Kentucky Science

# Grade 7

Adopted 2022

**Grade 7**

**Physical Science**

7-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. 7-PS1-2

7-SEPS1-2. Analyzing and Interpreting Data - Analyze and interpret data to determine similarities and differences in findings. 7-SEPS1-2

2A. Structure and Properties of Matter - Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. 7-DCI.PS1.2A

2B. Chemical Reactions - Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. 7-DCI.PS1.2B

PS1-2. Patterns - Macroscopic patterns are related to the nature of microscopic and atomic-level structure. 7-CC.PS1-2

7-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. 7-PS1-5

7-SEPS1-5. Developing and Using Models - Develop a model to describe unobservable mechanisms. 7-SEPS1-5

5B. Chemical Reactions - Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change. 7-DCI.PS1.5B

PS1-5. Energy and Matter - Matter is conserved because atoms are conserved in physical and chemical processes. 7-CC.PS1-5

7-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy.* 7-PS1-6

7-SEPS1-6. Constructing Explanations and Designing Solutions - Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. 7-SEPS1-6

B. Chemical Reactions - Some chemical reactions release energy, others store energy. 7-DCI.PS1.B

B. Developing Possible Solutions - A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. 7-DCI.ETS1.B

C. Optimizing the Design Solution - Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design. The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. 7-DCI.ETS1.C

PS1-6. Energy and Matter - The transfer of energy can be tracked as energy flows through a designed or natural system. 7-CC.PS1-6

7-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. 7-PS2-2

7-SEPS2-2. Planning and Carrying Out Investigations - Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. 7-SEPS2-2

A. Forces and Motion - The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. 7-DCI.PS2.A

PS2-2. Stability and Change - Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. 7-CC.PS2-2

7-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. 7-PS2-3

7-SEPPS2-3. Asking Questions and Defining Problems - Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. 7-SEPPS2-3

3B. Types of Interactions - Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. 7-DCI.PS2.3B

PS2-3. Cause and Effect - Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. 7-CC.PS2-3

7-PS2-5. 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. 7-PS2-5

7-SEPS2-5. Planning and Carrying Out Investigations - Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. 7-SEPS2-5

5B. Types of Interactions - Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). 7-DCI.PS2.5B

PS2-5. Cause and Effect - Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. 7-CC.PS2-5

7-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. 7-PS3-1

7-SEPPS3-1. Analyzing and Interpreting Data - Construct and interpret graphical displays of data to identify linear and nonlinear relationships. 7-SEPPS3-1

1A. Definitions of Energy - Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. 7-DCI.PS3.1A

PS3-1. Scale, Proportion, and Quantity - Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. 7-CC.PS3-1

7-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. 7-PS3-2

7-SEPS3-2. Developing and Using Models - Develop a model to describe unobservable mechanisms. 7-SEPS3-2

2A. Definitions of Energy - A system of objects may also contain stored (potential) energy, depending on their relative positions. 7-DCI.PS3.2A

2C. Relationship Between Energy and Forces - When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. 7-DCI.PS3.2C

PS3-2. Systems and System Models - Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. 7-CC.PS3-2

7-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. 7-PS3-3

7-SEPS3-3. Constructing Explanations and Designing Solutions - Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. 7-SEPS3-3

3A. Definitions of Energy - Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. 7-DCI.PS3.3A

3B. Conservation of Energy and Energy Transfer - Energy is spontaneously transferred out of hotter regions or objects and into colder ones. 7-DCI.PS3.3B

3A. Defining and Delimiting an Engineering Problem - The more precisely a design task's critria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. 7-DCI.ETS1.3A

3B. Developing Possible Solutions - A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. 7-DCI.ETS1.3B

PS3-3. Energy and Matter - The transfer of energy can be tracked as energy flows through a designed or natural system. 7-CC.PS3-3

7-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. 7-PS3-4

7-SEPS3-4. Planning and Carrying Out Investigations - Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. 7-SEPS3-4

4A. Definitions of Energy - Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. 7-DCI.PS3.4A

4B. Conservation of Energy and Energy Transfer - The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. 7-DCI.PS3.4B

PS3-4. Scale, Proportion, and Quantity - Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. 7-CC.PS3-4

7-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.Engaging in Argument from Evidence 7-PS3-5

7-SEPS3-5. Engaging in Argument from Evidence - Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. 7-SEPS3-5

5B. Conservation of Energy and Energy Transfer - When the motion energy of an object changes, there is inevitably some other change in energy at the same time. 7-DCI.PS3.5B

PS3-5. Energy and Matter - Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). 7-CC.PS3-5

7-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. 7-PS4-1

7-SEPS4-1. Using Mathematics and Computational Thinking - Use mathematical representations to describe and/or support scientific conclusions and

design solutions. 7-SEPS4-1

A. Wave Properties - A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. 7-DCI.PS4.A

PS4-1. Patterns - Graphs and charts can be used to identify patterns in data. 7-CC.PS4-1

7-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. 7-PS4-2

7-SEPS4-2. Developing and Using Models - Develop and use a model to describe phenomena. 7-SEPS4-2

2A. Wave Properties - A sound wave needs a medium through which it is transmitted. 7-DCI.PS4.2A

2B. Electromagnetic Radiation - When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. However, because light can travel through space, it cannot be a matter wave, like sound or water waves. 7-DCI.PS4.2B

PS4-2. Structure and Function - Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. 7-CC.PS4-2

7-PS4-3. Integrate qualitative scientific and technical information to support the claim that designed technologies can transmit digital information as wave pulses. 7-PS4-3

7-SEPS4-3. Obtaining, Evaluating, and Communicating Information - Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. 7-SEPS4-3

3C. Information Technologies and Instrumentation - Technologies allow us to detect and interpret waves and signals in waves that cannot be detected directly. 7-DCI.PS4.3C

PS4-3. Structure and Function - Structures can be designed to serve particular functions. 7-CC.PS4-3

**Life Science**

7-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. 7-LS1-1

7-SEPLS1-1. Planning and Carrying Out Investigations - Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. 7-SEPLS1-1

1A. Structure and Function - All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). 7-DCI.LS1.1A

LS1-1. Scale, Proportion, and Quantity - Phenomena that can be observed at one scale may not be observable at another scale. 7-CC.LS1-1

7-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function. 7-LS1-2

7-SEPLS1-2. Developing and Using Models - Develop and use a model to describe phenomena. 7-SEPLS1-2

2A. Structure and Function - Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. 7-DCI.LS1.2A

LS1-2. Structure and Function - Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural and designed structures/systems can be analyzed to determine how they function. 7-CC.LS1-2

7-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. 7-LS1-3

7-SEPLS1-3. Engaging in Argument from Evidence - Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. 7-SEPLS1-3

3A. Structure and Function - In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. 7-DCI.LS1.3A

LS1-3. Systems and System Models - Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. 7-CC.LS1-3

7-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. 7-LS1-7

7-SEPLS1-7. Developing and Using Models - Develop a model to describe unobservable mechanisms. 7-SEPLS1-7

C. Organization for Matter and Energy Flow in Organisms - Within individual organisms, food moves through a series of chemical reactions in which it is broken down and

rearranged to form new molecules, to support growth, or to release energy. 7-DCI.LS1.C

D. Energy in Chemical Processes and Everyday Life - Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. 7-DCI.PS3.D

LS1-7. Energy and Matter - Matter is conserved because atoms are conserved in physical and chemical processes. 7-CC.LS1-7

7-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. 7-LS1-8

7-SEPLS1-8. Obtaining, Evaluating, and Communicating Information - Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. 7-SEPLS1-8

8D. Information Processing - Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. 7-DCI.LS1.8D

LS1-8. Cause and Effect - Cause-and-effect relationships may be used to predict phenomena in natural systems. 7-CC.LS1-8

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**6-8 Engineering Design**

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

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**MS-SEPETS1-1. Asking Questions and Defining Problems - Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.** MS-SEPETS1-1

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**1A. Defining and Delimiting Engineering Problems - The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.** MS-DCI.ETS1.1A

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

**MS-SEPETS1-2.** **Engaging in Argument from Evidence - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.** MS-SEPETS1-2

**1-2B.** **Developing Possible Solutions - There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.** MS-DCI.ETS1.1-2B

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

**MS-SEPETS1-3.** **Analyzing and Interpreting Data - Analyze and interpret data to determine similarities and differences in findings.** MS-SEPETS1-3

**B.** **Developing Possible Solutions - There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.** MS-DCI.ETS1.B

**C.** **Optimizing the Design Solution - Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design.** MS-DCI.ETS1.C

**MS-ETS1-4.** **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

**MS-SEPETS1-4.** **Developing and Using Models - Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.** MS-SEPETS1-4

**1B.** **Developing Possible Solutions - A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. Models of all kinds are important for testing solutions.** MS-DCI.ETS1.1B

**1C.** **Optimizing the Design Solution - The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.** MS-DCI.ETS1.1C