Physical Science Comes Alive:
Energy Systems Grades 4 – 5 (EnerJeeps)

Alignments to State Science Standards

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Physical Science Comes Alive: Energy Systems Grades 4 – 5 (EnerJeeps)

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Key	California Science Standards K-5: Grade IE (Investigation and Experimentation)	California Science Standards K-5: Grade IE (Investigation and Experimentation)

Full Description of California State Standards Grades 4 and 5

California State Science Standards **Physical Sciences Grade 4**
4: PS 1. Electricity and magnetism are related effects that have many useful applications in everyday life. As a basis for understanding this concept: 4: PS 1.a. Students know how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs. 4: PS 1.d. Students know the role of electromagnets in the construction of electric motors, electric generators, and simple devices, such as doorbells and earphones. 4: PS 1.g. Students know electrical energy can be converted to heat, light, and motion.
California State Science Standards **Investigation and Experimentation Grade 4**
4: IE 6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will: 4: IE 6.a. Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations. 4: IE 6.b. Measure and estimate the weight, length, or volume of objects. 4: IE 6.c. Formulate and justify predictions based on cause-and-effect relationships. 4: IE 6.d. Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results. 4: IE 6.f. Follow a set of written instructions for a scientific investigation.
California State Science Standards **Investigation and Experimentation Grade 5**
5: IE 6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will: 5: IE 6.a. Classify objects (e.g., rocks, plants, leaves) in accordance with appropriate criteria. 5: IE 6.b. Develop a testable question. 5: IE 6.c. Plan and conduct a simple investigation based on a student-developed question and write instructions others can follow to carry out the procedure. 5: IE 6.d. Identify the dependent and controlled variables in an investigation. 5: IE 6.e. Identify a single independent variable in a scientific investigation and explain how this variable can be used to collect information to answer a question about the results of the experiment. 5: IE 6.f. Select appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.

California State Science Standards **Investigation and Experimentation Grade 5**
5: IE 6.g. Record data by using appropriate graphic representations (including charts, graphs, and labeled diagrams) and make inferences based on those data. 5: IE 6.h. Draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion. 5: IE 6.i. Write a report of an investigation that includes conducting tests, collecting data or examining evidence, and drawing conclusions.

District of Columbia Science Content Standards
Physical Science Comes Alive: Energy Systems Grades 4 – 5 (EnerJeeps)

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2. Make a Switch	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
3. Circuit diagrams	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
4. Let's roll	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
5. A Direct-drive car	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
6. Troubleshooting a Direct-drive car	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
7. How to Build a Direct-drive car	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
8. Make a Belt-drive or Propeller-drive car	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
9. Troubleshooting and Redesign of Belt-drive & Propeller-drive Cars	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
10. IMP(rove) your Ride: Add a Horn & Lights	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
Key	District of Columbia Science Standards K-5: Grade SI (Scientific Thinking and Inquiry) ST (Science and Technology) PS (Physical Science	District of Columbia Science Standards K-5: Grade SI (Scientific Thinking and Inquiry)

Lesson #	District of Columbia Science Content Standards – Grade 4	District of Columbia Science Content Standards – Grade 5
11. Gearing up for the Auto Show	4: SI 1.1, 2, 4, 5, 6, 7 4: ST 2.4 4: PS 6.1, 6, 9, 10	5: SI 1.1, 2, 3, 4, 5, 6, 7, 8
12. The Auto Show		
Key	District of Columbia Science Standards K-5: Grade SI (Scientific Thinking and Inquiry) ST (Science and Technology) PS (Physical Science	District of Columbia Science Standards K-5: Grade SI (Scientific Thinking and Inquiry)

Full Description of District of Columbia Standards Grades 4 and 5

District of Columbia Science Standards **Scientific Thinking and Inquiry Grade 4**
4: SI 1. Broad Concept: Scientific progress is made by asking relevant questions and conducting careful investigations. As a basis for understanding this concept, and to address the content in this grade, students should develop their own questions and perform investigations. Students: 4: SI 1.1. Recognize and describe how results of similar scientific investigations may turn out differently due to inconsistencies in methods, materials, or observations, or the limitations of the tools used. 4: SI 1.2. Explain that clear communication is an essential part of the process of scientific inquiry since it enables scientists to inform others about their work, to expose their ideas to evaluation by other scientists, and to allow scientists to stay informed about scientific discoveries around the world. 4: SI 1.4. Write descriptions of investigations, using observations as support for explanations. 4: SI 1.5. Support statements with ideas and data found in print and electronic media, identify and evaluate the sources used, and expect others to do the same. 4: SI 1.6. Identify better reasons for believing something rather than citing comments such as, "Everybody knows that," "I just know," or "Because they say," and discount such reasons when given by others. 4: SI 1.7. Explain how scientific thinking can be distorted by strong feelings, and explain why it is necessary to separate emotions from the reasoning process.
Science and Technology Grade 4
4: ST 2. Broad Concept: Although each of the human enterprises of science and technology has a character and history of its own, each is dependent on and reinforces the other. As a basis for understanding this concept, students: 4: ST 2.3. Make simple and safe electrical circuits with a battery and various plugs, sockets, and terminals.
Physical Science Grade 4
4: PS 6.1 Broad Concept: Scientific progress is made by asking relevant questions and conducting careful investigations. As a basis for understanding this concept, and to address the content in this grade, students should develop their own questions and perform investigations. Students: 4: PS 6.1.1 Recognize that some materials are electrical conductors and others are electrical insulators. 4: PS 6.1.6 Recognize there are two types of electric charge: positive and negative. 4: PS 6.1.9 Explain that the electric current can flow only if there is a complete close loop of conducting material (called a circuit) for it to flow through. Know a switch is a device for opening and closing a circuit. 4: PS 6.1.10 Explain how electrical energy can be used to produce light, heat energy, motion (kinetic energy), or sound energy.
District of Columbia Science Standards K-5: Grade SI (Scientific Thinking and Inquiry) ST (Science and Technology) PS (Physical Science

District of Columbia Science Standards Scientific Thinking and Inquiry Grade 5
5: SI 1. Broad Concept: Scientific progress is made by asking relevant questions and conducting careful investigations. As a basis for understanding this concept, and to address the content in this grade, students should develop their own questions and perform investigations. Students: 5: SI 1.1. Recognize and describe how results of similar scientific investigations may turn out differently because of inconsistencies in methods, materials, and observations, or limitations of the precision of the instruments used. 5: SI 1.2. Evaluate the validity of claims based on the amount and quality of the evidence cited. 5: SI 1.3. Keep a notebook to record observations and be able to distinguish inferences from actual observations. 5: SI 1.4. Write instructions that others can follow in order to carry out an investigation. 5: SI 1.5. Read and follow step-by-step instructions when learning new investigations. 5: SI 1.6. Identify the controlled variable and at least one independent variable in a scientific investigation, when appropriate. 5: SI 1.7. Explain that predictions can be based on what is known about the past, assuming that conditions are similar. 5: SI 1.8. Realize and explain why predictions may be more accurate if they are based on large collections of similar events for statistical accuracy.
District of Columbia Science Standards K-5: Grade SI (Scientific Thinking and Inquiry) ST (Science and Technology)

Minnesota State Science Content Standards
Physical Science Comes Alive: Energy Systems Grades 4 – 5 (EnerJeeps)

Lesson #	Minnesota State Science Content Standards – Grade 4	Minnesota State Science Content Standards – Grade 5
1. Turn a Motor on	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2
2. Make a Switch	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2
3. Circuit diagrams	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2
4. Let's roll	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2 5: PS 2.1.1, 2, 3
5. A Direct-drive car	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2 5: PS 2.1.1, 2, 3
6. Troubleshooting a Direct-drive car	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2 5: PS 2.1.1, 2, 3
7. How to Build a Direct-drive car	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2 5: PS 2.1.1, 2, 3
8. Make a Belt-drive or Propeller-drive car	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2 5: PS 2.1.1, 2, 3
9. Troubleshooting and Redesign of Belt-drive & Propeller-drive Cars	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2 5: PS 2.1.1, 2, 3
10. IMP(rove) your Ride: Add a Horn & Lights	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2 5: PS 2.1.1, 2, 3
11. Gearing up for the Auto Show	4: NES 2.2.1, 2, 3 4: PS 3.2.2	5: NES 1.1.1, 2, 3 5: NES 1.2.1, 2 5: PS 2.1.1, 2, 3
12. The Auto Show		
Key	Minnesota Science Standards K-5: Grade NSE (The Nature of Science and Engineering) PS (Physical Science)	Minnesota Science Standards K-5: Grade NSE (The Nature of Science and Engineering) PS (Physical Science)

Full Description of Minnesota State Standards Grades 4

Minnesota State Science Standards **The Nature of Science and Engineering Grade 4**
4: NES 2. Practice of Engineering 4: NES 2.2 Engineering design is the process of identifying problems, developing multiple solutions, selecting the best possible solution, and building the product. 4: NES 2.2.1 Identify and investigate a design solution and describe how it was used to solve an everyday problem. 4: NES 2.2.2 Generate ideas and possible constraints for solving a problem through engineering design. 4: NES 2.2.3 Test and evaluate solutions, including advantages and disadvantages of the engineering solution, and communicate the results effectively.
Physical Science Grade 4
4: PS 3. Energy 4: PS 3.2 Energy can be transformed within a system or transferred to other systems or the environment. 4: PS 3.2.2 Measure Construct a simple electrical circuit using wires, batteries and light bulbs.
Minnesota Science Standards K-5: Grade NSE (The Nature of Science and Engineering) PS (Physical Science)

Full Description of Minnesota State Standards Grades 5

Minnesota State Science Standards **The Nature of Science and Engineering Grade 5**
5: NES 1. Practice of Science 5: NES 1.1 Science is a way of knowing about the natural world, is done by individuals and groups, and is characterized by empirical criteria, logical argument and skeptical review. 5: NES 1.1.1 Explain why evidence, clear communication, accurate record keeping, replication by others, and openness to scrutiny are an essential part of doing science. 5: NES 1.1.2 Recognize that when scientific investigations are replicated they generally produce the same results, and when results differ significantly, it is important to investigate what may have caused such differences. 5: NES 1.1.3 Understand that different explanations for the same observations usually lead to making more observations and trying to resolve the differences. 5: NES 1.2 Scientific inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. 5: NES 1.2.1 Generate a scientific question and plan an appropriate scientific investigation, such as systematic observations, field studies, open-ended exploration or controlled experiments to answer the question. 5: NES 1.2.2 Identify and collect relevant evidence, make systematic observations and accurate measurements, and identify variables in a scientific investigation.

Full Description of Minnesota State Standards Grades 5 – continued

Minnesota State Science Standards **Physical Science Grade 5**
5: PS 2. Motion 5: PS 2.1 An object's motion is affected by forces and can be described by the object's speed and the direction it is moving. 5: PS 2.1.1 Give examples of simple machines and demonstrate how they change the input and output of forces and motion 5: PS 2.1.2 Identify the force that starts something moving or changes its speed or direction of motion. 5: PS 2.1.3 Demonstrate that a greater force on an object can produce a greater change in motion.
Minnesota Science Standards K-5: Grade NSE (The Nature of Science and Engineering) PS (Physical Science)

NY New York State Core Curriculum (updated) Elementary and Intermediate
Physical Science Comes Alive: Energy Systems Grades 4 – 5 (EnerJeeps)

Lesson #	NY New York State Core Curriculum (updated) Elementary and Intermediate
1. Turn a Motor on	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
2. Make a Switch	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
3. Circuit diagrams	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b **E** 4: PS.4.1c-e, 4.4d-e, 4.5a
4. Let's roll	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b, 5.1b, d **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
5. A Direct-drive car	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b, 5.1b, d **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
6. Troubleshooting a Direct-drive car	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b, 5.1b, d **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
Key	New York State Core Curriculum (Science) 1: Standard T (Engineering) S (Scientific Inquiry) PS (Physical Science)

Lesson #	NY New York State Core Curriculum (updated) Elementary and Intermediate
7. How to Build a Direct-drive car	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b, 5.1b, d **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
8. Make a Belt-drive or Propeller-drive car	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b, 5.1b, d **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
9. Troubleshooting and Redesign of Belt-drive & Propeller-drive Cars	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b, 5.1b, d **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
10. IMP(rove) your Ride: Add a Horn & Lights	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b, 5.1b, d **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
11. Gearing up for the Auto Show	1: T.1.1a-c, 1.2a-c, 1.3a-c, 1.4a-b, 1.5a-c **E** 1: T.1.1a, 1.2a, 1.3a-b, 1.4a-b, 1.5a-b **I** 1: S.1.1a-b, 1.2a, 1.3a, 2.1a, 2.2a, 2.3a-b, 3.1a, 3.2a, 3.3a, 3.4a-b **E** 1: S.1.1a-c, 1.2a-c, 1.3, 1.4, 2.1a-d, 2.2a-e, 2.3a-c, 3.1a-b, 3.2a-h, 3.3 **I** 4: PS.3.1e, 4.1a-e, 4.2a-b, 5.1b, d **E** 4: PS.4.1c-e, 4.4d-e, 4.5a **I**
12. The Auto Show	
Key	New York State Core Curriculum (Science) 1: Standard T (Engineering) S (Scientific Inquiry) PS (Physical Science)

Full Description of Standards K-4 and Elementary

NY New York State Core Curriculum (updated) Elementary Standards
Physical Science
4: PS.3.1e The material(s) an object is made up of determine some specific properties of the object (sink/float, conductivity, magnetism). Properties can be observed or measured with tools such as hand lenses, metric rulers, thermometers, balances, magnets, circuit testers, and graduated cylinders. 4: PS.4.1 Describe a variety of forms of energy (e.g., heat, chemical, light) and the changes that occur in objects when they interact with those forms of energy. 4: PS.4.1a Energy exists in various forms: heat, electric, sound, chemical, mechanical, light. 4: PS.4.1b Energy can be transferred from one place to another. 4: PS.4.1c Some materials transfer energy better than others (heat and electricity). 4: PS.4.1d Energy and matter interact: water is evaporated by the Sun's heat; a bulb is lighted by means of electrical current; a musical instrument is played to produce sound; dark colors may absorb light, light colors may reflect light 4: PS.4.1e Electricity travels in a closed circuit. 4: PS.4.2 Observe the way one form of energy can be transferred into another form of energy present in common situations (e.g., mechanical to heat energy, mechanical to electrical energy, chemical to heat energy). 4: PS.4.2a Everyday events involve one form of energy being changed to another. animals convert food to heat and motion; the Sun's energy warms the air and water 4: PS.4.2b Humans utilize interactions between matter and energy. chemical to electrical, light, and heat: battery and bulb; electrical to sound (e.g., doorbell buzzer); mechanical to sound (e.g., musical instruments, clapping); light to electrical (e.g., solar-powered calculator) 4: PS.5.1 Describe the effects of common forces (pushes and pulls) of objects, such as those caused by gravity, magnetism, and mechanical forces. 4: PS.5.1b The position or direction of motion of an object can be changed by pushing or pulling.
Engineering
1: T1.1 Describe objects, imaginary or real, that might be modeled or made differently and suggest ways in which the objects can be changed, fixed, or improved. 1: T1.1a Identify a simple/common object which might be improved and state the purpose of the improvement 1: T1.1b Identify features of an object that help or hinder the performance of the object 1: T1.1c Suggest ways the object can be made differently, fixed, or improved within given constraints 1: T1.2 Investigate prior solutions and ideas from books, magazines, family, friends, neighbors, and community members. 1: T1.2a Identify appropriate questions to ask about the design of an object 1: T1.2b Identify the appropriate resources to use to find out about the design of an object 1: T1.2c Describe prior designs of the object 1: T1.3 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 choices. 1: T1. 3a List possible solutions, applying age-appropriate math and science skills 1: T1.3b Develop and apply criteria to evaluate possible solutions 1: T1.3c Select a solution consistent with given constraints and explain why it was chosen

Engineering - continued

1: T1.4 Plan and build, under supervision, a model of the solution, using familiar materials, processes, and hand tools.
1: T1.4a Create a grade-appropriate graphic or plan listing all materials needed, showing sizes of parts, indicating how things will fit together, and detailing steps for assembly
1: T1.4b Build a model of the object, modifying the plan as necessary

1: T1.5 Discuss how best to test the solution; perform the test under teacher supervision; record and portray results through numerical and graphic means; discuss orally why things worked or didn't work; and summarize results in writing, suggesting ways to make the solution better.
1: T1.5a Determine a way to test the finished solution or model
1: T1.5b Perform the test and record the results, numerically and/or graphically
1: T1.5c Analyze results and suggest how to improve the solution or model, using oral, graphic, or written formats

Scientific Inquiry

1: S1.1 Ask "why" questions in attempts to seek greater understanding concerning objects and events they have observed and heard about.
1: S1.1a Observe and discuss objects and events and record observations
1: S1.1b Articulate appropriate questions based on observations
1: S1.2 Question the explanations they hear from others and read about, seeking clarification and comparing them with their own observations and understandings.
1: S1.2a Identify similarities and differences between explanations received from others or in print and personal observations or understandings
1: S1.3 Develop relationships among observations to construct descriptions of objects and events and to form their own tentative explanations of what they have observed.
1: S1.3a Clearly express a tentative explanation or description which can be tested

1: S2.1 Develop written plans for exploring phenomena or for evaluating explanations guided by questions or proposed explanations they have helped formulate.
1: S2.1a Indicate materials to be used and steps to follow to conduct the investigation and describe how data will be recorded (journal, dates and times, etc.)
1: S2.2 Share their research plans with others and revise them based on their suggestions.
1: S2.2a Explain the steps of a plan to others, actively listening to their suggestions for possible modification of the plan, seeking clarification and understanding of the suggestions and modifying the plan where appropriate
1: S2.3 Carry out their plans for exploring phenomena through direct observation and through the use of simple instruments that permit measurement of quantities, such as length, mass, volume, temperature, and time.
1: S2.3a Use appropriate "inquiry and process skills" to collect data
1: S2.3b Record observations accurately and concisely

1: S3.1 Organize observations and measurements of objects and events through classification and the preparation of simple charts and tables.
1: S3.1a Accurately transfer data from a science journal or notes to appropriate graphic organizer
1: S3.2 Interpret organized observations and measurements, recognizing simple patterns, sequences, and relationships.
1: S3.2a State, orally and in writing, any inferences or generalizations indicated by the data collected

New York State Core Curriculum (Science)

1: Standard
T (Engineering)
S (Scientific Inquiry)
P (Physical Science)

NY New York State Core Curriculum (updated) Elementary Standards
Scientific Inquiry (Continued)
1: S3.3 Share their findings with others and actively seek their interpretations and ideas. 1: S3.3a Explain their findings to others, and actively listen to suggestions for possible interpretations and ideas 1: S3.4 Adjust their explanations and understandings of objects and events based on their findings and new ideas. 1: S3.4a State, orally and in writing, any inferences or generalizations indicated by the data, with appropriate modifications of their original prediction/explanation 1: S3.4b State, orally and in writing, any new questions that arise from their investigation
New York State Core Curriculum (Science) 1: Standard T (Engineering) S (Scientific Inquiry) P (Physical Science)

NY New York State Core Curriculum (updated) Elementary Standards
STANDARD 6 - Interconnectedness:
Common Themes 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. **Area:** Systems Thinking **Key Idea:** Key Idea 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. **Indicator:** observe and describe interactions among components of simple systems **Indicator:** identify common things that can be considered to be systems (e.g., a plant, a transportation system, human beings) **Area:** Models **Key Idea:** Key Idea 2: Models are simplified representations of objects, structures, or systems, used in analysis, explanation, or design. **Indicator:** analyze, construct, and operate models in order to discover attributes of the real thing **Indicator:** discover that a model of something is different from the real thing but can be used to study the real thing **Indicator:** use different types of models, such as graphs, sketches, diagrams, and maps, to represent various aspects of the real world
STANDARD 7- Interdisciplinary Problem Solving
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. **Area:** Connections **Key Idea:** Key Idea 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. **Indicator:** analyze science/technology/society problems and issues that affect their home, school, or community, and carry out a remedial course of action **Indicator:** make informed consumer decisions by applying knowledge about the attributes of particular products and making cost/benefit trade-offs to arrive at an optimal choice **Indicator:** design solutions to problems involving a familiar and real context, investigate related science concepts to determine the solution, and use mathematics to model, quantify, measure, and compute **Indicator:** observe phenomena and evaluate them scientifically and mathematically by conducting a fair test of the effect of variables and using mathematical knowledge and technological tools to collect, analyze, and present data and conclusions **Area:** Strategies **Key Idea:** Key Idea 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. **Indicator:** work effectively **Indicator:** gather and process information **Indicator:** generate and analyze ideas **Indicator:** observe common themes **Indicator:** realize ideas **Indicator:** present results

NY New York State Core Curriculum (updated) Elementary Standards
Process Skills Based on Standard 4
Area: General Skills **Process Skill:** 1. Follow safety procedures in the classroom, laboratory, and field **Process Skill:** 2. Safely and accurately use the following tools: hand lens, ruler (metric), balance, gram weights, spring scale, thermometer (C°, F°), measuring cups, graduated cylinder, timepiece(s) **Process Skill:** 3. Develop an appreciation of and respect for all learning environments (classroom, laboratory, field, etc.) **Process Skill:** 4. Manipulate materials through teacher direction and free discovery **Process Skill:** 5. Use information systems appropriately **Process Skill:** 6. Select appropriate standard and nonstandard measurement tools for measurement activities **Process Skill:** 7. Estimate, find, and communicate measurements, using standard and nonstandard units **Process Skill:** 8. Use and record appropriate units for measured or calculated values **Process Skill:** 9. Order and sequence objects and/or events **Process Skill:** 10. Classify objects according to an established scheme **Process Skill:** 11. Generate a scheme for classification **Process Skill:** 12. Utilize senses optimally for making observations **Process Skill:** 13. Observe, analyze, and report observations of objects and events **Process Skill:** 14. Observe, identify, and communicate patterns **Process Skill:** 15. Observe, identify, and communicate cause-and-effect relationships **Process Skill:** 16. Generate appropriate questions (teacher and student based) in response to observations, events, and other experiences **Process Skill:** 17. Observe, collect, organize, and appropriately record data, then accurately interpret results **Process Skill:** 18. Collect and organize data, choosing the appropriate representation: journal entries, graphic representations, drawings/pictorial representations **Process Skill:** 19. Make predictions based on prior experiences and/or information **Process Skill:** 20. Compare and contrast organisms/objects/events in the living and physical environments **Process Skill:** 21. Identify and control variables/factors **Process Skill:** 22. Plan, design, and implement a short-term and long-term investigation based on a student- or teacher-posed problem **Process Skill:** 23. Communicate procedures and conclusions through oral and written presentations

Full Description of Standards 5-8 / Intermediate

NY New York State Core Curriculum (updated) Intermediate Standards
Physical Science
4: PS.4.1 Describe the sources and identify the transformations of energy observed in everyday life. 4: PS.4.1c Most activities in everyday life involve one form of energy being transformed into another. For example, the chemical energy in gasoline is transformed into mechanical energy in an automobile engine. Energy, in the form of heat, is almost always one of the products of energy transformations. 4: PS.4.1d Different forms of energy include heat, light, electrical, mechanical, sound, nuclear, and chemical. Energy is transformed in many ways. 4: PS.4.1e Energy can be considered to be either kinetic energy, which is the energy of motion, or potential energy, which depends on relative position. 4:PS.4.4 Observe and describe the properties of sound, light, magnetism, and electricity. 4:PS.4.4d Electrical energy can be produced from a variety of energy sources and can be transformed into almost any other form of energy. 4:PS.4.4e Electrical circuits provide a means of transferring electrical energy. 4:PS.4.5 Describe situations that support the principle of conservation of energy. 4:PS.4.5a Energy cannot be created or destroyed, but only changed from one form into another.
Engineering
1: T1.1 Identify needs and opportunities for technical solutions from an investigation of situations of general or social interest. 1: T1.1a identify a scientific or human need that is subject to a technological solution which applies scientific principles 1:T1.2 Locate and utilize a range of printed, electronic, and human information resources to obtain ideas. 1:T1.2a use all available information systems for a preliminary search that addresses the need 1: T1.3 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. 1: T1.3a generate ideas for alternative solutions 1: T1.3b evaluate alternatives based on the constraints of design 1: T1.4 Develop plans, including drawings with measurements and details of construction, and construct a model of the solution, exhibiting a degree of craftsmanship. 1: T1.4a design and construct a model of the product or process 1: T1.4b construct a model of the product or process 1: T1.5 In a group setting, test their solution against design specifications, present and evaluate results, describe how the solution might have been modified for different or better results, and discuss trade-offs that might have to be made. 1: T1.5a test a design 1: T1.5 In a group setting, test their solution against design specifications, present and evaluate results, describe how the solution might have been modified for different or better results, and discuss trade-offs that might have to be made. 1: T1.5b evaluate a design
New York State Core Curriculum (Science) 1: Standard T (Engineering) S (Scientific Inquiry) P (Physical Science) M (Mathematical Analysis)

NY New York State Core Curriculum (updated) Intermediate Standards
Scientific Inquiry
1: S1.1 Formulate questions independently with the aid of references appropriate for guiding the search for explanations of everyday observations. 1: S1.1a formulate questions about natural phenomena 1: S1.1b identify appropriate references to investigate a question 1: S1.1c refine and clarify questions so that they are subject to scientific investigation 1: S1.2 Construct explanations independently for natural phenomena, especially by proposing preliminary visual models of phenomena. 1: S1.2a independently formulate a hypothesis 1: S1.2b propose a model of a natural phenomenon 1: S1.2c differentiate among observations, inferences, predictions, and explanations 1: S1.3 Represent, present, and defend their proposed explanations of everyday observations so that they can be understood and assessed by others. 1: S1.4 Seek to clarify, to assess critically, and to reconcile with their own thinking the ideas presented by others, including peers, teachers, authors, and scientists. 1: S2.1 Use conventional techniques and those of their own design to make further observations and refine their explanations, guided by a need for more information. 1: S2.1a demonstrate appropriate safety techniques 1: S2.1b conduct an experiment designed by others 1: S2.1c design and conduct an experiment to test a hypothesis 1: S2.1d use appropriate tools and conventional techniques to solve problems about the natural world, including: measuring, observing, describing, classifying, sequencing 1: S2.2 Develop, present, and defend formal research proposals for testing their own explanations of common phenomena, including ways of obtaining needed observations and ways of conducting simple controlled experiments. 1: S2.2a include appropriate safety procedures 1: S2.2b design scientific investigations (e.g., observing, describing, and comparing; collecting samples; seeking more information, conducting a controlled experiment; discovering new objects or phenomena; making models) 1: S2.2c design a simple controlled experiment 1: S2.2d identify independent variables (manipulated), dependent variables (responding), and constants in a simple controlled experiment 1: S2.2e choose appropriate sample size and number of trials 1: S2.3 Carry out their research proposals, recording observations and measurements (e.g., lab notes, audiotape, computer disk, videotape) to help assess the explanation. 1: S2.3a use appropriate safety procedures 1: S2.3b conduct a scientific investigation 1: S2.3c collect quantitative and qualitative data 1: S3.1 Design charts, tables, graphs, and other representations of observations in conventional and creative ways to help them address their research question or hypothesis. 1: S3.1a organize results, using appropriate graphs, diagrams, data tables, and other models to show relationships 1: S3.1b generate and use scales, create legends, and appropriately label axes
New York State Core Curriculum (Science) 1: Standard T (Engineering) S (Scientific Inquiry) P (Physical Science) M (Mathematical Analysis)

NY New York State Core Curriculum (updated) Intermediate Standards
Scientific Inquiry (Continued)
1: S3.2 Interpret the organized data to answer the research question or hypothesis and to gain insight into the problem. 1: S3.2a accurately describe the procedures used and the data gathered 1: S3.2b identify sources of error and the limitations of data collected 1: S3.2c evaluate the original hypothesis in light of the data 1: S3.2d formulate and defend explanations and conclusions as they relate to scientific phenomena 1: S3.2e form and defend a logical argument about cause-and-effect relationships in an investigation 1: S3.2f make predictions based on experimental data 1: S3.2g suggest improvements and recommendations for further studying 1: S3.2h use and interpret graphs and data tables 1: S3.3 Modify their personal understanding of phenomena based on evaluation of their hypothesis.
New York State Core Curriculum (Science) 1: Standard T (Engineering) S (Scientific Inquiry) P (Physical Science) M (Mathematical Analysis)

NY New York State Core Curriculum (updated) Intermediate Standards
STANDARD 6 - Interconnectedness:
Common Themes 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. **Area:** SYSTEMS THINKING: **Key Idea:** Key Idea 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. **Indicator:** 1.1 Describe the differences between dynamic systems and organizational systems. **Indicator:** 1.2 Describe the differences and similarities among engineering systems, natural systems, and social systems. **Indicator:** 1.3 Describe the differences between open- and closed-loop systems. **Indicator:** 1.4 Describe how the output from one part of a system (which can include material, energy, or information) can become the input to other parts. **Area:** MODELS: **Key Idea:** Key Idea 2: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design. **Indicator:** 2.1 select an appropriate model to begin the search for answers or solutions to a question or problem. **Indicator:** 2.2 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). **Indicator:** 2.3 demonstrate the effectiveness of different models to represent the same thing and the same model to represent different things. **Area:** PATTERNS OF CHANGE: **Key Idea:** Key Idea 5: Identifying patterns of change is necessary for making predictions about future behavior and conditions. **Indicator:** 5.1 Use simple linear equations to represent how a parameter changes with time. **Indicator:** 5.2 Observe patterns of change in trends or cycles and make predictions on what might happen in the future. **Area:** OPTIMIZATION: **Key Idea:** Key Idea 6: In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs. **Indicator:** 6.1 determine the criteria and constraints and make trade-offs to determine the best decision. **Indicator:** 6.2 Use graphs of information for a decision-making problem to determine the optimum solution.

STANDARD 7 - Interdisciplinary Problem Solving
NY New York State Core Curriculum (updated) Intermediate Standards Description
Students will apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions. **Area:** CONNECTIONS: **Key Idea:** Key Idea 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. **Indicator:** 1.1 Analyze science/technology/society problems and issues at the local level and plan and carry out a remedial course of action. **Indicator:** 1.2 Make informed consumer decisions by seeking answers to appropriate questions about products, services, and systems; determining the cost/benefit and risk/benefit tradeoffs; and applying this knowledge to a potential purchase. **Indicator:** 1.3 Design solutions to real-world problems of general social interest related to home, school, or community using scientific experimentation to inform the solution and applying mathematical concepts and reasoning to assist in developing a solution. **Indicator:** 1.4 Describe and explain phenomena by designing and conducting investigations involving systematic observations, accurate measurements, and the identification and control of variables; by inquiring into relevant mathematical ideas; and by using mathematical and technological tools and procedures to assist in the investigation. **Area:** STRATEGIES: **Key Idea:** Key Idea 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. **Indicator:** 2.1 Students participate in an extended, culminating mathematics, science, and technology project. The project would require students to: Working Effectively: Contributing to the work of a brainstorming group, laboratory partnership, cooperative learning group, or project team; planning procedures; identify and managing responsibilities of team members; and staying on task, whether working alone or as part of a group. Gathering and Processing Information: Accessing information from printed media, electronic data bases, and community resources and using the information to develop a definition of the problem and to research possible solutions.; Generating and Analyzing Ideas: Developing ideas for proposed solutions, investigating ideas, collecting data, and showing relationships and patterns in the data.; Common Themes: Observing examples of common unifying themes, applying them to the problem, and using them to better understand the dimensions of the problem.; Realizing Ideas: Constructing components or models, arriving at a solution, and evaluating the result.; Presenting Results: Using a variety of media to present the solution and to communicate the results.
Process Skills Based on Standard 4
Area: General Skills **Process Skill:** 1. Follow safety procedures in the classroom and laboratory **Process Skill:** 2. Safely and accurately use the following measurement tools: metric ruler, balance, stopwatch, graduated cylinder, thermometer, spring scale, voltmeter **Process Skill:** 3. Use appropriate units for measured or calculated values **Process Skill:** 4. Recognize and analyze patterns and trends **Process Skill:** 5. Classify objects according to an established scheme and a student-generated scheme **Process Skill:** 6. Develop and use a dichotomous key **Process Skill:** 7. Sequence events **Process Skill:** 8. Identify cause-and-effect relationships **Process Skill:** 9. Use indicators and interpret results