

GRADE 6

SKILLS

These skills apply to the five topics of study identified for Grade 6. The organization of these skills reflects a general pattern of science activity, not a fixed instructional sequence. At Grade 6, students normally will show independence and the ability to work cooperatively in exploratory and investigative activities. Limited guidance may be required in defining problems and selecting appropriate variables. At this level, students should be able to describe the purpose of each step followed in investigative activities.

Science Inquiry	Problem Solving through Technology
<p>General Learner Expectations</p> <p><i>Students will:</i></p> <p>6-1 Design and carry out an investigation in which variables are identified and controlled, and that provides a fair test of the question being investigated.</p> <p>6-2 Recognize the importance of accuracy in observation and measurement; and apply suitable methods to record, compile, interpret and evaluate observations and measurements.</p>	<p>General Learner Expectations</p> <p><i>Students will:</i></p> <p>6-3 Design and carry out an investigation of a practical problem, and develop a possible solution.</p> <p><i>Note: The problem will involve construction or modification of a device that moves through air.</i></p>
<p>Specific Learner Expectations</p> <p><i>Students will:</i></p> <p>Focus</p> <ul style="list-style-type: none"> • ask questions that lead to exploration and investigation • identify one or more possible answers to questions by stating a prediction or a hypothesis <p>Explore and Investigate</p> <ul style="list-style-type: none"> • identify one or more ways of finding answers to given questions • plan and carry out procedures that comprise a fair test • identify variables: <ul style="list-style-type: none"> – identify the variable to be manipulated – identify variables to be held constant – identify the variable that will be observed (responding variable) • select appropriate materials and identify how they will be used • modify the procedures as needed • work individually or cooperatively in planning and carrying out procedures • identify sources of information and ideas and demonstrate skill in accessing them. Sources may include library, classroom, community and computer-based resources 	<p>Specific Learner Expectations</p> <p><i>Students will:</i></p> <p>Focus</p> <ul style="list-style-type: none"> • identify problems to be solved and the purpose(s) of problem-solving activities: What problem(s) are we trying to solve? What resources can we use? How will we know that we have done what we set out to do? What possible impacts do we need to consider? <p>Explore and Investigate</p> <ul style="list-style-type: none"> • identify one or more possible approaches and plan a set of steps for solving the problem • select appropriate materials and identify how they will be used • attempt a variety of strategies and modify procedures, as needed (troubleshoot problems) • work individually or cooperatively in planning and carrying out procedures • identify sources of information and ideas and demonstrate skill in accessing them. Sources may include library, classroom, community and computer-based resources

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Reflect and Interpret

- communicate effectively with group members in sharing and evaluating ideas, and assessing progress
- record observations and measurements accurately, using a chart format where appropriate. Computer resources may be used for record keeping and for display and interpretation of data
- evaluate procedures used and identify possible improvements
- state an inference, based on results. The inference will identify a cause and effect relationship that is supported by observations
- identify possible applications of what was learned
- identify new questions that arise from what was learned.

Reflect and Interpret

- communicate effectively with group members in sharing and evaluating ideas, and assessing progress
- evaluate procedures used and identify possible improvements
- evaluate a design or product, based on a given set of questions or criteria. The criteria/questions may be provided by the teacher or developed by the students. Example criteria include:
 - effectiveness—Does it work?
 - reliability—Does it work every time?
 - durability—Does it stand up to repeated use?
 - effort—Is it easy to construct? Is it easy to use?
 - safety—Are there any risks of hurting oneself in making it or using it?
 - use of materials—Can it be made cheaply with available materials? Does it use recycled materials, and can the materials be used again?
 - effect on environments
 - benefit to society
- identify positive and negative impacts that may arise and potential risks that need to be monitored: What good effects and what bad effects could this solution have? What would we need to look for to be sure that it is working as intended?
- identify new applications for the design or problem solution.

ATTITUDES

These attitudes apply across the five topics of study identified for Grade 6.

General Learner Expectations

Students will:

6–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.

Specific Learner Expectations

Students will show growth in acquiring and applying the following traits:

- curiosity
- confidence in personal ability to learn and develop problem-solving skills
- inventiveness and open-mindedness
- perseverance in the search for understandings and for solutions to problems
- flexibility in considering new ideas
- critical-mindedness in examining evidence and determining what the evidence means
- a willingness to use evidence as the basis for their conclusions and actions
- a willingness to work with others in shared activities and in sharing of experiences
- appreciation of the benefits gained from shared effort and cooperation
- a sense of personal and shared responsibility for actions taken
- respect for living things and environments, and commitment for their care.

UNDERSTANDINGS

Topic A: Air and Aerodynamics

Overview

Students explore the characteristics of air and the interaction between moving air and solids. They learn that air is a compressible fluid, that it is composed of many gases, and that moving air can support solid materials in sustained flight. By studying birds and airplanes, they learn a variety of adaptations and designs that make flight possible and that provide for propulsion and control.

General Learner Expectations

Students will:

6–5 Describe properties of air and the interactions of air with objects in flight.

Specific Learner Expectations

Students will:

1. Provide evidence that air takes up space and exerts pressure, and identify examples of these properties in everyday applications.
2. Provide evidence that air is a fluid and is capable of being compressed, and identify examples of these properties in everyday applications.
3. Describe and demonstrate instances in which air movement across a surface results in lift—Bernoulli’s principle.
4. Recognize that in order for devices or living things to fly, they must have sufficient lift to overcome the downward force of gravity.
5. Identify adaptations that enable birds and insects to fly.
6. Describe the means of propulsion for flying animals and for aircraft.
7. Recognize that streamlining reduces drag, and predict the effects of specific design changes on the drag of a model aircraft or aircraft components.
8. Recognize that air is composed of different gases, and identify evidence for different gases. Example evidence might include: effects on flames, the “using up” of a particular gas by burning or rusting, animal needs for air exchange.

Topic B: Flight

Overview

Students apply their knowledge of aerodynamics to design, build and test a variety of flying devices. In constructing models, students develop a basic design, then build it, test it, and solve the problems that inevitably arise. Through teamwork they learn that planning, communication, cooperation and flexibility are important to the overall result, even though parts of a task can be worked on individually. In the process, students learn about the parts of an aircraft, their role in controlled flight and the differences between aircraft and spacecraft.

General Learner Expectations

Students will:

6–6 Construct devices that move through air, and identify adaptations for controlling flight.

Specific Learner Expectations

Students will:

1. Conduct tests of a model parachute design, and identify design changes to improve the effectiveness of the design.
2. Describe the design of a hot-air balloon and the principles by which its rising and falling are controlled.
3. Conduct tests of glider designs; and modify a design so that a glider will go further, stay up longer or fly in a desired way; e.g., fly in a loop, turn to the right.
4. Recognize the importance of stability and control to aircraft flight; and design, construct and test control surfaces.
5. Apply appropriate vocabulary in referring to control surfaces and major components of an aircraft. This vocabulary should include: wing, fuselage, vertical and horizontal stabilizers, elevators, ailerons, rudder.
6. Construct and test propellers and other devices for propelling a model aircraft.

7. Describe differences in design between aircraft and spacecraft, and identify reasons for the design differences.

Note: Model aircraft or rockets may be constructed and used as part of this topic. It is recommended that these models be simple devices of the student's construction, not prefabricated models. Propulsion of rockets by chemical fuels is neither required nor recommended, due to safety considerations.

Topic C: Sky Science

Overview

Students learn about objects in the day and night sky. Through direct observation and research, students learn about the motions and characteristics of stars, moons and planets. Using simple materials, such as balls and beads, students create models and diagrams which they use to explore the relative position and motion of objects in space. As a result of these studies, students move from a simple view of land and sky, to one that recognizes Earth as a sphere in motion within a larger universe. With new understanding, students revisit the topics of seasonal cycles, phases of the Moon and the apparent motion of stars.

General Learner Expectations

Students will:

- 6–7 Observe, describe and interpret the movement of objects in the sky; and identify pattern and order in these movements.**

Specific Learner Expectations

Students will:

1. Recognize that the Sun and stars emit the light by which they are seen and that most other bodies in space, including Earth's Moon, planets and their moons, comets, and asteroids, are seen by reflected light.

2. Describe the location and movement of individual stars and groups of stars (constellations) as they move through the night sky.
3. Recognize that the apparent movement of objects in the night sky is regular and predictable, and explain how this apparent movement is related to Earth's rotation.
4. Understand that the Sun should never be viewed directly, nor by use of simple telescopes or filters, and that safe viewing requires appropriate methods and safety precautions.
5. Construct and use a device for plotting the apparent movement of the Sun over the course of a day; e.g., construct and use a sundial or shadow stick.
6. Describe seasonal changes in the length of the day and night and in the angle of the Sun above the horizon.
7. Recognize that the Moon's phases are regular and predictable, and describe the cycle of its phases.
8. Illustrate the phases of the Moon in drawings and by using improvised models. An improvised model might involve such things as a table lamp and a sponge ball.
9. Recognize that the other eight known planets, which revolve around the Sun, have characteristics and surface conditions that are different from Earth; and identify examples of those differences.
10. Recognize that not only Earth, but other planets, have moons; and identify examples of similarities and differences in the characteristics of those moons.
11. Identify technologies and procedures by which knowledge, about planets and other objects in the night sky, has been gathered.
12. Understand that Earth, the Sun and the Moon are part of a solar system that occupies only a tiny part of the known universe.

Topic D: Evidence and Investigation

Overview

Students sharpen their skills in observing and interpreting what they see by investigating evidence of human and animal activity. They explore and analyze indoor and outdoor environments as they look for footprints, markings, evidence of disturbance and things that are left behind. Through these studies, students learn to pose questions, devise investigations, recognize patterns and discrepancies, and think logically about what they have observed.

General Learner Expectations

Students will:

- 6–8 Apply observation and inference skills to recognize and interpret patterns and to distinguish a specific pattern from a group of similar patterns.**
- 6–9 Apply knowledge of the properties and interactions of materials to the investigation and identification of a material sample.**

Specific Learner Expectations

Students will:

1. Recognize evidence of recent human activity, and recognize evidence of animal activity in a natural outdoor setting.
2. Observe a set of footprints, and infer the direction and speed of travel.
3. Recognize that evidence found at the scene of an activity may have unique characteristics that allow an investigator to make inferences about the participants and the nature of the activity, and give examples of how specific evidence may be used.
4. Investigate evidence and link it to a possible source; e.g., by:
 - classifying footprints, tire prints and soil samples from a variety of locations
 - analyzing the ink from different pens, using paper chromatography
 - analyzing handwriting samples to identify the handwriting of a specific person

- comparing samples of fabric
- classifying fingerprints collected from a variety of surfaces.

Topic E: Trees and Forests

Overview

Students learn about trees as individual plants and as part of a forest ecosystem. By examining local species, they learn to recognize the characteristics of different trees and develop skill in describing and interpreting the structural features of trees. As part of their studies, students learn about a broad range of living things found on, under and around trees and study the complex interaction between trees and the larger environment. In examining human use of forests, they become aware of a broad range of environmental issues and develop an awareness of the need for responsible use.

General Learner Expectations

Students will:

- 6–10 Describe characteristics of trees and the interaction of trees with other living things in the local environment.**

Specific Learner Expectations

Students will:

1. Identify reasons why trees and forests are valued. Students meeting this expectation should be aware that forests serve as habitat for a variety of living things and are important to human needs for recreation, for raw materials and for a life-supporting environment.
2. Describe kinds of plants and animals found living on, under and among trees; and identify how trees affect and are affected by those living things.
3. Describe the role of trees in nutrient cycles and in the production of oxygen.
4. Identify general characteristics that distinguish trees from other plants, and characteristics that distinguish deciduous from coniferous trees.

5. Identify characteristics of at least four trees found in the local environment. Students should be familiar with at least two deciduous trees and two coniferous trees. Examples should include native species, such as spruce, birch, poplar, and pine and cultivated species, such as elm and crab apple.
6. Describe and classify leaf shapes, leaf arrangements, branching patterns and the overall form of a tree.
7. Interpret the growth pattern of a young tree, distinguishing this year's growth from that of the previous year and from the year before that. Students meeting this expectation should recognize differences in colouration and texture of new growth and old growth, and locate scars that separate old and new growth.
8. Identify human uses of forests, and compare modern and historical patterns of use.
9. Identify human actions that enhance or threaten the existence of forests.
10. Identify an issue regarding forest use, identify different perspectives on that issue, and identify actions that might be taken.