

# ASPECT

Assessing Students' Progress on the Energy Concept

## Dying Seaweed: AP21-6 (CR) & AP22-6 (MC)

Elementary school – Energy and Chemical Reactions

### TASK OVERVIEW

Students are introduced to a scenario in which scientists are finding that the seaweed off the coast of California is dying. Students are tasked with figuring out how the seaweed's dying could affect a local ecosystem. Students first create or select a flow chart showing the flow of food in the ecosystem. Students are then asked to predict how the food available to the organisms in the ecosystem could be affected if the seaweed continues to die. Then, students read that scientists have observed that sharks in the ecosystem are not performing their normal activities such as moving around, reproducing, and growing. Students are asked to write an argument for or against the idea that the seaweed's dying causes the sharks not to have the energy needed to perform their normal activities.

### TARGETED DCIs, SEPs, AND CCCs

#### Disciplinary core ideas

- LS1.C-5.1: Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion.
- LS2.A-5.1: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food

and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

- PS3.D-5.1: The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

### Science & engineering practices

- SEP2-E.4: Develop and/or use models to describe and/or predict phenomena.
- SEP7-E.4: Construct and/or support an argument with evidence, data, and/or a model.

### Crosscutting concepts

- CCC4-E.2: A system can be described in terms of its components and their interactions.

### Related Performance Expectations

- 5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. [*Clarification Statement:* Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [*Assessment Boundary:* Assessment does not include molecular explanations.]

## TASK PERFORMANCE EXPECTATION

*Create (or identify) a flow chart that shows what different animals in an ocean ecosystem eat. Use the flow chart to predict if a decrease in one of the organisms will change the availability of food for other organisms in the ecosystem and write an argument for whether it could cause certain organisms to not have the energy necessary to perform their normal activities.*

## LINK TO ONLINE VERSION

<http://assess.bsccs.org/i/test/600>

### Task

Scientists are noticing that the seaweed that grows in the ocean along the northern coast of California is starting to die. They are worried that this could cause a problem with the amount of food available for sea turtles, sharks, shrimp, and stingrays in the ecosystem.



Images from Wikimedia Commons

The scientists see that:

- shrimp and sea turtles eat seaweed
- stingrays eat shrimp
- sharks eat sea turtles and stingrays

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#### -----Constructed-response Version of #1-----

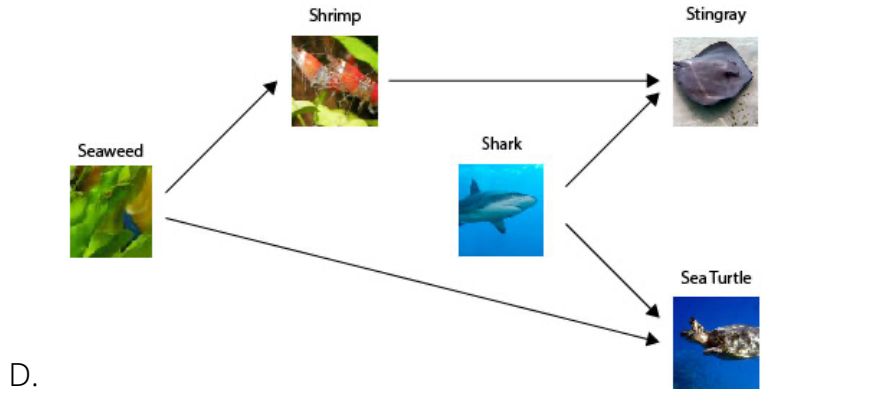
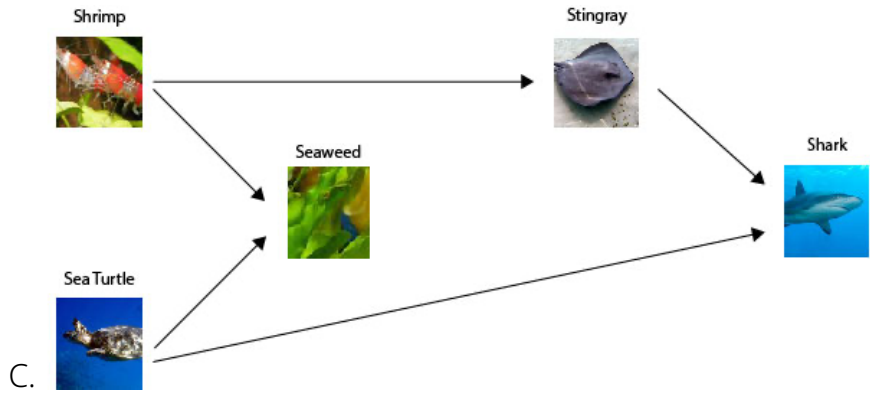
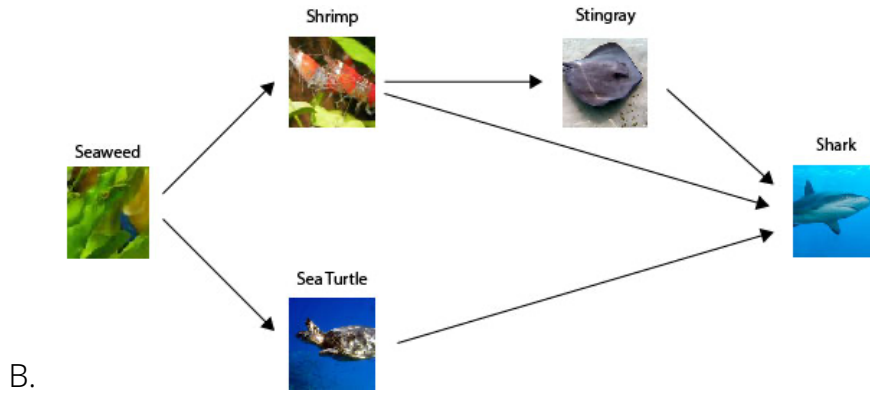
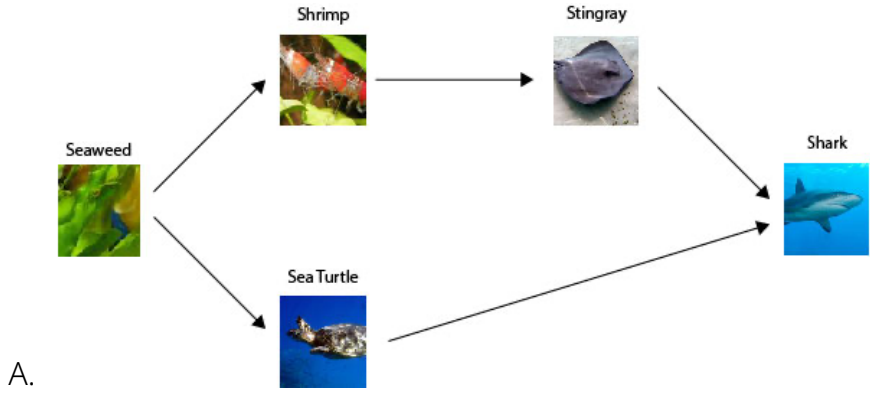
1. Create a flow chart that shows each of the animals in the ocean ecosystem and how food flows in the ecosystem. Your flow charts should include arrows to make it clear where each animal gets its food. Arrows should point toward the organism that is eating and away from the organism that is being eaten.

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#### -----Multiple-choice Version of #1-----

1. They create a flow chart to show each of the animals in the ocean ecosystem and how food flows in the ecosystem. Arrows point toward the organism that is eating and away from the organism that is being eaten.

Which of the following flow charts best represents how the animals in the ecosystem get food?



2. What will happen to the amount of food available to the sea turtles if the seaweed continues dying? Explain why. (You should assume that no new plants or animals enter the ecosystem.)

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3. What will happen to the amount of food available to the stingrays if the seaweed continues dying? Explain why. (You should assume that no new plant or animals enter the ecosystem.)

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4. Scientists notice that the sharks in the ocean ecosystem are having a hard time performing their normal activities, such as moving around, reproducing, and growing. Could the decrease in the amount of seaweed in the ocean cause the sharks to not have the energy needed to perform their normal activities?

Write an argument for or against the idea that the dying seaweed caused the sharks to not have the energy needed for their normal activities. Support your argument using your flow chart and ideas about energy.

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## Alignment to Targeted DCIs, SEPs, and CCCs and Scoring Rubrics

### QUESTION 1

Create a flow chart that shows each of the animals in the ocean ecosystem and how food flows in the ecosystem. Your flow charts should include arrows to make it clear where each animal gets its food. Arrows should point towards the organism that is eating and away from the organism that is being eaten.

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### LEARNING GOAL

#### Learning Performance

- Create (or identify) a flow chart that represents where animals in an ecosystem get food.

#### Targeted DCIs, SEP, and CCC

- LS2.A-5.1: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem
- SEP2-E.4: Develop and/or use models to describe and/or predict phenomena.
- CCC4-E.2: A system can be described in terms of its components and their interactions.

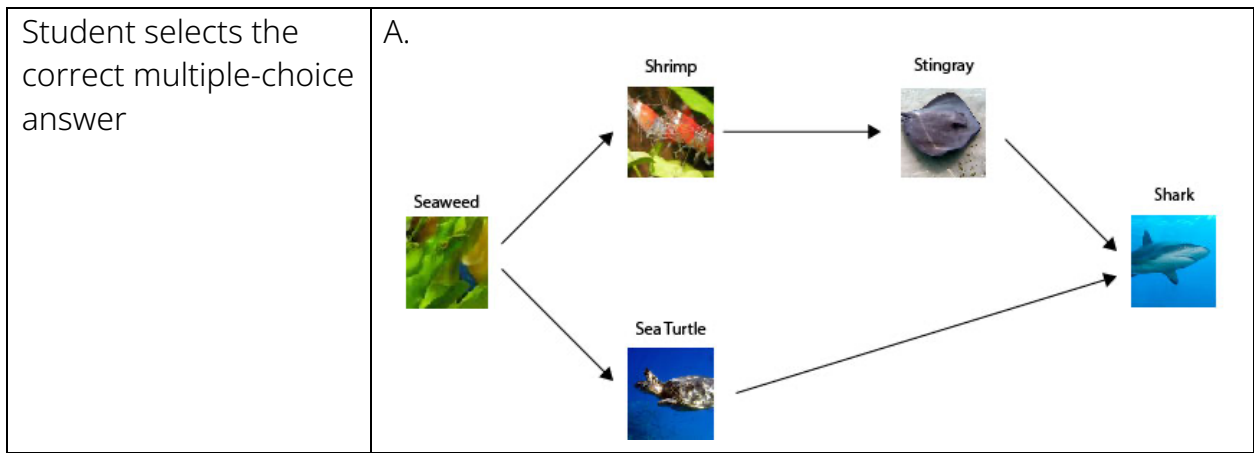
## SCORING RUBRIC

### Ideal Response

The student should draw a flow chart that include arrows from seaweed to shrimp, seaweed to turtle, shrimp to stingray, turtle to shark, and stingray to shark.

### Elements of a Correct Response

Categories	Elements
Student draws a flow chart that includes <b>all</b> the relevant relationships	<ul style="list-style-type: none"> <li>• Arrow from stingray to shark</li> <li>• Arrow from turtle to shark</li> <li>• Arrow from shrimp to stingray</li> <li>• Arrow from seaweed to shrimp</li> <li>• Arrow from seaweed to turtle</li> </ul>
Common errors to keep track of	<ul style="list-style-type: none"> <li>• Student draws the arrows backwards (i.e., from the predator to the prey).</li> <li>• Student includes all the arrows above plus additional arrows.</li> </ul>
OR	



Sample Student Responses

Student response	Scoring description
<pre> graph TD     Shark --&gt; Stingray     Shark --&gt; Shrimp     Shark --&gt; SeaTurtle[Sea Turtle]     Stingray --&gt; Seaweed     Shrimp --&gt; Seaweed     SeaTurtle --&gt; Seaweed         </pre>	<p>Score = 0</p> <p>The response draws the arrows from the predator to the prey instead of from the prey to the predator.</p>
<pre> graph TD     Seaweed --&gt; Shrimp     Seaweed --&gt; SeaTurtle[Sea Turtle]     Shrimp --&gt; Stingray     Stingray --&gt; Shark     SeaTurtle --&gt; Shark         </pre>	<p>Score = 1</p> <p>The response includes all the relevant relationships and draws arrows in the correct direction.</p>

## QUESTION 2

What will happen to the amount of food available to the sea turtles if the seaweed continues dying? Explain why. (You should assume that no new plants or animals enter the ecosystem.)

### LEARNING GOAL

#### Learning Performance

- Predict how seaweed’s dying will affect the availability of food to the shrimp in the ecosystem and justify the prediction.

#### Targeted DCIs, SEP, and CCC

- LS2.A-5.1 The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem
- SEP2-E.4 Develop and/or use models to describe and/or predict phenomena.

### SCORING RUBRIC

#### Ideal Response

Having less seaweed will result in less food for the sea turtle because seaweed is food for sea turtle.

#### Elements of a Correct Response

Categories	Elements
Student makes a valid prediction	<ul style="list-style-type: none"><li>• The amount of food available to the sea turtles will decrease (<i>direct effects</i>)</li></ul> <p><u>Note</u>: If the student says that the sea turtles will die of <u>starvation</u>, this implies that they don’t have food available to</p>



	them and the student should receive the point. Although if they student just says the turtles would die, they should not receive the point.
Student supports their prediction using the model and/or evidence	<ul style="list-style-type: none"> <li>Seaweed is food for sea turtles.</li> </ul> <p><u>Note:</u> The students must be explicit about the seaweed being food for sea turtles. Just saying that “if the seaweed dies, the turtles will have no food” is not enough.</p>

### Sample Student Responses

Student response	Scoring description
“If the seaweed keeps dying the turtles are going to dye and than they will extinct”	Score = 0  The response describes that the sea turtles will die but does not describe what will happen to the amount of food available to the sea turtles.
“The amount of living sea turtles will decrease in number because they will start to have less food.”	Score = 1  The response makes the correct prediction by does not support it by explicitly describing the relationship between seaweed and sea turtles.
“the only food that the turtles eat is the seaweed, because there is no new food entering the ecosystem the turtles would die with no food”	Score = 2  The response includes both elements in the rubric.

### QUESTION 3

What will happen to the amount of food available to the stingrays if the seaweed continues dying? Explain why. (You should assume that no new organisms enter the ecosystem.)

### LEARNING GOAL

#### Learning Performance

- Predict how seaweed’s dying will affect the availability of food to stingrays in an ecosystem and justify the prediction.

## Targeted DCIs, SEP, and CCC

- LS2.A-5.1 The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem
- SEP2-E.4 Develop and/or use models to describe and/or predict phenomena.

## SCORING RUBRIC

### Ideal Response

Having no seaweed will result in less food for the stingrays in the ecosystem. If the seaweed dies, shrimp will have less food. If the shrimp have less food, they will die. If the shrimp die, the stingrays will have less food.

### Elements of a Correct Response

Categories	Elements
Student makes a valid prediction	<ul style="list-style-type: none"> <li>• The amount of food available to the stingrays will decrease (<i>indirect effects</i>)</li> </ul> <p><u>Note:</u> If the student says that the stingrays will die of starvation, this implies that they don't have food available to them and the student should receive the point. Although if they student just says the stingrays would die, they should not receive the point.</p>
Student supports their prediction using the model and/or evidence	<ul style="list-style-type: none"> <li>• Seaweed is food for shrimp.</li> <li>• Shrimp are food for stingrays.</li> </ul> <p><u>Note:</u> The students must be explicit about the seaweed being food for shrimp and shrimp being food for stingrays. Just saying that “if the seaweed dies, the stingrays and shrimp will have no food” is not enough.</p>

Student either states or uses a general science idea	<ul style="list-style-type: none"> <li>Organisms can only survive in environments in which their particular needs are met (i.e., if the shrimp's food source is reduced, they will die). [<i>links needs and survival</i>]</li> </ul> <p><u>Note:</u> It is acceptable to write that the shrimp will leave the ecosystem and that's why there is less food for the stingrays.</p>
Student supports their prediction with reasoning	<ul style="list-style-type: none"> <li>The decrease in seaweed will reduce the food source for shrimp, which means some shrimp will die and there will be less food for stingrays. (<i>Describing a mechanism</i>)</li> </ul>

### Sample Student Responses

Student response	Scoring description
"the stingrays will die."	Score = 0  The response does not describe what will happen to the amount of food or the mechanism that leads to the decrease in food.
"he has less prey to eat"	Score = 1  The response describes that the stingray will have less food.
"Like I said for the last question they wont have anywhere to get the food from so they will continue to die and go instinct."	Score = 2  The response describes how the amount of food decreases and uses the science idea about not being able to survive when an organism's needs are not met.
"the shrimps will starve and start dying, and eventually when there are no shrimp to eat the stingray will die."	Score = 3  The response implies the amount of food for the stingrays decreases and that shrimp is food for stingrays, and it uses the science idea about not being able to survive when an organism's needs are not met. However, it doesn't clearly describe the mechanism so did not receive the reasoning point.

"The stingrays eat shrimps and shrimp eat seaweed if the seaweed dies then the shrimps main food source would cut of which would result in the shrimp dying. The shrimp are a food source for the stingrays and if the shrimp die than the stingrays would too."	Score = 4  The response includes all the elements in the rubric.
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## QUESTION 4

Scientists notice that the sharks in the ocean ecosystem are having a hard time performing their normal activities, such as moving around, reproducing, and growing. Could the decrease in the amount of seaweed in the ocean cause the sharks to not have the energy needed to perform their normal activities?

Write an argument for or against the idea that the dying seaweed caused the sharks to not have the energy needed for their normal activities. Support your argument using your flow chart and ideas about energy.

## LEARNING GOAL

### Learning Performance

- Write an argument for why the seaweed's dying could result in sharks not having the energy necessary for their normal activities.

### Targeted DCIs, SEP, and CCC

- LS1.C-5.1 Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion.
- LS2.A-5.1 The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to

meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem

- PS3.D-5.1 The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).
- SEP7-E.4 Construct and/or support an argument with evidence, data, and/or a model.

## SCORING RUBRIC

### Ideal Response

The seaweed's dying could result in the sharks not having enough energy to do their normal activities because they will have less food and animals get energy from food. The sharks will have less food because the animals the shark eats (turtles and stingrays) depend on the seaweed as a source of food. Without seaweed, these animals will die resulting in the shark having less animals to eat. Having less food means not having energy to do normal activities.

### Elements of a Correct Response

Categories	Elements
Student makes a valid claim	<ul style="list-style-type: none"> <li>• The dying seaweed caused the sharks to not have enough energy to move.</li> </ul> <p><u>Note:</u> An implied claim or a claim that doesn't explicitly mention energy are acceptable. For example, students could write "yes, ..."</p>
Student supports their prediction using the model and/or evidence	<ul style="list-style-type: none"> <li>• The sharks' food supply is affected by the seaweed. Examples of this include listing what each animal in the ecosystem eats to demonstrate sharks are linked to seaweed or citing the correct flow chart model showing how sharks are linked to seaweed in the food web               <ul style="list-style-type: none"> <li>○ Sharks eat stingrays, stingrays eat shrimp, shrimp eat seaweed.</li> <li>○ The animals that the sharks eat eat seaweed.</li> <li>○ The model shows that sharks can trace their food source back to seaweed.</li> </ul> </li> </ul>

	<u>Note</u> : Implying these relationships is acceptable and students do not have to list all.
Student either states or uses a general science idea	<ul style="list-style-type: none"> <li>• Food is a source of energy (i.e., the turtles and stingrays are sources of energy for the sharks or the sharks have less food and therefore less energy). [<i>links food and energy</i>]</li> <li>• Organisms can only survive in environments in which their particular needs are met (i.e., if the shrimp's food source is reduced, they will die). [<i>links needs and survival</i>]</li> </ul>
Student supports their claim with reasoning	<ul style="list-style-type: none"> <li>• The food for sharks can be traced back to seaweed, so when the seaweed dies sharks will end up having less food and, therefore, won't have energy to move.</li> </ul> <p><u>Note</u>: Students may indicate that the shark's food can be traced back to the seaweed by listing the connections in the food chain/web that link the shark and seaweed, noting that they are connected through the food web/chain, or making a statement that indicates the sharks' food source is linked to the seaweed.</p> <p><u>Note</u>: The students must use the word energy in their response to get this point.</p>

## Sample Student Responses

Student response	Scoring description
"I am against it because sharks don't have to do anything with seaweed so I don't think the sharks are causing the seaweed to die."	Score = 0  The response does not include the correct claim.
"The sharks get their energy from seaweed, it is about 10% of the energy that is transferred from one trophic level to the next trophic level. If the sharks don't eat enough seaweed, they would have less energy to use, which would make them weak."	Score = 1  The response includes the correct claim but does not include the correct explanation.

<p>"The fact that dying seaweed causes the sharks to decrease in population because since the sea turtles eat seaweed and the sharks eat sea turtles there would be a lack in the shark population."</p>	<p>Score = 2</p> <p>The response includes the correct claim and evidence linking sharks and seaweed, but it does not use reasoning with energy science ideas.</p>
<p>"Yes, because animals need food to survive, and if their seaweed is gone the animals that the sharks need to eat will also die. Meaning the sharks would not have anything to eat, so it will be hard for them to do any tasks."</p>	<p>Score = 3</p> <p>The response includes the claim, evidence, and science ideas about not surviving when needs are not met but does not use reasoning with energy ideas.</p>
<p>"Yes it could. In order to maintain their energy they need to gain energy. Sharks do this by eating food. Since seaweed is dying out their prey is also dying out, making it harder for them to eat, leaving them with insufficient energy. You can see in the flow chart that all energy starts from the seaweed and since the seaweed is decreasing energy will decrease!"</p>	<p>Score = 4</p> <p>The response includes all the elements in the rubric.</p>

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