

Maine Learning Standards - Science and Technology - Middle Grades (5-8)

H. Energy - Students will understand concepts of energy. Students will be able to:

1. Analyze the benefits and drawbacks of energy conversions (e.g., in electricity generation).

- States that energy can be transformed.
- Uses wind power to generate electricity.
- Explains wind energy and its uses.
- States the applications of water for energy.
- Examines how energy is produced by a nuclear power plant.
- States the dangers of using nuclear energy.
- Defines the energy problem.
- States some of the energy theory behind the 'greenhouse effect'.
- Defines alternative energy.
- Explains the principles of electric power generation.
- States the energy groups.
- States the general uses of energy in society.
- States the forms and types of energy.
- Recognizes the sources of energy used in transportation systems.
- Describes methods of transferring energy using mechanical systems.
- Investigates motion and energy transformations in pneumatics.
- Evaluates compressed air as a medium for transferring energy in fluid power systems.

2. Demonstrate that energy cannot be created or destroyed but only changed from one form to another.

- States that energy can be transformed.
- Investigates motion and energy transformations in pneumatics.
- States the changes Electronics Technology has made to society.
- Explains wind energy and its uses.
- States the applications of water for energy.
- Examines how energy is produced by a nuclear power plant.
- States the dangers of using nuclear energy.
- Defines the energy problem.
- States some of the energy theory behind the 'greenhouse effect'.
- States the energy groups.
- Recognizes the difference between potential and kinetic energy.
- Gives direct instructions to control movement to identify potential and kinetic energy.
- States the main sources of energy used in transportation systems.
- States the general uses of energy in society.
- States the forms and types of energy.
- Describes methods of transferring energy using mechanical systems.
- Evaluates compressed air as a medium for transferring energy in fluid power systems.

3. Compare and contrast the ways energy travels (e.g., conduction, convection, radiation).

- States factors effecting the resistance of a conducting material.
- Identifies the effect that occurs close to a current carrying conductor.
- Explains how a magnetic field is produced around a conductor.

4. Describe the characteristics of static and current electricity.

- States features of static electricity.
- Identifies that charges can be positive and negative.
- Explains that current flow is controlled by circuit elements.
- Identifies the magnitude and direction of the current flow.
- Defines the term 'electric current'.
- Measures d.c. current.
- Measures d.c. current in a circuit containing a variable resistor.
- Identifies the effect that occurs close to a current carrying conductor.
- States the characteristics of current flow.
- Explains that current is proportional to resistance in a D.C circuit.
- States the relationship between current and voltage.
- States the different connections required when using a multimeter to measure voltage and current.
- Uses a multimeter to measure current.
- States that the gain of a transistor is a function of base and collector current.
- Recognizes the relationship between current and resistance and current and voltage.
- Recognizes the units of current, voltage, resistance and frequency.

5. Categorize energy sources as renewable or non-renewable and compare how these sources are used by humans.

- States the main sources of energy used in transportation systems.
- Distinguishes between basic power sources that drive robots.

6. Describe how energy put into or taken out of a system can cause changes in the motion of particles in matter.

- Compares the sizes of dust particles able to pass through a filter element.
- States the main sources of energy used in transportation systems.
- States the difference between acceleration and deceleration and how these affect vehicular systems.

I. Motion - Students will understand the motion of objects and how forces can change that motion. Students will be able to:

1. Describe the motion of objects using knowledge of Newton's Laws.

- Investigates the relationship between force and motion.
- Investigates motion and energy transformations in pneumatics.

2. Use mathematics to describe the motion of objects (e.g., speed, distance, time, acceleration).

- Identifies the units used to measure speed.
- Calculates the distance of a thunderstorm, by counting seconds.
- States the reason for the difference in time taken for a timed run when the fan motor is reversed.
- States the difference between acceleration and deceleration and how these affect vehicular systems.
- States if a propeller driven computer controlled maglev system can be accelerated and decelerated
- States the relationship between velocity, speed, acceleration and deceleration.
- Calculates speed using the formula $d \div t$.
- Observes the effect of changing wind speed on lift.
- Calculates average speed of a rocket in flight.
- Investigates the relationship between force and motion.
- Describes speed changes in moving gear trains.
- Performs calculations and makes inferences about gear train speeds.
- Estimates distance.

Explains how mechanisms can be used to change speed and direction.
Investigates motion and energy transformations in pneumatics.

3. Describe and quantify the ways machines can provide mechanical advantages in producing motion.

Solves problems involving mechanical advantage.
Calculates mechanical advantage for system of mechanisms.
Demonstrates mechanical advantage using first order levers.
Uses formula to calculate mechanical advantage.
Uses ratios to calculate mechanical advantage.
Calculates mechanical advantage.

J. Inquiry and Problem Solving - Students will apply inquiry and problem-solving approaches in science and technology. Students will be able to:

1. Make accurate observations using appropriate tools and units of measure.

Identifies the units used to measure speed.
Works with units of weight.
Works with units of measure.
States units of measurement.
Works with units of measure of velocity.
States vertical angle measured using protractor and plumb line.
Converts ounces to grams.
Identifies the tools used to perform specified operations using audio software.
Identifies tools involved in digital speech synthesis.
Interprets computer icon tool buttons.
Demonstrate knowledge of design tools used for desktop publishing.
States the unit of measure for light.
Recognizes the computer as a design tool.
Calculates area and volume using units of measure.
Describes tools used to produce graphics.
Identifies tools used in constructing a multimedia presentation.
States the correct range selections for measuring electrical quantities with a multimeter.
States the different connections required when using a multimeter to measure voltage and current.
Identifies the correct method for measuring electrical quantities in a series circuit.
Uses a multimeter to measure voltage.
Uses a multimeter to measure current
Uses an oscilloscope to measure voltage, frequency and time period.
Recognizes the units of current, voltage, resistance and frequency.
Identifies and uses software function tools to edit and format a document
Identifies the equator and prime meridian as the origins for latitude and longitude measurement.

2. Design and conduct scientific investigations which include controlled experiments and systematic observations. Collect and analyze data, and draw conclusions fairly.

Uses their own observations to identify the components of a hydro-electric power plant.
Investigates the greenhouse effect using experimental models.
Demonstrates aerodynamic principles using simple experiments.
Performs experiments to demonstrate the effects of gravity.
States scientific principles of importance to space technology.
Uses the mechanical trainer to investigate pulley systems.
Makes inferences based on experiments using first order levers.

Interprets experimental observations.

Uses a multimedia Atlas to observe 3D topographic detail viewed from above.

3. Verify and evaluate scientific investigations and use the results in a purposeful way.

Fills in a table and states which set of results represents high wind speeds.

Performs calculations to evaluate communication systems.

Performs force-pressure-area evaluation on cylinder applications.

Records sound effects and adds the results to an animation.

Investigates the impact of technology on medical treatments.

Investigates the requirements for a balanced diet.

Investigates the causes of daily stress.

4. Compare and contrast the processes of scientific inquiry and the technological method.

Identifies methods for gathering weather data.

Defines methods for monitoring weather.

States scientific principles of importance to space technology.

Describes publication production methods.

Describes methods of transferring energy using mechanical systems.

Documents the technological advances in industrial control.

Identifies the correct method for measuring electrical quantities in a series circuit.

5. Explain how personal bias can affect observations.

Uses their own observations to identify the components of a hydro-electric power plant.

Interprets experimental observations.

Interprets instructions for a specific task.

Interprets technical data.

Interprets text, instructions, tables and diagrams.

Identifies the difference between fact and opinion

6. Design, construct, and test a device (invention) that solves a special problem.

Uses test equipment.

Interprets a brief to design a bridge.

Designs a bridge construction.

Explores the role of CAD in the design process.

Follows a design brief to draw a mechanical component.

Solves problems in a circuit during testing.

States the differences between problems solved by invention and by innovation.

States the purpose of research and the design brief.

States the features and operating parameters of a vehicular system which has been tested by the

Describes the stages in the Design and problem solving loop.

Interprets written words from a short piece of text relating to the Design Loop.

Applies tests and improvement procedures to check the quality of systems.

Measures the effect of vehicle design on drag.

Identifies the ways car design affects performance.

Uses car performance simulation software to design a streamlined car.

Designs and tests car on computer.

Observes airstreams around different wing designs.

Describes the theory behind wing design.

Solves a car design problem using computer software.

Designs a car following a design brief.

Solves problems in aerodynamics to test a glider.
Applies aerodynamic principles to automobile design.
Relates vehicle design to efficiency.
Identifies the features of wing design.
Identifies the application of aerodynamics in aircraft design.
Investigates the effect of gravity on mechanical devices.
States factors that are important in launch vehicle design.
Recognizes the computer as a design tool.
Designs a transmission system for a winch.

L. Communication - Students will communicate effectively in the application of science and technology. Students will be able to:

1. Discuss scientific and technological ideas and make conjectures and convincing arguments.

Analyzes data to select the most appropriate technology for the given problem.
Outlines how satellite technology is used to gather weather data.
Defines the term 'technology'.
Interprets the term Construction Technology.
Recognizes the impact of technology upon drafting.
Investigates the impact of technology on medical treatments.
Recognizes the impact of technology on health.
Draws similarities and differences between model rocketry and space technology.
States scientific principles of importance to space technology.
Evaluates the impact of space technology on society.
Extracts information about communications technology using a Web Browser.
Investigates radar technology.
Explores the benefits of new technology on communication systems.
Extracts science and technology facts from an encyclopedia CD-ROM.
Recognizes an application of mechanical technology.
Documents the technological advances in industrial control.
Describes how technology is used producing multimedia presentations.
Recognizes the contribution that electronics technology has made to society.
Interprets text from a book relating to the application of electronics technology.
States the impact transistors have made to electronics technology.
States the changes Electronics Technology has made to society.

2. Defend problem-solving strategies and solutions.

Describes the stages in the Design and problem solving loop.
Speaking - presents a solution to a bridge construction problem.
Explains weaknesses in a problem solution.
Identifies the medical solutions to kidney failure.
Presents a solution to a communication problem.
Evaluates proposed solutions to a pneumatic problem.
Investigates the design problem and solution for a simulated TV animation.
Identifies problems and solutions in animating a human walk.
Explains other potential solutions to the TV animation.
Speaking - presents reasoning and solutions to the TV animation problem.
Recalls some of the problems and solutions associated in producing a simulated TV sequence.
Compares the hardness of materials to find appropriate solutions for product designs.

Evaluates the heat properties of materials to find appropriate solutions for product designs.

Evaluates the densities of materials to find appropriate solutions for product designs.

3. Evaluate individual and group communication for clarity, and work to improve communication.

Speaking - presents a solution to a bridge construction problem.

Speaking - presents technical details clearly.

Describes the communication process of a string based communication system.

Describes the basic process of radio communication.

Presents a solution to a communication problem.

Explores basic principles of communication using sound.

Explores basic principles of communication using sound.

Identifies parts of the human anatomy that allow us to speak and hear.

Identifies computer aided publishing as an effective form of communication.

Presents an effective advert.

Speaking - presents an advert.

Speaking - presents reasoning and solutions to the TV animation problem.

Makes a presentation to a group on Alternative Energy.

Makes a presentation to a group on Weather Monitoring.

Makes a presentation to a group on Construction Technology.

Makes a presentation to a group on Computer Aided Design.

Makes a presentation to a group on Basic Electricity.

Makes a presentation to a group on Research and Design.

Makes a presentation to a group on Health Management.

Makes a presentation to a group on Biomedical Technology.

Uses a multimedia presentation.

Completes a multimedia presentation.

Explains the processes involved in creating a multimedia presentation.

Describes the components of a multimedia presentation.

Makes a presentation to a group on Aerodynamics Technology.

Makes a presentation to a group on Space Technology.

Makes a presentation to a group on Electronic Communications.

Makes a presentation to a group on Digital Sound Technology.

Makes a presentation to a group on Computer Applications.

Makes a presentation to a group on Computer Aided Publishing.

Makes a presentation to a group on Robotics and Automation.

Makes a presentation to a group on Mechanisms.

Makes a presentation to a group on Pneumatics.

Makes a presentation to a group on Hydraulics.

Makes a presentation to a group on Industrial Control Technology.

Makes a presentation to a group on Graphics and Animation.

Makes a presentation to a group on Electronics Technology.

Makes a presentation to a group on Materials and Processes.

Makes a presentation to a group on Navigation and GPS.

Makes a presentation to a group on Digital Photography.

4. Make and use scale drawings, maps, and three-dimensional models to represent real objects, find locations, and describe relationships.

Investigates the greenhouse effect using experimental models.

Extracts data from an air to ground lightning strike map.

Creates a CAD drawing using coordinate systems.
Completes a CAD drawing of a kitchen plan.
Determines the size of the drawing area.
Draws an orthographic projection of a 3D model.
Recognizes how to print out CAD drawings.
Translates 'real world' information into working drawings.
Uses CAD to create 3D models.
States the relationship between velocity, speed, acceleration and deceleration.
Assembles a model of a human body.
Uses the model of a human body to appreciate the position of major organ systems.
Uses models to gain insight into eye structure and function.
Identifies location of pulse point.
Sets up a model wing in a wind tunnel.
Compares and contrasts real with model rockets.
Uses IT to examine the structure of model rockets.
Investigates the relationship between force and motion.
Draws similarities and differences between model rocketry and space technology.
Recognizes the relationship between current and resistance and current and voltage.
Uses a simple alpha-numeric grid reference system to identify location.
Uses a 4 figure grid reference system to identify location.
Uses a 4 figure grid reference system to locate features on a simple map.

5. Access information at remote sites using telecommunications.

Describes the communication process of a string based communication system.
Describes the basic process of radio communication.
Follows instructions to set-up a microwave communication link.
Examines wire communication systems.
Extracts information about communications technology using a Web Browser.
Explores the benefits of new technology on communication systems.
Evaluates communication links.
Presents a solution to a communication problem.
Explores wire cable communications.
Extracts information on communications from a portion of text.
Investigates satellite communications.
Deduces communication possibilities in computer to computer communication.
Identifies computer aided publishing as an effective form of communication.

6. Identify and perform roles necessary to accomplish group tasks.

Identifies the role of Construction Technology.
Explores the role of CAD in the design process.
Interprets instructions for a specific task.
Defines career roles in computer aided publishing.
Identifies the primary tasks required to animate a simple sequence.
Distinguishes between video production and pre-production tasks.

M. Implications of Science and Technology - Students will understand the historical, social, economic, environmental, and ethical implications of science and technology. Students will be able to:

1. Research and evaluate the social and environmental impacts of scientific and technological developments.

- Indicates that the use of fossil fuels harms the environment.
- Identifies characteristics of the environment.
- Recognizes the impact of technology upon drafting.
- Identifies the function of CAD within society.
- States the general uses of energy in society.
- States the impact of technology on health.
- Recognizes the impact of technology on health.
- Explores the impact of advertising on drinking.
- Explores the impact of advertising on smoking.
- Investigates the impact of orthotics and prosthetics on society.
- Evaluates the impact of space technology on society.
- Recognizes how environmental obstructions can block microwave signals.
- States the possible impact of transportation systems of the future.
- Investigates the impact of technology on medical treatments.
- States the impact transistors have made to electronics technology.
- Recognizes the contribution that electronics technology has made to society.
- States the changes Electronics Technology has made to society.

2. Describe the historical and cultural conditions at the time of an invention or discovery, and analyze the societal impacts of that invention.

- States the differences between problems solved by invention and by innovation.
- Identifies points in the origin and history of animation.
- Identifies the function of CAD within society.
- States the general uses of energy in society.
- Investigates the impact of orthotics and prosthetics on society.
- Evaluates the impact of space technology on society.
- Recognizes the contribution that electronics technology has made to society.
- States the changes Electronics Technology has made to society.

3. Discuss the ethical issues surrounding a specific scientific or technological development.

- Analyzes data to select the most appropriate technology for the given problem.
- Defines the meaning of the term technology.
- Recognizes the impact of technology on health.
- States the impact of technology on health.
- Investigates the impact of technology on medical treatments.

4. Describe an individual's biological and other impacts on an environmental system.

- Indicates that the use of fossil fuels harms the environment.
- Identifies characteristics of the environment.
- Recognizes how environmental obstructions can block microwave signals.
- Recognizes the impact of technology on health.
- States the impact of technology on health.
- Investigates the impact of technology on medical treatments.
- Explores the impact of advertising on drinking.

Explores the impact of advertising on smoking.
Investigates the impact of orthotics and prosthetics on society.
Evaluates the impact of space technology on society.
States the impact transistors have made to electronics technology.

5. Identify factors that have caused some countries to become leaders in science and technology.

Analyzes data to select the most appropriate technology for the given problem.
Outlines how satellite technology is used to gather weather data.
Interprets the term Construction Technology.
Identifies the role of Construction Technology.
Recognizes the impact of technology upon drafting.
Defines the meaning of the term technology.
Investigates the impact of technology on medical treatments.
Recognizes the impact of technology on health.
States the impact of technology on health.
Describes different careers in biomedical technology.
Examines propulsion systems used with space technology.
Draws similarities and differences between model rocketry and space technology.
States scientific principles of importance to space technology.
Evaluates the impact of space technology on society.

6. Give examples of actions which may have expected or unexpected consequences that may be positive, negative, or both.

Interprets information from written text as to the positive features of different robots.

7. Explain the connections between industry, natural resources, population, and economic development.

Identifies how pneumatics is used in industry.

8. Recognize scientific and technological contributions of diverse people including women, different ethnic groups, races, and physically disabled.

Analyzes data to select the most appropriate technology for the given problem.
Defines the meaning of the term technology.
Investigates the impact of technology on medical treatments.
Recognizes the impact of technology on health.
States the impact of technology on health.
Describes the main factors that contribute to good health.
Describes different careers in biomedical technology.
States scientific principles of importance to space technology.
Recognizes the contribution that electronics technology has made to society.
Identifies jobs provided by the alternative energy industries.
States responsibilities of personnel working in therapeutic services.
Defines career options in computer aided publishing.
Identifies the working situations of careers based on digital photography.