning.
  - c. frying or boiling an egg.

### III. Skill statement:

In order to demonstrate an understanding of the principles of chemistry, students must use the scientific skills delineated in standards 5.1, 5.2, 5.3, and 5.4.

## **Physical Science: Physics**

Standards: 5.7 (2) A, B; 5.7 (4) A, B

### I. Macro statement:

The study of physics must include an understanding of force, energy, and motion.

### II. Knowledge statement:

#### A. Motion and Forces

1. The motion of an object can vary in speed and direction.
2. An object can be described by the place in space that it occupies. For example:
  - a. Orientation: upside down, right side up, backward, forward.
  - b. Position in relation to another object: in front of, behind, above, below, inside, outside.
  - c. Speed: fast or slow.
3. The position and motion of an object can be changed by pushing or pulling.
4. The change in position and motion of an object is related to the strength of the applied force.
  - a. The push or pull (force) needed to cause a change in motion of an object depends upon the weight of the object. The heavier the object, the greater the push or pull needed to produce the same change in motion.
  - b. The rougher the surface, the greater the push or pull needed to move the object on the surface.
5. Some forces are invisible and act at a distance.
  - a. Earth's gravity pulls an object toward it without touching it.
  - b. A magnetic force can push or pull certain objects without touching them.
  - c. An electrical force (such as static electricity) can push or pull certain objects without touching them.

#### B. Energy Transformations

1. Energy is the ability to cause motion.
2. Energy is something that can be stored.
3. Energy can be changed from one form to another.
4. Sound is produced when an object vibrates.
  - a. Sounds can be loud or soft.
  - b. The pitch of a sound depends upon the rate of vibration.
  - c. The faster the vibration of the object, the higher the pitch.
  - d. The slower the vibration, the lower the pitch.
5. Heat and light energy come from a variety of sources.
  - a. The Sun is the primary source of heat and light on Earth.
  - b. Things that give off light also give off heat.
  - c. Sources of heat: burning, rubbing, or mixing one substance with another.  
Examples include: sunlight, fire, a lightbulb.
6. Heat can be transferred from one place to another, always moving from a warmer object to a colder object.

7. Sources of light energy include: Sun, lightbulb, stars, flames, fireflies.
8. Light behaves differently when it strikes different objects.
  - a. When light strikes a transparent material such as glass, almost all the light passes through. We see clearly through transparent materials.
  - b. When light strikes a translucent material such as waxed paper, only some of the light passes through it. We cannot see clearly through translucent materials.
  - c. When light strikes opaque materials such as wood, none of the light passes through it. Some light is reflected and some light is absorbed. We cannot see through opaque materials.
9. Electricity can be used to produce heat, light, and magnetic effects.
10. Electrical current flows from the source of electricity along one path to the appliance (i.e., lightbulb, bell), passes through the appliance, then returns through a second path to the source.
11. Electricity flowing through a wire may cause the wire to become warm and glow. For example: the filament of an incandescent lightbulb, the heating filament in a toaster, the coil in an electric heater.

### **III. Skill statement:**

In order to gain an understanding of the principles of physics, students must use the scientific skills delineated in standards 5.1, 5.2, 5.3, and 5.4.

## **Earth Science**

Standards: 5.8 (2) A, B, C, D; 5.8 A, B, C, D

### **I. Macro statement:**

The study of Earth Science includes a description of the materials that form Earth and the processes that affect it.

### **II. Knowledge statement:**

#### **A. Earth's Properties and Materials**

1. Different materials, such as rocks, minerals, and soil make up Earth.
  - a. Observe and identify earth materials such as rocks and soils.
  - b. Compare and contrast earth materials such as soils and sand, through simple observation and investigation.
  - c. Recognize that fossils are the remains or evidence of once living plants and animals. Fossils provide clues about past environmental conditions.

#### **B. Atmosphere and Water**

1. Air:
  - a. is a mixture of gases.
  - b. can be measured.
  - c. moves around us as wind.
2. Water:
  - a. Sources: oceans, lakes, rivers, streams, glaciers, and precipitation.
  - b. Uses: drinking, recreation, bathing, transportation, solvent.



- c. Forms: solid, liquid, gas
  - 1. Water can be a solid, liquid, or gas and can change back and forth from one form to another.
  - 2. When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point.
  - 3. Water evaporates from the surface of Earth, rises and cools, condenses into rain or snow, and falls again to the surface. The water falling on the land collects in rivers and lakes, soil, and porous layers of rock, and much of it flows back into the ocean. This is known as the water cycle.
- d. Using maps, charts, graphs, and other visual materials, sources and uses of water and its forms can be identified.
- 3. Weather can be described in measurable quantities.
  - a. To fully understand weather, it is important to observe, collect, and record data daily.
  - b. Temperature, wind direction and speed, precipitation and types of cloud cover are examples of measurable quantities of weather data.
  - c. Clouds are masses of water droplets or ice crystals that hang over Earth.
  - d. Rain, snow, and other precipitation come from clouds but not all clouds produce precipitation.

### **C. Processes that Shape Earth**

- 1. Earth's materials are formed in different ways.
  - a. For example, by erosion, weathering, and sometimes by rapid processes such as landslides, volcanic eruptions, and earthquakes
  - b. Fossils are sometimes revealed by erosion.

### **D. How We Study Earth**

- 1. Observe, collect, and record sample materials that describe features of the local Environment (e.g., rocks, and soil).
- 2. Maps are used to present information about Earth (e.g., land features and weather conditions).

### **III. Skill statement:**

In order to understand the principles of Earth Science, students must use the scientific skills delineated in standards 5.1, 5.2, 5.3, and 5.4.

## **Astronomy and Space Science**

Standards: 5.9 (2) A, B, C, D; 5.9 (4) A, B, C, D

### **I. Macro statement:**

All students will gain a better understanding of the origin, evolution, and structure of the universe.

### **II. Knowledge statement:**

#### **A. Earth, Moon, Sun System**

- 1. The Sun is the primary source of energy for all living things.
- 2. Objects in the sky have patterns of movement.

- a. Earth orbits (revolves) around the Sun and spins (rotates) on its axis.
- b. The Sun appears to move across the sky in the same way every day but changes its path over the seasons. (Note: students should never look directly at the Sun.)
3. Demonstrate day and night by modeling Earth as it spins on its axis.
4. The Moon moves across the sky.
5. The observable shape (phases) of the Moon changes from day to day in a cycle that lasts about a month. There are four major phases of the Moon and each phase takes a week.

#### **B. Solar System**

1. From Earth the Sun can only be seen during the day; the Moon can be seen sometimes at night and sometimes during the day.
2. Time is related to the motions within the Earth-Moon-Sun system.
  - a. Earth orbits (revolves) around the Sun in approximately 365 days.
  - b. Earth spins (rotates) on its axis every 24 hours.
  - c. The Moon orbits around Earth in about 29 days.
  - d. Earth is the third planet in our solar system.

#### **C. Stars**

1. Observe that there are numerous stars in the sky.
2. The stars are unevenly distributed and differ in size, color, and brightness.

#### **D. Galaxies and Universe**

1. Celestial objects can be seen in greater detail when observed using a light telescope or binoculars.
2. Journals may be used to recognize and record short- and long-term changes in the night sky.

### **III. Skill statement:**

In order to understand the principles of astronomy, students must use the scientific skills delineated in standards 5.1, 5.2, 5.3, and 5.4.

## **Environmental Science**

Standards: 5.10 (2) A, B; 5.10 (4) A, B

### **I. Macro statement:**

The environment is a system of independent components affected by human activity and natural phenomena.

### **II. Knowledge statement:**

#### **A. Natural Systems and Interactions**

1. Identify the basic needs of plants and animals and recognize how they meet these needs within their surroundings.
2. Animals need air, food, and water to live.
3. Plants need water, light, air, and certain nutrients.
4. Plants and animals need ways to dispose of wastes.
5. Natural resources are not always renewable (e.g., fossil fuels and metals).
6. Some natural resources are renewable (e.g., air, water, trees).

## **B. Human Interactions and Input**

1. Humans are able to control some conditions around them to meet their needs. For example:
  - a. Humans increase the amount of food produced by providing favorable conditions for its growth, that is, by farming.
  - b. Humans can compensate for difficulties or disabilities by controlling their environment.
2. Human needs impact the environment in ways that can be either beneficial or detrimental.
  - a. Humans depend on other organisms. For example:
    1. Humans make clothing from parts of other animals.
    2. Humans make pets of some animals for enjoyment, protection, and assistance in compensating for disabilities.
    3. Humans use some animals to perform work and to provide recreation.
3. Recognize through reading, observing, and/or analyzing data, the interdependence of living things and their environment.
4. Infer through reading, observing, and/or analyzing data, how meeting human needs affects the environment.
5. Create flow charts/concept maps to show how humans impact the environment.

## **III. Skill statement:**

In order to demonstrate an understanding of the principles of environmental studies, students must use the scientific skills delineated in standards 5.1, 5.2, 5.3, and 5.4.

The taxonomy provided below can be employed as a useful structure in which to categorize possible test questions.

<b>Competence</b>	<b>Skills Demonstrated</b>
<b>Comprehension</b>	understanding information grasp meaning interpret facts order, group, infer cause predict consequences <b>Cues:</b> summarize, describe, interpret, contrast, predict
<b>Application</b>	use information use methods, concepts, theories in new situations solve problems using required skills <b>Cues:</b> apply, demonstrate, calculate, illustrate, show, solve, examine, classify
<b>Analysis</b>	seeing patterns organization of parts identification of components <b>Clue:</b> analyze, separate, order, explain, connect, arrange, compare, select
<b>Synthesis</b>	use old ideas to create new ones generalize from given facts predict, draw conclusions <b>Cues:</b> combine, integrate, modify, rearrange, substitute, plan, create, design, what if?
<b>Evaluation</b>	compare and discriminate between ideas assess the values of theories make choices based on reasoned arguments verify value of evidence <b>Cues:</b> assess, decide, grade, test, measure, judge,

\* Adapted from: Bloom, B.S. (ED) (1956) Taxonomy of Educational Objectives: The classification of educational goals: Handbook I, cognitive domain. New York; Toronto: Longmans, Green.

## NJ ASK Test Matrix

Knowledge			Application	
	Comprehension	Science, Society and Technology (5.2, 5.4)	Habits of Mind and Inquiry (5.1)	Mathematics (5.3)
<b>Life Cluster 5.5 (40%)</b>				
Energy, Organization of Living Things	A1	B1	C1	D1
Diversity, Biological Evolution	A2	B2	C2	D2
Reproduction and Heredity	A3	B3	C3	D3
Environment	A4	B4	C4	D4
<b>Physical Science 5.6, 5.7 (30%)</b>				
Matter (Chemistry)	A5	B5	C5	D5
Chemical Reactions (Chemistry)	A6	B6	C6	D6
Motion and Forces (Physics)	A7	B7	C7	D7
Energy Transformations (Physics)	A8	B8	C8	D8
<b>Earth Science and Astronomy 5.8, 5.9 (30%)</b>				
Structure, Dynamics of Geophysical Systems	A9	B9	C9	D9
Origin, Evolution/Structure of the Universe	A10	B10	C10	D10
	<b>10%</b>	<b>10%</b>	<b>70%</b>	<b>10%</b>