Identifying Curriculum Materials for Science Literacy

A 2061 Evaluation Tool

With Project 2061's publication of *Science for All Americans* in 1989 and *Benchmarks for Science Literacy* in 1993, and the National Research Council's release of the *National Science Education Standards* in 1996, there now exists a strong national consensus among educators and scientists on what all K-12 students need to know and be able to do in science, mathematics, and technology. These documents -- along with state and district curriculum frameworks that draw upon *Benchmarks* and *NSES* -- provide schools and school districts with a solid conceptual basis for reform in science education. As a consequence, educators committed to these goals have begun to search for curriculum resources that will help students move toward achieving them. Funded projects such as the Systemic Initiatives's are being required to select curriculum materials that target science literacy and leaders of these projects and other educators have asked Project 2061 for advice. Developers are making claims of fidelity of their materials to *Benchmarks* and *NSES* and educators want help in evaluating those claims. Existing analysis procedures do not pay adequate attention to specific learning goals and hence are insufficient for judging how well curriculum materials serve them.

As a further step toward science curriculum reform, Project 2061 is developing a reliable and valid procedure to analyze how well curriculum materials match *Benchmarks* and *NSES* content standards-in terms of both their literal content and their instructional plausibility. Materials that meet the criteria specified by the procedure will be more likely to support teaching that enables students to achieve benchmarks and standards.

This paper lists purposes of the analysis procedure and describes its main features. Additional details about the procedure, including directions for its use, are provided in the accompanying document "How to Use the 2061 Curriculum Analysis Procedure."

Purposes of the Analysis Procedure

An important premise of Project 2061 is that reform in science education should start from, and be guided by, a clear understanding of what is essential for all students to know and be able to do. Project 2061 believes that true reform requires paying attention to all aspects of the education system---how we can serve the needs of ALL students, what kinds of teachers are needed and how they should be educated, how schools can be organized, what kinds of materials and technologies are needed, how all of this can be paid for, and so forth. The Project also believes that recommendations for changing these various aspects of the education system should focus on what will be necessary to produce science- literate high school graduates.

Consequently, the Curriculum Analysis Procedure has been designed to be goal-specific. It specifies features of materials likely to help students make progress toward science

literacy goals and evaluates materials on these features. In principle, a `curriculum material' might be anything from a single one-period activity sheet to an entire K-12 text series, but for our purposes here is restricted from something like a one-week unit to a several-year textbook series.

Results of the analysis can be used to:

- Improve decisions about the **selection** of materials
- Identify shortcomings in existing materials and possibilities of **improving** them
- Inform the **development** of new materials

The teachers, teacher educators, and materials developers who have participated in the development of the procedure have already begun to use it in their work. We plan to monitor their use of the procedure in order to further refine it and suggest effective adaptations for various purposes.

Overview of the Analysis Procedure

Analysis of how well materials promote science literacy involves considering both the detailed content and instructional strategy (or pedagogy) of the materials. The content analysis examines the match between the specific content in the material and the specific contents in the learning goals in *Benchmarks* and *NSES.* The pedagogy analysis links the procedure to *Science for All Americans* Chapter 13: Principles of Learning and Teaching, *Benchmarks* Chapter 15: The Research Base, and the *NSES* teaching standards, examining whether the material includes various explicit instructional features that are likely to foster student learning of the specific benchmarks and standards. While there are certainly other important considerations for evaluating materials, the Project 2061 Curriculum Analysis Procedure focuses on criteria most relevant to achieving science literacy.

The analysis work is organized into 4 phases: Preliminary Phase (to become familiar with the curriculum material and identify specific learning goals that the material would appear to serve), Content Analysis Phase (to determine how well the content in the material matches the content of the specific benchmarks and standards identified), Pedagogy Analysis Phase (to determine the consistency of the material's treatment of each benchmark or standard with what is known about how students learn), and Report Phase (to prepare a report that summarizes findings about what the material might accomplish in terms of *Benchmarks* and *NSES).*

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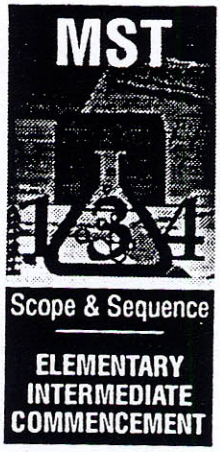
1 Content includes the knowledge, skills, and habits of mind that are important for science literacy. Project 2061 has defined science literacy in 12 chapters of recommendations in *Science for All Americans (AAAS,* 1989) and elaborated them into specific learning goals in *Benchmarks for Science Literacy (AAAS,* 1993). Both include natural and social science, mathematics, and technology as part of science literacy. The National Research Council's *National Science Education Standards* (NRC, 1996) recommends learning goals in 8 categories that overlap considerably with the natural science learning goals of *Benchmarks.* The numerous similarities, and small number of differences, are explicated in *Resources for Science Literacy: Professional Development (AAAS,* 1996).

Checklist for Selecting Quality Mathematics and Science Materials and Programs



DIRECTIONS

This checklist is intended to be used by educators to examine and evaluate instructional materials. It is organized into three sections: ***Contextual View, Examine Closer, and Verification.***

The four questions under Contextual View are intended to be the filter for the instructional materials. If those questions cannot be answered positively, then the materials should not be considered for use with students. If the questions can be answered positively, then the materials should be analyzed using the questions posed under ***Examine Closer*** and then confirmed with the ***Verification*** section.

CONTEXTUAL VIEW

Are the materials/activities safe for both the teacher and the students and/or include the appropriate safety precautions and directions?

___ Do the materials stimulate students' interest and relate to their daily lives?

___ Do the materials actively engage the students in learning?

___ Do the materials contain substantive ideas and strategies?

EXAMINE CLOSER

Do the materials stimulate students' interest and relate to their daily lives?

___ Are the materials appropriate for diverse student populations and diverse learning styles?

___ Are the materials, instructional strategies, and assessments bias free and do they promote equity (culture, gender, ability, etc.)?

___ Do the materials reflect the high expectations for ALL students regardless of race, culture, gender, religion, physical ability, or socioeconomic status?

___ Does the material/activity utilize and model for the teacher and learner appropriate use of technology?

___ Are there connections made with real world life situations and within disciplines?

Do the materials actively engage students in learning?

___ Do the materials provide numerous and varied experiences that require students to reason and think critically, use problem solving techniques, and promote higher level thinking?

___ Do the materials present a logical sequence of related activities that will help students build conceptual understanding through multiple learning opportunities?

___ Do the materials provide the learner opportunities to communicate ideas orally and in writing in the development of the appropriate language of science and/or mathematics?

___ Do the materials provide opportunities for students to express in a variety of ways what they know, can do, and how they think about math and science?

___ Does the material/activity provide opportunities for students to work both independently and collaboratively with others?

Do the materials contain substantive ideas and strategies?

___ Do the materials provide students opportunities to investigate important mathematics and science concepts in depth over an extended period of time?

___ Do the materials use multiple means of assessment that can be integrated with instruction?

___ Do the materials address the domains in mathematics and science described in the national standards and the State frameworks?

___ Do the materials allow teachers to take into account the students' prior knowledge, experience, and prerequisite skills?

Other Considerations

___ Are the materials and activities safe?

___ Do the materials/activities meet rules, regulations, and policies?

___ Are the materials accurate, error-free, and up-to-date?

___ Are the materials cost effective?

___ Are the materials readily available?

VERIFICATION

___ Do the materials/activities incorporate appropriate research, strategies, and methods?

___ Can the material/activity be adapted or modified to meet the needs of the students or program?

___ Is the assessment relevant, unbiased, and aligned with instruction?

Source: Adapted from: George, Y.S. and VanHorne, V.V. *Science Education Reform for All (SERA)*, AAAS, 1996

AAAS Curriculum Analysis Procedures

I. Identifying and Maintaining a Sense of Purpose

I.1 Unit purpose
Does the material convey an overall sense of purpose and direction that is understandable and motivating to students?

I.2 Activity purpose
Does the material convey the purpose of each activity and its relationship to others?

I.3 Activity sequence
Does the material involve students in a logical or strategic sequence of activities (versus a collection of activities) that build toward understanding of a benchmark(s)?

II. Taking Account of Student Ideas

II.1 Prerequisite knowledge/skills
Does the material specify prerequisite knowledge/skills that are necessary to the learning of the benchmark(s)?

II.2 Alerting the teacher to commonly held ideas
Does the material alert teachers to commonly held student ideas (both troublesome and helpful) such as those described in Benchmarks Chapter 15: The Research Base?

II.3 Assisting the teacher in identifying students' ideas
Does the material include suggestions for teachers to find out what their students think about familiar phenomena related to a benchmark before the scientific ideas are introduced?

II.2 Addressing student commonly held ideas
Does the material explicitly address commonly held student ideas?

III. Engaging Students with Phenomena

III.1 Variety of phenomena
Does the material provide multiple and varied phenomena to support the benchmark idea?

III.1 First-hand experiences
Does the material include activities that promote first-hand experiences with phenomena when practical or provide students with vicarious sense of the phenomena when not practical?

IV. Developing and Using Scientific Ideas

IV.1 Building a case
Does the material develop an evidence-based argument in support of benchmark ideas?

IV.2 Introducing terms
Does the material introduce technical terms only in conjunction with experience with the idea or process and only as needed to facilitate thinking and promote effective communication?

IV.3 Representing ideas
Does the material include accurate and comprehensible representations of scientific ideas?

IV.4 Connecting ideas
Does the material explicitly draw attention to conceptual connections among benchmark ideas?

IV.5 Demonstrating/modeling skills and use of knowledge
Does the material demonstrate/model or include suggestions for teachers on how to demonstrate/model skills or the use of knowledge?

IV.6 Practicing skills and use of knowledge
Does the material provide tasks/questions for students to practice skills or use of knowledge in a variety of situations?

V. Promoting Student Thinking About Phenomena, Experiences, and Knowledge

V.1 Providing opportunities for students to express ideas
Does the material routinely include suggestions for having each student express, clarify, justify, and represent his/her ideas? Are suggestions made for when and how students will get feedback from peers and the teacher?

V.2 Guiding student interpretation and reasoning
Does the material include tasks and/pr question sequences to guide student interpretation and reasoning about experiences with phenomena and readings?

V.3 Encouraging self-monitoring
Does the material suggest ways to have students check their own progress?

VI. Assessing Student Progress

VI.1 Alignment of goals
Assuming a content match between the curriculum material and the benchmark, are assessment items included that match the same benchmark?

VI.2 Application
Does the material include assessment tasks that require application of ideas and avoid allowing students a trivial way out, like using a formula or repeating a memorized item without understanding?

VI.3 Embedded
Are some assessments embedded in the curriculum along the way, with advice to teachers as to how they might use the results to choose or modify activities?

VII. Enhancing the Learning Environment

VII.1 Teacher content learning

Would the material help teachers improve their understanding of the science, mathematics, and technology necessary for teaching the material?

VII.2 Classroom environment

Does the material help teachers to create a classroom environment that welcome student curiosity, rewards creativity, encourages a spirit of health questioning, and avoids dogmatism?

VII.3 Welcoming all students

Does the material help teachers to create a classroom community that encourages high expectations for all students, that enables all students to experience success, and that provides all different kinds of students a feeling of belonging in the science classroom?

VII.4 Connecting beyond the unit

Does the material explicitly draw attention to appropriate connections to ideas in other units?

NSF Framework for Review of Instructional Materials for Middle School Science

NOTE: Although this framework is for middle school science, many of the review criteria can be generalized to elementary MST. Where the items refer to science standards, look for a match to math and technology standards as well. NSF reports that the procedure in the framework works well only when the reviewer is forced to cite evidence.

Title:
Author(s):
Publisher:
Reviewed by:
Copyright date:
Reviewer: Date:

I. Descriptors

a. Write a brief description of the components of the curriculum upon which this review is based (e.g., teachers guide, student books, hands-on materials, multimedia material). That is, what materials did you receive and include in your review?

b. Write a brief description of the purpose and broad goals of these materials. That is, what were the stated purposes and what were the actual purposes of the materials?

c. What grade levels do the materials serve? ____5 ____6 ____7 ___8

d. Are the instructional materials designed to
__ provide a complete multi-year program for middle school science.
__ provide a complete one-year course for middle school science.
__ provide multiple modules or units that could be used to supplement other course materials for middle school science.
__ provide a single module or collection of activities that could be used to supplement other course materials for middle school science.
__ other(explain):

e. What are the major domains/topics of content covered by these materials?

Source: This framework is adapted from an instrument developed by Inverness Research under contract to the National Science Foundation. The framework was refined as part of a panel review of NSF-supported materials for middle school science, which was limited to projects that provide at least a year-long course of study.

II. Quality of the Science

Directions: For each item, circle the number corresponding with your response to the question. Write an explanation for your rating of each item below the item.

a. Does the content in the instructional materials align well with all eight areas of the Content Standards as described in the National Science Education Standards (NSES)? (See attached guidelines)

1	2	3	4	5
Omits substantial content included in NSES and/or includes substantial content not recommended in NSES		Some misalignment of content with recommendations in NSES		The curriculum with aligns well content recommendations in NSES

b. Are the science concepts presented in the instructional materials accurate and correct? [Provide examples of major errors where they are evident. Attach extra page if necessary]

1	2	3	4	5
Substantial, major errors		Mostly correct, with some minor errors		Scientifically accurate and correct

c. Do the instructional materials adequately present the major concepts in the standanls and adequately demonstrate and model the processes of science?

1

1	2	3	4	5
Major concepts and processes not addressed		Major concepts and processes somewhat addressed		Major concepts and processes addressed well

d. Does the science presented in the instructional materials reflect current disciplinary knowledge.

1	2	3	4	5
The ideas are out of date		Somewhat current		Current

e. Do the instructional materials accurately represent views of science as inquiry as the National Science Education Standards?

1	2	3	4	5
Poor examples of inquiry		Mixed quality		Rich and accurate examples of inquiry

Source: This framework is adapted from an instrument developed by Inverness Research under contract to the National Science Foundation. The framework was refined as part of a panel review of NSF-supported materials for middle school science, which was limited to projects that provide at least a year-long course of study.

II. Quality of the Science, continued

f. Do the instructional materials accurately present the history of science?

1	2	3	4	5
Poor portrayal of history of science		Mixed quality		Rich and accurate portrayal of history of science

g. Do the materials emphasize technology as an area of study?

h. Do the materials emphasize the personal and societal dimensions of science?

i. Do the materials emphasize the content of life science?

j. Do the materials emphasize the content of earth science?

k. Do the materials emphasize the content or physical science?

1	2	3	4	5
Little or no emphasis		Some emphasis		Rich and well designed emphasis

l.. Do the instructional materials provide sufficient activities for students to develop a good understanding of key science concepts?

1	2	3	4	5
Too few learning activities		Activities provide some opportunity for students to learn some important concepts		Activities provide many rich opportunities to learn key science concepts

m. Do the instructional materials provide sufficient opportunities for students to apply their understanding of the concepts (i.e., designing of solutions to problems or issues)?

1	2	3	4	5
Very few application activities		Some application activities		Very rich in application activities

n. Do the instructional materials present an accurate picture of the nature of science as a dynamic endeavor?

1	2	3	4	5
Image of science out-of-date, inaccurate, or non-existent.		The image of science is of mixed quality.		The image of science is current and accurate.

Source: This framework is adapted from an instrument developed by Inverness Research under contract to the National Science Foundation. The framework was refined as part of a panel review of NSF-supported materials for middle school science, which was limited to projects that provide at least a year-long course of study.

II. Quality of the Science, continued

o. Do the materials develop an appropriate breadth and depth of science content?

1	2	3	4	5
Too narrow or too broad		Somewhat balanced		Good balance of breadth and depth

p. What is the overall quality of the science presented in the instructional materials?

1	2	3	4	5
Low		Medium		High

III. The Pedagogical Design

a. Do the instructional materials provide a logical progression for developing conceptual understanding in science?

1	2	3	4	5
No logical progression of ideas		Somewhat logical progression of ideas		Logical progression of ideas that builds conceptual understanding

b. Do the instructional materials provide students the opportunity to make conjectures, gather evidence, and develop arguments to support, reject, and revise their preconceptions and explanations for natural phenomena?

1	2	3	4	5
No opportunity		Some opportunity		Rich and well designed opportunity

c. To what extent do the instructional materials engage students in doing science inquiry?

1	2	3	4	5
Very few or very contrived activities for students to do science inquiry		Some good activities for students to do science inquiry		Many rich and authentic opportunities to do science inquiry

d. To what extent do the instructional materials engage students in doing technology problem solving?

1	2	3	4	5
Very few or very contrived activities for students to do technology problem solving		Some good activities for students to do technology problem solving		Many rich, authentic opportunities for students to do technology problem solving

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III. The Pedagogical Design, continued

e. To what extent does the curriculum engage students in activities that help them connect science to everyday issues and events?

1	2	3	4	5
Very few or very contrived activities for students to make connections		Some good activities for students to make connections		Many rich and authentic opportunities for students to make connections

f. How would you rate the overall developmental appropriateness of the instructional materials, given its intended audience of ALL students at the targeted level(s)?

1	2	3	4	5
Not developmentally appropriate		Somewhat developmentally appropriate		Developmentally appropriate

g. Do the materials reflect current knowledge about effective teaching and learning practices (e.g, active learning, inquiry, community of learners) based on research related to science education?

1	2	3	4	5
Do not reflect current knowledge about teaching and learning		Somewhat reflective of current knowledge about teaching and learning		Reflect well current knowledge about teaching and learning

h. Do the instructional materials provide students the opportunity to clarify, refine, and consolidate their ideas, and to communicate them through multiple modes?

i. Do the instructional materials provide students opportunity to think and communicate scientifically?

j. Do the instructional materials provide students with activities connecting science with other subject areas?

1	2	3	4	5
No opportunity		Some opportunity		Rich and well designed opportunity

k. Are the instructional materials likely to be interesting, engaging, and effective for students?

1	2	3	4	5
Not at all interesting		Somewhat interesting		Interesting and engaging

Source: This framework is adapted from an instrument developed by Inverness Research under contract to the National Science Foundation. The framework was refined as part of a panel review of NSF-supported materials for middle school science, which was limited to projects that provide at least a year-long course of study.

III. The Pedagogical Design, continued

1. Are the instructional materials likely to be interesting, engaging, and effective for girls and boys?

1	2	3	4	5
No sensitivity to gender issues		Some sensitivity to gender issues		Sensitive to gender issues

m. Are the instructional materials likely to be interesting, engaging, and effective for underrepresented and underserved students (e.g., ethnic, urban, rural; with disabilities)?

1	2	3	4	5
No sensitivity to underrepresented and underserved students		Some sensitivity to underrepresented and underserved students		Sensitive to underrepresented and underserved students

n. Does assessment have explicit purposes connected to decisions to be made by teachers (e.g., prior knowledge, conceptual understanding, grades)?

1	2	3	4	5
Unclear purposes		Somewhat clear purposes		Clear statement of purposes

o. Do assessments focus on the curriculum's important content and skills?

1	2	3	4	5
Poor correspondence(l		Fair correspondence		Full correspondence

p. Do the instructional materials include multiple kinds of assessments (e.g., performance, paper/pencil, portfolios, student interviews, embedded, projects)?

1	2	3	4	5
Little or no student assessment provided		Some variety of student assessment		Complete student assessment package

q. Are the assessment practices fair to all students?

1	2	3	4	5
Fair for a few		Fair to most		Fair to all

r. Do the instructional materials include adequate and appropriate uses of a variety of educational technologies (e.g., calculators, video, computers, telecommunications)?

1	2	3	4	5
Little or nor educational technologies included		Some appropriate educational technologies included		Many appropriate applications of educational technologies included

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III. The Pedagogical Design, continued

s. What is the overall quality of the pedagogical design of these instructional materials?

1	2	3	4	5
Low		Medium		High

t. To what extent are the purposes of the materials clear to students?

1	2	3	4	5
Purposes are unclear		Purposes are somewhat clear		Purposes are clear

IV. Implementation and System Support

a. Will the teachers find the materials interesting and engaging?

1	2	3	4	5
Dry and boring		Somewhat interesting and engaging		Interesting and engaging

b. Do the instructional materials include information and guidance to assist the teacher in implementing the lessons?

1	2	3	4	5
No teacher support		Some teacher support		Rich and useful teacher support

c. Do the instructional materials provide information about the kind of resources and support system required to facilitate the district implementation of the science materials?

1	2	3	4	5
No materials support		Some materials support		Rich and useful materials support

d. Do the instructional materials provide information about how to establish a safe science learning environment?

1	2	3	4	5
No safety information		Some safety information		Rich and useful safety information

e. Do the instructional materials provide information about the kinds of professional development experiences needed by teachers to implement the materials?

1	2	3	4	5
Little or no information provided		Partial information provided		Rich and useful information provided

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f. Do the materials provide guidance in how to link the materials with the district and state assessment frameworks and programs?

g. Do the materials provide guidance and assistance for involving administrators, parents, and the community at large actively in supporting school science?

1	2	3	4	5
No guidance		Some guidance		Rich and useful guidance

h. Overall, are the materials usable b,. realistic in expectations of, and supportive of teachers?

1	2	3	4	5
Teacher unfriendly		Somewhat teacher friendly		Teacher friendly

V. Major Strengths and Weaknesses

a. In your opinion, what are the three major strengths of this curriculum?

b. In your opinion, what are the three major weaknesses of this curriculum?

VI. Overall Quality, Value, and Contribution

a. In your opinion what is the overall quality of these materials relative to:

	low **high**
- turning students on to science?	1.....2.....3.....4.....5
- making students think?	1.....2.....3.....4.....5
- quality of science content?	1.....2.....3.....4.....5
- quality of pedagogy?	1.....2.....3.....4.....5
- quality of classroom assessments?	1.....2.....3.....4.....5
- pushing teachers to teach differently?	1.....2.....3.....4.....5

b. In your opinion, what is the overall quality of these instructional materials?

1	2	3	4	5
Low		Medium		High

c. To what extent would you encourage the dissemination, adoption, and implementation of this curriculum?

1	2	3	4	5
Not worthy of disseminat ion, adoption, or implementation		OK to disseminate, adopt, and implement **if revised**		OK to disseminate, adopt, and implement **as is**

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Guidelines for Section II.

The following is a brief outline of the National Science Education Standards. It should be used to guide your responses to Section II.

CONTENT STANDARD
A. Science as Inquiry
1. Abilities necessary to do science inquiry
2. Understandings about scientific inquiry
B. Physical Science
1. Properties and changes of properties in matter
2. Motions and forces
3. Transfer of energy
C. Life Science
1. Structure and function in living organisms
2. Reproduction and heredity
3. Regulation and behavior
4. Populations and ecosystems
5. Diversity and adaptations of organisms
D. Earth and Space Science
1. Structure of the earth system
2. Earth's history
3. Earth in the solar system
E. **Science and Technology**
1. Abilities of technological design
2. Understandings about science and technology
F. **Science in Personal and Social Perspectives**
1. Personal health
2. Populations, resources, and environments
3. Natural hazards
4. Risks and benefits
5. Science and technology in society
G. History and Nature of Science
1. Science as a human endeavor
2. Nature of science
3. History of Science
H. Unifying concepts is and processes
1. Systems, order, and organization
2. Evidence, models, and explanation
3. Change, constancy, and measurement
4. Evolution and equilibrium
5. Form and function

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A Correlation of the New York State Learning Standards for Mathematics, Science, and Technology and the Science and Technology for Children Curriculum

Prepared by Carolina Biological Supply Company

The following tables are provided to give a quick visual guide to the correlation of the New York State Learning Standards for Mathematics, Science, and Technology and the individual *Science and Technology for Children* (STC) units of study.

Key to Abbreviations of STC Units

O	Organisms	PGD	Plant Growth and Development	Mw	Microworlds
W	Weather	RM	Rocks and Minerals	E	Ecosystems
SL	Solids and Liquids	CT	Chemical Tests	FC	Food Chemistry
CM	Comparing and Measuring	So	Sounds	FS	Floating and Sinking
LCB	The Life Cycle of Butterflies	AS	Animal Studies	EP	Experiments with Plants
S	Soils	LW	Land and Water	MT	Measuring Time
C	Changes	MD	Motion and Design	TP	The Technology of Paper
BW	Balancing and Weighing	EC	Electric Circuits	MM	Magnets and Motors

Recommended Grade Levels for STC Units

(The NSRC recommends that an STC unit not be moved up or down more than one grade level from these recommendations.)

1st				2nd				3rd			
O	W	SL	CM	LCB	S	C	BW	PGD	RM	CT	So

4th				5th				6th			
AS	LW	MD	FC	Mw	E	FC	FS	EP	MT	TP	MM

Source: Carolina Biological Supply Company, **Science and Technology for Children (STC) Curriculum**

Standard 1—Analysis, Inquiry, and Design

Mathematical Analysis

1. Abstraction and symbolic representation are used to communicate mathematically.
W CM C BW PGD AS MD Mw E FS EP MT TP MM

2. Deductive and inductive reasoning are used to reach mathematical conclusions.
All STC Units

3. Critical thinking skills are used in the solution of mathematical problems.
All STC Units

Scientific Inquiry

1. The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.
All STC Units

2. Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.
S C BW RM CT So AS LW MD EC E FC FS EP MT TP MM

3. The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.
All STC Units

Engineering Design

1. Engineering design is an iterative process involving modeling and optimization finding the best solution within given constraints which is used to develop technological solutions to problems within given constraints.
W SL CM LCB S C BW PGD CT So AS LW MD EC E FS EP MT TP MM

Standard 2—Information Systems

All STC units are compatible with this standard; however, STC does not *require* the use of computers, etc.

Standard 3—Mathematics

1. Students use mathematical reasoning to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.
O W CM C BW PGD MD E FS EP MT TP MM

2. Students use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.
W CM BW PGD MD Mw E FS EP MT TP MM

Source: Carolina Biological Supply Company, **Science and Technology for Children (STC) Curriculum**

3. Students use mathematical operations and relationships among them to understand mathematics.
CM BW PGD MD E EP MM

4. Students use mathematical modeling/multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships.
All STC Units

5. Students use measurement in both metric and English measure to provide a major link between the abstractions of mathematics and the real world in order to describe and compare objects and data.
W CM C BW PGD AS LW MD Mw E FS EP MT TP MM

6. Students use ideas of uncertainty to illustrate that mathematics involves more than exactness when dealing with everyday situations.
CM BW MD FS MT MM

7. Students use patterns and functions to develop mathematical power, appreciate the true beauty of mathematics, and construct generalizations that describe patterns simply and efficiently.
O W SL CM LCB C BW PGD CT So AS LW MD E FC FS EP MT TP MM

Standard 4—Science

Physical Setting

1. The Earth and celestial phenomena can be described by principles of relative motion and perspective.
W MT

2. Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.
W SL CM S C RM LW E FS MT

3. Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.
O W SL CM S C BW RM CT So LW MD Mw E FC FS TP MM

4. Energy exists in many forms, and when these forms change energy is conserved.
W C CT So LW MD EC E FC FS EP MT TP MM

5. Energy and matter interact through forces that result in changes in motion.
SL C BW RM So LW MD FS MT MM

The Living Environment

1. Living things are both similar to and different from each other and nonliving things.
O LCB S PGD AS E FC EP

2. Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.
O LCB S PGD AS E FC EP

Source: Carolina Biological Supply Company, **Science and Technology for Children (STC) Curriculum**

3. Individual organisms and species change over time.
O LCB S PGD AS E EP

4. The continuity of life is sustained through reproduction and development.
O LCB S PGD AS E EP

5. Organisms maintain a dynamic equilibrium that sustains life.
O LCB S PGD AS E FC EP

6. Plants and animals depend on each other and their physical environments.
O LCB S PGD AS E FC EP

7. human decisions and activities have had a profound impact on the physical and living environment.
W PGD RM LW MD E EP TP MM

Standard 5—Technology

1. Engineering design is an iterative process involving modeling and optimization used to develop technological solutions to problems within given constraints.
W SL CM LCB S C BW PGD CT So AS LW MD EC E FS EP MT TP MM

2. Technological tools, materials, and other resources should be selected on the basis of safety, cost, availability, appropriateness, and environmental impact; technological processes change energy, information, and material resources into more useful forms.
W CM S C BW So LW MD EC E FS MT TP MM

3. Computers, as tools for design, modeling, information processing, communication, and system control, have greatly increased human productivity and knowledge.

4. Technological systems are designed to achieve specific results and produce outputs, such as products, structures, services, energy, or other systems.
W CM S C BW So LW MD EC E FS MT TP MM

5. Technology has been the driving force in the evolution of society from an agricultural to an industrial to an information base.
W CM MD EC FS MT TP MM

6. Technology can have positive and negative impacts on individuals, society, and the environment and humans have the capability and responsibility to constrain or promote technological development.
W CM S LW MD E TP

7. Project management is essential to ensuring that technological endeavors are profitable and that products and systems are of high quality and built safely, on schedule, and within budget.
LW MD E TP

Source: Carolina Biological Supply Company, **Science and Technology for Children (STC) Curriculum**

Standard 6—Interconnectedness: Common Themes

1. Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

All STC Units

2. Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

All STC Units

3. The grouping of magnitudes of size, time, frequency, and pressures of other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.

O W SL CM LCB BW PGD RM AS LW MD Mw E FS EP MT

4. Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).

W C BW AS LW MD E FS EP

5. Identifying patterns of change is necessary for making predictions about future behavior and conditions.

LCB S C BW PGD CT So AS LW MD EC Mw E FC FS EP MT TP MM

6. In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.

All STC Units

Standard 7—Interdisciplinary Problem Solving

1. The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.

All STC Units

2. Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits, gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.

All STC Units

Source: Carolina Biological Supply Company, **Science and Technology for Children (STC) Curriculum**

Introduction

Correlation of AIMS Activities to the New York State Learning Standards for Mathematics, Science and Technology

This correlation document lists and describes activities published by the AIMS Education Foundation as they relate to the Learning Standards for Mathematics, Science, and Technology, published by the University of the State of New York.

Key ideas are listed at the beginning of each section, and are indicated by numbers. Performance indicators are identified by bullets (•).

AIMS activities are published in book form and in AIMS Magazine. In this document, those activities that are in books are sorted before those that are only in the magazine. The latter are listed by issue volume and number.

AIMS activities do not address all parts of all Standards for New York State. Those activities that directly satisfy each Standard are included.

It is hoped that classroom teachers seeking activities that support the Standards will find this format useful.

Learning Standards for Mathematics, Science, and Technology

Standard 1: Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

Standard 2: Students will access, generate, process, and transfer information using appropriate technologies.

Standard 3: Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Standard 4: Students will understand and apply scientific concepts, principles, and theories pertaining to physical setting and living environment and recognize the historical development of ideas in science.

Standard 5: Students will apply technological knowledge and skills to design, construct, use, and evaluate products and systems to satisfy human and environmental needs.

Standard 6: Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.

Standard 7: Students will apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions.

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New York State Learning Standards Mathematics

Standard 3 - Mathematics

3.1 Mathematical Reasoning
Students use mathematical reasoning to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.

Elementary students:

- use models, facts, and relationships to draw conclusions about mathematics and explain their thinking.
- use patterns and relationships to analyze mathematical situations.
- justify their answers and solution processes.
- use logical reasoning to reach simple conclusions.

Intermediate students:

- apply a variety of reasoning strategies.
- make and evaluate conjectures and arguments using appropriate language.
- make conclusions based on inductive reasoning.
- justify conclusions involving simple and compound (i.e., and/or) statements.

Level	Activity	Source	Students will:
Elementary	Blow Ye Winds	Popping with Power	study the effect of wind forces on suspension bridges.
Elementary	Level the Lever (1996 Edition)	Popping with Power	discover the mathematical pattern for balancing a first-class lever.
Elementary	Metal Detector (1996 Edition)	Popping with Power	observe that some metals are attracted to a magnet.
Elementary	Take it Easy	Popping with Power	learn how the six simple machines work.
Elementary	Hungry Hounds	Mostly Magnets	move paper dogs along a path by pushing or pulling with a magnet.
Elementary	What Will a Magnet Attract?	Mostly Magnets	predict and then test objects for their magnetic interaction.
Elementary	Winding Wheels	8.06	explore the relationship between wheel size and lift in a winch.
Elementary	Clever Lever - 1	Brick Layers 7.02	observe relationship between force, distance and effort.
Elementary	Hungry Hounds	5.09	move paper dogs along a path by pushing or pulling with a magnet.
Elementary	Puff-Mobiles	5.07	observe the energy of the wind and its effects on a wheel.
Elementary	Inclined to Work	3.04	explore the inclined plane and how it makes work easier.
Elementary	What is Work?	3.04	*** this is part of "Inclined to Work"
Elementary	Defying Gravity	Mostly Magnets	use problem solving skills to create a magnetic system that defies gravity.
Elementary	Face To Face	Mostly Magnets	use pairs of magnets to discover how like and unlike poles react to one another.
Elementary	Floating Magnets	Mostly Magnets	experiment with two or more ring magnets stacked on a pencil.
Elementary	Holding Power	Mostly Magnets	observe and compare the effect of various groupings of magnets.

continued

3.1 Mathematical Reasoning

Students use mathematical reasoning to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.

Level	Activity	Source	Students will:
Elementary	How Close Can You Get?	Mostly Magnets	observe the interaction between a magnet and a paper clip
Elementary	Magnetic Tug of War	Mostly Magnets	discover which is stronger, the push or pull of a magnet.
Elementary	Magnets Apart	Mostly Magnets	study the effect of the force of magnetic attraction when the distance between magnets is increased.
Elementary	Through It All	Mostly Magnets	investigate the relationship between magnetic attraction and distance from the magnet to a paper clip.
Elementary	What's the Attraction?	Mostly Magnets	determine the magnetic attraction and repulsion of magnets and compare the data mathematically.
Elementary	Will a Magnet Attract Through These?	Mostly Magnets	investigate magnetic attraction through various materials.
Elementary	All Wound Up	Machine Shop	examine the role of friction in the movement of a thread spool tractor.
Elementary	The Plane Truth	Machine Shop	make and compare different surfaces of inclined planes, testing the efficiency of each surface.
Elementary	Fiddling With Fulcrums	Brick Layers	study how the position of the fulcrum affects the amount of effort needed to lift a consistent resistance.
Elementary	M.V.P. (Most Valuable Place)	Brick Layers	explore the workings of a lever.
Elementary	Defying Gravity	5.09	use problem solving skills to create a magnetic system that defies gravity.
Elementary	What's the Attraction?	5.08	determine the magnetic attraction and repulsion of magnets and compare the data mathematically.
Elementary	Through It All	5.07	investigate the relationship between magnetic attraction and distance from the magnet to a paper clip.
Elementary	Holding Power	5.05	observe and compare the effect of various groupings of magnets.
Elementary	Face To Face	2.09	use pairs of magnets to discover how like and unlike poles react to one another.
Elementary	Come About	11.04	make a simple compass and compass rose. They will time sailing regattas around buoys located at these directional points.
Elementary	Science on the Slide	10.03	explore the force of friction.
Intermediate	Lighten Up	Popping with Power	take a home survey and design an energy-saving for the home.

3.2 Number and Numeration

Students use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of numbers in the development of mathematical ideas.

Elementary students:

- use whole numbers and fractions to identify locations, quantify groups of objects, and measure distances.
- use concrete materials to model numbers and number relationships for whole number and common fractions, including decimal fractions.
- relate counting to grouping and to place-value.
- recognize the order of whole numbers and commonly used fractions and decimals.
- demonstrate the concept of percent through problems related to actual situations.

Intermediate students:

- understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, expanded, and scientific notation).
- understand and apply ratios, proportions, and percents through a wide variety of hands-on explorations.
- develop an understanding of number theory (primes, factors, and multiples).
- recognize order relations for decimals, integers, and rational numbers.

Level	Activity	Source	Students will:
Elementary	A Bus for Us	9.01	explore multiple math concepts (patterning, counting, patterning vocabulary) from a story about a bus ride.
Elementary	Making Ten, My Way	8.10	gather objects from around the classroom and group them in arrangements that will, when added together, equal combined groups of 10.
Elementary	Space Base Three	8.08	use astronauts, space shuttles, and space stations to understand grouping and trading in base three.
Elementary	Counting On One Hundred	8.07	perform various activities in his/her quest for 100.
Elementary	A Fish Story, More or Less	8.06	use a number line to assist them in understanding inequalities.
Elementary	A Pig's Tale	7.10	understand a relationship between numerals, counting and number of objects.
Elementary	A Pumpkin With Class	6.03	count pumpkin seeds and group them in sets of hundreds, tens and ones.
Elementary	Scatter Beans	10.04	play an adapted version of a Native American game using mental math to keep track of their score.
Elementary	Pockets	10.02	practice counting skills using 1-to-1 correspondence.
Elementary	Tangrammy Squares	10.02	use tangrams to explore shapes.
Elementary	Oranges–For the Most Part	10.05	convert fractions to decimals to percents while finding edible portion of oranges.

3.3 Operations

Students use mathematical operations and relationships among them to understand mathematics.

Elementary students:

- add, subtract, multiply, and divide whole numbers.
- develop strategies for selecting the appropriate computational and operational method in problem-solving situations.
- know single digit addition, subtraction, multiplication, and division facts.
- understand the commutative and associative properties.

Intermediate students:

- add, subtract, multiply, and divide fractions, decimals and integers.
- explore the use of operations dealing with roots and powers.
- use grouping symbols (parentheses) to clarify the intended order of operations.
- apply the associative, commutative, distributive, inverse, and identity properties.
- demonstrate an understanding of operational algorithms (procedures for adding and subtracting, etc.).
- develop appropriate proficiency with facts and algorithms.
- apply concepts of ratio and proportion to solve problems.

Level	Activity	Source	Students will:
Elementary	Joys of Jelly Beans, The	Primarily Bears	use jelly beans to estimate
Elementary	Let Me Count the Ways	Primarily Bears	find the mass of various objects and indicate the ordered position.
Elementary	Math with "M&M's"® Candies	Primarily Bears	estimate the number of M&M candies and complete the activities of addition and subtraction.
Elementary	Teddy Bears and Oranges	Primarily Bears	use a non-standard unit of measurement to count, mass, compare and complete the activities of addition and subtraction.
Elementary	Goody Goody Gumballs	Fall into Math and Science	complete an activity in addition looking for combinations for 3, 4, 5, and 6.
Elementary	A Fish Story, More or Less	8.06	use a number line to assist them in understanding inequalities.
Elementary	Cookies For All	8.01	practice the skill of fair sharing.
Elementary	Raisin Fun	6.02	count and record data from examining miniature boxes of two brands of raisins.
Elementary	Rock Hounds and Bears	4.04	use an assortment of small rocks to experience weight measure.
Elementary	Teddy Bears Love to Swim	3.09	explore fair shares with remainders and averaging.
Elementary	Teddy Bears Come Ashore	3.06	practice division using teddy bear counters.
Elementary	Matching Tops and Bottoms	10.08	join two smaller groups to form one larger group of objects.
Elementary	Lattice Multiplication (Napier)	Historical Connections, Vol. I	investigate a method of multiplication used by the early Hindus that uses a lattice and addition is performed diagonally.

3.4 Modeling/Multiple Representation

Students use mathematical modeling/multiple representation to provide means of presenting, interpreting, communicating, and connecting mathematical information and relationships.

Elementary students:

- use concrete materials to model spatial relationships.
- construct tables, charts, and graphs to display and analyze real-world data.
- use multiple representations (simulations, manipulative materials, pictures, and diagrams) as tools to explain the operation of everyday procedures.
- use variables such as height, weight, and hand size to predict changes over time.
- use physical materials, pictures, and diagrams to explain mathematical ideas and processes, and to demonstrate geometric concepts.

Intermediate students:

- visualize, represent, and transform two- and three-dimensional objects.
- use maps and scale drawings to represent real objects or places.
- use the coordinate plane to explore geometric ideas.
- represent numerical relationships in one- and two-dimensional graphs.
- use variables to represent relationships.
- use concrete materials and diagrams to describe the operation of real-world processes and systems.
- develop and explore models that do and do not rely on chance.
- investigate both two- and three-dimensional transformations.
- use appropriate tools to construct and verify geometric relationships.
- develop procedures for basic geometric constructions.

Level	Activity	Source	Students will:
Elementary	A Weigh We Go	Fall into Math and Science	measure his or her own weight.
Elementary	Pop Out Patterns	9.10	make patterns which have a three-dimensional appearance and discover the different designs that are possible by changing the order of the pattern pieces.
Elementary	Taking Turns With Triangles	9.05	describe a square and triangle as he/she cuts the square to make triangles.
Elementary	Quick Quilts, Parts 1 and 2	7.08	design a seasonal/holiday related quilt square by using a specified amount of money to purchase items to be used to decorate the square.
Elementary	Space Shuttle Coordinate Graph	6.08	make an outline drawing of the space shuttle on graph paper by locating and connecting coordinate points.
Elementary	Balanced Faces (Activity Page)	3.01	place numbers on the vertices of a cube such that the sum of each face is 22.
Elementary	Fun Fruits	2.06	use "Fun Fruits" to make four kinds of graphs.
Elementary	Tangrammy Squares	10.02	use tangrams to explore shapes.

3.5 Measurement

Students use measurement in both metric and English measure to provide a major link between the abstractions of mathematics and the real world in order to describe and compare objects and data.

Elementary students:

- understand that measurement is approximate, never exact.
- select the appropriate standard and nonstandard measuring tools in measurement activities.
- understand the attributes of area, length, capacity, weight, volume, time, temperature, and angle.
- estimate and find measures such as length, perimeter, area, and volume using both standard and nonstandard units.
- collect and display data.
- use statistical methods such as graphs, tables, and charts to interpret data.

Intermediate students:

- estimate, make, and use measurement in real-world situations.
- select appropriate standard and nonstandard measurement units and tools to measure to a desired degree of accuracy.
- develop measurement skills and informally derive and apply formulas in direct measurement activities.
- use statistical methods and measures of central tendency to display, describe, and compare data.
- explore and produce graphical representations of data using calculators/computers.
- develop critical judgment for the reasonableness of measurement.

Level	Activity	Source	Students will:
Elementary	Observe a Tree	The Budding Botanist	measure the height and circumference of a tree.
Elementary	Feet Findings	Spring into Math and Science	use non-standard units of measure to measure distance.
Elementary	Let Me Count the Ways	Primarily Bears	explore the concept of measurement by finding the mass of various objects and indicate the ordered position.
Elementary	Teddy Bears and Oranges	Primarily Bears	use a non-standard unit of measurement to count, mass, compare and complete the activities of addition and subtraction.
Elementary	Potato "Eye"-deas	Overhead and Underfoot	compare and contrast potatoes, and list similarities and differences.
Elementary	Are You an Average Joe?	Jawbreakers & Heart Thumpers	find the size of the average person in their class and compare themselves to that average.
Elementary	Have You Got a Minute? (now Minute Minders)	Hardhatting in a Geo-World	perform various tasks for one minute, then repeat the tasks the same number of times to test their reliability as time keepers.
Elementary	Links to Length (1996 Edition)	Hardhatting in a Geo-World	create the longest paper chain possible from limited materials and then measure the results.
Elementary	Minute Minders (formerly Have You Got a Minute?)	Hardhatting in a Geo-World	perform various tasks for one minute, then repeat the tasks the same number of times to test their reliability as time keepers.

continued

3.5 Measurement

Students use measurement in both metric and English measure to provide a major link between the abstractions of mathematics and the real world in order to describe and compare objects and data.

Level	Activity	Source	Students will:
Elementary	Whoa - That's Heavy!	Glide into Winter w/ Math and Science	compare objects and determine which is heavier.
Elementary	A Weigh We Go	Fall into Math and Science	measure his or her own weight.
Elementary	How Tall Are You?	Fall into Math and Science	measure his or her own height.
Elementary	Spread Your Wings	Bats Incredible	estimate and measure the wingspans of a microbat and a megabat using concrete objects.
Elementary	Rainwater Tea	8.08	predict how many small containers or water are needed to fill a larger container and subsequently how many large containers to fill a carafe.
Elementary	A Fit Mitten	5.06	compare the volume of various sizes of mittens using concrete materials as he/she explores the concepts of volume and place value.
Elementary	All Around the Apple	5.02	use an apple to explore measurement and fractional parts.
Elementary	Leaf Safari	3.01	compare, measure, and describe leaves.
Elementary	Pumpkin Caper, The	2.02	make predictions and estimation relating to pumpkins and check them by testing and measuring. They will also prove or disprove two hypotheses using the data they collect.
Elementary	Rows of Bows	11.06	compare their height to a length of ribbon. They will build their understanding of conservation of length.
Elementary	Talk About Time	11.01	position the hands of an analog clock to correspond to various times of day.
Elementary	Just A Minute	10.10	make a timer which will measure a minute.
Elementary	Now That's Using Your Head! (Revised Edition)	Jawbreakers & Heart Thumpers	explore the relationship between height and circumference of the head.
Elementary	Are You a Square?	Hardhatting in a Geo-World	compare their height and arm span. They will examine and interpret class data.
Elementary	Cups 'n Stuff (formerly Volumes of Fun)	Hardhatting in a Geo-World	compare mass of five items with equal volume.
Elementary	Filling Stations (1996 Edition)	Hardhatting in a Geo-World	compare the capacity of various containers including a liter.
Elementary	Volumes of Fun (now Cups 'n Stuff)	Hardhatting in a Geo-World	compare mass of five items with equal volume.

continued

3.5 Measurement

Students use measurement in both metric and English measure to provide a major link between the abstractions of mathematics and the real world in order to describe and compare objects and data.

Level	Activity	Source	Students will:
Elementary	Temperature's Rising	From Head to Toe	analyze information gathered from a sample population to determine whether activity changes body temperature.
Elementary	Paper - Penny Boxes	6.06	explore the concept of volume by building a variety of paper boxes.
Elementary	Wrap Around Ruler	11.10	use a non-customary ruler made from straw pieces to determine equalities and inequalities.
Elementary	Balance Bazaar (Maximizing Math)	11.05	compare the mass of up to five objects.
Intermediate	Big Banana Peel! The	Math + Science, A Solution	use metric measurement to find the mass of a banana and its peel.
Intermediate	Mini Metric Olympics	Math + Science, A Solution	practice using metric units by estimating and measuring in an Olympic setting.
Intermediate	Mini Metric Olympics II	Math + Science, A Solution	practice using metric units by estimating and measuring in an Olympic setting.
Intermediate	Weight Watchers	Math + Science, A Solution	find and record the difference between the actual mass and the estimated mass.
Intermediate	Water in Apples	Jawbreakers & Heart Thumpers	investigate water loss in diced, peeled and unpeeled apples.
Intermediate	A Salty Problem	Floaters & Sinkers	calculate the ratio of salt to water for two different solutions and then calculate the percentage of salt in each solution.
Intermediate	How Much Cargo Will It Hold?	Floaters & Sinkers	compare mass, volume, and density to determine which should be used for making fair changes for hauling cargo.
Intermediate	Tin Can Space	Floaters & Sinkers	estimate, measure, and calculate the volume of six different cans.
Intermediate	Student Made Measuring Tools	5.01	make measuring tools to use in a variety of activities.
Intermediate	Make Room for Me!	10.02	combine different liquids and solids to discover that these materials do not completely fill the space measured by their volumes.

3.6 Uncertainty

Students use the idea of uncertainty to illustrate that mathematics involves more than exactness when dealing with everyday situations.

Elementary students:

- make estimates to compare to actual results of both formal and informal measurement.
- make estimates to compare to actual results of computations.
- recognize situations where only an estimate is required.
- develop a wide variety of estimation skills and strategies.
- determine the reasonableness of results.
- predict experimental probabilities.
- make predictions using unbiased random samples.
- determine probabilities of simple events.

Intermediate students:

- use estimation to check the reasonableness of results obtained by computation, algorithms, or the use of technology.
- use estimation to solve problems for which an exact answer is inappropriate.
- estimate the probability of events.
- use simulation techniques to estimate probabilities.
- determine probabilities of independent and mutually exclusive events.

Level	Activity	Source	Students will:
Elementary	Jar that Likes to Keep you Guessing, The	Primarily Bears	use a jar of small objects to build skills in estimation, counting, and place value.
Elementary	Math with "M&M's"® Candies	Primarily Bears	estimate the number of M&M candies and complete the activities of addition and subtraction.
Elementary	Teddy Bears Playing in the Den	Primarily Bears	use random samples to make predictions about a population.
Elementary	A Birthday Surprise (Pascal)	Historical Connections, Vol. I	survey their classmates until a common birthdate is found.
Elementary	Shaping Up	Hardhatting in a Geo-World	look at nature and man-made things for examples of different shapes.
Elementary	Valentine Candy Count	Glide into Winter with Math and Science	discover what color valentine candy is found more often than any other in a standard bag of Valentine candy.
Elementary	Gimme A Gimel (Dreidel Game)	8.05	play a game and identify the possible outcomes of “take all”.
Elementary	A Pumpkin Cover Up	8.03	explore estimation, grouping, and area using a point of reference as he/she counts a large number.
Elementary	A Pumpkin With Class	6.03	count pumpkin seeds and group them in sets of hundreds, tens and ones.
Elementary	Disease X Dilemma, The	5.01	compare blood profiles obtained by random sampling and make diagnoses by comparing these to predetermined profiles from the general population.

continued

3.6 Uncertainty

Students use the idea of uncertainty to illustrate that mathematics involves more than exactness when dealing with everyday situations.

Level	Activity	Source	Students will:
Elementary	Ahlewus	4.10	play a Native American game based on predictions about events, gathering data, and arriving at results.
Elementary	Disease X Crisis, The	4.10	compare blood profiles obtained by random sampling and make diagnoses by comparing these to predetermined profiles from the general population.
Elementary	Fair Play	3.05	determine how to award points to players and the probability of winning a game of chance.
Elementary	Good Order Provides the Clue	3.05	determine the theoretical probability of a player winning a "Scissors, Paper, Rock" game.
Elementary	Scissors, Rock, or Paper	3.05	play a probability game.
Elementary	Sharing Birthdays	2.01	create and interpret a class birthday graph.
Elementary	Spinning Sums (Maximizing Math)	11.08	determine the probability of specific sums when adding the numbers from each of two 0-9 spinners.
Elementary	A Close Call	6.01	estimate the number of objects in a container and devise a strategy for calculating a close approximation to the exact number without counting.
Elementary	A Definite "Maybe"	3.04	brainstorm vocabulary related to mathematical probability - from "no chance" to "certainty".
Intermediate	Probably Pythagorean!	Pieces & Patterns	roll three dice and determine what the probability will be that the resulting triangles will be acute, obtuse, or right, based on the Pythagorean Theory.
Intermediate	See How They Roll	Pieces & Patterns	investigate the probability of rolling three dice so that a given type of triangle will result.
Intermediate	Penny Sort & Nickel Dates, The	Math + Science, A Solution	classify pennies and nickels by minting dates, determine median and modes, construct real, representational, and abstract bar graphs, and interpret results.
Intermediate	Great Expectations on the Midway, Part III	8.05	investigate the probability factors involved in carnival midway spin games.
Intermediate	Great Expectations on the Midway, Part II	8.04	investigate the probability factors involved in carnival midway spin games.
Intermediate	Great Expectations on the Midway: Using Probability to Find Expected Value	8.03	investigate the probability factors involved in carnival midway spin games.

3.7 Patterns/Functions

Students use patterns and functions to develop mathematical power, appreciate the true beauty of mathematics, and construct generalizations that describe patterns simply and efficiently.

Elementary students:

- recognize, describe, extend, and create a wide variety of patterns.
- represent and describe mathematical relationships.
- explore and express relationships using variables and open sentences.
- solve for an unknown using manipulative materials.
- use a variety of manipulative materials and technologies to explore patterns.
- interpret graphs.
- explore and develop relationships among two- and three-dimensional geometric shapes.
- discover patterns in nature, art, music, and literature.

Intermediate students:

- recognize, describe, and generalize a wide variety of patterns and functions.
- describe and represent patterns and functional relationships using tables, charts and graphs, algebraic expressions, rules, and verbal descriptions.
- develop methods to solve basic linear and quadratic equations.
- develop an understanding of functions and functional relationships: that a change in one quantity (variable) results in change in another.
- verify results of substituting variables.
- apply the concept of similarity in relevant situations.
- use properties of polygons to classify them.
- explore relationships involving points, lines, angles, and planes.
- develop and apply the Pythagorean principle in the solution of problems.
- explore and develop basic concepts of right triangle trigonometry.
- use patterns and functions to represent and solve problems.

Level	Activity	Source	Students will:
Elementary	Peeking at Patterns	Sense-able Science	look for patterns inside and outside the classroom.
Elementary	Shape Search	Sense-able Science	identify, sort, and count sets of shapes using only the sense of touch.
Elementary	Watching the Weather	Primarily Earth	observe and record weather conditions over a long period of time.
Elementary	Teddy Bears Dress for Summer, Fall, Winter & Spring	Primarily Bears	explore permutations, describing the possible combinations of given outfits for a Teddy Bear.
Elementary	Going Nuts	Fall into Math and Science	use nuts to count, classify, and construct a graph.
Elementary	Shape Up	Fall into Math and Science	predict where shapes belong.
Elementary	Making Ten, My Way	8.10	gather objects from around the classroom and group them in arrangements that will, when added together, equal combined groups of 10.

continued

3.7 Patterns/Functions

Students use patterns and functions to develop mathematical power, appreciate the true beauty of mathematics, and construct generalizations that describe patterns simply and efficiently.

Level	Activity	Source	Students will:
Elementary	Counting On One Hundred	8.07	perform various activities in his/her quest for 100.
Elementary	Picking Apart Patterns	8.05	construct, describe and group similar patterns into pattern families.
Elementary	Gingerbread Kids Make Connections	6.05	use measurement and observe attributes to help them sort, and graph, while making both paper and real gingerbread children.
Elementary	Pyramid Patterns (Activity Page)	2.10	explore the pattern of how many sides of squares are exposed (on the perimeter) of various pyramids.
Elementary	Square Patterns (Activity Page)	2.10	explore the pattern of how many sides of squares are exposed (on the perimeter) of various squares.
Elementary	Pass The Peanuts (Math Poster)	2.08	discover how many ways three people can share various numbers of peanuts.
Elementary	Quilted Bread Spreads	11.05	use bread to explore quilting patterns.
Elementary	McGregors' Garden, The	10.09	use positional and ordinal descriptions. Counting and whole number operations will be practiced.
Elementary	Shape Weavers	10.07	weave two oblong shapes together to form a patterned heart.
Elementary	Pop Out Patterns	9.10	make patterns which have a three-dimensional appearance and discover what different designs he/she gets by changing the order of the pattern pieces.
Elementary	Taking Turns With Triangles	9.05	describe a square and triangle as he/she cuts the square to make triangles.
Elementary	Eager Weavers	8.04	construct patterns to discover additional patterns/designs which emerge through the art of weaving.
Elementary	Counting on Combinations (Maximizing Math)	10.07	learn that the sum stays the same when changing the order of addends.
Intermediate	Teddy Bear Clubs Go Weighing	Primarily Bears	find the masses of a variety of objects in a problem solving mode.
Intermediate	Teddy Bears Go Sledding, The	Primarily Bears	explore arrangements involving 2, 3, and 4 objects to create a pattern for predicting a general result.
Intermediate	Practically Pi	Math + Science, A Solution	explore the relationship between the circumference and diameter of any given circle to find pi.
Intermediate	Clever Lever 2	Machine Shop	build a second class lever and explore how it works.

New York State Learning Standards Science

Standard 4 - Science - Living Environment

4.1 Living things are both similar to and different from each other and non-living things.

Elementary students:

- describe the characteristics of and variations between living and non-living things.
- describe the life processes common to all living things.

Intermediate students:

- compare and contrast the parts of plants, animals and one-celled organisms.
- explain the function of the major human organ systems and their interactions.

Level	Activity Title	Source	Students will:
Elementary	Exploring Germination	The Budding Botanist	plant a spoonful of mixed seeds and observe the seeds germinating.
Elementary	Seed Plants (Background Info)	The Budding Botanist	read facts about seed plants (gymnosperms and angiosperms).
Elementary	Test a Seed	The Budding Botanist	test seeds for oil and starch content.
Elementary	A Seed Grows	Primarily Plants	grow a bean seed and observe the growth.
Elementary	Cuttings	Primarily Plants	observe that plants can be grown by other means than by germination of seeds.
Elementary	Inside a Seed	Primarily Plants	observe lima beans and identify the major parts of the seed.
Elementary	It's in the Bag	Primarily Plants	plant seeds and observe and measure the growth of roots, stems and leaves.
Elementary	Plants and Space	Primarily Plants	understand that plants grow in many places and need space.
Elementary	Plants and Sunlight	Primarily Plants	prove that plants need light in order for it to grow correctly.
Elementary	Plants and Water	Primarily Plants	investigate whether or not a plant needs water to live.
Elementary	Root Study	Primarily Plants	describe the function of the root in a plant.
Elementary	Stem Study	Primarily Plants	learn how stems are necessary to plants.
Elementary	What Temperature is Best?	Primarily Plants	realize that plants are affected by extremes in temperature.
Elementary	Fishful Thinking	Critters	draw a goldfish before and after observing one.
Elementary	Gone Fishing	Critters	use paper fish cutouts to see the effects of camouflage on prey populations.
Elementary	Missing Moths	Critters	observe an environment with a variety of moths to see the effects of camouflage on animal visibility
Elementary	Under Cover	Critters	explore various kinds of animal coverings
Elementary	Observing Bulbs	7.03	observe and describe physical characteristics of bulbs.
Elementary	Hide And Seek	2.10	make a critter and observe the effects of camouflage on animal visibility.
Elementary	Hot Foot, Cold Feet	2.09	study the response of isopods (sowbugs)
Elementary Intermediate	Enviroscape	The Budding Botanist	study a plant in its natural environment using eyes, hand lenses and/or microscopes.

continued Living Environment

4.1 Living things are both similar to and different from each other and non-living things.

Level	Activity Title	Source	Students will:
Intermediate	Cell as a Factory, The	Magnificent Microworld Adventures	build a model of a cell to learn its structures and functions.
Intermediate	How Does Your Heart Rate?	From Head to Toe	gather, graph and analyze information about the pulse rate, breath rate, and lung capacity.
Intermediate	Lenses and Ladybugs	9.08	explore insect features by observing a ladybug.
Intermediate	Protozoan a Goin': Dropping in on Protozoa	9.04	observe one-celled organisms, called protozoa, in a drop of pond water.
Intermediate	Reaction Countdown	5.08	experiment with reaction time.
Intermediate	Animals of a Sort	10.07	use animal attributes to sort in a tree diagram.

4.2 Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parent and offspring.

Elementary students:

- recognize that traits of living things are both inherited and acquired or learned.
- recognize that for humans and other living things there is genetic continuity between generations.

Intermediate students:

- describe sexual and asexual mechanisms for passing on genetic materials from generation to generation.
- describe simple mechanisms related to the inheritance of some physical traits in offspring.

Level	Activity Title	Source	Students will:
Elementary	Picturing a Dichotomy	9.08	compare and contrast with others the data they record about certain traits.
Intermediate	Trait Combos	6.10	collect and analyze data about common human traits (heredity).
Intermediate	Teddy Bears Come in Pairs	2.05	investigate Mendelian Law of Heredity using teddy bear counters.

Living Environment

4.3 Individual organisms and species change over time.

Elementary students:

- describe how the structures of plants and animals compliment the environment of the plant or animal.
- observe that differences within a species may give individuals an advantage in surviving and reproducing.

Intermediate students:

- describe the sources of variation in organisms and their structures and relate the variations to survival.
- describe factors responsible for competition within species and the significance of that competition.

Level	Activity Title	Source	Students will:
Elementary	A Weigh We Go	Fall into Math and Science	measure his or her own weight.
Elementary	How Tall Are You?	Fall into Math and Science	measure his or her own height.
Elementary	Noses for Nectar	Bats Incredible	understand how nectar-eating bats contribute to plant pollination.
Elementary	Just Between Bats	Bats Incredible 7.03	complete a Venn diagram by comparing and contrasting physical characteristics of two kinds of bats.
Elementary	Bat Masks	Bats Incredible	identify the kind of food a bat eats by its facial features.
Elementary	Microbat and Megabat	Bats Incredible	compare facial features of microbats and megabats.
Elementary	Wings N' Things	Bats Incredible	build a large bat wing and a bird wing to fit the students' arm. Compare and contrast these.
Elementary	Look at Me Now!	9.02	compare and contrast human characteristics with bats.
Elementary	Inside a Bat	7.01	explore common traits between bats.
Elementary	Cactus	The Budding Botanist 7.10	study the adaptations of a cactus plant.
Elementary	Blue Wave	Spring into Math and Science	discover that all liquids do not mix
Elementary	Bunny Dough	Spring into Math and Science	bake dough bunnies and observe the changes over time.
Elementary	Making Ice Cream	Spring into Math and Science	observe liquid changing to solid.
Elementary	Rock Groups	Primarily Earth 9.07	observe the physical properties of rocks and group them according to certain attributes.
Elementary	Water to Ice to Water	Primarily Earth	discover that water expands as it freezes and that it will float in water.
Elementary	Slip Sliding Away	Popping with Power	discover the lubricating properties of various oils.
Elementary	How Does Your Corn Pop?	Glide into Winter w/ Math and Science	listen for evidence that popcorn is popping and guess how far it will travel from the popper.

continued Living Environment

4.3 Individual organisms and species change over time.

Level	Activity Title	Source	Students will:
Elementary	Polar Bear Pie	Glide into Winter w/ Math and Science	observe how long it takes for an ice cream bar to melt.
Elementary	Washers and Dryers	8.02	observe and measure changes in peeled apple slices as fruit is exposed to air over a period of time.
Elementary	Let's Make Ice Cream!	6.06	observe the process of liquid changing to a solid
Elementary	Thanksgiving Soup	6.04	observe change in ingredients as they cook
Elementary	Cranberries to Craisins	10.04	learn that cranraisins come from cranberries
Elementary	Going to the Bog (Song)	10.04	sing a song that reinforces the properties of cranberries.
Elementary	Can It Matter?	10.02	use their sense of hearing to determine the state of matter found in four film canisters.
Elementary	What Can This Matter Be? (Song)	10.02	sing a song that reinforces states of matter.
Elementary	My Rock	Primarily Earth 4.02	experience that rocks have properties and characteristics.
Elementary	Sorda Pop	Glide into Winter w/Math and Science	observe chemical change.
Elementary	Water Olympics	Water Precious Water 2.06	discover properties of water through an activity (Olympic) format.
Elementary	By Golly By Gum!	Jawbreakers & Heart Thumpers 5.10	use the scientific method to discover what happens to the mass of gum when it is chewed.
Elementary	By Golly, By Gum, By Time (Revised Edition)	Jawbreakers & Heart Thumpers 5.10	discover how the mass of gum is affected by the amount of time it is chewed.
Elementary	Water in Apples	Jawbreakers & Heart Thumpers 4.01	investigate water loss in diced, peeled and unpeeled apples.
Elementary	Sweat It Out (now Cut and Dried)	Jawbreakers & Heart Thumpers	explore the comparative amount of water in different food.
Elementary	Grapes to Raisins	Fall into Math and Science	observe the change from grapes to raisins as the grapes lose water.
Elementary	What Do You Think Will Float?	3.09	determine the density of various materials and predict whether it will sink or float in water.
Elementary	Plastics by the Numbers	11.09	observe the characteristics that help us separate one type of plastic container from another.

continued Living Environment

4.3 Individual organisms and species change over time.

Level	Activity Title	Source	Students will:
Elementary	Change Matters	11.08	determine whether various changes in matter are physical or chemical.
Elementary	No Chore to Pour (Mind Boggler)	10.10	observe adhesion and cohesion in water as it is poured down a string.
Elementary	Salty H20	Off the Wall Science	observe that salt remains in the pan when salt water is evaporated.
Elementary	Cut and Dried (formerly Sweat It Out)	Jawbreakers & Heart Thumpers	explore the comparative amount of water in different food.
Elementary	A Crazy Colloid (formerly Goo Yuck)	6.01	experience the properties of a substance that is both a liquid and a solid.
Intermediate	Super Sleuth	Math + Science, A Solution	discover chemical changes of several white powders.
Intermediate	Better Butter	Fun with Foods	observe changes in appearance and volume of cream as it turns to butter.
Intermediate	I Scream!	Fun with Foods	observe the change of liquid to a semi-solid state due to a change in temperature.
Intermediate	My-O-Mayo	Fun with Foods	make an emulsion, specifically mayonnaise.
Intermediate	Yeast High Risers	Fun with Foods	measure changes in the mass and volume of bread dough over time.
Intermediate	Will It Float?	Floaters & Sinkers 3.09	explore the density of an orange then predict if it will sink or float in water.
Intermediate	Tub That Spilleth Over, The	8.06	explore and test ideas about water displacement.
Intermediate	Where Do You Draw the Line?	8.03	calculate the volume and density of a cargo ship.
Intermediate	A Strange Change (Mind Boggler)	11.10	observe the chemical changes of rust.
Intermediate	Dealing with Density	11.06	compare and contrast volume and mass using water-filled balloons.
Intermediate	How Sweet It Is...	Fun with Foods 10.09	use "Clinitest" strips to test various foods for simple sugars.
Intermediate	Trickle Down Theory	9.03	observe the infiltration of water through particles with different porosity.

Living Environment

4.4 The continuity of life is sustained through reproduction and development.

Elementary students:

- describe the major stages of life cycles of selected plants and animals.
- describe evidence of growth, repair and maintenance, such as nails, hair, and bone, and the healing of cuts and bruises.

Intermediate students:

- observe and describe variations in reproductive patterns of organisms, including sexual and asexual reproduction.
- explain the role of sperm and egg cells in sexual reproduction.
- observe and describe developmental patterns in selected plants and animals (e.g., insects, frogs, humans, seed-bearing plants).
- observe and describe cell division at the microscopic level and its macroscopic effects.

Level	Activity	Source	Students will:
Elementary	Life Cycle of a Mealworm, The	Magnificent Microworld Adventures	observe a mealworm with the unaided eye and a hand lens. They draw and record data about the mealworms.
Elementary	Brine Shrimp	Critters	observe and study brine shrimp as they hatch and grow.
Elementary	Mealworms on Stage	Critters	observe and record data for a changing population of mealworms.
Elementary	My Mealworm	Critters	use science process skills to become familiar with mealworms and their lifecycles.
Elementary	Family Sense	Bats Incredible	simulate the ways a mother bat finds her pup.
Elementary	A Time of Their Own	9.03	observe and compare the metamorphosis of a butterfly and a moth.

Living Environment

4.5 Organisms maintain a dynamic equilibrium that sustains life.

Elementary students:

- describe basic life functions of common living specimens (e.g., guppy, mealworm, gerbil).
- describe some survival behaviors of common living specimens.
- describe the factors that promote good health in growth in humans.

Intermediate students:

- compare the way a variety of living specimens carry out basic life functions and maintain dynamic equilibrium.
- describe the importance of basic nutrients, vitamins and minerals in maintaining health and promoting growth and explain the need for constant input of energy for living organisms.

Level	Activity	Source	Students will:
Elementary	I'm Stuck On You	9.05	simulate how animals catch their food.
Intermediate	Fat Finders (Revised Edition)	Jawbreakers & Heart Thumpers	explore the digestive process in the small intestine.
Intermediate	Humpback Habits	9.02	study feeding habits of humpback whales.

4.6. Plants and animals depend on each other and their physical environment.

Elementary students:

- describe how plants and animals, including humans, depend on each other and the nonliving environment.
- describe the relationship if the sun as an energy source for living and nonliving cycles

Intermediate students:

- describe the flow of energy and matter through food chains and food webs.
- provide evidence that green plants make food and explain the significance of this process to other organisms.

Level	Activity	Source	Students will:
Elementary	Don't Leaf Out The Vegetables	Fall into Math and Science	learn that certain types of leaves are edible.
Elementary	Catch Me If You Can	Critters	learn how energy is passed through a food chain
Elementary	Make Believe Bats	Bats Incredible	play a game that simulates how bats use echolocation to determine location of prey.
Elementary	Sensational Ears	Bats Incredible	attempt to catch a moving object using only the sense of hearing.
Elementary	Food Chains and Webs	9.09	learn about the interdependence of life.
Elementary	A Special Plot	10.01	observe a microhabitat to understand a larger habitat.
Elementary	Classy Caves	Bats Incredible	create caves to understand the structure of caves and their role as one type of bat environment.
Elementary	Color Me Safe	Overhead and Underfoot	discover the importance of an animal's coloring in relation to its survival.

Living Environment

4.6. Plants and animals depend on each other and their physical environment.

Level	Activity	Source	Students will:
Elementary	Dirt Dwellers	10.09	collect and observe tiny decomposers animals.
Intermediate	Photosynthesis	The Budding Botanist	observe the production of oxygen through photosynthesis.
Intermediate	Transpiration	The Budding Botanist	observe transpiration and water movement that occurs in plant leaves.
Intermediate	My Moldy Garden	Fun with Foods	record mold growth over time.
Intermediate	Pyramid of Choices	8.04	categorize food in a food pyramid.

4.7. Human decisions and activities have had a profound impact on the physical and living environment

Elementary students:

- identify ways in which humans have changed their environment and the effects of those changes

Intermediate students:

- describe how living things, including humans, depend upon the living and nonliving environment for their survival.
- describe the effects of environmental changes on human and other populations.

Level	Activity	Source	Students will:
Elementary	Leaf The Dyeing To Us!	Fall into Math and Science	learn how dyes are made from food.
Elementary	Bats Incredible! (Post-assessment)	Bats Incredible	write a friendly letter discussing bats and the need for bat preservation.
Elementary	Save the Bats	Bats Incredible	play a game to learn why bats are necessary in nature.
Intermediate	Pollution Solution	Overhead and Underfoot	observe and identify pollutants.
Intermediate	Bottled Pollution	Our Wonderful World	measure pollution in the air.
Intermediate	What's In The Air?	Our Wonderful World	learn that pollutants vary in different habitats.
Intermediate	Every Breath You Take	Down to Earth	measure amount of pollution produced by cars.
Intermediate	A Sign of the Times	9.06	determine the types of products that are made from recycled paper.
Intermediate	Teddy Bears Fight Pollution	2.03	study the effects of pollutants on animals.
Intermediate	Global Gains	11.02	study world population changes.

Standard 4 - Science - Physical Setting

4.1 The Earth and celestial phenomena can be described by principles of relative motion and perspective.

Elementary students:

- describe patterns of daily, monthly, and seasonal changes in their environment.

Intermediate students:

- explain daily, monthly, and seasonal changes on earth.

Level	Activity	Source	Students will:
Elementary	Watching the Weather	Primarily Earth	observe and record weather conditions over a long period of time.
Elementary	Weather Wear	Fall into Math and Science	learn that weather influences what they wear.
Elementary	April Showers Bring May Flowers	3.10	record weather types on a graph and compare weather types to the day's temperature recorded on a graph.
Elementary	Me And My Shadow	Pieces & Patterns	measure the length of their shadows at different times of the day to determine when a shadow casts its longest and shortest image.
Elementary	Sunshine	6.01	investigate one aspect of seasonal changes by observing and recording the number of hours of daylight.
Intermediate	Sun Dance	Through the Eyes of the Explorers	track shadows from the sun over a period of several months to determine patterns of sun motions. The cycles they discover will relate to using the sun as a timepiece and navigational guide.
Intermediate	Sun Watchers	Pieces & Patterns	use the angle of the shadow cast by a meter stick to learn about time of day and apply information to construct a sundial watch.
Intermediate	Moon Shines Bright, The	Out of This World	chart the apparent movement of the moon over a five hour period.
Intermediate	Wrap Around the Clock	8.03	determine the number of daylight hours and observe the changes over time.
Intermediate	Sun Watchers (SPANISH VERSION)	6.08	use the angle of the shadow cast by a meter stick to learn about time of day and apply information to construct a sundial watch.
Intermediate	Isn't It Interesting: Enlightening Weather	11.10	read facts about lightning.
Intermediate	Facing Up to the Moon	10.08	observe changing moon phases.
Intermediate	Weather Watch	10.02	gather hourly weather Information from radio, TV or computer , and observe weather patterns in a particular location.

Physical Setting

4.2 Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.

Elementary students:

- describe the relationships among air, water, and land on Earth.

Intermediate students:

- explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
- describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.

Level	Activity Title	Source	Students will:
Elementary	Huff and Puff	Spring into Math and Science	move objects by blowing at them.
Elementary	Ice Breakers	Primarily Earth	observe the effect of freezing water on simulated rock.
Elementary	Agent Erosion	Primarily Earth	use models to observe that rocks are weathered into sands and soils.
Elementary	A Disappearing Act	Primarily Earth	see the results of water evaporating.
Elementary	Rock 'N Rule (1994 Edition)	Overhead and Underfoot	classify rocks according to properties.
Elementary	Drying on the Line	9.07	observe differences in evaporation in various conditions.
Elementary	Rain Away	Water Precious Water	observe the action of rain on a bare hillside.
Elementary	Don't Rain Away	Water Precious Water	observe the action of rain on a protected hillside.
Elementary	Mini Water Cycle	Water Precious Water	demonstrate evaporation and condensation inside a plastic bag.
Elementary	Puddle Pushers	9.06	observe that water in a puddle evaporates after a period of time.
Elementary	Moving Water	Water Precious Water	use a demonstration to introduce the concept of water changing forms through the process of evaporation and condensation.
Elementary	Moving Molecules	Water Precious Water	determine if the amount of surface area will affect the evaporation rate of liquids.
Elementary	Moving Raindrops	Water Precious Water	construct a visual aid that depicts the water cycle.
Elementary	Pond Today Meadow Tomorrow	Water Precious Water	simulate a pond turning into a meadow as water evaporates due to physical and biological interactions.
Elementary	Water in 5 Containers	Off the Wall Science	observe that the larger the surface area of water exposed to the air, the greater the evaporation.
Elementary	Water Cycle (Song)	9.07	sing a song that reinforces the water cycle.
Elementary	Erosion (Song)	9.05	sing a song that reinforces erosion concepts.
Elementary	Moving Raindrops in the Water Cycle	2.03	move the same water drops through the water cycle emphasizing form and distance the water molecule will follow.

continued Physical Setting

4.2 Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.

Intermediate	Water Still On The Hill	Our Wonderful World	observe and experience the process of extracting water from the air through condensation.
Intermediate	Quick Sand	Down to Earth	observe the effect of a streams slope and rate of flow on its rate of erosion.
Intermediate	Sand Dunes and Snow Drifts	9.05	observe the effect of moving air on sand and snow.

4.3 Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Elementary students:

- observe and describe properties of materials using appropriate tools.
- describe chemical and physical changes, including changes in states of matter.

Intermediate students:

- observe and describe physical properties of materials, such as density, conductivity, and solubility.
- distinguish between chemical and physical changes.
- develop their own mental models to explain common chemical reactions and changes in states of matter.

Level	Activity	Source	Students will:
Elementary	Blue Wave	Spring into Math and Science	discover that all liquids do not mix
Elementary	Bunny Dough	Spring into Math and Science	bake dough bunnies and observe the changes over time.
Elementary	Making Ice Cream	Spring into Math and Science	observe liquid changing to solid.
Elementary	Rock Groups	Primarily Earth 9.07	observe the physical properties of rocks and group them according to certain attributes.
Elementary	Water to Ice to Water	Primarily Earth	discover that water expands as it freezes and that it will float in water.
Elementary	Slip Sliding Away	Popping with Power	discover the lubricating properties of various oils.
Elementary	How Does Your Corn Pop?	Glide into Winter w/ Math and Science	listen for evidence that popcorn is popping and guess how far it will travel from the popper.
Elementary	Polar Bear Pie	Glide into Winter w/ Math and Science	observe how long it takes for an ice cream bar to melt.

continued Physical Setting

4.3 Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Level	Activity	Source	Students will:
Elementary	Washers and Dryers	8.02	observe and measure changes in peeled apple slices as fruit is exposed to air over a period of time.
Elementary	Let's Make Ice Cream!	6.06	observe the process of liquid changing to a solid
Elementary	Thanksgiving Soup	6.04	observe change in ingredients as they cook
Elementary	Cranberries to Craisins	10.04	learn that cranraisins come from cranberries
Elementary	Going to the Bog (Song)	10.04	sing a song that reinforces the properties of cranberries.
Elementary	Can It Matter?	10.02	use their sense of hearing to determine the state of matter found in four film canisters.
Elementary	What Can This Matter Be? (Song)	10.02	sing a song that reinforces states of matter.
Elementary	My Rock	Primarily Earth 4.02	experience that rocks have properties and characteristics.
Elementary	Sorda Pop	Glide into Winter w/ Math and Science	observe chemical change.
Elementary	Water Olympics	Water Precious Water 2.06	discover properties of water through an activity (Olympic) format.
Elementary	By Golly By Gum!	Jawbreakers & Heart Thumpers 5.10	use the scientific method to discover what happens to the mass of gum when it is chewed.
Elementary	By Golly, By Gum, By Time (Revised Edition)	Jawbreakers & Heart Thumpers 5.10	discover how the mass of gum is affected by the amount of time it is chewed.
Elementary	Water in Apples	Jawbreakers & Heart Thumpers 4.01	investigate water loss in diced, peeled and unpeeled apples.
Elementary	Sweat It Out (now Cut and Dried)	Jawbreakers & Heart Thumpers	explore the comparative amount of water in different food.
Elementary	Grapes to Raisins	Fall into Math and Science	observe the change from grapes to raisins as the grapes lose water.
Elementary	What Do You Think Will Float?	3.09	determine the density of various materials and predict whether it will sink or float in water.
Elementary	Plastics by the Numbers	11.09	observe the characteristics that help us separate one type of plastic container from another.
Elementary	Change Matters	11.08	determine whether various changes in matter are physical or chemical.
Elementary	No Chore to Pour (Mind Boggler)	10.10	observe adhesion and cohesion in water as it is poured down a string.

continued Physical Setting

4.3 Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Level	Activity	Source	Students will:
Elementary	Salty H20	Off the Wall Science	observe that salt remains in the pan when salt water is evaporated.
Elementary	Cut and Dried (formerly Sweat It Out)	Jawbreakers & Heart Thumpers	explore the comparative amount of water in different food.
Elementary	A Crazy Colloid (formerly Goo Yuck)	6.01	experience the properties of a substance that is both a liquid and a solid.
Intermediate	Super Sleuth	Math + Science, A Solution	discover chemical changes of several white powders.
Intermediate	Better Butter	Fun with Foods	observe changes in appearance and volume of cream as it turns to butter.
Intermediate	I Scream!	Fun with Foods	observe the change of liquid to a semi-solid state due to a change in temperature.
Intermediate	My-O-Mayo	Fun with Foods	make an emulsion, specifically mayonnaise.
Intermediate	Yeast High Risers	Fun with Foods	measure changes in the mass and volume of bread dough over time.
Intermediate	Will It Float?	Floaters & Sinkers 3.09	explore the density of an orange then predict if it will sink or float in water.
Intermediate	Tub That Spilleth Over, The	8.06	explore and test ideas about water displacement.
Intermediate	Where Do You Draw the Line?	8.03	calculate the volume and density of a cargo ship.
Intermediate	A Strange Change (Mind Boggler)	11.10	observe the chemical changes of rust.
Intermediate	Dealing with Density	11.06	compare and contrast volume and mass using water-filled balloons.
Intermediate	How Sweet It Is...	Fun with Foods 10.09	use "Clinitest" strips to test various foods for simple sugars.
Intermediate	Trickle Down Theory	9.03	observe the infiltration of water through particles with different porosity.

Physical Setting

4.4 Energy exists in many forms, and when these forms change, energy is conserved.

Elementary students:

- describe a variety of forms of energy (e.g., heat, chemical, and light) and the changes that occur in objects when they interact with those forms of energy.
- observe the way one form of energy can be transformed into another form of energy present in common situations (e.g., mechanical to heat energy, mechanical to electrical energy, chemical to heat energy).

Intermediate students:

- describe the sources and identify the transformations of energy observed in everyday life.
- observe and describe heating and cooling events.
- observe and describe energy changes related to chemical reactions.
- observe and describe the properties of sound, light, magnetism and electricity.
- describe situations that support the principle of conservation of energy.

Level	Activity	Source	Students will:
Elementary	Cold Tin and Hot Hands	Primarily Physics; 5.05	observe that air, when heated, will expand.
Elementary	Eggs - Full of Sound	Primarily Physics	identify objects by the sound they make.
Elementary	Heat and Color	Primarily Physics	observe that dark colors absorb radiant energy faster than light colors.
Elementary	Heat Energy and Color	Primarily Physics	observe that dark colors absorb radiant energy faster than light colors.
Elementary	Heat Energy from Friction	Primarily Physics	discover that rubbing two surfaces together produces heat energy.
Elementary	Heat Energy Moves	Primarily Physics	discover that metals are a good conductor of heat and plastic and wood are not.
Elementary	Heat Energy Travels	Primarily Physics	observe that metal is a good conductor of heat energy.
Elementary	Musical Bottles	Primarily Physics	observe differences in sound when glass bottles, filled with different amounts of water, are tapped.
Elementary	Musical Instruments	Primarily Physics	construct instruments that can be struck, blown into, or plucked.
Elementary	Paper Cup Telephone	Primarily Physics	demonstrate that sound travels through solids.
Elementary	Sound Energy (Fact Sheet)	Primarily Physics	read facts about sound energy.
Elementary	Sound is Vibration	Primarily Physics	learn that vibrating objects produce sounds and cause vibrations in whatever they touch.
Elementary	Traveling Sounds	Primarily Physics	explore the concept that sound travels through air, water and wood.
Elementary	What is Energy (Fact Sheet)	Primarily Physics	read facts about energy.
Elementary	Cartons 'N Cotton	Popping with Power	discover the effectiveness of insulation.
Elementary	Polar Brrrs	Popping with Power	design ways to prevent an ice cube from melting.

Physical Setting

4.4 Energy exists in many forms, and when these forms change, energy is conserved.

Level	Activity	Source	Students will:
Elementary	Rally Round the Room	Pieces & Patterns	use hot wheels or matchbox type cars to explore concepts of friction, kinetic energy and distance traveled off an inclined plane.
Elementary	Butter and Margarine Candles	Off the Wall Science	observe that there are oils in butter and margarine.
Elementary	Electric Breakfast I	Glide into Winter w/ Math and Science	learn that friction causes static electricity.
Elementary	Electric Breakfast II	Glide into Winter w/ Math and Science	learn that friction causes static electricity.
Elementary	Melt an Ice Cube	7.04	determine ways in which to rapidly melt and ice cube and ways in which to prevent ice from melting.
Elementary	Plastic, Oh No, Band	3.09	observe sound pitch using a straw.
Elementary	All About Drums (Fact Sheet)	11.04	read facts about drums.
Elementary	Beat of the Drum, The	11.04	explore changes in vibration using different materials and sizes.
Elementary	Tints and Temps	10.01	discover that dark colored cars radiate more heat than light colored cars.
Elementary	Ball on a Roll (formerly Roller Ball)	Popping with Power	discover the relationship between the slope of an incline and the speed of a ball.
Elementary	Roller Ball (now Ball on a Roll)	Popping with Power	discover the relationship between the slope of an incline and the speed of a ball.
Elementary	Pouring Carbon Dioxide Gas	Off the Wall Science 2.05	observe the mixture of baking soda and vinegar extinguish a flame.
Elementary	Homemade Fire Extinguisher	Off the Wall Science	observe the chemical change that occurs when baking soda and vinegar are mixed.
Elementary	Sparky's Light Kit	Electrical Connections	discover how to make a complete circuit using a D-cell, a flashlight bulb, and a paper clip.
Elementary	All Wrapped Up	11.07	compare various insulating materials.
Elementary	Feel the Heat	10.10	observe the transformation of chemical energy into heat energy as water is added to plaster of Paris.
Intermediate	May the Force be with You	Machine Shop 1.08	isolate variables to learn that energy in equals energy out.
Intermediate	Red C, The	Fun with Foods	use red cabbage juice as an acid-base indicator to test a various liquids.
Intermediate	Wet Cell Battery	Electrical Connections 6.04	watch a demonstration of chemical energy transformed into electrical energy in a wet well battery.

Physical Setting

4.5 Energy and matter interact through forces that result in changes in motion.

Elementary students:

- describe the effects of common forces (pushes and pulls) on objects, such as those caused by gravity, magnetism, and mechanical forces.
- describe how forces can operate across distances.

Intermediate students:

- describe different patterns of motions of objects.
- observe, describe, and compare effects of forces (gravity, electric current, and magnetism) on the motion of objects.

Level	Activity	Source	Students will:
Elementary	Blow Ye Winds	Popping with Power	study the effect of wind forces on suspension bridges.
Elementary	Level the Lever (1996 Edition)	Popping with Power	discover the mathematical pattern for balancing a first-class lever.
Elementary	Metal Detector (1996 Edition)	Popping with Power	observe that some metals are attracted to a magnet.
Elementary	Take it Easy	Popping with Power	learn how the six simple machines work.
Elementary	Hungry Hounds	Mostly Magnets	move paper dogs along a path by pushing or pulling with a magnet.
Elementary	What Will a Magnet Attract?	Mostly Magnets	predict and then test objects for their magnetic interaction.
Elementary	Winding Wheels	8.06	explore the relationship between wheel size and lift in a winch.
Elementary	Clever Lever - 1	7.02	observe relationship between force, distance and effort.
Elementary	Hungry Hounds	5.09	move paper dogs along a path by pushing or pulling with a magnet.
Elementary	Puff-Mobiles	5.07	observe the energy of the wind and its effects on a wheel.
Elementary	Inclined to Work	3.04	explore the inclined plane and how it makes work easier.
Elementary	What is Work?	3.04	*** this is part of "Inclined to Work"
Elementary	Defying Gravity	Mostly Magnets	use problem solving skills to create a magnetic system that defies gravity.
Elementary	Face To Face	Mostly Magnets	use pairs of magnets to discover how like and unlike poles react to one another.
Elementary	Floating Magnets	Mostly Magnets	experiment with two or more ring magnets stacked on a pencil.
Elementary	Holding Power	Mostly Magnets	observe and compare the effect of various groupings of magnets.
Elementary	How Close Can You Get?	Mostly Magnets	observe the interaction between a magnet and a paper clip
Elementary	Magnetic Tug of War	Mostly Magnets	discover which is stronger, the push or pull of a magnet.
Elementary	Magnets Apart	Mostly Magnets	study the effect of the force of magnetic attraction when the distance between magnets is increased.

Standard 5 - Technology

5.1 Engineering Design

Engineering design is an iterative process involving *modeling* and *optimization* used to develop technological solutions to problems within given constraints.

Elementary students:

- describe objects, imaginary or real, that might be modeled or made differently and suggest ways in which the objects and be changed, fixed, or improved.
- investigate prior solutions and ideas from books, magazines, family, friends, neighbors, and community members.
- generate ideas for possible solutions, individually and through group activity; apply age appropriate mathematics and science skills; evaluate the ideas and determine the best solution; and explain reasons for the choice.
- plan and build, under supervision, a model of the solution using familiar materials, processes, and hand tools.
- discuss how best to test the solution; perform the test under teacher supervision; record and portray results through numerical and graphical means; discuss orally why things worked or didn't work; and summarize results in writing, suggesting ways to make the solution better.

Intermediate students engage in the following steps in a design process:

- identify needs and opportunities for technical solutions from an investigation of situations of general or social interest.
- locate and utilize a range of printed, electronic, and human information resources to obtain ideas.
- consider constraints and generate several ideas for alternative solutions, using group and individual ideation techniques (group discussion, brainstorming, forced connections, role play); defer judgment until a number of ideas have been generated; evaluate (critique) ideas; and explain why the chosen solution is optimal.
- develop plans, including drawings with measurements and details of construction, and construct a model of the solution, exhibiting a degree of craftsmanship.
- in a group setting, test their solutions against design specifications, present and evaluate results, describe how the solution might have been modified for different or better results, and discuss tradeoffs that might have been made.

Level	Activity	Source	Students will:
Elementary	Bag It	Under Construction	design a bag for a particular purpose.
Elementary	Can It Open?	Under Construction	explore different designs of can openers.
Elementary	Designer Books	Under Construction	design and construct their own books.
Elementary	Exploring Bridges	Under Construction	explore bridges through their block play and begin to construct their own knowledge about bridges.
Elementary	Fold to Hold	Under Construction	discover why a variety of containers are designed as they are.

continued

5.1 Engineering Design

Engineering design is an iterative process involving *modeling* and *optimization* used to develop technological solutions to problems within given constraints.

Level	Activity	Source	Students will:
Elementary	Hold the Load	Under Construction	build and then compare and contrast the strength of two bridge designs.
Elementary	Huff 'n Puff Houses	Under Construction	design and test various model buildings.
Elementary	Pull-It Eggs	Under Construction	design and construct a puppet.
Elementary	Push 'n Pull Puppets	Under Construction	design puppets to move in different ways.
Elementary	Tall Walls	Under Construction	through trial and error experiences, the students will discover appropriate materials for building.
Elementary	But Will It Fly?	The Sky's the Limit!	explore the characteristics of a variety of polygons using popsicles sticks as a construction material.
Elementary	It's The Last Straw	The Sky's the Limit!	construct a paper airplane using a straw and two strips of paper.
Elementary	Unbelievable Flying Objects	The Sky's the Limit!	construct various symmetric shapes using rulers, compasses, and protractors and then explore their flight properties.
Elementary	Distance Data	The Sky's the Limit!	learn the effects of design on the distance a plane will fly.
Elementary	A Stable Table	Brick Layers	build polygons and test them for stability.
Elementary	Angle Fixer	Brick Layers	modify polygons to make them stable.
Elementary	All's Well that Works Well	9.08	investigate the relationship between a wheel and the number of turns it takes to raise an object.
Elementary	Working Out the Wiggles	10.04	construct, test, and find ways to stabilize various polygons.
Elementary	Be A Rotor Promoter	The Sky's the Limit!	investigate the behavior of a paper rotor, testing for both the rate and accuracy of the fall; examine ways the behavior can be altered.
Elementary	On Your Mark-Accuracy	The Sky's the Limit!	manipulate design features of paper airplanes to improve accuracy.
Elementary	Train Your Plane Aerobatics	The Sky's the Limit!	manipulate paper airplanes to enable then to perform certain stunts.
Elementary	Bridge It	Hardhatting in a Geo-World	build a straw bridge to certain specifications.
Elementary	Sky High	Hardhatting in a Geo-World	use creativity, teamwork, and problem solving as they build a tall, stable structure.
Elementary	Straws Take a Stand (1996 Edition)	Hardhatting in a Geo-World	build a cube with straws and discover that triangular braces are needed to make it stable.

continued

5.1 Engineering Design

Engineering design is an iterative process involving *modeling* and *optimization* used to develop technological solutions to problems within given constraints.

Level	Activity	Source	Students will:
Elementary	Thanks for Your Support! (1996 Edition)	Hardhatting in a Geo-World	use creativity, teamwork, and problem solving to build a drinking straw structure which can hold 400 grams of mass.
Elementary	Pillars of Strength	9.07	explore how height, diameter and thickness affect the strength of a paper tube.
Elementary	Bungee Rockets	9.01	design, build, and launch bungee rockets. They will measure the distance traveled, and compare results.
Intermediate	Big Boom Construction Project, The	Brick Layers	apply their understanding of tension, compression and stability to construct the longest stable boom.
Intermediate	Paul Bunyan's Bear-Barrow & Challenge	Brick Layers	design a wheelbarrow that requires the least effort to use.
Intermediate	Stable Structures (Fact Sheets)	Brick Layers	read facts about structures.
Intermediate	Stress on a String	Brick Layers	build various trusses and determine members are under compression or tension.
Intermediate	Canopy Pilot	9.08	construct and drop test a paper model of a parafoil parachute. They determine the glide ratio.
Intermediate	Tinkering, Toys & Teaching: Wing-On-A-Straw	11.01	construct a wing and balance system.

Standard 5 - Technology

5.2 Tools, Resources, and Technological Processes
Technological tools, materials, and other resources should be selected on the basis of safety, cost, availability, appropriateness, and environmental impact; technological processes change energy, information, and material resources into more useful forms.

Elementary students:

- explore, use and process a variety of materials and energy sources to design and construct things.
- understand the importance of safety, cost, ease of use, and availability in selecting tools and resources for a specific purpose.
- develop basic skills in the use of hand tools.
- use simple manufacturing processes (e.g., assembly, multiple stages of production, quality control) to produce a product.
- use appropriate graphic and electronic tools and techniques to process information.

Level	Activity	Source	Students will:
Elementary	A Safe Landing	Under Construction	explore different materials that will absorb energy.
Elementary	Made by Nature and Made by Me!	Under Construction	explore and use materials for manufacturing jewelry.
Elementary	Materials Matter	Under Construction	explore different materials and their uses.
Elementary	Plan a Pot	Under Construction	explore different materials to be used as a planter.
Elementary	Tools of the Trade	Under Construction	explore different tools and be given problems to solve using those tools.

New York State Learning Standards Interconnectedness: Common Themes

Standard 6 - Interconnectedness: Common Themes

6.1 Systems Thinking

Through systems thinking, people can recognize the commonalties that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

Elementary students:

- observe and describe interactions among components of simple systems.
- identify common things that can be considered to be simple systems (e.g., a plant population, a subway system, human beings).

Intermediate students

- describe the differences between dynamic systems and organizational systems.
- describe the differences and similarities between engineering systems, natural systems, and social systems.
- describe the differences between open- and closed-loop systems
- describe how output from one part of a system (which can include material, energy, or information) can become input to the other parts.
- describe how output from one part of a system (which can include material, energy, or information) can become input to the other parts

Level	Activity	Source	Students will:
Elementary	Mini Water Cycle	Water Precious Water	demonstrate evaporation and condensation inside a plastic bag.
Elementary	Moving Water	Water Precious Water 2.04	use a demonstration to introduce the concept of water changing forms through the process of evaporation and condensation.
Elementary	Moving Raindrops	Water Precious Water	construct a visual aid that depicts the water cycle.

New York State Learning Standards — Interconnectedness: Common Themes

6.2 Models

Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

Elementary students:

- analyze, construct, and operate models in order to discover the attributes of the real thing.
- discover that a model of something is different from the real thing but can be used to study the real thing.
- use different types of models such as graphs, sketches, diagrams, and maps, to represent various aspects of the real world.

Intermediate students

- selects an appropriate model to begin the search for answers or solutions to a question or problem.
- use models to study processes that cannot be studied directly (e.g., when the real process is too slow, too fast, or too dangerous for direct observation).
- demonstrate the effectiveness of different models to represent the same thing and same model to represent different things.

Level	Activity	Source	Students will:
Elementary	Ice Breakers	Primarily Earth 8.09	observe the effect of freezing water on simulated rock.
Elementary	Agent Erosion	Primarily Earth 10.03	use models to observe that rocks are weathered into sands and soils.
Elementary	A Disappearing Act	Primarily Earth	see the results of water evaporating.
Elementary	Cloudy Weather	Primarily Earth	use a model to observe and classify clouds.
Elementary	Earth's Features, The	Primarily Earth	observe and compare their familiar environment with other physical features of the Earth by making models and using pictures.
Elementary	Quaking Earth	Primarily Earth	simulate earthquakes to determine the effect on buildings and on the Earth.
Elementary	Volcanoes	Primarily Earth	construct and observe an erupting volcano model.
Elementary	What Makes Rain?	Primarily Earth	observe the water cycle diagram and model.
Elementary	What's Inside?	Primarily Earth	use a model to discover the Earth's interior.
Elementary	Which Way?	Primarily Earth	construct and observe a wind vane, then measure wind direction.
Elementary	Rain Away	Water Precious Water 5.07	observe the action of rain on a bare hillside.
Elementary	Don't Rain Away	Water Precious Water	observe the action of rain on a protected hillside.
Elementary	Help Save The Birds	Water Precious Water	construct a filtration system clean dirty water.
Elementary	Mini Water Treatment Simulation	Water Precious Water	simulate the water treatment process.
Elementary	Getting There	Finding your Bearings	design an amusement park and use directions and distances to find their way to designates places.
Elementary	Navigating Numerically	Finding your Bearings	discover the system for numbering interstate highways.

continued

6.2 Models

Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

Level	Activity	Source	Students will:
Elementary	Physically Featured	Finding your Bearings	coordinate directions to draw the physical features of a fictitious country on a map.
Elementary	Surf 'n Sand Count	Finding your Bearings	discover the ratio of water to land on the Earth by estimating on a square grid world map.
Elementary	Surf 'n Sand Spin	Finding your Bearings	discover the ratio of water to land on the Earth by using spinners to select latitude and longitude, then locating the point on a world map.
Elementary	Surf 'n Sand Toss	Finding your Bearings	discover the ratio of water to land on the Earth by tossing an inflatable globe and recording whether the right index finger touches land or water.
Elementary	Pond Today Meadow Tomorrow	Water Precious Water	simulate a pond turning into a meadow as water evaporates due to physical and biological interactions.
Intermediate	Water Island	Water Precious Water	play a simulation on water distribution and conservation of natural resources.
Intermediate	It's a Court Case	Through the Eyes of the Explorers	measure a basketball court and make a scale drawing of it.
Intermediate	Space Maps	Through the Eyes of the Explorers	determine the pattern used to record digital data and how data represents a geographical form. Students will construct and draw a topographical map and a perspective drawing.
Intermediate	Topping Off Mt. St. Helens	Through the Eyes of the Explorers	use contour maps to construct models of Mt. St. Helens before and after the 1980 eruption.
Intermediate	Uncanny Vision	Through the Eyes of the Explorers	make a 2 dimensional contour map of an unknown 3-D object.
Intermediate	How Does Your Heart Rate?	From Head to Toe	gather, graph and analyze information about the pulse rate, breath rate, and lung capacity.
Intermediate	Pressure's On, The	From Head to Toe	determine how exercise affects blood pressure.
Intermediate	Ya Gotta Have Heart!	From Head to Toe	create a model of the exterior and interior of the heart.

6.3 Magnitude and Scale

The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.

Elementary students:

- provide examples of natural and manufactured things that belong to the same category yet have very different sixes, weights, ages, speeds, and other measurements.
- identify the biggest and smallest values as well as the average value of a system when given information about its characteristics and behavior.

Intermediate students

- cite examples of how different aspects of natural and designed systems change at different rates with changes in scale.
- use powers of ten notation to represent very small and very large numbers.

Level	Activity	Source	Students will:
Elementary	Are You an Average Joe?	Jawbreakers & Heart Thumpers	find the size of the average person in their class and compare themselves to that average.
Elementary	By Golly By Gum!	Jawbreakers & Heart Thumpers 5.10	use the scientific method to discover what happens to the mass of gum when it is chewed.
Elementary	By Golly, By Gum, By Time (Revised Edition)	Jawbreakers & Heart Thumpers 5.10	discover how the mass of gum is affected by the amount of time it is chewed.
Elementary	How Do You Measure Up?	Jawbreakers & Heart Thumpers	discover how the length of the femur is related to the total height
Elementary	Now That's Using Your Head! (Revised Edition)	Jawbreakers & Heart Thumpers	explore the relationship between height and circumference of the head.
Elementary	Rallying Around	Finding your Bearings	use a U.S. road map to measure and compare distances between 5 randomly selected cities while participating in road rally simulation.
Intermediate	Going Ballistic	Through the Eyes of the Explorers	measure the maximum height of a moving object with a clinometer; use a graph to see the connection of trigonometry to simpler forms of indirect measurement.
Intermediate	Hill-Sides	Through the Eyes of the Explorers	take full measurements and make a scale drawing of a cross section of a hill.
Intermediate	Honey, I shrunk the…	Through the Eyes of the Explorers	draw the classroom or another room to the scale of a toy action figure.
Intermediate	Measuring Up	Through the Eyes of the Explorers	study different angles of elevation to discover that each angle has a proportion between the height of the object being measured and the sighter's distance from the object.

6.4 Equilibrium and Stability

Equilibrium is a state of stability due either to lack of changes (static equilibrium) or a balance between opposing forces (dynamics equilibrium).

Elementary students:

- cite examples of systems in which some features stay the same while other features change.
- distinguish between reasons for stability - from lack of changes to changes that counterbalance one another to changes within cycles.

Intermediate students

- describe how feedback mechanisms are used in both designed and natural systems to keep changes within desired limits.
- describe changes in equilibrium cycles in terms of frequency or cycle length and determine the highest and lowest values and when they occur.

Level	Activity	Source	Students will:
Elementary	Temperature's Rising	From Head to Toe	analyze information gathered from a sample population to determine whether activity changes body temperature.
Intermediate	Wrap Around the Clock	8.03	determine the number of daylight hours and observe the changes over time.

6.5 Patterns of Change

Identifying patterns of change is necessary for making predictions about future behavior and conditions.

Elementary students:

- use simple instruments to measure such quantities as distance, size, and weight, and look for patterns in the data.
- analyze data by making tables and graphs and looking for patterns of change.

Intermediate students

- use simple linear equations to represent how a parameter changes with time.
- observe patterns of change in trends or cycles and make predictions on what might happen in the future.

Level	Activity	Source	Students will:
Elementary	Are You a Square?	Hardhatting in a Geo-World	compare their height and arm span. They will examine and interpret class data.
Elementary	What Is The Average Student Like?	From Head to Toe	gather information about themselves and compare this to class norms.
Intermediate	It's Simply Marbleous	Math + Science, A Solution	explore the relationship between the slope of an inclined plane and the distance a marble rolls.
Intermediate	Corpus All Around Us	From Head to Toe	use information to determine body "outline".
Intermediate	Dem Bones Skeleton	From Head to Toe	visualize what the average skeletal system looks like.

6.6 Optimization

In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.

Elementary students:

- determine the criteria and constraints of a simple decision making problem.
- use simple quantitative methods, such as ratios, to compare costs to benefits of a decision problem.

Intermediate students

- determine the criteria and constraints and make trade-offs to determine the best decision.
- use graphs of information for a decision making problem to determine the optimum solution.

Level	Activity	Source	Students will:
Elementary	Oranges–For the Most Part	10.05	convert fractions to decimals to percents while finding edible portion of oranges.

GEMS Correlation to NYS Learning Standards for Mathematics, Science, and Technology

Standard 1 - Analysis, Inquiry, and Design Elementary	
Mathematical Analysis 1. Abstraction and symbolic representation are used to communicate mathematically. 2. Deductive and inductive reasoning are used to reach mathematical conclusions. 3. Critical thinking skills are used in the solution of mathematical problems.	**GEMS Guides** 1. Frog Math: Predict, Ponder, Play (K-3) 2. Math on the Menu (Gr. 3-5)
Scientific Inquiry 1. The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	1. Involving Dissolving (Gr. 1-3) 2. Oobleck: What Do Scientists Do? (Gr. 4-8)
2. Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	1. Mystery Festival (Gr. 2-8) 2. Environmental Detectives (Gr. 5-9)
3. The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.	1. Sifting Through Science (K-2) 2. Mystery Festival (Gr. 2-8) 3. Fingerprinting (Gr. 4-8)
Engineering Design 1. Engineering design is an iterative process involving modeling and optimization finding the best solution within given constraints which is used to develop technological solutions to problems within given constraints.	1. Animal Defenses (PreK-K) 2. Build It! Festival (K-6) 3. Secret Formulas (K-4)
Standard 2 - Information Systems Elementary	
Information Systems 1. Information technology is used to retrieve, process, an communicate information and as a tool to enhance learning.	
2. Knowledge of the impacts and limitations of information systems is essential to its effective and ethical use.	1. Schoolyard Ecology (Gr. 3-6)
3. Information technology can have positive and negative impacts on society, depending upon how it is used.	

Source: Dr. Karen L. Ostlund – Great Explorations in Math & Science (GEMS)

Standard 3 – Mathematics **Elementary**	
Mathematical Reasoning 1. Students use mathematical reasoning to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.	1. Build It! Festival (K-6) 2. Frog Math: Predict, Ponder, Play (K-3)
Number and Numeration 2. Students use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.	1. Group Solutions (K-4) 2. Group Solutions, Too! (K-4) 3. Treasure Boxes (K-3)
Measurement 5. Students use measurement in both metric and English measure to provide a major link between the abstractions of mathematics and the real world in order to describe and compare objects and data.	*(Note: All Key Ideas in Measurement, Uncertainty, and Patterns/Functions)* 1. Build It! Festival (K-6) 2. Frog Math: Predict, Ponder, Play (K-3) 3. Treasure Boxes (K-3) 4. Group Solutions (K-4)
Uncertainty 6. Students use ideas of uncertainty to illustrate that mathematics involves more than exactness when dealing with everyday situations	5. Group Solutions, To! (K-4) 6. Quadice (Gr. 4-8) 7. Shapes, Loops, & Images
Patterns/Functions 7. Students use patterns and functions to develop mathematical power, appreciate the true beauty of mathematics, and construct generalizations that describe patterns simply and efficiently.	
Standard 4 - Science **Elementary**	
Physical Setting 1. The Earth and celestial phenomena can be described by principles of relative motion an perspective.	1. Earth, Moon & Stars (Gr. 5-9) 2. Moons of Jupiter (Gr. 4-9)
2. Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.	1. Stories in Stone (Gr. 4-9)
3. Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.	1. Solids, Liquids, and Gases (Gr. 3-6) 2. Secret Formulas (Gr. 1-3) 3. Bubble Festival (K-6) 4. Involving Dissolving (Gr. 1-3) 5. Crime Lab Chemistry (Gr. 4-8) 5. Liquid Explorations (Gr. 1-3)
4. Energy exists in many forms and when these	1. Hot Water & Warm Homes

Source: Dr. Karen L. Ostlund – Great Explorations in Math & Science (GEMS)

forms change energy is conserved.	2. The Magic of Electricity 3. The Wizard's Lab
5. Energy and matter interact through forces that result in changes in motion.	1. Sifting Through Science (K-2)
The Living Environment 1. Living things are both similar to and different from each other and nonliving things.	1. Tree Homes (PreK-1)
2. Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.	1. Mother Opossum & Her Babies (PreK-1) 2. Penguins & Their Young (PreK-1)
3. Individual organisms and species change over time.	1. Terrarium Habitats (K-6) 2. Aquatic Habitats (Gr. 2-6)
4. The continuity of life is sustained through reproduction and development.	1. Ladybugs (PreK-1) 2. Ant Homes (PreK-1) 3. Mother Opossum & Her Babies (Pre-K-1) 4. Buzzing A Hive (K-3)
5. Organisms maintain a dynamic equilibrium that sustains life.	1. Ladybugs (Pre-K-1)
6. Plants and animals depend on each other and their physical environment.	1. Ant Homes (PreK-1) 2. Buzzing a Hive (K-3) Tree Homes (PreK-1)
7. Human decisions and activities have had a profound impact on the physical and living environment.	1. On Sandy Shores (Gr. 2-4) 2. Environmental Detectives (Gr. 5-9(
6. Plants and animals depend on each other and their physical environment.	1. Mapping Animal Movements (Gr. 5-9) 2. Mapping Fish Habitats (Gr. 6-10)
7. Human decisions and activities have had a profound impact on the physical and living environment.	1. Acid Rain (Gr. 6-10) 2. Global Warming & the Greenhouse Effect (Gr. 7-10) 3. Only Once Ocean (Gr. 5-8) 4. Environmental Detectives (Gr. 5-9)
Standard 5 - Technology **Elementary**	
Engineering Design 1. Engineering design is an iterative process involving modeling and optimization used to develop technological solutions to problems within given constraints.	1. Oobleck: What Do Scientists Do? (Gr. 4-8)
Tools, Resources, and Technological Processes 2. Technological tools, materials, and other resources should be selected on the basis of safety, cost, availability, appropriateness, and environmental impact; technological processes change energy, information, and material resources into more useful forms.	1. Investigating Artifacts (K-6)

Source: Dr. Karen L. Ostlund – Great Explorations in Math & Science (GEMS)

History and Evolution of Technology 5. Technology has been the driving force in the evolution of society from an agricultural to an industrial to an information base.	1. Moons of Jupiter (Gr. 4-8)
Standard 6 - Interconnectedness: Common Themes **Elementary**	
Systems Thinking 1. Through systems thinking, people can recognize the commonalties that exist among all systems and how parts of a system interrelate and combine to perform specific functions.	1. An Homes (PreK-1) 2. On Sandy Shores (Gr. 2-4)
Models 2. Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.	1. Tree Homes (PreK-1) 2. Oobleck: What Do Scientists Do? (Gr. 4-8) 3. Build It! Festival (K-6) 4. Buzzing A Hive (K-3) 5. Hide-a-Butterfly (PreK-K) 7. Ladybugs (PreK-1)
Magnitude and Scale 3. The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.	1. Treasure Boxes (K-3) 2. Penguins and their Young (PreK-1)
Equilibrium and Stability 4. Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).	1. Terrarium Habitats (K-6) 2. Aquatic Habitats (Gr. 2-6)
Patterns of Change 5. Identifying patterns of change is necessary for making predictions about future behavior and conditions.	1. Sifting Through Science (K-2) 2. Frog Math (K-3)
Optimization 6. In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.	1. Secret Formulas (Gr. 1-3)
Standard 7 - Interdisciplinary Problem Solving **Elementary**	
Connections 1. The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.	1. Vitamin C Testing (Gr. 4-8)

Source: Dr. Karen L. Ostlund – Great Explorations in Math & Science (GEMS)

Strategies 2. Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.	2. Microscopic Explorations: A GEMS Festival Guide (Gr. 4-8)

Source: Dr. Karen L. Ostlund – Great Explorations in Math & Science (GEMS)