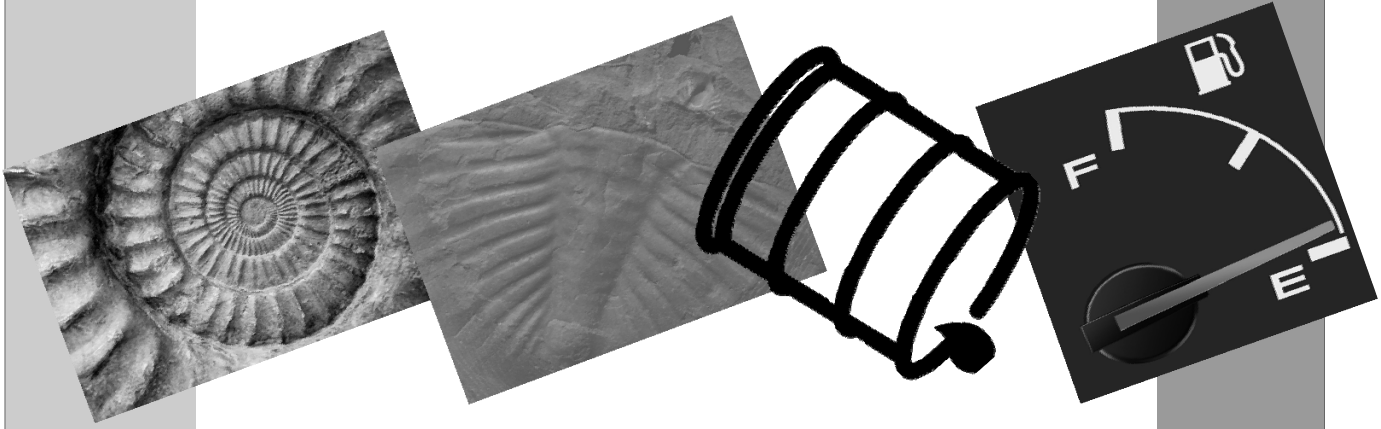
An Elementary School PETRO SCIENCE CURRICULUM

Elementary Petro Science

Illinois Petroleum Resources Board



POWERING EDUCATION

Original curriculum courtesy of

Oklahoma Energy Resources Board

Aligned to Illinois Learning Standards

Last Updated: 1/1/2020

What is the IPRB?

The **Illinois Petroleum Resources Board** formed to provide public awareness and education programs and to clean up abandoned well sites throughout the state. Funding for IPRB programs comes from voluntary contributions of oil and natural gas producers and royalty owners in Illinois.

IPRB provides funding and expertise in the reclamation and restoration of abandoned oilfield sites in the State of Illinois. These restoration projects fulfill another goal of IPRB which is to restore abandoned sites previously used for oil and gas production back to commercial or agricultural use for current land owners.

For more information about the IPRB and free education programs, please visit the IPRB website at iprb.org, contact us at office@iprb.org or call the Illinois Petroleum Resources Board at 618-242-2861.

One of our most important missions is Energy Education! Our program serves two primary goals:

1. To develop and design oil and natural gas education activities for K-12 teachers and students in Illinois.

2. To provide teachers with:

- Workshops statewide that provide free training and resources in energy education
- Educational field trips for students and teachers
- Professional development hours
- Other education resources that help interest students in science and math, energy, and their understanding of how Illinois crude oil and natural gas are an important part of the energy picture and the Illinois economy. Utilize the videos provided at iprb.org to help students understand.

Professional development

The IPRB will provide professional development for use of this curriculum. To receive information on professional development sessions, please contact the IPRB at iprb@yahoo.com or 618-242-2861.

FREQUENTLY ASKED QUESTIONS

The activities in this book are designed to teach students through discovery hands-on investigative experiences and open-ended inquiry questions.

WHAT IS ENERGY?

The world is full of movement. Birds fly in the air, trees move in the wind, and ships sail on the sea. People, animals, and machinery move around, but not without a source of energy.

Living things and machines need energy to work. For example, the energy that turns the blade of a windmill comes from the wind. The sun provides the energy needed to produce the food you eat. Food provides the energy your muscles need to ride your bike. The energy to make a car, plane or motorboat move comes from the gasoline inside the engine.

FROM WHERE DOES ENERGY COME?

All energy originates from the sun. Without the sun, there would be no life on earth. The energy from the sun is transformed into many other types of energy that we use every day. Important forms of energy are oil, natural gas and coal, also known as fossil fuels.

HOW ARE OIL, NATURAL GAS AND COAL FORMED?

Millions of years ago, the seas were filled with billions of tiny plants and animals. As these plants and animals died, their remains sank to the ocean floor and were buried in layers of sand and sediment. As more and more time passed, heat and pressure worked on the buried remains until they became fossil fuels. These fossil fuels were then trapped in underground rock formations. If rock is porous (containing holes or void spaces), it can accumulate oil, natural gas and coal.

For more than 150 years, man has been exploring and extracting fossil fuels. Today, when we use the estimated 6,000 products made from fossil fuels, we are releasing the energy that first came to earth from the sun millions of years ago.

HOW DO WE FIND OIL AND NATURAL GAS?

Edwin L. Drake was the first person to drill specifically for oil. In 1859, near Titusville, Pennsylvania, Drake struck oil. Drake's discovery helped make the finding of oil a big business. By 1900, prospectors had found oil fields all over the country, especially in Oklahoma and Texas.

Today, prospecting for oil and natural gas is highly skilled detective work as scientists use computers, satellites, sound waves and high-tech equipment to search both underground and under the ocean floor. Long before drilling can begin, geologists and geophysicists (scientists who explore for oil and gas) gather clues to locate possible sites for drilling. These clues come in many forms . . . from maps to locating fossils to studying sound waves from deep beneath the surface. The scientists make their best predictions, locate the spot and then the exploration begins. However, this process does not proceed without concern for the environment.

For many years, oil and gas companies have devoted considerable time and resources to finding ways of reducing their impact on the environment. In fact, U.S. companies are spending more dollars protecting the environment than drilling new wells. The effects that drilling, as well as any eventual production operations, will have on an offshore environment or a sensitive onshore tract must be anticipated and thoroughly spelled out. Blowout preventers used during the drilling process insure against the potential release of oil or natural gas into the atmosphere making oil "gushers" a relic of the distant past. Steel casing is set and cemented to protect the water table from contamination. Oil companies routinely take all necessary steps to prevent harmful interaction with wildlife and crop production.

In the final analysis, it is a question of balance between the need for energy and the desire to have an undisturbed environment. Oil companies and the government must cooperate to ensure this balance is achieved.

HOW IS OIL AND NATURAL GAS TRANSPORTED AND USED?

Once oil and natural gas are produced and collected, they must be safely transported for their many uses. Oil can be transported by truck, pipeline or ships to factories called refineries. Natural gas can only be transported in large quantities through high pressure pipelines. Consequently, natural gas produced in the U.S. can only be used on this continent. Crude oil can be shipped all over the world where it is made into the thousands of products that we use every day. You don't need to leave home to find oil in some of its many forms.

By processing fossil fuels at power stations, stored energy can be converted to electricity. The carpet on your floor and the paint on your walls probably have oil in them. You brush your teeth with a plastic tooth brush which is made from petroleum (oil is the key ingredient of plastic). It is estimated that we have found more than 500,000 uses for oil.

Learning Cycle

Elementary Petro Science activities follow the learning cycle format:

1. Wonder Why

The Wonder Why question focuses on the topic of the activity and engages student interest.

2. WOW!

The WOW is a discrepant event activity used to set the stage for the hands-on-exploration of the concept.

3. Discovery Procedure

This stage of the learning cycle provides information and procedures for inquiry based, hands-on investigations.

4. Concept Formation

Based on the discovery activity, this stage of the learning cycle develops the main idea through questioning and additional resources.

5. Extensions

Extensions allow for further development of the concept through the use of subject integration, resources, community outreach, experimentation, creativity and decision-making.

Treasure Hunt

Next Generation Science Standards

Grade 4

Earth's Place in the Universe

4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers for changes in a landscape over time to support an explanation for changes in a landscape over time.

Earth's Systems

4-ESS2-1 Plan and conduct investigations on the effects of water, ice, wind, and vegetation on the relative rate of weathering and erosion.

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.

Grade 6

Earth's Systems

MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Common Core Standards

Literacy in Science and Technical subjects

Grade 3

Reading Informational Text

Key Ideas and Details

3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Integration of Knowledge and Ideas

3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence).

Writing

Text Types and Purposes

3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Production and Distribution of Writing

3.4 With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose.

Research to Build and Present Knowledge

3.7 Conduct short research projects that build knowledge about a topic

3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

Grade 4

Reading Informational Text

Integration of Knowledge and Ideas

4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Writing

Research to Build and Present Knowledge

4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

Grade 5

Writing

Text Types and Purposes

5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Production and Distribution of Writing

5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

5.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

Grade 6

Reading

Integration of Knowledge and Ideas

6.7 Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

Writing

Research to Build and Present Knowledge

6.7 Conduct short research projects to answer a question, drawing on several sources andrefocusing the inquiry when appropriate.

Science and Technical Subjects-Writing

Production and distribution of Writing

6-8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow formultiple avenues of exploration.

Common Core Mathematics

Grade 5
Mathematics
Geometry

Graph points on the coordinate plane to solve real-world and mathematical problems.
5.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond.

Rock Detective

Next Generation Science Standards

Grade 4

Earth's Place in the Universe

4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers for changes in a landscape over time to support an explanation for changes in a landscape over time.

Earth and Human Activity

4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Grade 5

Matter and Its Interactions

5-PS1-3 Make observations and measurements to identify materials based on their properties.

Common Core Standards

Literacy in Science and Technical subjects

Grade 3

Reading Informational Text

Key Ideas and Details

3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Integration of Knowledge and Ideas

3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence).

Writing
Text Types and Purposes

3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Production and Distribution of Writing

3.4 With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose.

Research to Build and Present Knowledge

3.7 Conduct short research projects that build knowledge about a topic

3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

Grade 4

Reading Informational Text

Integration of Knowledge and Ideas

4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears

Writing

Research to Build and Present Knowledge

4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

Grade 5

Writing

Text Types and Purposes

5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Production and Distribution of Writing

5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

5.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

Grade 6

Reading

Integration of Knowledge and Ideas

6.7 Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

Writing

Research to Build and Present Knowledge

6.7 Conduct short research projects to answer a question, drawing on several sources andrefocusing the inquiry when appropriate.

Science and Technical Subjects-Writing

Production and distribution of Writing

6-8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Thirsty Rocks

Next Generation Science Standards

Grade 4

Earth's Place in the Universe

4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers for changes in a landscape over time to support an explanation for changes in a landscape over time.

Earth's Systems

4-ESS2-1 Plan and conduct investigations on the effects of water, ice, wind, and vegetation on the relative rate of weathering and erosion.

Earth and Human Activity

4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Grade 5

Matter and Its Interactions

5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.

5-PS1-3 Make observations and measurements to identify materials based on their properties.

Common Core Standards

Literacy in Science and Technical subjects

Grade 3

Reading Informational Text

Key Ideas and Details

3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.

3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Craft and Structure

3.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.

Range of Reading and Level of Text Complexity

3.10 By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 2–3 text complexity bandindependently and proficiently.

Writing

Text Types and Purposes

3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. b. Develop the topic with facts, definitions, and details.

Grade 4

Reading Informational Text

Key Ideas and Details

4.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Craft and Structure

4.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 4 topic or subject area.

4.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

Range of Reading and Level of Text Complexity

4.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Writing

Range of Writing

4.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Grade 5

Reading Informational Text

Key Ideas and Details

5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

Craft and Structure

5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.

Range of Reading and Level of Text Complexity

5.10 By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.

Writing

Range of Writing

5.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Grade 6

Reading Informational Text

Key Ideas and Details

6.2 Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

Craft and Structure

6.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings

Range of Reading and Level of Text Complexity

6.10 By the end of the year, read and comprehend literary nonfiction in the grades 6–8 text complexity band proficiently, with scaffolding as needed at the high end of the range

Writing

Range of Writing

6.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Science and Technical Subjects-Reading

Key Ideas and Details

6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Integration of Knowledge and Ideas

6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Science and Technical Subject-Writing

Production and Distribution of Writing

6-8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Grade 3

Measurement and Data

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

3.MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).6 Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units. e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

Visiting Viscosity

Next Generation Science Standards

Grade 3

Motion and Stability: Forces and Interactions

3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that that a pattern can be used to predict future motion.

Grade 4

Energy

4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.

Grade 5

Matter and Its Interactions

5-PS1-3 Make observations and measurements to identify materials based on their properties.

Grade 6

Energy

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

Common Core Mathematics

Grade 3

Measurement and Data

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

3.MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).6 Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

Common Core State Standards

Literacy in Science and Technical subjects

Grade 3

Reading Informational Text

Key Ideas and Details

3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.

3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Craft and Structure

3.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.

Range of Reading and Level of Text Complexity

3.10 By the end of the year, read and comprehend informational texts, including history/ social studies, science, and technical texts, at the high end of the grades 2–3 text complexity bandindependently and proficiently.

Grade 4

Reading Informational Text

Key Ideas and Details

4.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Craft and Structure

4.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 4 topic or subject area.

4.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

Range of Reading and Level of Text Complexity

4.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Grade 5

Reading Informational Text

Key Ideas and Details

5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

Craft and Structure

5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.

Range of Reading and Level of Text Complexity

5.10 By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.

Grade 6

Reading Informational Text

Key Ideas and Details

6.2 Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

Craft and Structure

6.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.

Range of Reading and Level of Text Complexity

6.10 By the end of the year, read and comprehend literary nonfiction in the grades 6–8 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Science and Technical Subjects-Reading

Key Ideas and Details

6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Integration of Knowledge and Ideas

6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Pulley's: A Weighty Problem

Next Generation Science Standards

Grade 3

Motion and Stability: Forces and Interactions

3-PS2-1 Plan and conduct investigations on the effects of balanced and unbalanced forces on the motion of an object.
3-PS2-2 Make observations and/or measurements of the object's motion to provide evidence that a pattern can be used to predict future motion.

Grade 4

Energy

4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Grades 3-5

Engineering Design

3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Grade 6

Engineering Design

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Energy

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

Common Core Standards

Literacy in Science and Technical subjects

Grade 3

Reading Informational Text

Key Ideas and Details

3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.

3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Craft and Structure

3.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.

Range of Reading and Level of Text Complexity

3.10 By the end of the year, read and comprehend informational texts, including history/ social studies, science, and technical texts, at the high end of the grades 2–3 text complexity bandindependently and proficiently.

Grade 4

Reading Informational Text

Key Ideas and Details

4.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

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4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Craft and Structure

4.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 4 topic or subject area.

4.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

Range of Reading and Level of Text Complexity

4.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Grade 5

Reading Informational Text

Key Ideas and Details

5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

Craft and Structure

5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.

Range of Reading and Level of Text Complexity

5.10 By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.

Grade 6

Reading Informational Text

Key Ideas and Details

6.2 Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

Craft and Structure

6.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.

Range of Reading and Level of Text Complexity

6.10 By the end of the year, read and comprehend literary nonfiction in the grades 6–8 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Science and Technical Subjects-Reading

Key Ideas and Details

6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Integration of Knowledge and Ideas

6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Common Core Mathematics

Grade 3
Measurement and Data

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

3.MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).6 Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

Rises to the Top

Next Generation Science Standards

Grade 5

Matter and Its Interactions

5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.

5-PS1-3 Make observations and measurements to identify materials based on their properties.

5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Common Core Standards

Literacy in Science and Technical subjects

Grade 3

Reading Informational Text

Key Ideas and Details

3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.

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Craft and Structure

3.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.

Range of Reading and Level of Text Complexity

3.10 By the end of the year, read and comprehend informational texts, including history/ social studies, science, and technical texts, at the high end of the grades 2–3 text complexity bandindependently and proficiently.

Writing

Text Types and Purposes

3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly a. Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.

Range of Writing

3.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Grade 4

Reading Informational Text

Key Ideas and Details

4.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Craft and Structure

4.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 4 topic or subject area.

4.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

Range of Reading and Level of Text Complexity

4.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Writing

Text Types and Purposes

4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly
a. Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

Production and Distribution of Writing

4.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

Range of Writing

4.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Grade 5

Reading Informational Text

Key Ideas and Details

5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

Craft and Structure

5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.

Range of Reading and Level of Text Complexity

5.10 By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.

Writing

Text Types and Purposes

5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly

a. Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

Production and Distribution of Writing

5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

Range of Writing

5.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Grade 6

Reading Informational Text

Key Ideas and Details

6.2 Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

Craft and Structure

6.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings

Science and Technical Subjects-Reading

Key Ideas and Details

6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Integration of Knowledge and Ideas

6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Realistic Recycling

Next Generation Science Standards

Grade 4

Earth and Human Activity

4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Grade 5

Matter and Its Interactions

5-PS1-3 Make observations and measurements to identify materials based on their properties.

Earth and Human Activity

5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Grade 6

Matter and Its Interactions

MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Common Core State Standards

Literacy in Science and Technical Subjects

Grade 3

Reading Informational Text

Key Ideas and Details

3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.

Integration of Knowledge and Ideas

3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence).

Writing

Text Types and Purposes

3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Grade 4

Reading Informational Text

Key Ideas and Details

4.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

Grade 5

Reading Informational Text

Key Ideas and Details

5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

Grade 6

Reading Informational Text

Key Ideas and Details

6.2 Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgements.

Science and Technical Subjects-Reading

Key Ideas and Details

6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

Integration of Knowledge and Ideas

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Science and Technical Subject-Writing

Production and Distribution of Writing

6-8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Cooking Up Crude

Next Generation Science Standards

Grade 3

Biological Evolution: Unity and Diversity

3-LS4-1 Analyze and interpret data from fossils to provide evidence of organisms and environments in which they lived long ago.

Grade 4

Earth's Place in the Universe

4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers for changes in a landscape over time to support an explanation for changes in a landscape over time.

Earth's Systems

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.

Earth and Human Activity

4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.