Grade 2	Material Science Properties of Mater	• **READ THE FEEDBACK** • **IT ALL BEGINS WITH A CHANGE IN THINKING** • **LIVE BY THE NATURAL LAWS**

Curriculum Framework
PLTW Launch – 2nd Grade – Matter and Materials Science: Properties of Matter

PREFACE

Students investigate and classify different kinds of materials by their observable properties, including color, texture, and heat conduction. After analyzing data from materials testing, the students design an insulating cover for an ice pop to prevent melting.

All materials have a melting point, or a temperature at which a solid becomes a liquid. The melting point for water is 32 degrees Fahrenheit. Ice pops have a slightly lower melting point, but both water and ice pops are liquid at room temperature because room temperature is above the melting point of the substance.

Every material has unique properties of insulation. The better a material is at insulating, the more it will keep an object at the starting temperature. This means a cup made from a good insulator, such as Styrofoam™, will keep hot liquids hot and cold liquids cold better than a cup made from a poor insulator such as paper.

Engineers and designers select materials which have properties that are best suited for an intended purpose. Properties such as color, texture, and heat conduction may influence design choices.

Desired Results *(stage 1)*

Standards

Next Generation Science Standards

- 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- 2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
- PS1.A: Structure and Properties of Matter – Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.

Transfer

Students will be able to independently use their learning to …

T1 – Evaluate a problem in a new and novel situation.
T2 – Apply a step by step design process to solve a problem.
T3 – Identify observable properties of real world objects.

Meaning

UNDERSTANDINGS:
Students will understand that …

- U1 – The design process is a step by step method used to guide people in developing solutions to problems.
- U2 – Engineers and designers create new products or improve existing products and technology to meet human needs and wants.

ESSENTIAL QUESTIONS:
Students will keep considering …

- Q1 – Is it more important when designing a consumer product (toy, tool, or tennis shoe) to select a material that looks good, a material that will last a long time, or a material that doesn't cost too much? Why?

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• PS1.A: Structure and Properties of Matter – Different properties are suited to different purposes. • PS1.B: Chemical Reactions – Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4) • K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. • K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. • K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs. • ETS1.A: Defining and Delimiting an Engineering Problem - Asking questions, making observations, and gathering information are helpful in thinking about problems. • ETS1.B: Developing Possible Solutions - Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. • ETS1.C: Optimizing the Design Solution – Because there is always more than one possible solution to a problem, it is useful to compare and test designs. • Science and Engineering Practice – Planning and Carrying Out Investigations – Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • Science and Engineering Practice – Analyzing and Interpreting Data – Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.	• U3 – Engineers ask questions, make observations, and gather information about a situation people want to change. • U4 – The shape of an object can help it perform as needed to solve a given problem. • U5 – Products may be analyzed by comparing objects designed to solve the same problem. • U6 – Engineers keep and organize all of their work in an engineering notebook. • U7 – Engineers share their work and get feedback from others during the design process. • U8 – Materials may be classified and described by a variety of different observable properties. • U9 – Matter is anything that has mass and takes up space. • U10 – Some changes caused by heating or cooling can be reversed and some cannot. • U11 – Engineers and designers select materials which have the properties that are best suited for an intended purpose. • U12 – Properties of materials such as color, texture, and heat transfer may influence design choices.	• Q2 – Why can some changes caused by heating or cooling not be reversed?
	Acquisition	
	KNOWLEDGE: Students will…	*SKILLS: Students will…*

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• Science and Engineering Practice – Constructing Explanations and Designing Solutions – Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Science and Engineering Practice – Engaging in Argument from Evidence – Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). • Crosscutting Concept – Patterns – Patterns in the natural world and human designed world can be observed. • Cross Cutting Concept – Cause and Effect – Events have causes that generate observable patterns. • Crosscutting Concept – Cause and Effect – Simple tests can be designed to gather evidence to support or refute student ideas about causes *Common Core English Language Arts* • RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. • RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. • RI.2.8 Describe how reasons support specific points the author makes in a text. • W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). • W.2.8 Recall information from experiences or gather information from provided sources to answer a question. *Common Core Mathematics* • 2. MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories.	• K1 – List products created by engineers and designers that were created to meet a human need or want. U2 • K2 – State questions engineers may ask when gathering information about a situation people want to change. U3 • K3 – Identify the differences between a new object and an improved object. U2 • K4 – List observable properties of common materials, including color, texture, and heat conduction. U8 • K5 – Recognize states of matter as solid, liquid, or gas. U9, U10 • K6 – Describe the changes between states of matter as a result of temperature change.U10	• S1 – Follow a step by step method to solve a problem. U1 • S2 – Examine how other people have tried to solve a design problem. U2 • S3 – Gather information about a situation people want to change. U3 • S4 – Describe how the shape of a structure helps it function as needed to meet a human need or want. U4 • S5 – Brainstorm possible solutions and select one solution to develop, taking into account strengths and weaknesses of each design. U5 • S6 – Build and test a physical model of an improved object or tool designed to meet a human need or want. U2, U3 • S7 – Collect and analyze data from two models and compare the strengths and weaknesses of how each performed. U5 • S8 – Organize and maintain an engineering notebook to document work. U6 • S9 – Share findings and conclusions with others. U7 • S10 – Describe and classify a variety of objects according to observable physical properties. U8

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Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. • MP.4 Model with mathematics. • MP.5 Use appropriate tools strategically.		• S11 – Defend the statement that some changes caused by heating and cooling can be reversed and some cannot. U10 • S12 – Describe the properties of a material that make it the best choice for an intended purpose. U11, U12 • S13 – Design a tool utilizing materials that are best suited for the intended purpose. U12

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Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1 Young Inventors	• Essential questions • Responses to the question what is an engineer? • Notes in Launch Log about the favorite desert • Discussion of deserts • Notes in Launch Log about the What is an Engineer presentation • Drawings in engineering notebook of object features • Notes in Launch Log about the ice pop melt demonstration • Notes in Launch Log about the Design Process presentation and the crayon holder • Notes in Launch Log about the young inventors presentation • Discussion about the young inventors presentation	• Responses to the question what is an engineer? • Notes in Launch Log about the favorite desert • Notes in Launch Log about the What is an Engineer presentation • Drawings in engineering notebook of object features • Notes in Launch Log about the ice pop melt demonstration • Notes in Launch Log about the Design Process presentation and the crayon holder • Notes in Launch Log about the young inventors presentation • Conclusion questions	MS.1.1.A Young Inventors • Prior to this activity, students will be introduced to the challenge faced by the fictional characters involving keeping a frozen dessert solid in a warm environment. • In this activity students work in small groups researching and documenting the products created by young inventors and innovators including the Popsicle, Ear Muffs, and the Trampoline.	K1, K2, K3, S1, S5, S8

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	• Discussion about the need for a patent			
Activity 2 Properties of Matter: Color and Texture	• Essential questions • Discussion about the Color and Texture presentation • Discussion about the monster truck observations • Notes in the Launch Log about the monster truck observations	• Description about the Color and Texture presentation • Notes in the Launch Log about the monster truck observations • Conclusion questions	MS.1.2.A Properties of Matter: Color and Texture • In this activity students will be introduced to the concepts of matter and the physical properties of color and texture by exploring features and materials of toy monster trucks. The students will also classify the trucks in a variety of ways, including color.	K4, S10
Activity 3 States of Matter	• Essential questions • Examples in Launch Log of things that are not matter • Discussion of states of matter during the physical demonstration • Discussion of the online categorizing activity • Drawings in Launch Log of three states water • Matching state of matter to common objects • Drawings in Launch Log of water in cups	• Examples in Launch Log of things that are not matter • Drawings in Launch Log of three states water • Matching state of matter to common objects • Drawings in Launch Log of water in cups • Drawings in Launch Log of leaves • Conclusion questions	MS.1.3.A States of Matter • In this activity students will observe and describe reversible and non-reversible changes in matter as a result of temperature change.	K5, K6, S3, S11

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	• Drawings in Launch Log of leaves • Discussion of the book *Snowmen All Year* • Discussion of presentation titled Changes in Matter			
Project 4 The Heat Is On	• Essential questions • Observations in Launch Log of Part 1 hand warmer temperature changes • Notes in Launch Log of part 2 of the presentation titled Conductors and Insulators • Discussion of the book *Snowmen The Mitten* • Data and bar graphs in the Launch Log of he temperature of the different materials	• Observations in Launch Log of Part 1 hand warmer temperature changes • Notes in Launch Log of part 2 of the presentation titled Conductors and Insulators • Discussion of the book *Snowmen The Mitten* • Data and bar graphs in the Launch Log of he temperature of the different materials • Conclusion questions	MS.1.4.P The Heat Is On • In this project students will investigate the material property of heat conduction. Students will test a variety of materials and classify the material either as good or poor at conducting heat. This project is an inquiry experience. The teacher will guide the students to an understanding of heat conduction and insulation at the conclusion of the assignment.	K5, K6, S11
Problem 5 Save the Ice Pop!	• Essential questions • Documentation in the Launch Log of each of the design process steps	• Documentation in the Launch Log of each of the design process steps • Discussion of each of the design process steps	MS.1.5.B Save the Ice Pop! • In this problem, students will design, prototype, and test a product to insulate a frozen dessert. Using technology, the students will document and describe the process they used to design and test their ice pop cover.	K1, K2, K3, K6, S1, S2, S3, S4, S5, S6, S7, S8, S9, S12, S13

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	• Discussion of each of the design process steps	• Conclusion questions
Materials Science: Properties of Matter Check for Understanding		Check for Understanding Summative Assessment

Materials Science: Properties of Matter Check for Understanding	K4, K5, K6, S10, S11, S12

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Grade 2	The Changing Earth	• READ THE FEEDBACK • IT ALL BEGINS WITH A CHANGE IN THINKING • LIVE BY THE NATURAL LAWS • THINK 1000 YEARS • RECOGNIZE AND PROTECT THE COMMONS • HEALTHY SYSTEMS HAVE LIMITS

Curriculum Framework
PLTW Launch – 2nd Grade – The Changing Earth

Desired Results *(stage 1)*

Standards

Next Generation Science Standards

- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- 2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
- 2-ESS1-1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
- 2-ESS2-2 Develop a model to represent the shapes and kinds of land and bodies of water in an area.
- 2-ESS2-3 Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Transfer

Students will be able to independently use their learning to …

T1 – Evaluate a problem in a new and novel situation.
T2 – Apply a step-by-step design process to solve a problem.
T3 – Perform investigations to find answers to questions.
T4 – Interpret maps or other visual resources to communicate and use spatial information.

Meaning

UNDERSTANDINGS: Students will understand that …

- U1 – The design process is a step-by-step method used to guide people in developing solutions to problems.
- U2 – Engineers and designers create new products or improve existing products and technology to meet human needs and wants.
- U3 – Engineers and scientists ask questions, make observations, and gather information about a situation people want to change.

ESSENTIAL QUESTIONS: Students will keep considering …

- Q1 – How can Earth events change the shape of the land?
- Q2 – Why should engineers prevent or reduce the impact of erosion?

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• PS1.A: Structure and Properties of Matter
  ○ Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
• ETS1.A Defining and Delimiting Engineering Problems
  ○ Asking questions, making observations, and gathering information are helpful in thinking about problems.
  ○ Before beginning to design a solution, it is important to clearly understand the problem.
• ETS1.B Developing Possible Solutions—Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas from a problem's solutions to other people.
• ETS1.C Optimizing the Design Solution—Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
• Cross-Cutting Concept: Systems and System Models—A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
  ○ Objects and organisms can be described in terms of their parts.
  ○ Systems in the natural and designed world have parts that work together.
• Cross-Cutting Concept: Structure and Function—The way an object is shaped or structured determines many of its properties and functions.
  ○ The shape and stability of structures of natural and designed objects are related to their function(s).
	• U4 – The properties of an object can help it perform as needed to solve a given problem.
	• U5 – Multiple solutions may be analyzed by comparing solutions to solve the same problem.
	• U6 – Engineers and scientists keep and organize all of their work in a notebook.
	• U7 – Engineers share their work and get feedback from others during the design process.
	• U8 – Engineers and scientists make observations and/or collect data that serves as evidence used to answer questions.
	• U9 – Engineers and scientists work collaboratively and communicate their findings with others.
	• U10 – Engineers and scientists develop and use models to represent amounts, relationships, relative scales, and/or patterns in the natural and designed world(s).
	• U11 – The Earth's landscape is always changing and is affected by wind, water, and natural disasters.
	• U12 – Water is located throughout the Earth and exists in different forms.	

	Acquisition	

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• Science and Engineering Practice: Asking Questions and Defining Problems—Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested. • Science and Engineering Practice: Developing and Using Models—Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. • Science and Engineering Practice: Planning and Carrying Out Investigations—Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • Science and Engineering Practice: Analyzing and Interpreting Data—Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Science and Engineering Practice: Using Mathematics and Computational Thinking—Mathematical and computational thinking in K–2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s). • Science and Engineering Practice: Constructing Explanations and Designing Solutions—Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Science and Engineering Practice: Engaging in Argument from Evidence—Engaging in argument from evidence in K–2 builds on prior experiences and progresses to	*KNOWLEDGE: Students will…* • K1 – State questions engineers and scientists may ask when gathering information about a situation people want to change. • K2 – Describe where water is found on Earth. • K3 – Identify where bodies of water are found in both solid and liquid states on Earth. • K4 – Explain ways that wind, water, and natural disasters can change the shape of the Earth. • K5 – Describe how maps may be used to represent information for various purposes. • K6 – Describe evidence that Earth events can occur quickly or slowly.	*SKILLS: Students will…* • S1 – Follow a step-by-step method to solve a problem. • S2 – Examine how existing solutions solve a design problem. • S3 – Gather information about a situation people want to change. • S4 – Describe how the properties of a structure help it function as needed to meet a human need or want. • S5 – Brainstorm possible solutions and select one solution to develop, taking into account strengths and weaknesses of each design. • S6 – Build and test a physical model designed to meet a human need or want. • S7 – Collect and analyze data from two models and compare the strengths and weaknesses of how each performed. • S8 – Organize and maintain a notebook to document work. • S9 – Share findings and conclusions with others. • S10 – Create a model to represent the shapes and kinds of land and bodies of water in an area. • S11 – Observe changes water, wind, and natural disasters cause to land over time. • S12 – Describe information presented in a map.

comparing ideas and representations about the natural and designed world(s). • Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information—Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. *Common Core ELA* • RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. • RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. • RI.2.9 Compare and contrast the most important points presented by two texts on the same topic. • W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. • W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). • W.2.8 Recall information from experiences or gather information from provided sources to answer a question. • SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media. • SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. *Common Core Math* • MP.2 Reason abstractly and quantitatively • MP.4 Model with mathematics		• S13 – Create a map that communicates information about a given area.

• MP.5 Use appropriate tools strategically.
• 2.NBT.A Understand place value.
• 2.NBT.A.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones.
  ○ 2.NBT.A.1.B
  The numbers 100, 200, 300, 400, 500, 600, 700, 800, and 900 refer to one, two, three, four, five, six, seven, eight, and nine hundreds (and 0 tens and 0 ones).
• 2.NBT.A.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.
• 2.MD.B.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.		

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Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1: All About Maps	• Essential questions • Discussion of symbols, legends, routes, compass, scale bar, weather information, topographic information, and landmarks on maps • Class discussion of interpretation of different maps from the *Follow That Map! A First Book of Mapping,* by Scot Ritchie book	• Analysis of map in Launch Log and completion of corresponding questions • Creation of map in Launch Log • Conclusion questions	Activity 1: All About Maps • In this activity students will read a fictional story that follows five friends as they go on an adventure to find a missing cat and dog. Using maps as their guide, the friends make their way through the neighborhood, into the city, across the country, and around the world. Through this story, students will explore different types of maps used to present different information, and will learn key components of maps, including legends, symbols, scale, landmarks, and a compass rose. • Students will use what they learn to analyze a map and then make a map of their own.	K4, S12, S13
Activity 2: Water, Water Everywhere	• Essential questions • Exploration of the continents, major lakes, and major rivers of the world using the Google Earth™ app	• Labeled maps of the Earth, color coded to indicate where water is found as a liquid and where it is found as a solid • Conclusion questions	Activity 2: Water, Water Everywhere • In this activity students will discover where water is found on Earth and whether it exists as solid ice or as a liquid. They will apply what they learned about maps in the previous activity and use the Google Earth application on their tablet to explore the continents and the major oceans, lakes, and rivers on Earth. They will add all of this information to a world map in their Launch Logs.	K2, K3, K5, S12
Activity 3: Changing Earth's Surface	• Essential questions • Discussion of *Cracking Up: A Story About Erosion*, by	• Description of the forces of erosion that were involved in creating two example landscapes	Activity 3: Changing Earth's Surface • In this activity students will explore how erosion changes the shape of the Earth's surface. They will see how moving water, freezing ice, blowing wind, and moving glaciers all work to create different landscapes over long periods of	K4, K6, S11

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	Jacqui Bailey and Matthew Lilly • Completion of the Erosion presentation • Classification of whether examples of erosion occurred quickly or slowly over time	• Conclusion questions • Classification of whether examples of erosion occurred quickly or slowly over time	time. They will also investigate events that cause changes to the landscape in very short periods of time, such as hurricanes, earthquakes, and floods. • They will use this knowledge to analyze various photographs of different areas from around the world, determine what forces of erosion caused the landscapes they see, and predict whether the change occurred quickly or slowly.	
Project: Investigating Erosion	• Essential questions • Discussion and documentation of all steps of the scientific inquiry process	• Discussion and documentation of all steps of the scientific inquiry process • Analysis and conclusions of experimental results • Conclusion questions	Project: Investigating Erosion • In this project students will model erosion caused by wind, earthquakes, glaciers, and moving water. They will build a model landscape using an erosion tray and complete different trials to determine whether wind, earthquakes, ice, or water causes more sand to be eroded from the tray.	K4, S10, S11
Problem: Save the City!	• Essential questions • Documentation of each step of the design process • Discussion of each step of the design process	• Analysis of mini topographic map and determination of which houses are most at risk of being destroyed, or damaged, by a landslide • Documentation of each step of the design process • Discussion and reflection of each step of the design process	Problem: Save the City! • In this design challenge, students will design, build, and test a solution to prevent water from changing the shape of the land. Students will work to save a city from a possible landslide created by a pending rain storm. They will choose materials that are best suited for the purpose of preventing erosion and explain why they believe they have made the best choice in material and design.	K1, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11

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		• Conclusion questions
The Changing Earth Check for Understanding		• Check for Understanding Summative Assessment

The Changing Earth Check for Understanding	

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Curriculum Framework
PLTW Launch – 2nd Grade – Grids and Games

PREFACE

In this module, students build knowledge and skills that enable them to program a game on a device. Through the activities and project in the module, students explore how mathematics is used in animation by using addition and subtraction to move characters on a numbered grid. Students discover that computer science is important to many parts of our lives, and that computer scientists do more than just program computers.

<table>
<tr><th colspan="3">Desired Results (stage 1)</th></tr>
<tr><td rowspan="2">Standards

Computer Science Teachers Association K-12 CS Standards
• 1A-CS-01 Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use.
• 1A-DA-05 Store, copy, search, retrieve, modify, and delete information using a computing device and define the information stored as data.
• 1A-AP-09 Model the way programs store and manipulate data by using numbers or other symbols to represent information.
• 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.
• 1A-AP-11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
• 1A-AP-12 Develop plans that describe a program's sequence of events, goals, and expected outcomes.</td><td colspan="2">Transfer
Students will be able to independently use their learning to …
T1 – Work effectively within a team.
T2 – Break a problem down into smaller problems in order to construct a sequence of steps to solve the problem.
T3 – Persist when solving problems and exercise patience while iterating through testing and fixing solutions.</td></tr>
<tr><td>Meaning
UNDERSTANDINGS: Students will understand that …
• U1 – Computing is a collaborative activity that fosters creativity, communication, and teamwork.
• U2 – People can use technology to create digital artifacts illustrating concepts learned across disciplines.
• U3 – People control computers to help them do things that they could not do without a computer.
• U4 – People control computers by entering set of sequential instructions called a program.
• U5 – One strategy for solving a problem is to break it down into smaller problems and then solve each of the smaller problems.
• U6 – Programs need to be written in a language or "code" that a computer can understand.</td><td>ESSENTIAL QUESTIONS:
Students will keep considering …
• Q1 – How can digital tools be used to express thoughts and ideas?
• Q2 – How do humans use computers to solve problems?</td></tr>
</table>

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• 1A-AP-14 Debug (identify and fix) errors in an algorithm or program than includes sequences and simple loops.
• 1A-AP-15 Using correct terminology, describe steps taken and choices made during the iterative process of program development.
 	
Next Generation Science Standards
 	
• ETS1.A Defining and Delimiting Engineering Problems
  ○ Asking questions, making observations, and gathering information are helpful in thinking about problems.
  ○ Before beginning to design a solution, it is important to clearly understand the problem.
• ETS1.B Developing Possible Solutions – Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas from a problem's solutions to other people.
• ETS1.C Optimizing the Design Solution – Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
• Science and Engineering Practice – Asking Questions and Defining Problems – Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
• Science and Engineering Practice – Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
• Science and Engineering Practice – Generate and/or compare multiple solutions to a problem.
• Science and Engineering Practice – With guidance, plan and conduct an investigation in collaboration with peers (for K).
 	
Common Core ELA
	• U7 – To fix unexpected behavior by a computer, a programmer must look at the instructions to see if there is an incorrect or missing step.
	• U8 – Computer programs do not need to be right the first time. Testing and fixing things is normal when programming.
	
	Acquisition
	
	KNOWLEDGE: Students will…
	• K1 – Identify ways that students can work together on a task. U1
	• K2 – Explain in simple terms how humans control computers. U3, U4, U6, U7
	• K3 – Define a program as a set of step by step instructions written in a language that a computer can understand. U4, U5, U6
	• K4 – Explain that programming often requires going through the design process many times to test and fix the program. U7, U8
	• K5 – Explain that computer scientists break big problems down into smaller ones. U2
	• K6 -- Identify an event as a trigger to which a program can respond. U4, U5
	• K7 -- Define a loop as a section of code in a computer program that is repeated until an ending condition is reached. U5, U6
	• K8 – Identify characteristics of technology that are not found in non-digital tools. U2, U3
	• K9 – Give examples of how computers are used by people in many different jobs. U1, U2, U3
		SKILLS: Students will…
		• S1 – When working in a group, organize and collaborate with group members by assigning roles and taking turns. U1
		• S2 – Use technology to express ideas. U2, U3, U4
		• S3 -- Decompose large problems into smaller ones. U5
		• S4 – Evaluate a problem and, using a predefined set of commands, write an algorithm that will solve the problem. U3, U5, U6
		• S5 -- Design and implement a digital artifact using age appropriate programming tools. U2, U3, U5, U6
		• S6 -- Create computer programs using step by step instructions that a computer can understand. U4, U6
		• S7 -- Use common computer interfaces to give input and receive output. U3, U4
		• S8 -- Implement a loop when appropriate to make a program repeat a section of code until an ending condition is reached. U5, U6
		• S9 – Program characters in an animation or game to respond to event triggers. U4, U6
		• S10 -- Apply mathematics (addition, subtraction, rotation) to control the movements of a programmable agent. U1, U2, U4

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• .SL.2.1Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups. • SL.2.1.A Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion). • SL.2.1.B Build on others' talk in conversations by linking their comments to the remarks of others. • SL.2.1.C Ask for clarification and further explanation as needed about the topics and texts under discussion. *Common Core Math* • 2.OA.B.2 Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers. • 2.OA.C.3 Work with equal groups of objects to gain foundations for multiplication. • 2.NBT.B.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. • 2.MD.B.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.		• S11 – Test a program and identify incorrect behavior in a program. U7 , U8 • S12 – Identify and fix errors in a program that demonstrates incorrect behavior. U7, U8 • S13 – Demonstrate persistence in the cycle of testing, finding, and fixing problems in computer programs. U8

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• 2.MD.C.7 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m. • 2.G.A.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them. • 2.G.A.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.		

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Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1 Repeating Rosie	• Assembling a program that successfully navigates Rosie through the maze board game. • Answering the conclusion questions and completing the Launch Log.	• Teacher observes each student's participation in group problem solving. • Teacher checks student's entries in Launch Log.	2.4.1.A: Repeating Rosie • Students play a life-sized board game called Rosie's Runtime. The teacher plays the role of a robotic dog. Students work in groups of 4-6 to program the dog to move through a maze by making a sequence of instructions out of playing cards. A special Repeat command can be used to enclose a set of cards in a loop that repeats a number of times as designated by the programmer. This activity helps students build programming skills such as putting steps in the correct order and giving complete instructions.	K1, K3, K4, K7, S1, S3, S4, S6, S8, S11,S12, S13
Activity 2 Moving with Math	• Programming characters to move on the screen to visually represent mathematical equations and mathematical reasoning. • Answering the conclusion questions and completing the Launch Log.	• Teacher observes each student's participation in group programming project. • Teacher verifies that student produces working project. • Teacher checks student's entries in Launch Log.	2.4.2.A: Moving with Math • With the grid turned on so that the row and column numbers are visible, students program characters in ScratchJr to move back and forth on the number line to solve math challenges. Examples: ○ Challenge 1: Two characters are sitting on column 5. Using two move blocks for each character, program each of them to move 10 spaces to the right. You must use different programs for each character. (one solution: A move 5, move 5; B move 3, move 7) ○ Challenge 2: Make two equivalent programs, one using a Repeat 2 block and one not using any repeat blocks. For example: Does Repeat 2(move up 3) get a character to the same spot as Move Up 3 + Move Up 3 ? • Student teams create program challenges for each other and then trade devices to solve the challenge problems.	K1, K2, K3, K4, K7, K8, S1, S2, S6, S7, S8, S9, S10, S11, S12, S13
Activity 3 Computer Science Explorers	• Discussions about computer science	• Teacher observes each student's	2.4.3.A: Computer Science Explorers	K1, K2, K6, K9, S1, S5,

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	and computer scientists. • Building a scorekeeping app in ScratchJr. • Answering the conclusion questions and completing the Launch Log.	participation in group project. • Student produces working scorekeeping app. • Teacher checks student's entries in Launch Log.	• Students brainstorm different parts of our lives that are enhanced by technology. Students discover that computers are not just laptops and tablets and that computing touches nearly every aspect of our lives. • Students read a story to learn about different roles computer scientists have in the world, from obvious ones like video game programmers, to less obvious ones like scientists. • Students create a scorekeeping app in ScratchJr. This one-screen project has a ball in the center and two goals on either side. At the top of the screen are a right arrow and a left arrow. When the left arrow is pressed it sends a message to the ball to move one step to the left. When the right arrow is pressed it sends a message to the ball to move one step to the right. Each team taps their arrow when they get a question right. The first team to reach their goal wins. • Students play a math game with number cards. Rolling a twenty sided die gives a target number. Students play cards from their hand that, when added together, get as close to the target number as possible. • In all of the activities in this module, students will work in groups of 2-4 with one device per group. They will be given roles to help them collaborate successfully in the group.	S6, S7, S9, S10, S11, S12, S13

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Project 4 Sweep the Grid	• Building a successful animation of a character that traverses the entire 20x15 grid in ScratchJr Answering the conclusion questions. • Answering the conclusion questions and completing the Launch Log.	• Teacher observes each student's participation in group animation project. • Student produces working animation. • Teacher checks student's entries in Launch Log.	2.4.4.P: Sweep the Grid • Animate a character to sweep across every row and column of the ScratchJr grid such that every single square in the grid of the screen is traversed by the Sweeper character. Students will be required to use a Repeat block to solve the problem. • Launch Log will scaffold students to: o Break problem down into smaller problems. o Sketch out an algorithm and then program it. o Test it. o Iterate on design cycle until you are satisfied with the output of your program. • Optional extra challenge: Put objects on the grid that the sweeper picks up as it sweeps over them. How do you program the objects to disappear when the sweeper bumps into them?	K1, K2, K3, K4, K5, K6, K7, S1, S3, S4, S5, S6, S7, S9, S10, S11, S12, S13
Problem 5 Game Makers	• Creating a working game that has a main character that is controlled by the player, an obstacle character to be avoided by the player, and a target character to be acquired by the player. • Answering the conclusion questions and completing the Launch Log.	• Teacher observes each student's participation in group game project. • Student produces working game with required specifications. • Teacher checks student's entries in Launch Log.	2.4.5.B: Game Makers • Create a game with a main character, a moving target, and a moving obstacle (Repeat Forever block will be helpful). The player must use game controls such as tapping directional arrows or tapping the character itself to navigate the main character past the moving obstacle to get to the target. If the character gets hit by the obstacle then the game moves to Screen 2 where the player is asked if they want to play again. If the player gets to the target safely then the game switches to a celebration screen. • This will be presented with the criteria listed above but will otherwise be open-ended so that students can be creative with their games.	K1, K2, K3, K4, K5, K6, K7, K8, S1, S2, S3, S5, S6, S7, S8, S9, S10, S11, S12, S13

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Grids and Games Check for Understanding	• Review with teacher and peers the Grids and Games Check for Understanding.	Check for Understanding Summative Assessment	Grids and Games Check for Understanding	K2, K3, K5, K6, K7, S3, S4, S6, S8, S9, S10, S11, S12

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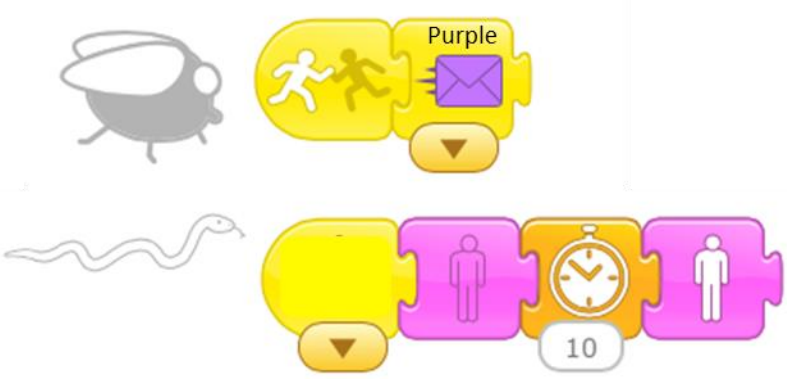
PLTW | Launch

Grids and Games Check for Understanding

1. Angelina is making a game in which the player has to move a frog to its lily pad home. The player taps left and right arrows to move the frog's position left and right while the frog continuously moves up the screen. Here are the rules for her game:
    - If the frog bumps into the snake, then the player loses and the game ends by jumping to page 3.
    - If the frog bumps into the fly, then the snake becomes invisible for a short time.
    - If the frog bumps into the lily pad, then the player wins and the game ends by jumping to page 2.

Page 1 Page 2 Page 3

a. Look at the blocks below for the snake and for the fly. What block should be the trigger in the snake's program? Write or draw the answer in the block.



b. Here are the blocks for the two arrows that control the frog's movement. In the frog's program, draw in the arrows in the Move blocks to show which way the frog should

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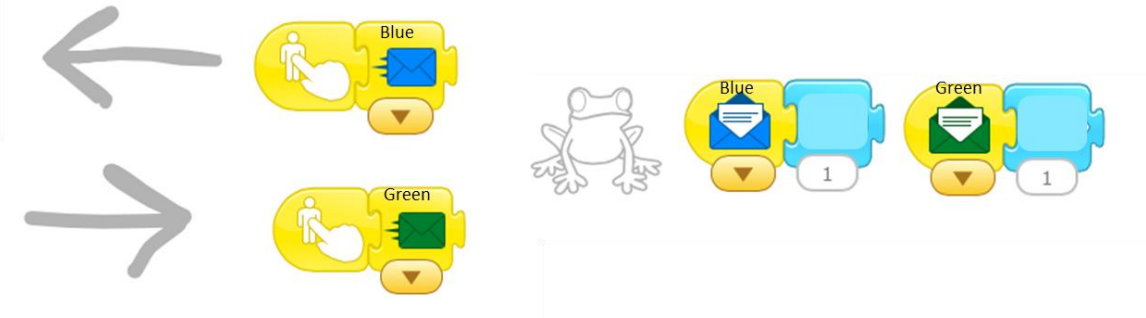
move when a message is received.



c. The lilypad's program is below. Fill in the Go To Page block with the page number that the game should go to when the lilypad is bumped by the frog (You can see all three game pages at the top of this worksheet).

d. Explain why Angelina must be careful to make sure that the frog is the only character that can bump into the lily pad.

_____

_____

_____

_____

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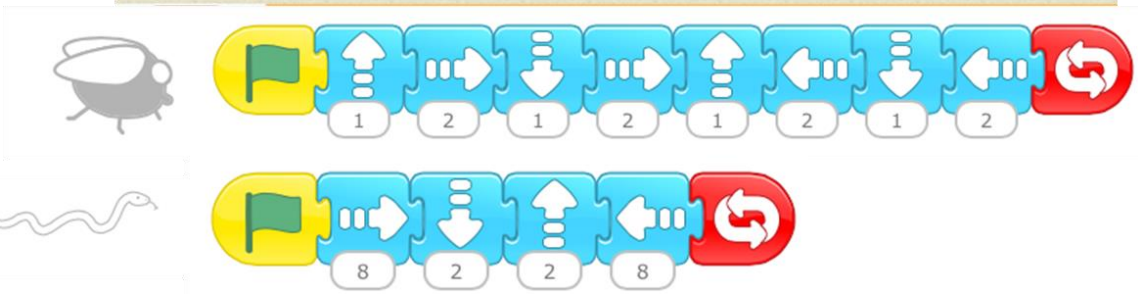
e. In the grid below, the snake and the fly are located on the squares that they will be sitting on when the game begins. Look at the blocks for the snake and fly programs and think about which squares on the grid the snake and the fly will touch while the program runs. Color in the blocks that the snake will touch and the blocks that the fly will touch when they follow their programs.



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f. Angelina wrote this simple program:

Her partner, Suzi, suggested this program instead:

What is the difference between the two programs?

_____

_____

_____

_____

_____

_____

_____

_____

_____

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Materials Science: Properties of Matter
Check for Understanding

1. Circle the words in each row that describe the object's texture and its ability to transfer heat.

Object	Texture	Heat Transfer
 Jacket	Sticky Soft Bumpy	Conductor Insulator
 Pan	Sticky Soft Smooth	Conductor Insulator

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2. Draw a line to match the object with the correct state of matter.

Clouds 

Juice 

Sand 

Crayons 

Tablet 

Air inside basketball 

Solid

Liquid

Gas

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3. Mario made a snowman on Monday. The table shows a picture that Mario drew of the snowman and the highest temperature for each day.

Monday	Tuesday	Wednesday	Thursday	Friday
30ºF	30ºF	33ºF	33ºF	36ºF
				

The temperature is 36ºF on Friday. Circle the picture that best predicts what the snowman will look like on Friday.

Explain why you circled that picture.

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4. Madeline needs to build a new doghouse for her dog Harry.

The doghouse needs to:

- Keep Harry warm at night
- Allow for water to fall off the roof quickly after it rains

Sketch a picture of how you would design the doghouse. Label the materials you would use.

How do the materials you chose help to keep Harry the dog warm at night and dry if it rains? Use words like conductor, insulator, and temperature in your answer.

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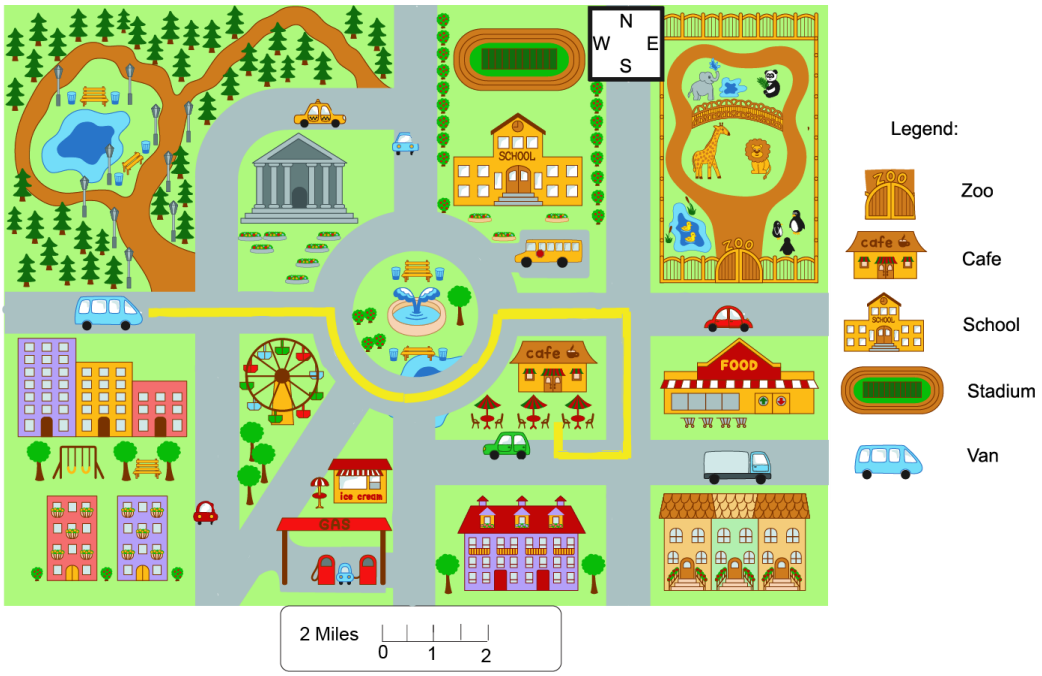
The Changing Earth
Check for Understanding

5.



Use the map above to answer the following questions.

a. To what location is the van going? (Hint: Follow the van's route.)

_____

_____

b. What is directly north of the school?

_____

_____

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6. The picture below shows a canyon.

Think about the forces that were involved in the erosion of the surface of the land to create this landscape.

a. Do you think the forces that caused this landscape occurred fast or slow?

Fast Slow

b. Describe these forces and explain why they change the shape of the land.

_____

_____

_____

_____

_____

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