

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

Alignments to National Science, Math and English Language Arts Standards

Table of Contents

National Science Education Standards	2-8
Standards by lesson	2-3
Description of standards (K-4)	4-5
Description of standards (5-8)	6-8
National Council of Teachers of Mathematics Principles & Standards for School Mathematics	9-13
Standards by lesson	9-11
Description of standards (3-5)	12-13
National Council of Teachers of English: Standards for the English Language Arts	14-16
Standards by lesson	14-15
Description of standards	16

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

Lesson #	National Science Education Standards K-4 and 5-8
1. Turn a Motor on	E: ST 1a-e K-4, 5-8 B: PS 3c K-4 B: PS 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
2. Make a Switch	E: ST 1a-e K-4, 5-8 B: PS 3c K-4 B: PS 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
3. Circuit diagrams	E: ST 1a-e K-4, 5-8 B: PS 3c K-4 B: PS 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
4. Let's roll	E: ST 1a-e K-4, 5-8 B: PS 2c, 3c K-4 B: PS 2a-c, 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
5. A Direct-drive car	E: ST 1a-e K-4, 5-8 B: PS 2c, 3c K-4 B: PS 2a-c, 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
6. Troubleshooting a Direct-drive car	E: ST 1a-e K-4, 5-8 B: PS 2c, 3c K-4 B: PS 2a-c, 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
7. How to Build a Direct-drive car	E: ST 1a-e K-4, 5-8 B: PS 2c, 3c K-4 B: PS 2a-c, 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
Key	National Science Standards A-E: Content Standard SI (Scientific Inquiry) PS (Physical Science) ST (Science and Technology)

Lesson #	National Science Education Standards K-4 and 5-8
8. Make a Belt-drive or Propeller-drive car	E: ST 1a-e K-4, 5-8 B: PS 2c, 3c K-4 B: PS 2a-c, 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
9. Troubleshooting and Redesign of Belt-drive & Propeller-drive Cars	E: ST 1a-e K-4, 5-8 B: PS 3c K-4 B: PS 2a-c, 3a, d-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
10. IMP(rove) your Ride: Add a Horn & Lights	E: ST 1a-e K-4, 5-8 B: PS 2c, 3c K-4 B: PS 2a-c, 3a, c-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
11. Gearing up for the Auto Show	E: ST 1a-e K-4, 5-8 B: PS 2c, 3c K-4 B: PS 2a-c, 3a, c-e 5-8 A: SI 1a-e K-4, 5-8 A: SI 1f-h 5-8
12. The Auto Show	
Key	National Science Standards A-E: Content Standard SI (Scientific Inquiry) PS (Physical Science) ST (Science and Technology)

Full Description of NSES Standards K-4

National Science Education Standards K-4 Physical Science
<p>B: PS 2c The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.</p> <p>B: PS 3c: Electricity in circuits can produce light, heat, sound, and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass.</p>
National Science Education Standards K-4 Standards Description Science and Technology/Engineering
<p>E: ST 1a IDENTIFY A SIMPLE PROBLEM. In problem identification, children should develop the ability to explain a problem in their own words and identify a specific task and solution related to the problem.</p> <p>E: ST 1b PROPOSE A SOLUTION. Students should make proposals to build something or get something to work better; they should be able to describe and communicate their ideas. Students should recognize that designing a solution might have constraints, such as cost, materials, time, space, or safety.</p> <p>E: ST 1c IMPLEMENTING PROPOSED SOLUTIONS. Children should develop abilities to work individually and collaboratively and to use suitable tools, techniques, and quantitative measurements when appropriate. Students should demonstrate the ability to balance simple constraints in problem solving.</p> <p>E: ST 1d EVALUATE A PRODUCT OR DESIGN. Students should evaluate their own results or solutions to problems, as well as those of other children, by considering how well a product or design met the challenge to solve a problem. When possible, students should use measurements and include constraints and other criteria in their evaluations. They should modify designs based on the results of evaluations.</p> <p>E: ST 1e COMMUNICATE A PROBLEM, DESIGN, AND SOLUTION. Student abilities should include oral, written, and pictorial communication of the design process and product. The communication might be show and tell, group discussions, short written reports, or pictures, depending on the students' abilities and the design project.</p>
National Science Education Standards K-4 Standards Description Scientific Inquiry
<p>A: SI 1a ASK A QUESTION ABOUT OBJECTS, ORGANISMS, AND EVENTS IN THE ENVIRONMENT. This aspect of the standard emphasizes students asking questions that they can answer with scientific knowledge, combined with their own observations. Students should answer their questions by seeking information from reliable sources of scientific information and from their own observations and investigations.</p> <p>A: SI 1b PLAN AND CONDUCT A SIMPLE INVESTIGATION. In the earliest years, investigations are largely based on systematic observations. As students develop, they may design and conduct simple experiments to answer questions. The idea of a fair test is possible for many students to consider by fourth grade.</p>
National Science Standards A-E: Content Standard SI (Scientific Inquiry) PS (Physical Science) ST (Science and Technology)

**National Science Education Standards K-4 Standards Description
Scientific Inquiry (Continued)**

A: SI 1c EMPLOY SIMPLE EQUIPMENT AND TOOLS TO GATHER DATA AND EXTEND THE SENSES. In early years, students develop simple skills, such as how to observe, measure, cut, connect, switch, turn on and off, pour, hold, tie, and hook. Beginning with simple instruments, students can use rulers to measure the length, height, and depth of objects and materials; thermometers to measure temperature; watches to measure time; beam balances and spring scales to measure weight and force; magnifiers to observe objects and organisms; and microscopes to observe the finer details of plants, animals, rocks, and other materials. Children also develop skills in the use of computers and calculators for conducting investigations.

A: SI 1d USE DATA TO CONSTRUCT A REASONABLE EXPLANATION. This aspect of the standard emphasizes the students' thinking as they use data to formulate explanations. Even at the earliest grade levels, students should learn what constitutes evidence and judge the merits or strength of the data and information that will be used to make explanations. After students propose an explanation, they will appeal to the knowledge and evidence they obtained to support their explanations. Students should check their explanations against scientific knowledge, experiences, and observations of others.

A: SI 1e COMMUNICATE INVESTIGATIONS AND EXPLANATIONS. Students should begin developing the abilities to communicate, critique, and analyze their work and the work of other students. This communication might be spoken or drawn as well as written. [See Teaching Standard B]

National Science Standards
A-E: Content Standard
SI (Scientific Inquiry)
PS (Physical Science)
ST (Science and Technology)

Students will use develop and use the following throughout the entire curriculum.

Unifying Concepts and Processes

National Science Education Standards K-4 Standards Description

STANDARD: As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes:

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement
- Evolution and equilibrium
- Form and function

Full Description of NSES Standards 5-8

National Science Education Standards 5-8 Standards Description Physical Science
<p>B: PS 2a The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.</p> <p>B: PS 2b An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.</p> <p>B: PS 2c If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object's motion.</p> <p>B: PS 3a Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.</p> <p>B: PS 3c Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object--emitted by or scattered from it--must enter the eye.</p> <p>B: PS 3d Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.</p> <p>B: PS 3e In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.</p>
National Science Education Standards 5-8 Standards Description Science and Technology/Engineering
<p>E: ST 1a IDENTIFY APPROPRIATE PROBLEMS FOR TECHNOLOGICAL DESIGN. Students should develop their abilities by identifying a specified need, considering its various aspects, and talking to different potential users or beneficiaries. They should appreciate that for some needs, the cultural backgrounds and beliefs of different groups can affect the criteria for a suitable product.</p> <p>E: ST 1b DESIGN A SOLUTION OR PRODUCT. Students should make and compare different proposals in the light of the criteria they have selected. They must consider constraints--such as cost, time, trade-offs, and materials needed--and communicate ideas with drawings and simple models.</p> <p>E: ST 1c IMPLEMENT A PROPOSED DESIGN. Students should organize materials and other resources, plan their work, make good use of group collaboration where appropriate, choose suitable tools and techniques, and work with appropriate measurement methods to ensure adequate accuracy</p> <p>E: ST 1d EVALUATE COMPLETED TECHNOLOGICAL DESIGNS OR PRODUCTS. Students should use criteria relevant to the original purpose or need, consider a variety of factors that might affect acceptability and suitability for intended users or beneficiaries, and develop measures of quality with respect to such criteria and factors; they should also suggest improvements and, for their own products, try proposed modifications.</p> <p>E: ST 1e COMMUNICATE THE PROCESS OF TECHNOLOGICAL DESIGN. Students should review and describe any completed piece of work and identify the stages of problem identification, solution design, implementation, and evaluation</p>
National Science Standards A-E: Content Standard SI (Scientific Inquiry) PS (Physical Science) ST (Science and Technology)

**National Science Education Standards 5-8 Standards Description
Scientific Inquiry**

A: SI 1a IDENTIFY QUESTIONS THAT CAN BE ANSWERED THROUGH SCIENTIFIC INVESTIGATIONS. Students should develop the ability to refine and refocus broad and ill-defined questions. An important aspect of this ability consists of students' ability to clarify questions and inquiries and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations. Students should develop the ability to identify their questions with scientific ideas, concepts, and quantitative relationships that guide investigation.

A: SI 1b DESIGN AND CONDUCT A SCIENTIFIC INVESTIGATION. Students should develop general abilities, such as systematic observation, making accurate measurements, and identifying and controlling variables. They should also develop the ability to clarify their ideas that are influencing and guiding the inquiry, and to understand how those ideas compare with current scientific knowledge. Students can learn to formulate questions, design investigations, execute investigations, interpret data, use evidence to generate explanations, propose alternative explanations, and critique explanations and procedures.

A: SI 1c USE APPROPRIATE TOOLS AND TECHNIQUES TO GATHER, ANALYZE, AND INTERPRET DATA. The use of tools and techniques, including mathematics, will be guided by the question asked and the investigations students design. The use of computers for the collection, summary, and display of evidence is part of this standard. Students should be able to access, gather, store, retrieve, and organize data, using hardware and software designed for these purposes.

A: SI 1d DEVELOP DESCRIPTIONS, EXPLANATIONS, PREDICTIONS, AND MODELS USING EVIDENCE. Students should base their explanation on what they observed, and as they develop cognitive skills, they should be able to differentiate explanation from description--providing causes for effects and establishing relationships based on evidence and logical argument. This standard requires a subject matter knowledge base so the students can effectively conduct investigations, because developing explanations establishes connections between the content of science and the contexts within which students develop new knowledge.

A: SI 1e THINK CRITICALLY AND LOGICALLY TO MAKE THE RELATIONSHIPS BETWEEN EVIDENCE AND EXPLANATIONS. Thinking critically about evidence includes deciding what evidence should be used and accounting for anomalous data. Specifically, students should be able to review data from a simple experiment, summarize the data, and form a logical argument about the cause-and-effect relationships in the experiment. Students should begin to state some explanations in terms of the relationship between two or more variables.

A: SI 1f RECOGNIZE AND ANALYZE ALTERNATIVE EXPLANATIONS AND PREDICTIONS. Students should develop the ability to listen to and respect the explanations proposed by other students. They should remain open to and acknowledge different ideas and explanations, be able to accept the skepticism of others, and consider alternative explanations.

A: SI 1g COMMUNICATE SCIENTIFIC PROCEDURES AND EXPLANATIONS. With practice, students should become competent at communicating experimental methods, following instructions, describing observations, summarizing the results of other groups, and telling other students about investigations and explanations.

A: SI 1h USE MATHEMATICS IN ALL ASPECTS OF SCIENTIFIC INQUIRY. Mathematics is essential to asking and answering questions about the natural world. Mathematics can be used to ask questions; to gather, organize, and present data; and to structure convincing explanations.

National Science Standards
A-E: Content Standard
SI (Scientific Inquiry)
PS (Physical Science)
ST (Science and Technology)

Students will use develop and use the following throughout the entire curriculum.

Unifying Concepts and Processes

National Science Education Standards K-4 Standards Description

STANDARD: As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes:

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement
- Evolution and equilibrium
- Form and function

**National Council of Teachers of Mathematics Principles & Standards for School Mathematics
Physical Science Comes Alive: Energy Systems Grades 4 – 5 (EnerJeeps)**

Lesson #	National Council of Teachers of Mathematics Principles & Standards for School Mathematics											
	Grades 3–5											
1. Turn a Motor on	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c											
2. Make a Switch	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c											
3. Circuit diagrams	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c											
4. Let's roll	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c											
5. A Direct-drive car	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c											
Key	<table border="0"> <tr> <td>AB (Algebra)</td> <td>CM (Communication)</td> </tr> <tr> <td>DP (Data Analysis and Probability)</td> <td>CT (Connections)</td> </tr> <tr> <td>PS (Problem Solving)</td> <td>RT (Representation)</td> </tr> <tr> <td>RP (Reasoning and Proof)</td> <td>1-4 Skill</td> </tr> <tr> <td></td> <td>a-e Expectations</td> </tr> </table>		AB (Algebra)	CM (Communication)	DP (Data Analysis and Probability)	CT (Connections)	PS (Problem Solving)	RT (Representation)	RP (Reasoning and Proof)	1-4 Skill		a-e Expectations
AB (Algebra)	CM (Communication)											
DP (Data Analysis and Probability)	CT (Connections)											
PS (Problem Solving)	RT (Representation)											
RP (Reasoning and Proof)	1-4 Skill											
	a-e Expectations											

Lesson #	National Council of Teachers of Mathematics Principles & Standards for School Mathematics	
	Grades 3–5	
6. Troubleshooting a Direct-drive car	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c	
7. How to Build a Direct-drive car	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c	
8. Make a Belt-drive or Propeller-drive car	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c	
9. Troubleshooting and Redesign of Belt-drive & Propeller-drive Cars	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c	
10. IMP(rove) your Ride: Add a Horn & Lights	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c	
Key	AB (Algebra) DP (Data Analysis and Probability) PS (Problem Solving) RP (Reasoning and Proof)	CM (Communication) CT (Connections) RT (Representation) 1-4 Skill a-e Expectations

Lesson #	National Council of Teachers of Mathematics Principles & Standards for School Mathematics	
	Grades 3–5	
11. Gearing up for the Auto Show	AB: 4a-b DP: 1a-d PS: a-d RP: a-d CM: a-d CT: a-c RT: a-c	
12. The Auto Show		
Key	AB (Algebra) DP (Data Analysis and Probability) PS (Problem Solving) RP (Reasoning and Proof)	CM (Communication) CT (Connections) RT (Representation) 1-4 Skill a-e Expectations

Full Description of NCTM Standards

NCTM Principles & Standards for School Mathematics											
Algebra Standard											
Skill	Grades 3–5 Expectations:										
4. Analyze change in various contexts	a. Investigate how a change in one variable relates to a change in a second variable; b. Identify and describe situations with constant or varying rates of change and compare them.										
Data Analysis and Probability Standard											
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them	a. Design investigations to address a question and consider how data-collection methods affect the nature of the data set; b. Collect data using observations, surveys, and experiments; c. Represent data using tables and graphs such as line plots, bar graphs, and line graphs; d. Recognize the differences in representing categorical and numerical data.										
Key	<table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">AB (Algebra)</td> <td style="width: 33%;">CM (Communication)</td> </tr> <tr> <td>DP (Data Analysis and Probability)</td> <td>CT (Connections)</td> </tr> <tr> <td>PS (Problem Solving)</td> <td>RT (Representation)</td> </tr> <tr> <td>RP (Reasoning and Proof)</td> <td>1-4 Skill</td> </tr> <tr> <td></td> <td>a-e Expectations</td> </tr> </table>	AB (Algebra)	CM (Communication)	DP (Data Analysis and Probability)	CT (Connections)	PS (Problem Solving)	RT (Representation)	RP (Reasoning and Proof)	1-4 Skill		a-e Expectations
AB (Algebra)	CM (Communication)										
DP (Data Analysis and Probability)	CT (Connections)										
PS (Problem Solving)	RT (Representation)										
RP (Reasoning and Proof)	1-4 Skill										
	a-e Expectations										

NCTM Principles & Standards for School Mathematics	
Problem Solving	
Instructional programs from pre-kindergarten through grade 12 should enable all students to—	
a. Build new mathematical knowledge through problem solving b. Solve problems that arise in mathematics and in other contexts c. Apply and adapt a variety of appropriate strategies to solve problems d. Monitor and reflect on the process of mathematical problem solving	
Reasoning and Proof	
Instructional programs from pre-kindergarten through grade 12 should enable all students to—	
a. Recognize reasoning and proof as fundamental aspects of mathematics b. Make and investigate mathematical conjectures c. Develop and evaluate mathematical arguments and proofs d. Select and use various types of reasoning and methods of proof	
Communication	
Instructional programs from pre-kindergarten through grade 12 should enable all students to—	
a. Organize and consolidate their mathematical thinking through communication b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others c. Analyze and evaluate the mathematical thinking and strategies of others; d. Use the language of mathematics to express mathematical ideas precisely.	

NCTM Principles & Standards for School Mathematics - continued		
Connections		
Instructional programs from pre-kindergarten through grade 12 should enable all students to—		
<ul style="list-style-type: none"> a. Recognize and use connections among mathematical ideas b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole c. Recognize and apply mathematics in contexts outside of mathematics 		
Representation		
Instructional programs from pre-kindergarten through grade 12 should enable all students to—		
<ul style="list-style-type: none"> a. Create and use representations to organize, record, and communicate mathematical ideas b. Select, apply, and translate among mathematical representations to solve problems c. Use representations to model and interpret physical, social, and mathematical phenomena 		
Key	AB (Algebra) DP (Data Analysis and Probability) PS (Problem Solving) RP (Reasoning and Proof)	CM (Communication) CT (Connections) RT (Representation) 1-4 Skill a-e Expectations

**National Council of Teachers of English: Standards for the English Language Arts
Physical Science Comes Alive: Energy Systems Grades 4 – 5 (EnerJeeps)**

Lesson #	National Council of Teachers of English: Standards for the English Language Arts
1. Turn a Motor on	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
2. Make a Switch	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
3. Circuit diagrams	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
4. Let's roll	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
5. A Direct-drive car	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
6. Troubleshooting a Direct-drive car	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12

Lesson #	National Council of Teachers of English: Standards for the English Language Arts
7. How to Build a Direct-drive car	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
8. Make a Belt-drive or Propeller-drive car	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
9. Troubleshooting and Redesign of Belt-drive & Propeller-drive Cars	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
10. IMP(rove) your Ride: Add a Horn & Lights	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
11. Gearing up for the Auto Show	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12
12. The Auto Show	Standard 4 Standard 5 Standard 6 Standard 7 Standard 8 Standard 11 Standard 12

Full Description of NCTE Standards

National Council of Teachers of English: Standards for the English Language Arts	
Standard 4	
	Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
Standard 5	
	Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
Standard 6	
	Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and nonprint texts.
Standard 7	
	Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
Standard 8	
	Students use a variety of technological and informational resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
Standard 11	
	Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
Standard 12	
	Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).