

Magic of Electrons (ME)

Common Core State Standards for English Language Arts

Lesson 6.1 - What Is Electricity?

Reading

Comprehension and Collaboration

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. (AS.SL.4)

Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. (AS.L.1)
2. Demonstrate command of the conventions of Standard English capitalization, punctuation, and spelling when writing. (AS.L.2)
6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. (AS.L.6)

Lesson 6.2 - Electronics

Reading

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Lesson 6.3 - Digital Electronics

Reading

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Standards for Technological Literacy

Lesson 6.1 - What Is Electricity?

Students will develop an understanding of the characteristics and scope of technology.

6-8

H. Technology is closely linked to creativity, which has resulted in innovation. (1.6-8.H)

Students will develop an understanding of the core concepts of technology.

6-8

P. Technological systems can be connected to one another. (2.6-8.P)

Students will develop an understanding of the attributes of design.

6-8

E. Design is a creative planning process that leads to useful products and systems. (8.6-8.E)

G. Requirements for design are made up of criteria and constraints. (8.6-8.G)

Students will develop an understanding of engineering design.

6-8

F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. (9.6-8.F)

G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. (9.6-8.G)

H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. (9.6-8.H)

Students will develop the abilities to apply the design process.

6-8

J. Make two-dimensional and three-dimensional representations of the designed solution. (11.6-8.J)

K. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. (11.6-8.K)

L. Make a product or system and document the solution. (11.6-8.L)

Lesson 6.2 - Electronics

Students will develop an understanding of the characteristics and scope of technology.

6-8

- F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (1.6-8.F)

Students will develop an understanding of the core concepts of technology.

6-8

- M. Technologies systems include input, processes, output, and at times, feedback. (2.6-8.M)
- N. Systems thinking involves considering how every part relates to others. (2.6-8.N)
- P. Technological systems can be connected to one another. (2.6-8.P)

Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

6-8

- D. Technological systems often interact with one another. (3.6-8.D)

Students will develop an understanding of the role of society in the development and use of technology.

6-8

- D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. (6.6-8.D)
- E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. (6.6-8.E)

Students will develop an understanding of the attributes of design.

6-8

- E. Design is a creative planning process that leads to useful products and systems. (8.6-8.E)
- F. There is no perfect design. (8.6-8.F)
- G. Requirements for design are made up of criteria and constraints. (8.6-8.G)

Students will develop an understanding of engineering design.

6-8

- H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. (9.6-8.H)

Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

6-8

F. Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system. (10.6-8.F)

Lesson 6.3 - Digital Electronics

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F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (1.6-8.F)

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F. Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system. (10.6-8.F)

Students will develop an understanding of and be able to select and use information and communication technologies.

6-8

K. The use of symbols, measurements, and drawings promotes a clear communication by providing a common language to express ideas. (17.6-8.K)

Next Generation Science Standards

Lesson 6.1 - What Is Electricity?

Middle School

Matter and Its Interactions

1. Develop models to describe the atomic composition of simple molecules and extended structures. (MS.PS1.1)

Motion and Stability: Forces and Interactions

3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS.PS2.3)
5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. (MS.PS2.5)

Lesson 6.2 - Electronics

Middle School

Waves and their Applications in Technologies for Information Transfer

2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. (MS.PS4.2)
3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. (MS.PS4.3)

Engineering Design

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.ETS1.1)

Lesson 6.3 - Digital Electronics

Middle School

Waves and their Applications in Technologies for Information Transfer

3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. (MS.PS4.3)

Engineering Design

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.ETS1.1)

2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS.ETS1.2)
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. (MS.ETS1.3)
4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS.ETS1.4)

Common Core State Standards for Mathematical Practice (6- 8)

Lesson 6.1 - What Is Electricity?

Grade 8

Expressions and Equations

Work with radicals and integer exponents.

4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology. (8.EE.A.4)

Lesson 6.2 - Electronics

Grade 8

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Analyze and solve linear equations and pairs of simultaneous linear equations.

7. Solve linear equations in one variable. (8.EE.C.7)

Lesson 6.3 - Digital Electronics

Grade 8

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Functions

Use functions to model relationships between quantities.

5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. (8.F.B.5)