CEREAL CITY SCIENCE by BCAMSC

Teacher Guide and Student Journal
Sample Activity and Planning Pages

Plant and Animal Traits
1LNG

SECOND EDITION

A first grade unit supporting Next Generation Science Standards
and Michigan Science Standards

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A first-grade unit supporting **Next Generation Science Standards** and the **Michigan Science Standards** developed and written by the Battle Creek Area Mathematics and Science Center for

CEREAL CITY SCIENCE™

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Plant and Animal Traits

Pre-activity Informational Pages

Activities

Appendix

NEXT GENERATION SCIENCE STANDARDS

Disciplinary Core Ideas/Performance Assessments	Activities
LS1.A: Structure and Function • All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.	1,2,3,4,5,6
1-LS1-1. Use material to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	4
LS1.B: Growth and Development of Organisms • Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.	5
1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	5,6
LS1.D: Information Processing • Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.	1,2,3,4,6
1-LS1-1. Use material to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	1,2,3,4,5,6
LS3.A: Inheritance of Traits • Young animals are very much, but not exactly, like their parents. Plants also are very much, but not exactly, like their parents.	5,6
1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	5,6
LS3.B: Variation of Traits • Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.	5
1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	5,6

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices	Activities
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. • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. • Use materials to design a device that solves a specific problem or a solution to a specific problem.	1,2,3,5,6
1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	5
1-LS1-1. Use material to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	2,3
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. • Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world.	2,5
1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	2,3,5,6
Connections to Nature of Science **Scientific Knowledge is Based on Empirical Evidence** Scientists look for patterns and order when making observations about the world.	3,5,6
1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	3,5,6

NEXT GENERATION SCIENCE STANDARDS

Crosscutting Concepts	Activities
Patterns • Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.	3,6
1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	3
1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	3
Structure and Function • The shape and stability of structures of natural and designed objects are related to their function.	1,2,3
1-LS1-1. Use material to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	2,3
Connections to Engineering, Technology, and Science on Society and the Natural World Influence of Engineering, Technology, and Science on Society and the Natural World Every human-made product is designed by applying some knowledge of the natural world and is built by using materials derived from the natural world.	1,2,3,4,5,6
1-LS1-1. Use material to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	1,2,3,4,5,6

COMMON CORE STATE STANDARDS - READING

Reading Standards for Informational Text—Grade 1	Activities
Key Ideas and Details	
RI.1.1: Ask and answer questions about key details in a text.	2,4,5
RI.1.2: Identify the main topic and retell key details of a text.	2,4,5
RI.1.3: Describe the connection between two individual events, ideas, or pieces of information in a text.	2,4,5
Craft and Structure	
RI.1.4: Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.	2,4,5
RI.1.5: Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.	5
RI.1.6: Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.	2,4,5
Integration of Knowledge and Ideas	
RI.1.7: Use the illustration and details in a text to describe its key ideas.	2,4,5
RI.1.8: Identify the reasons an author gives to support points in a text.	2,4,5
RI.1.9: Identify the basic similarities in and differences between two texts on the same topic (e.g., in illustrations, descriptions, or procedures).	5,6
Range of Reading and Level of Text Complexity	
RI.1.10: With prompting and support, read informational texts appropriately complex for grade 1.	2,4,5

COMMON CORE STATE STANDARDS - WRITING

Writing Standards—Grade 1	Activities
Text Types and Purposes	
W.1.1: Write opinion pieces in which they introduce the topic or name the book they are writing about, state an opinion, supply a reason for the opinion, and provide some sense of closure.	
W.1.2: Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.	2,4,5,6
W.1.3: Write narratives in which they recount two or more appropriately sequenced events, include some details regarding what happened, use temporal words to signal event order, and provide some sense of closure.	
Production and Distribution of Writing	
W.3.4: (Begins in grade 3).	
W.1.5: With guidance and support from adults, focus on a topic, respond to questions and suggestions from peers, and add details to strengthen writing as needed.	2,4,5,6
W.1.6: With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.	2,4,5
Research to Build and Present Knowledge	
W.1.7: Participate in shared research and writing projects (e.g., explore a number of how-to books on a given topic and use them to write a sequence of instructions).	2,4,5,6
W.1.8: With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.	2,4,5,6
W.4.9: (Begins in grade 4.)	
Range in Writing	
W.3.10: (Begins in grade 3.)	

COMMON CORE STATE STANDARDS - LANGUAGE

Language Standards—Grade 1	Activities
L.1.1: Understand the command of the conventions of standard English grammar and usage when writing or speaking. a. Print all upper- and lowercase letters. b. Use common, proper, and possessive nouns. c. Use singular and plural nouns with matching verbs in basic sentences (e.g., He hops; We hop). d. Use personal, possessive, and indefinite pronouns (e.g., *I, me, my; they, them, their; anyone, everything*). e. Use verbs to convey a sense of past, present, and future (e.g., Yesterday I walked home; Today I walk home; Tomorrow I will walk home). f. Use frequently occurring adjectives. g. Use frequently occurring conjunctions (e.g., *and, but, or, so, because*). h. Use determiners (e.g., articles, demonstratives). i. Use frequently occurring prepositions (e.g., *during, beyond, toward*). j. Produce and expand complete simple and compound declarative, interrogative, imperative, and exclamatory sentences in response to prompts.	1,2,3,4,5,6
L.1.2: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. a. Capitalize dates and names of people. b. Use end punctuation for sentences. c. Use commas in dates and to separate single words in a series. d. Use conventional spelling for words with common spelling patterns and for frequently occurring irregular words. e. Spell untaught words phonetically, drawing on phonemic awareness and spelling conventions.	1,2,3,4,5,6
L.1.4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 1 reading and content, choosing flexibly from an array of strategies. a. Use sentence-level context as a clue to the meaning of a word or phrase. b. Use frequently occurring affixes as a clue to the meaning of a word. c. Identify frequently occurring root words (e.g., *look*) and their inflectional forms (e.g., *looks, looked, looking*).	1,2,3,4,5,6

COMMON CORE STATE STANDARDS - LANGUAGE

Language Standards—Grade 1	Activities
L.1.5: With guidance and support from adults, demonstrate understanding of word relationships and nuances in word meanings. a. Sort words into categories (e.g., colors, clothing) to gain a sense of the concepts the categories represent. b. Define words by category and by one or more key attributes (e.g., a duck is a bird that swims; a tiger is a large cat with stripes). c. Identify real-life connections between words and their use (e.g., note places at home that are cozy). d. Distinguish shades of meaning among verbs differing in manner (e.g., *look*, *peek*, *glance*, *stare*, *glare*, *scowl*) and adjectives differing in intensity (e.g., *large*, *gigantic*) by defining or choosing them or by acting out the meanings.	1,2,3,4,5,6
L.1.6: Use words and phrases acquired through conversations, reading, and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships.	1,2,3,4,5,6

COMMON CORE STATE STANDARDS - MATHEMATICS

Mathematics—Grade 1	Activities
Mathematical Practices	
1. Make sense of problems and persevere in solving them.	1,2,3,4,5,6
2. Reason abstractly and quantitatively.	1,2,3,4,5,6
3. Construct viable arguments and critique the reasoning of others.	1,2,3,4,5,6
4. Model with mathematics.	1,2,3,4,5,6
5. Use appropriate tools strategically.	1,2,3,4,5,6
6. Attend to precision.	1,2,3,4,5,6
7. Look for and make use of structure.	1,2,3,4,5,6
8. Look for and express regularity in repeated reasoning.	1,2,3,4,5,6
1.OA Operations and Algebraic Thinking	
Represent and solve problems involving addition and subtraction. 1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem). 2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20 (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem).	
Understand and apply properties of operations and the relationship between addition and subtraction. 3. Apply properties of operations as strategies to add and subtract. 4. Understand subtraction as an unknown-addend problem.	
Add and subtract within 20. 5. Relate counting to addition and subtraction (e.g., by counting on 2 add 2). 6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting; making ten; decomposing a number leading to addition and subtraction; and creating equivalent but easier or known sums.	

UNIT AT A GLANCE

Activity	Time to Complete	Lesson Level Learning Goals	Phenomena	Summary: Students Will…
1 Fiddler Crabs in the Classroom	Preparation: 15–20 min. Activity 1: Lesson 1A: 45–50 min., 2 classes Lesson 1B: 45–50 min., 2 classes	Observe the external parts of the fiddler crab to determine how the traits help it to survive.	The male fiddler crab has one large claw and one small claw.	• make and record observations of the fiddler crab. • brainstorm ideas of how the traits of the fiddler crab help it to survive. • develop a schedule for the care and feeding of the fiddler crab in the classroom. • compare the large and small claws of the fiddler crab to different tools humans use.
2 Structure and Function Analogies	Preparation: 15–20 min. Activity 2: Lesson 2A: 45–50 min., 2 classes Lesson 2B: 45–50 min., 2–3 classes Lesson 2C: 45–50 min., 2 classes	Compare external parts of the fiddler crab to common tools developed by humans. Make connections from fiddler crab observations and analogies to the blue heron and other animals.	The male fiddler crab has one large claw and one small claw. The blue heron can eat a large fish or other animal whole.	• brainstorm how different tools used by humans are similar to the different structures of the fiddler crab. • use pictures of the anatomy of the crab and pictures of common tools to make comparisons. • view a video on the blue heron to make observations of its traits and how they function. • read the book *Feathers: Not Just for Flying.*
3 Structure and Function of Plant Parts	Preparation: 20–30 min. Activity 3: Lesson 3A: 45–50 min., 2 classes Lesson 3B: 45–50 min., 2 classes	Make observations of plant parts to determine their function. Develop analogies between the function of plant parts and tools used by humans.	A plant stays anchored in a pot of soil when a gentle force is applied. A pencil is easily removed from the pot of soil when a gentle force is applied.	• make purposeful observations of plants to determine how a plant's structures help it to survive. • create a chart to explain the structure and function of different plant parts. • relate the function of plant parts to different tools used by humans.

UNIT AT A GLANCE

Students Figure Out How to:	Practices and Crosscutting Concepts	Assessment
• develop a model that explains how the traits of the fiddler crab help it to survive. • use prior knowledge and informational text to determine how to meet the needs of the fiddler crab in the classroom habitat.	**Obtaining, Evaluating, and Communicating Information** **Developing and Using Models** **Structure and Function**	**Formative Assessment** Activity Pages Science Talk What We Think chart Observation Log Journal Entry
• develop an analogy between a tool used by humans and one structure of the fiddler crab. • use prior knowledge about the function of a common tool used by humans to compare to the function of a part of the fiddler crab. • use strategies for the fiddler crab analogy using other animals and their traits. • relate their analogies to information obtained in reading *Feathers: Not Just for Flying.*	**Obtaining, Evaluating, and Communicating Information** **Developing and Using Models** **Constructing Explanations and Designing Solutions** **Structure and Function** **Patterns**	**Formative Assessment** Activity Page Science Talk **Summative Assessment** Activity Pages Science Talk Journal Entry class discussion Respond To Text
• use plant observations to create analogies between plant parts and tools used by humans. • use prior knowledge about the function of a common tool used by humans to compare to the function of a plant part. • relate analogies of plants and tools to those of animals and tools.	**Constructing Information and Designing Solutions** **Obtaining, Evaluating, and Communicating Information** **Developing and Using Models** **Structure and Function** **Patterns**	**Formative Assessment** Activity Page Science Talk **Summative Assessment** Journal Entry Science Talk

UNIT AT A GLANCE

Activity	Time to Complete	Lesson Level Learning Goals	Phenomena	Summary: Students Will…
4 **Solving Problems with Plant and Animal Structures**	Preparation: 15–20 min. Activity 4: Lesson 4A: 50–55 min., 2 classes Lesson 4B: 50–55 min., 2 classes Lesson 4C: 45–50 min., 2 classes	Use analogies and plant and animal structure information to design a device that solves a human problem.	The fiddler crab claws function like a pair of pliers. The blue heron can eat a large fish or other animal whole because of its long neck.	• plan and draw their model of a device that mimics a plant or animal structure to solve a human problem. • collaborate as a team and use the Engineering Design Process to solve a problem. • present their solution to the class. • compare their inventions to that in an account of young Benjamin Franklin.
5 **Plants and Animals and Their Young**	Preparation: 10 min. Activity 5: Lesson 5A: 45–50 min., 2 classes Lesson 5B: 45–50 min., 2 classes	Obtain information to compare how baby animals are alike and different from their parents. Obtain information to determine how some animals care for their young and some do not.	*Whose Baby Is This?*	• make observations and obtain information from media about the elephant and the turtle. • read the book *Whose Baby is This?* to compare how the parent and offspring are alike and different. • read the book *Whose Baby is This?* to find out how animals care for their young. • match adult animals to their babies.
6 **Making Sense of Our Observations and Data**	Preparation: 10 min. Activity 6: Lesson 6A: 45–50 min., 3 classes Lesson 6B: 45–50 min.	Construct explanations using results from investigations, text, and long-term observations.	The male fiddler crab has one large claw and one small claw.	• share their results from their investigations. • compile and summarize observations from the *Fiddler Crab Observation Log.* • compare information from books about adult animals and their young.

UNIT AT A GLANCE

Students Figure Out How to:	Practices and Crosscutting Concepts	Assessment
• identify a human problem that can be solved by mimicking a plant or animal structure. • use their analogies to develop a model of a device that solves a human problem. • use information from prior lessons to build a model of a device that mimics the function of a plant or animal part to solve a human problem.	**Constructing Information and Designing Solutions** **Developing and Using Models** **Structure and Function** **Influence of Engineering, Technology, and Science on Society and the Natural World**	**Formative Assessment** Activity Page Science Talk **Summative Assessment** Group presentations Science Talk Journal Entries/Respond To Text
• obtain information from text to determine how baby animals are like and different from their parents. • use observations from media and information from text to find out how different baby animals change and grow into adults. • use information from text and reasoning to determine that some animals are born resembling their parents and others go through great changes before they look like their parents.	**Constructing Explanations and Designing Solutions** **Obtaining, Evaluating, and Communicating Information** **Structure and Function** **Patterns**	**Formative Assessment** Class discussion Journal Entry/Respond to Text **Summative Assessment** Activity Page Science Talk Journal Entry
• construct explanations using results from investigations, analogies, and long-term observations. • determine patterns in data and long-term observations. • gather information from books to determine how some baby animals resemble their parents and some do not. • gather information from books to find out how some animal structures function to help the babies to survive.	**Analyzing and Interpreting Data** **Construction Explanations and Designing Solutions** **Structure and Function** **Patterns**	**Summative Assessment** Science Talk Journal Entries Respond to Text class discussion

PARENT LETTER

Dear Parent,

Your child is beginning a unit created at the Battle Creek Area Mathematics and Science Center. This unit was designed to promote science and engineering literacy and integrate reading and writing skills into high-interest science content. During the next twelve weeks, your child will be actively involved with the *Plant and Animal Traits* unit. This unit is geared for first-grade students and focuses on the big idea of obtaining information to determine how plants and animals use their different structures to help them to survive. Students also explore the concept of how baby plants and animals resemble their parents but are not exactly the same. This unit covers the following main areas of study:

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1. Obtain information through observations, reading, models, and discussions to describe patterns in the structure and function of different animal parts.
2. Obtain information through investigations, models, and discussions to describe patterns in the structure and function of animal parts and how they help the animal to survive.
3. Apply information about the structure and function of a plant or animal part to design and develop a model of a tool that solves a human problem.

First-grade students are also encouraged to think and act like scientists and engineers and begin to develop observation and communication skills in science.

1. Make purposeful observations of plant and animal structures.
2. Generate questions based on their observations of the function of different animal and plant structures.
3. Plan and conduct simple investigations into how patterns can be used to determine how plant and animal traits help the organism to survive.
4. Manipulate simple tools that aid observation and data collection.
5. Develop analogies between animal and plant parts and familiar tools used by humans.
6. Work in teams to design a model to explain how the traits of plants and animals can be mimicked to solve a human problem.

In this unit, the activities are geared toward building on the inherent knowledge and experience that young students have already acquired and using their knowledge in a wider range of tasks. Students will be given the opportunity to observe, research, reflect upon, describe, and discuss how traits help plants and animals to survive and how adult animals use traits to care for their young. Suggestions for activities to do at home are included with this letter. These activities will reinforce the concepts taught during this unit's instruction.

May you enjoy quality time with your child while discussing the concepts involved with the *Plant and Animal Traits* unit. Let us know if we may be of assistance.

The Outreach Staff
Battle Creek Area Mathematics and Science Center
(269) 213-3907 or (269) 213-3908

ACTIVITIES TO DO AT HOME

1. Make observations of family pets and animals in the backyard to determine how the different traits or parts of the animal help it to get food, take in water, build shelter, protect against predators, protect against heat and cold, and move from place to place.
2. Visit a local zoo or animal preserve and make a list of the different animals and how they have similar and different traits that help them to survive.
3. Collect bird feathers and discuss the different ways that birds use feathers (flying, insulation, buoyancy, protection, camouflage).
4. Compare common kitchen tools and tools in the tool box to the traits of different plants and animals.
5. Practice making analogies between familiar items and animal parts. (These pliers are like a beak of a parrot, this awl is like a talon of an eagle, and this extension ladder is like the telescoping eyes of a fiddler crab.)
6. Go to the library and check out books to read that relate to animal traits and animals and their babies. Example titles:

   Feathers: Not Just for Flying by Melissa Stewart

   Beaks! by Sneed B. Collard III

   Does a Fiddler Crab Fiddle? by Corinne Demas and Artemis Roehring

   Animal Mouths by Mary Holland

   Animal Eyes by Mary Holland

   Animal Legs by Mary Holland

   Animal Tails by Mary Holland

   The Beaver's Busy Year by Mary Holland

   Otis the Owl by Mary Holland

   Traits for Survival by Dona Herweck Rice

   Pileated Woodpeckers by Laura Hamilton Waxman

   Shell, Beak, Tusk by Bridget Heos

ACTIVITY 1

FIDDLER CRABS IN THE CLASSROOM

Teacher Background Information
Young learners build understanding of life science concepts through direct experience with living things. Students are naturally curious about the nature of their world and eagerly ask questions, such as: What do different animals eat? Where do they live? What do they do all day? Why do they look like that? Questions like these, along with natural interest, lead students to an understanding of the traits or characteristics of living things and how they help plants and animals to survive.

The following lessons lay the foundation for explorations into plant and animal traits, how traits help in survival, and finally how humans mimic animal traits to help solve problems and fill a need.

Structure and Function is a unifying Crosscutting Concept throughout the unit. This concept is applicable to both the natural and designed worlds. Structure relates to the properties of an object or thing, including its size, shape, texture, color, flexibility, rigidity, strength, motion, and configuration. Function is the purpose or use of the trait in completing a task.

Engage the Learner
This initial phase of learning activates students' prior knowledge and preconceptions regarding plant and animal traits. Through careful observation of one organism, students recognize the importance of structures to survival. Then students begin to make connections between what they have observed in their own backyards and the patterns that they discover through observation, exploration, text, and media.

Considerations for Students with Special Needs
All prompts and passages in the Student Journal should be read aloud, with repeated directions and checking for understanding prior to writing.

Students are asked to draw and write in their Student Journals. Students may benefit by working with a partner in the longer writing pieces. Students with an IEP should be allowed to dictate their ideas and answers.

This lesson provides the high interest opportunity for students to make observations, raise questions, and plan for the care and safety of an animal in the classroom. Students may become overly excited about the fiddler crabs. Be sure to prepare students ahead of time. Lower your voice and explain that the fiddler crab is a living thing that lives in quiet places and that when observing, we should lower our voices and provide a safe, quiet space for it.

ESTIMATED TIME
Lesson 1A: 45–50 minutes, 2 classes
Lesson 1B: 45–50 minutes, 2 classes

LESSON LEVEL LEARNING GOALS
Observe the external parts of the fiddler crab to determine how the traits help it to survive.

LS1.A: STRUCTURE AND FUNCTION
- All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

LESSON 1A

MATERIALS NEEDED

For each student:
- student pages
- hand lens

For each group of 4:
- 1 fiddler crab
- observation cup, 9oz. w/ lid

For the class:
- 2 fiddler crab habitats (1.5 gal. aquariums with lids)
- sand
- 8oz. deli containers, 2
- petri dishes, 2
- crab food
- water conditioner
- water
- small rocks
- sticks
- kosher salt
- teaspoon

Teacher provides:
- chart paper
- markers
- colored pencils
- 2-liter soda bottle or gallon milk jug
- water
- small rocks
- sticks

TEACHING TIP

Throughout the activities in the Teacher Guide you will notice that specific student instructions from the Student Journal pages are given first and italicized. Additional information for the teacher follows the italicized instructions in plain print. Throughout this unit you will find examples of questions that will aid in facilitation of student-led discussion and collaboration. This facilitation guide is intended to draw ideas from previous knowledge, observations, and investigations.

Students with special needs may have difficulty controlling their excitement during the observation of the fiddler crabs. Have students who struggle with self-control observe how you observe the crabs and become comfortable and relaxed before observing the crabs themselves. Some students may try to sabotage the fiddler crab observations and try to harm or squash the animal. Explain that all living organisms are to be respected.

LESSON 1A: RAISING QUESTIONS ABOUT THE FIDDLER CRAB

Advance Preparation

Duplicate copies of the unit *Parent Letter* and *Activities to Do at Home* to send home with the students.

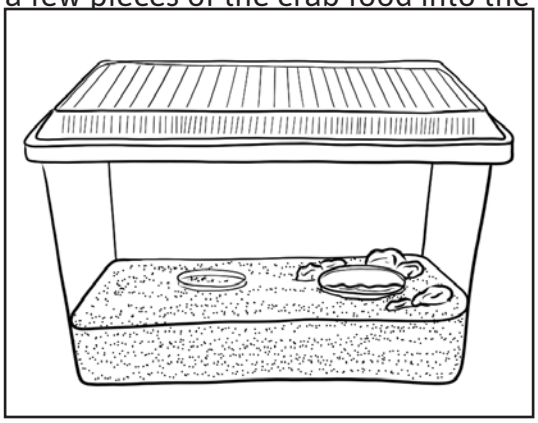
Review the Fiddler Crab background information on pages 2-4.

Prepare conditioned water to have on hand for the arrival of your crabs. Fill a two-liter bottle or cleaned milk jug with tap water (filtered is okay). Add one to two drops of water conditioner and 3/4 teaspoon of kosher salt to the gallon of water (1/3 tsp. for 2-liter bottle). Let stand at room temperature. The conditioned water is used to replenish and add fresh water to the crabs' water dish.

Find a location in your classroom where you will be able to keep your habitats. They should not be in direct sunlight, nor should they be in the dark or near a heater. Maintain a classroom temperature of about 68˚F to 77˚F. The fiddler crabs will be more active in warm temperatures.

Prepare your classroom habitats: Cover the bottom of each aquarium with 4 to 5 cm (about 2 inches) of sand. For interest and decoration you may want to add rocks or sticks. Set an 8oz. deli container into the sand in each aquarium so the rim of the container is even with the top of the sand. Fill the deli containers halfway with the conditioned water from above. Keep the deli containers half full and change when dirty.

Place a petri (food) dish on top of the sand in each habitat. Add a few pieces of the crab food into the food dishes, add the crabs (4 per habitat), and cover. If males and females were shipped in separate bags, you will want to keep them in separate habitats.



Note: Fiddler crabs will also eat dried plankton, brine shrimp flakes, pet food and small bits of fruits and vegetables.

To keep your crabs healthy, keep them at a constant temperature and change the water regularly. A stinky tank usually means the water dish needs to be changed more often.

Make a What We Think About Fiddler Crabs chart. Plan to keep the chart visible and available for reference and revision throughout the following lessons. In lesson 2C, the class will add Blue Herons to the What We Think Chart.

What We Think About Fiddler Crabs

What We Think	Questions We Have	What We Did	What We Figured Out	How Does That Help Us to Figure Out the Phenomenon?

Procedure

Engage the learner.

Inform the class that they will be caring for special visitors in the classroom. Show the class the fiddler crabs in their classroom habitat. Allow sufficient time for the class to observe the crabs in their habitat and discuss their ideas about the crabs with questions and wonderings. Listen for questions about the difference in the size of the claws.

Explore the concept.

Divide the class into observation groups of three or four students. Inform the class that each group is going to make close observations of one crab and draw their initial observations in their Student Journals. Students will revisit their original models to add new information and ideas as the lessons progress.

Draw and label a model of the fiddler crab. Look carefully at the fiddler crab. Draw what you observe in the box below. Include labels that give information.

Write what you observe:
Write what you wonder:

Carefully remove one crab at a time and place them in observation cups. Distribute the observation cups and hand lenses to each group. Ask the students to make careful observations of the crab in the observation cup. Demonstrate how to use the hand lens and how to gently lift the observation cup and observe the underside of the crab.

After the groups have had the opportunity to draw and label their observation crab, encourage them to trade specimens with another group and compare the traits of the different crabs. Guide groups to exchange specimens with teams that have a crab with different claws. Students will revisit their original drawings to add new information and ideas as the lessons progress.

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, storyboard) that represent concrete events or design solutions.

- Distinguish between a model and the actual object, process, and/or events the model represents.
- Compare models to identify common features and differences.
- **Develop and/or use a model to represent ~~amounts,~~ relationships, ~~relative scales (bigger, smaller),~~ and/or patterns in the natural and designed world(s).**
- **Develop a simple model based on evidence to represent a proposed object or tool.**

SCIENCE TALK

Science Talk is a critical component of science lessons. Science Talk provides an avenue for the exploration of ideas and exchange of points of view, and is intellectually and academically challenging. Science Talk is not an add-on to the lesson and provides academically productive talk that is critical for learning in science. (See Science Talk in the appendix.)

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence-based accounts of natural phenomena and designing solutions.

- **Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.**
- Use tools or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
- Generate and/or compare multiple solutions to a problem.

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.

- **Ask questions based on observations to find more information about the natural and/or designed world.**
- Ask and/or identify questions that can be answered by an investigation
- ~~Define a simple problem that can be solved through the development of a new or improved object or tool.~~

Allow sufficient time for students to make observations and drawings. Facilitate the group activity by circulating among the students, listening to their observations and exchange of ideas. Take this opportunity to record student observations and questions to reference during their Science Talk and at the end of the unit. To help students elaborate on their observations and explanations, ask:

- Can someone share some of the observations you have made so far?
- What do you mean when you say…?
- Tell me more about…
- What did you notice about the crab's legs? How do you think they help the crab?
- Why do you think the crabs have claws? What do you notice about the claws on some crabs? Why do you think some have one large claw and one small claw and others have two small claws? How might we figure this out?
- What do you notice about the crab's eyes?
- What other parts or traits of the crab did you observe? How do you think the trait helps the crab to survive?
- Do you think the crabs have senses like you have? Do you think the crab can hear, see, smell, feel, and taste? What makes you think that?

Science Talk

Conduct a whole-class discussion that encourages students to share and generate as many ideas as possible about what they observed and wonder. Display the What We Think About Fiddler Crabs chart. Explain that the class will use the chart to add new information as they continue their observations and investigations into the fiddler crab. Ask a team to begin the Science Talk by sharing their observations, questions, and wonderings about the crab. Encourage others to confirm the observations and add new ideas. Record ideas and questions on the What We Think column of the chart.

To help students collectively generate questions about the fiddler crab, ask:

- Are you curious to find out about where fiddler crabs live and how they survive?
- What have we figured out so far?
- What can we do to keep track of the habits and daily activities of the fiddler crab?

- How can we investigate some of the questions we have on our What We Think chart?
- Do we have any more questions about the fiddler crab?
- What could we do to figure out why there is a difference in the size of the claws?
- What could we do to figure out the different traits that help the fiddler crab to survive?

Students may not recall all the questions that they raised during their observations. You may need to refer to your notes to encourage students to share questions for further investigations and explorations. Listen for student ideas of the next steps in figuring out how different traits or structures of the fiddler crab help it to survive or how they use the different traits the students observed. Record all ideas and questions on the What We Think chart to use as a reference as students learn more about the crab.

Samples:

- We could make and record observations of the fiddler crabs in their habitat over a period of time to find out how they use their different traits or structures.
- We could get information about the fiddler crab from books and other sources to find out how they use their different traits or structures.

To help all students participate in the next steps in their exploration, after a suggestion is presented, have other students restate the suggestion. Have them explain what that might look like in the classroom, or make predictions about what they might find out.

As a class, develop a driving question about the structures of the fiddler crab and how they help the fiddler crab to survive. At this point in their learning, students may need to have the driving question formed for them based on their ideas. Example:

How does the fiddler crab use its different structures to help it survive?

Record student initial ideas regarding the driving question on the What We Think chart.

Assessment: Formative
Use the Activity Page and Science Talk to assess the students' initial understandings of how physical traits of different animals help them to survive in their environment.

TEACHING TIP
Each lesson is closed in a similar manner in which it is introduced. In the Science Talk, students should capture what they have observed, figured out, and wonder about to guide following lessons. The Science Talk is open to all ideas and does not necessarily mean the students will come to a consensus at the close of each lesson.

STRUCTURE AND FUNCTION
- The shape and stability of structures of natural and designed objects are related to their function.

LESSON 1B: PLANNING FOR FIDDLER CRAB OBSERVATIONS

Teacher Background Information

Using their initial observations and wonderings about the fiddler crab, students will want to figure out how the crab uses its claws and why some crabs have one large claw and one small claw and other crabs have two small claws.

This lesson is designed to set up a long-term observation schedule and to create a classroom anchor chart that guides students in making detailed observations. Students will make regular observations of the movement and behavior of the crabs in their habitat and look for patterns that can lead to more information about the crabs.

Advance Preparation

Make a copy of the *Fiddler Crab Observation Log* for the class. Provide sufficient observation pages for each student to have the opportunity to observe and enter data. Set up an observation schedule to make observations on a regular basis.

Display the What We Think About Fiddler Crabs chart to keep a record of students' initial thinking and how their thinking changes and develops in following lessons.

Display the fiddler crab habitat where all the students can see it and refer to it during the discussion.

Procedure

Explain the concept and define the terms.
Ask students to share their initial drawings of the fiddler crab in the habitat from their initial observations in the Student Journal. Ask students to describe the different structures of the crab and to explain what they think is the function of each structure. To help students elaborate on their observations and explanations of what they have figured out so far about the fiddler crab, ask:

- What is one thing your group noticed about the fiddler crab in the observation cup?
- Are you curious to find out what the crabs use their claws for? What do you think they use their claws for? What makes you think that?
- Why do you think some crabs have one large claw and one small claw and other crabs have two small claws? What makes you think that?
- What other structures of the crab do you have questions about?

MATERIALS NEEDED

For each student:
student pages
For the class:
handout: *Fiddler Crab Observation Log*
Teacher provides:
chart paper
markers

TEACHING TIP

If your class is equipped with digital photography tools, have students make a digital scrapbook of different activity and observations in the fiddler crab habitat. Be sure students label and log the date and time of the picture in the *Observation Log*.

LS1.A: STRUCTURE AND FUNCTION

- All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

LS1.D: INFORMATION PROCESSING

- Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.

TEACHING TIP

As students share their ideas, draw their attention to the Crosscutting Concept of Structure and Function. Use the term *structure* when referring to physical traits of the crab and *function* when referring to how it helps the crab to meet its needs. For example, if students mention the claw or jointed legs, use the terms *structure* and *function* to restate what the students share.

Sample Chart:

When We Make Observations, We…

- *draw pictures*
- *label*
- *use descriptive words about color, size, shape*
- *use our senses of sight, hearing, and smell*
- *predict*
- *raise questions*
- *gather and use facts*

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.

- **Ask questions based on observations to find more information about the natural and/or designed world.**
- Ask and/or identify questions that can be answered by an investigation
- ~~Define a simple problem that can be solved through the development of a new or improved object or tool.~~

- What do you think we should or could do to help us find out more about the different structures of the fiddler crab and how they function?
- How should we keep track of the activity of the fiddler crab throughout the days and weeks ahead?

Take this opportunity to review the What We Think About Fiddler Crabs chart from the previous lesson. Explain that the chart will be used to keep a record of their initial thoughts and questions about the crab and for adding new information and questions as they carry out observations and investigations in following weeks. Record any new ideas about the fiddler crab in the first column of the chart. Ask students for questions they have about the crab and ideas of how they can learn more.

Ask students how they think making observations over several weeks might give them more information about how the fiddler crab uses its different structures or traits to find food and water and protect itself. To help students make connections and collectively plan an investigation, ask:

- Can someone share one piece of information you learned from observing the crab so far? How might we learn more about that if we make observations over a long period of time? How often do you think we might observe that behavior?
- What previous observations have you made that are similar to observations of the crab?
- Can you give me an example of what you would look for if you were to observe the crab on a regular schedule?
- What might that look like? What do good scientific observations look like? How can we investigate the structures and behavior of the fiddler crab?

As a class, develop an anchor chart that will serve as a guide in making good observations. The chart will be revisited as students begin to make observations of the fiddler crabs in their habitat in following lessons. Title the chart, "When We Make Observations, We…" (see sample left).

Write the terms *observe* and *observation* on the board. As a class, develop definitions of the terms and have students write their definitions in the Key Terms section of the Student Journal.

Elaborate on the concept.

Science Talk

Display the *Fiddler Crab Observation Log* for the class. Discuss a schedule for the class to use to make regular observations of the activity of the crabs and how they use their different structures throughout the day. Ask students to make predictions as to what they might observe. Review the different spaces for entering their observations and why it is important to have a date and time of day on the *Observation Log* entry.

As a class, make the first entry in the *Fiddler Crab Observation Log*. Model how to draw the habitat and stress that the drawing of the crab can be very general or basic and that the labels give information that explains the drawings.

Add students' observations, questions, and wonderings. Explain that the "I think" is what they think the function is of the structures in the crab activity they observed. As the observations continue, students will be able to revisit the "I think" section and use patterns in their observations to support their initial ideas. As a class, come to a consensus as to what the initial entry should say and look like. If students offer new ideas, be sure to add them to the What We Think chart as a record of their thinking as the unit progresses. Listen for initial ideas that relate to the senses of the fiddler crab. Review how humans use their senses (see, hear, feel, smell, and taste) to respond to their surroundings. Ask:

- What senses do you think the fiddler crab uses? Do you think the crabs know that we are observing them?
- What structures do fiddler crabs have that make you think that?
- How might that help them to survive?

Ask students for their ideas of what the class should do next to find out more about the function of the different structures of the fiddler crab. Write their ideas in the What We Think column of the chart.

Evaluate the students' understanding of the concept.

Read the Journal Entry prompt to the class. Ask students to use the What We Think chart and first entry on the *Observation Log* to assist them in ideas for drawing and writing their response.

PLANNING AND CARRYING OUT INVESTIGATIONS

Planning and carrying out investigations 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.

- With guidance, plan and conduct an investigation in collaboration with peers (for K).
- **Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.**
- Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.
- **Make observations (firsthand or from media)and/or measurements to collect data that can be used to make comparisons.**
- ~~Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal.~~
- **Make predictions based on prior experiences.**

STRUCTURE AND FUNCTION

- The shape and stability of structures of natural and designed objects are related to their function.

WRITING
Text and Type Purposes
W.1.2: Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
Research to Build and Present Knowledge
W.1.7: Participate in shared research and writing projects (e.g., explore a number of how-to books on a given topic and use them to write a sequence of instructions).

Journal Entry

Look at the picture of the fiddler crab. Circle one structure of the crab and write what you think it is used for.

I think the _____ is used for _____ _____.

Write what you think the class could do to find out more about the function of the structures of the fiddler crab.

I think we should _____ _____.

Assessment: Formative

Use the What We Think chart, *Observation Log*, and Journal Entry to assess the students' initial ideas of the relationship between the structure and function of the different traits of the fiddler crab.

APPENDIX

ENGINEERING DESIGN PROCESS

The Engineering Design Process provides students with a series of steps to guide them as they solve problems and design and test products, models, and solutions. The process is cyclical, yet not necessarily in an order. Students are encouraged to evaluate as they progress through the process, revisit the mission often, and revise thinking and their plan multiple times as the process unfolds.

Engineers do not always follow the Engineering Design Process steps in order, one after another. It is very common to design something, test it, find a problem, and then go back to an earlier step to make a modification or change the design. Engineers must always keep in mind the mission or problem they are trying to solve and the limitations (cost, time, material, etc.) that are part of the solution to the problem. Two key elements in working as an engineer are teamwork and design-test-and-redesign.

Mission
- Defines the problem and what the engineers are trying to design or build.
- Describes the limitations within which the engineers must solve the problem.

Brainstorm Ideas
- Imagine, discuss, and sketch possible solutions.
- Conduct research into what has already been done.
- Discover what materials are available, time frame, and other limitations.

Plan and Design
- Draw and write a plan.
- Design your solution through drawing and manipulating materials.
- Develop a plan or steps and a schedule.

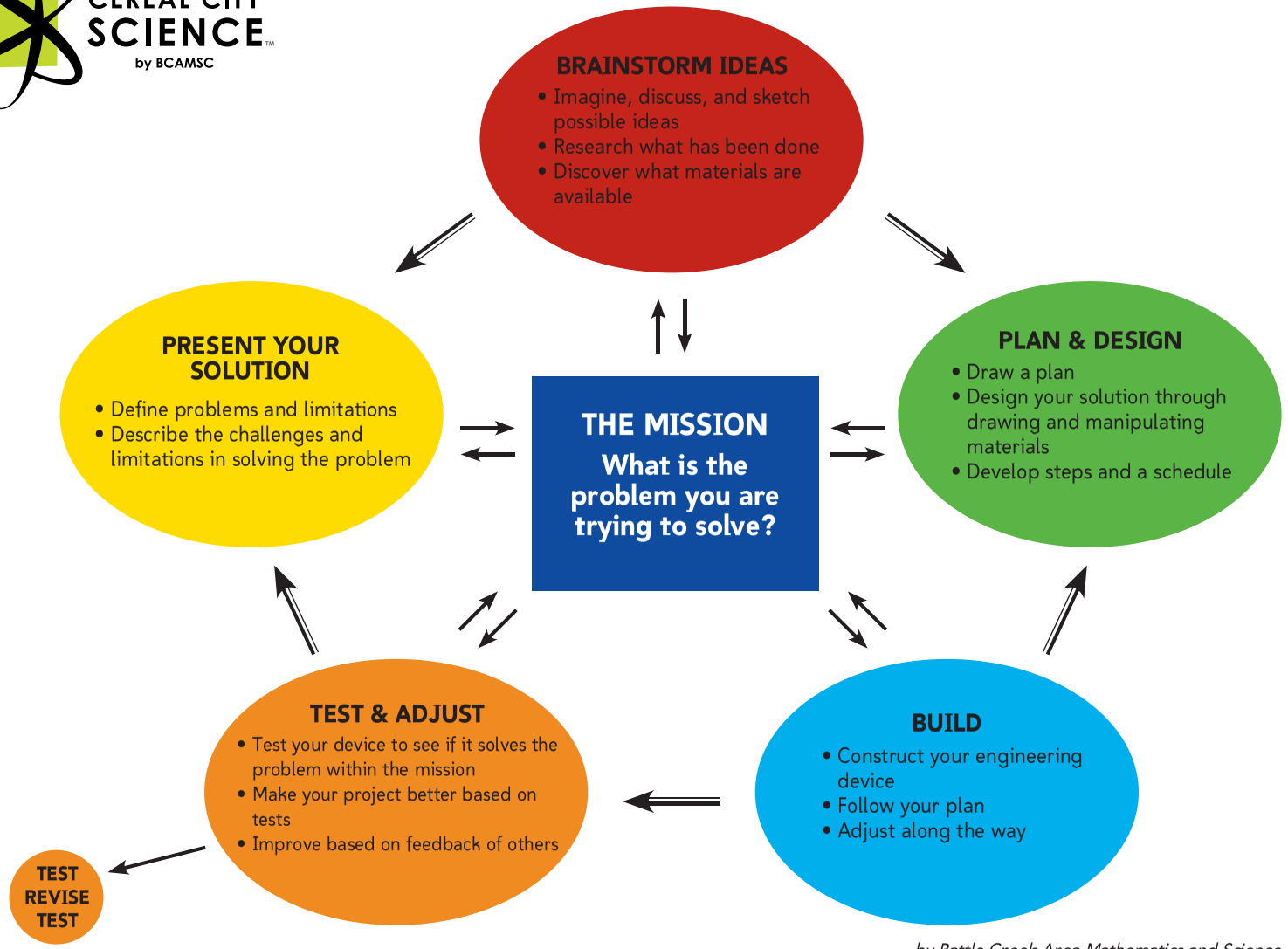
Build
- Construct your engineering device or project.
- Follow your plan.
- Adjust and test along the way.

Test and Adjust
- Test your device to see if it solves the problem within the mission and limitations.
- Make your project better based on tests: Test → Revise → Test.
- Improve based on feedback of others.

Present Your Solution
- Demonstrate how your solution solves the problem.
- Define problems and limitations.
- Describe the challenges and limitations in solving the problem.
- Describe additional revisions that could improve the device or project.

CEREAL CITY SCIENCE™ by BCAMSC

ENGINEERING DESIGN PROCESS



by Battle Creek Area Mathematics and Science Center
Cereal City Science
Adopted from the Carnegie Mellon Robotics Academy

APPENDIX

CEREAL CITY SCIENCE by BCAMSC

Student Journal
1.LS.NGSS

Plant and Animal Traits
1LNG

SECOND EDITION

A first grade unit supporting Next Generation Science Standards
and Michigan Science Standards

Name:_____

Name _____

Date _____

ACTIVITY 1A

Raising Questions About the Fiddler Crab

Draw and label a model of the fiddler crab. Look carefully at the fiddler crab. Draw what you observe in the box below. Include labels that give information.

ACTIVITY

1A Raising Questions About the Fiddler Crab

Name _____

Date _____

Write what you observe:

Name _____

Date _____

ACTIVITY 1A

Raising Questions About the Fiddler Crab

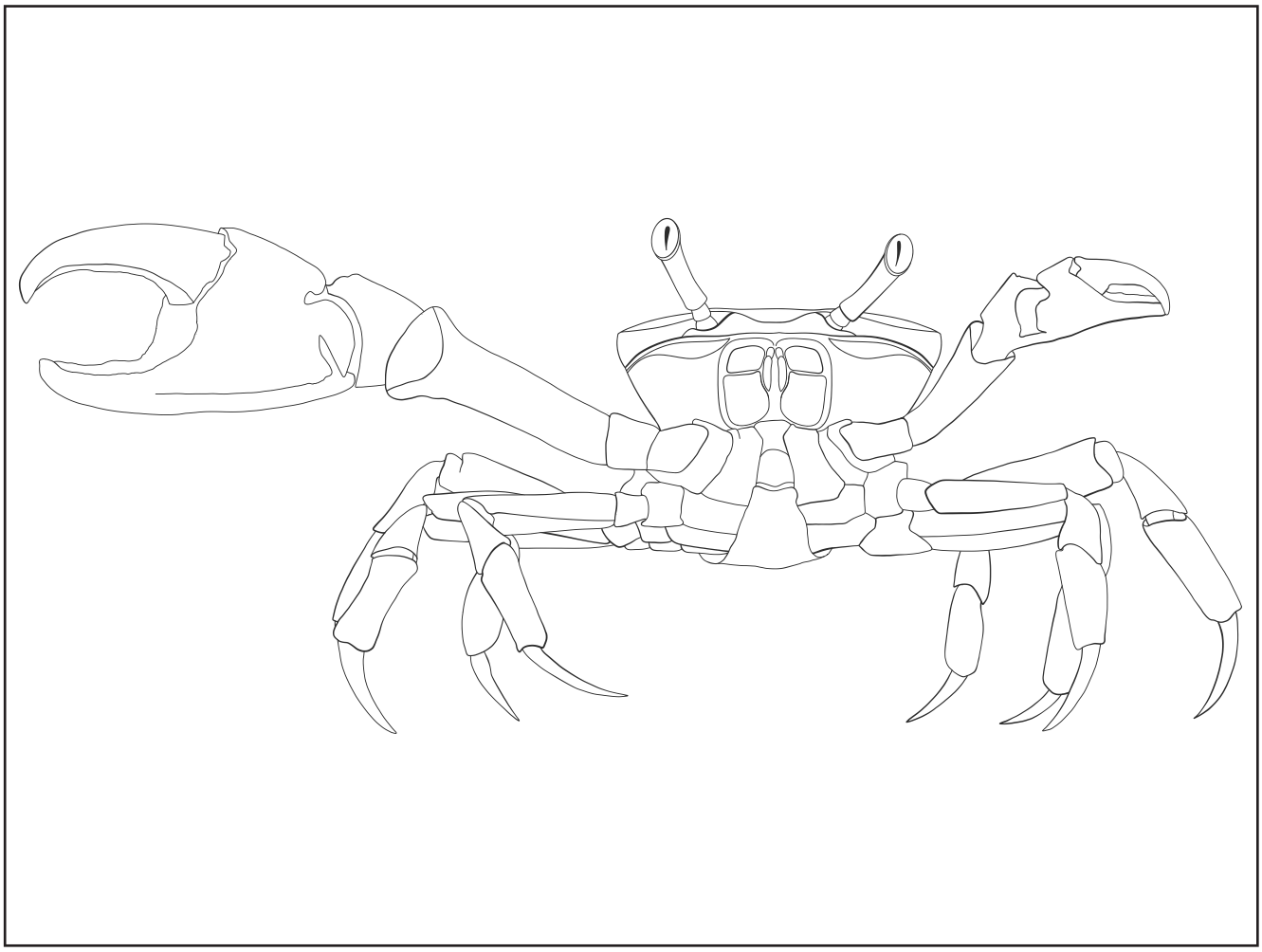
Write what you wonder:

JOURNAL

1B Planning for Fiddler Crab Observations

Name _____

Date _____



Look at the model of the fiddler crab. Circle one structure of the crab and write what you think it is used for.

I think the _____ is used for _____

_____.

Write what you think the class could do to find out more about the function of the structures of the fiddler crab.

I think we should _____

_____.

Name _____

Date _____

Key Terms

Key Terms

Name _____

Date _____