Teacher Version

Delaware Science Assessment Prototype: Grade 5 Integrative Item Cluster

Prepared for the Delaware Department of Education
by WestEd

Delaware
Department of Education

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Delaware NGSS Assessment Prototype
Grade 5 Integrative Item Cluster

Background:

The Delaware Department of Education engaged with WestEd to design and develop sample tasks to measure the Next Generation Science Standards (NGSS). These tasks were administered to Delaware students as part of a process to evaluate the tasks' effectiveness at measuring all three dimensions of the NGSS—Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCC). These tasks were revised based on the data collected during the research period, and are now available to Delaware educators as sample NGSS-aligned assessments for use in their classrooms.

Recommendations on how to use the Integrative Item Cluster Prototype:

The following Integrative Item Cluster (IIC) is designed to elicit evidence of a student's understanding and ability to apply specific science skills in a real-world context. Each IIC is designed around a central phenomenon and requires students to use and apply all three dimensions to respond to questions associated with a common stimulus. ***It is recommended that this IIC be administered following the instruction of Performance Expectation (PE) 05-PS3-1.***

This IIC also assesses a student's ability to apply science practices that are not specific to PE 05-PS3-1. For example, in addition to the SEP of *Developing and Using Models* (MOD) that was originally part of PE 05-PS3-1, the IIC also requires students to apply the practices of *Analyzing and Interpreting Data* (DATA) and *Constructing Explanations and Designing Solutions* (E/S) as part of the assessment. In this way, the IICs prepare students to ***integrate, transfer, and apply*** knowledge and skills to novel situations, an important expectation of Delaware's Comprehensive Science Assessment System.

This IIC prototype is provided as a formative assessment tool and is not meant to demonstrate the exact mode or content that will appear in Delaware's future assessments (e.g., some IICs may be delivered online). Rather, we invite teachers to explore the use of IICs in their classroom to better understand the nature of NGSS assessment.

Materials:

Student Version PDF: This version is available to download and print in order to administer the IIC prototype directly to students. All student responses can be captured on this hard copy, **OR** a set of class copies can be printed and student responses can be captured on a separate piece of paper. The IIC is designed to be self-explanatory and should require little instruction on the part of the teacher or proctor. The suggested time to complete the IIC is 20–25 minutes.

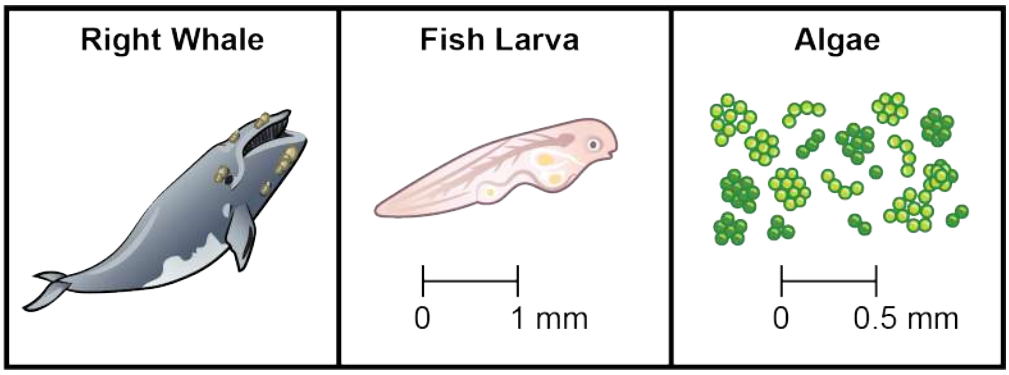
Teacher Version PDF: In addition to the content contained in the student version, the teacher version provides alignment information in gray metadata boxes. Scoring information (the key) is included in the metadata or is provided as a detailed rubric/scoring information section below items where relevant. Keys and recommended point values for each question are provided in the metadata tables (9 points total for the IIC), but point values can be adjusted based on overall class performance.

These resources are available for public use and we encourage you to share them freely. Questions can be sent to april.mccrae@doe.k12.de.us.

Introduction: Organisms in an Ocean Ecosystem

Grade: 5
PE/PE Bundle: **05-PS3-1:** Use models to describe that energy in animals' food (used for body repair, growth, and motion, and to maintain body warmth) was once energy from the sun.
Dimensions: SEP: MOD, DATA, E/S **DCI:** PS3.D, LS1.C **CCC:** E/M
Focus: Right whale migration - Students will develop and use models of ecosystem interactions that include energy and matter flows, and construct an explanation of energy and matter flows using evidence, to explain why Right whales migrate during certain times of the year.
Phenomenon: Microscopic animals eat algae, which get energy from the Sun. The amount of algae changes in different parts of the world at different times of year. Right Whales migrate north in the spring to where algae are increasing.

A group of scientists is studying organisms in an ocean ecosystem. They show you three pictures of the organisms they see.



- Right whales grow to be about 15 meters (m) long. That is about the length of a tractor-trailer.
- Fish larva are young fish that just hatched from an egg. They are only a few millimeters (mm) in length, which is smaller than a sesame seed.
- Algae are plants that live in the ocean. They are smaller than the period at the end of this sentence.

Scientists' Observations: Flow of Energy and Matter

The scientists watch the right whales eating the fish larva as they swim in the ocean. They also watch the tiny fish larva eating algae as they swim in the ocean. More fish larvae are found in areas of the ocean that have more algae.

Item: 1	**Item Format: MS**
Grade: 5	
PE/PE Bundle: 05-PS3-1	**Total Points:** 1
Dimensions: SEP: E/S **DCI:** LS1.C **CCC:** E/M	**Key(s):** A, B, D
Focus: Fish larva are food that whales need: matter to grow and energy to swim.	

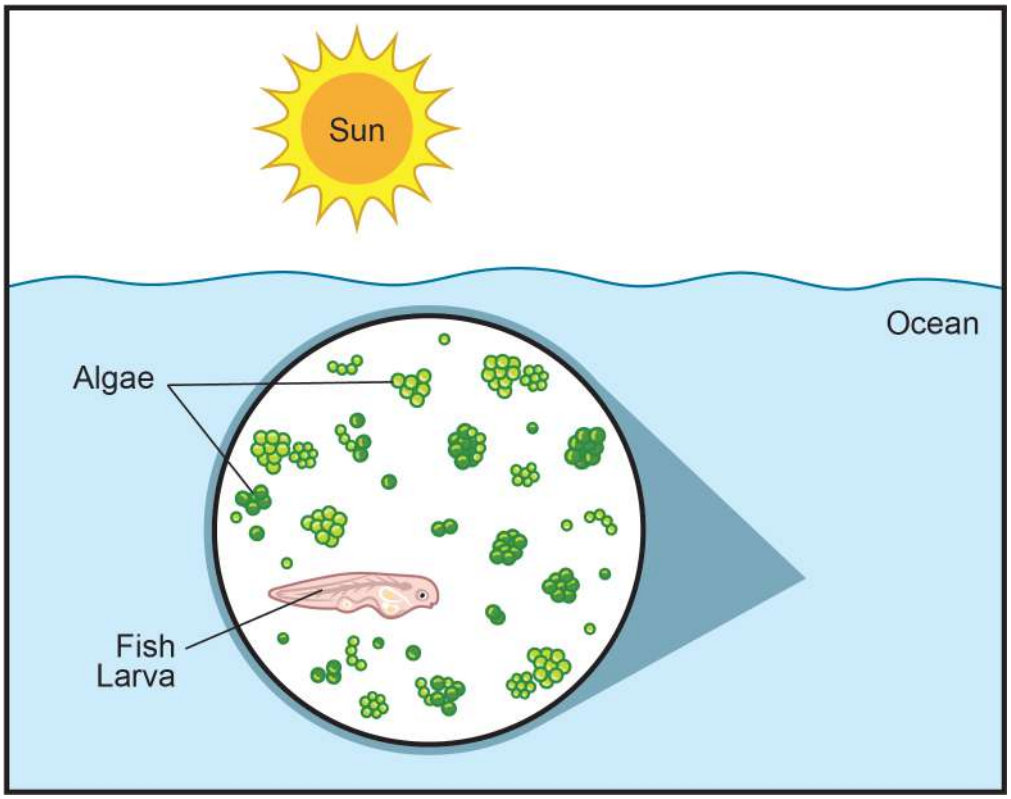
Question 1. Which statements explain what happens when right whales eat the fish larva as they swim in the ocean? Select the **three** correct answers.

A. Whales get matter they need to grow.*
B. Whales get energy they need to swim.*
C. Energy is transferred from the whales to the fish larva as the whales eat.
D. Energy and matter are transferred from the fish larva to the whales as the whales eat.*
E. Matter is transferred from the water to the whales and the fish larva as the whales eat.

Item: 2	**Item Format: TEI**
Grade: 5	
PE/PE Bundle: 05-PS3-1	**Total Points:** 1
Dimensions: SEP: MOD **DCI:** PS3.D **CCC:** E/M	**Key(s):** See scoring below.
Focus: Show transfer of energy within an ecosystem	

Question 2. The scientists want you to model the flow of energy and matter through the ecosystem as fish larva eat the algae. The scientists have a diagram showing the Sun, fish larva, and algae.

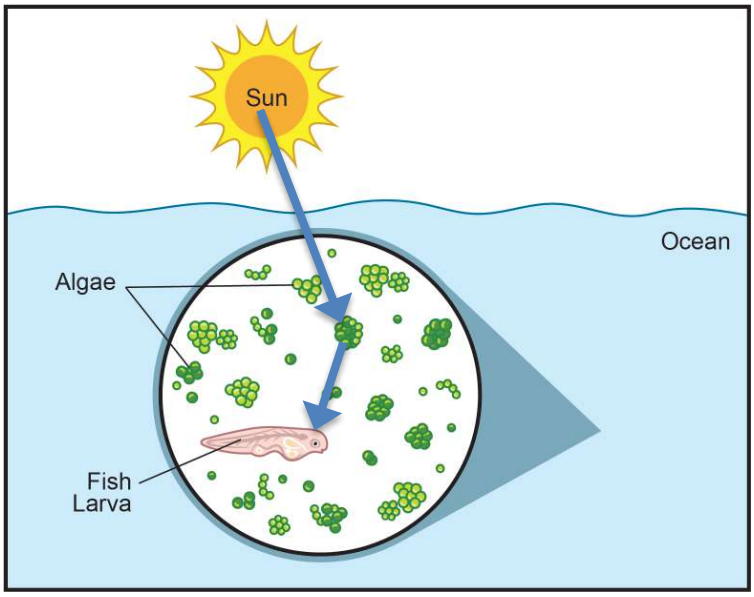
Complete the model by drawing **two** arrows to show how energy flows among the Sun, the fish larva, and the algae. The arrows should point in the direction energy flows.



Scoring for Question 2:

One point total:

- One point for drawing an arrow from the sun to the algae **and** one arrow from the algae to the fish larva.

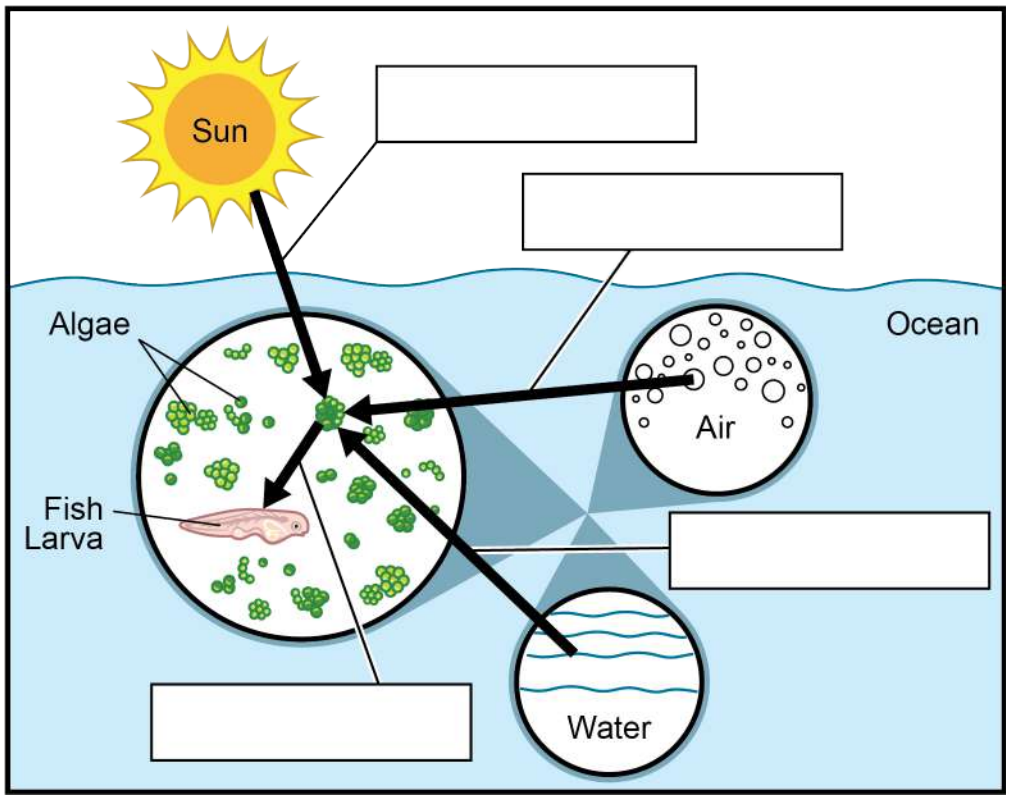


Item: 3	**Item Format: TEI**
Grade: 5	
PE/PE Bundle: 05-PS3-1	**Total Points:** 2
Dimensions: SEP: MOD **DCI:** PS3.D **CCC:** E/M	**Key(s):** see scoring below
Focus: Draw matter and energy arrows	

Question 3. The scientists add both air and water to the model. They add arrows to show the direction in which matter and energy flow among the different parts in the model. They want you to label each arrow to show if the arrow represents only the flow of energy, only the flow of matter, or the flow of both energy and matter.

Label **each** arrow to show what it represents by writing **one** of the following in each box:

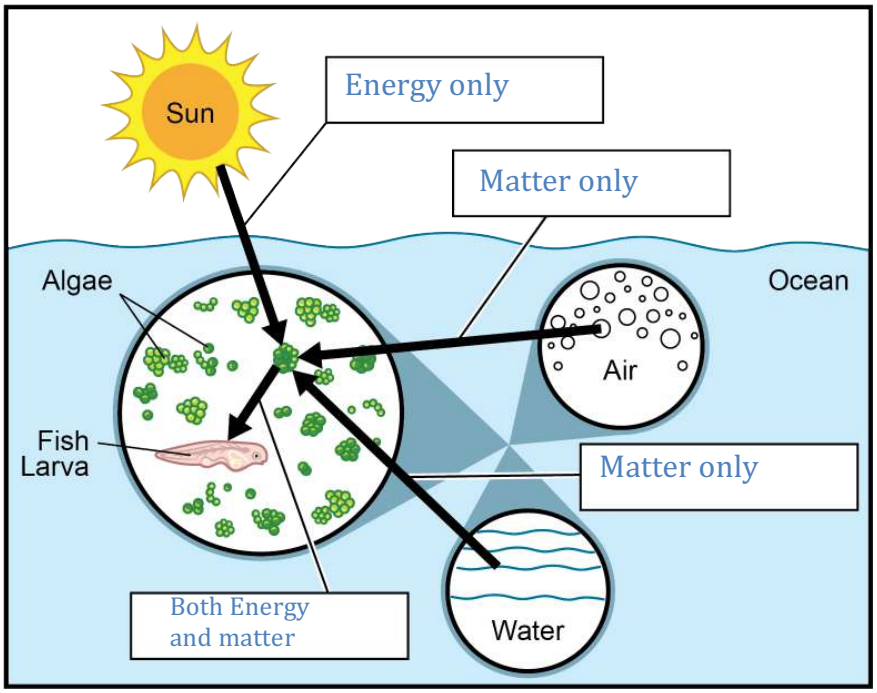
- Energy Only
- Matter Only
- Both Energy and Matter



Scoring for Item 3:

Two points total:

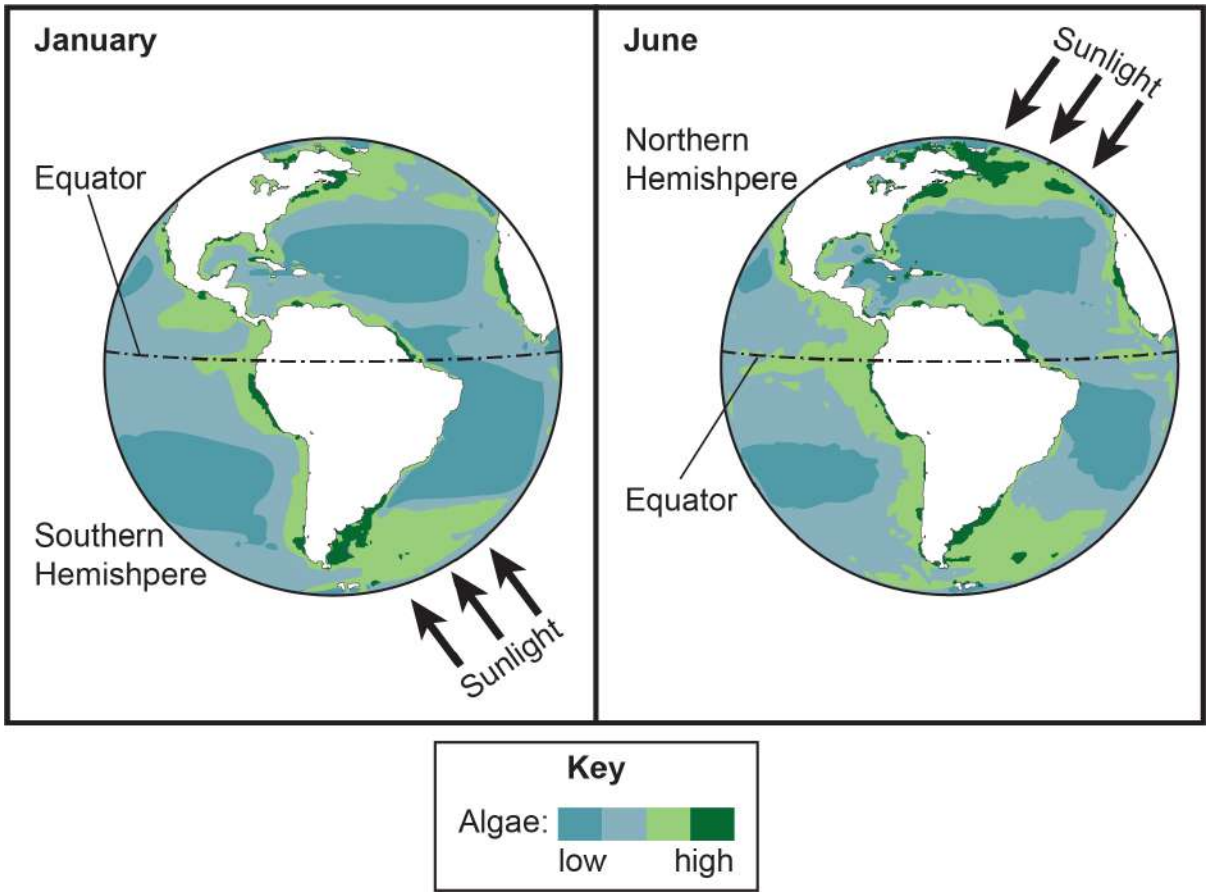
- One point for labeling the arrow from the sun to the algae as "energy only" **and** for labeling the arrow from the algae to the fish larva as "both".
- One point for labeling arrows from the air to the plant **and** from the water to the plant as "matter only".



Global Seasonal Changes in Energy and Matter

The diagram below shows how the amount of algae in the ocean changes from January to June. The arrows show where sunlight is more direct during each season. Areas where the sunlight is more direct receive more sunlight. In January, the sunlight is more direct in the Southern Hemisphere. In June, the sunlight is more direct in the Northern Hemisphere.

Global Seasonal Changes



Item: 4	**Item Format: MC**
Grade: 5	
PE/PE Bundle: 05-PS3-1	**Total Points:** 1
Dimensions: SEP: MOD, DATA, E/S **DCI:** PS3.D **CCC:** E/M	**Key(s):** D
Focus: Explain patterns in populations changes due to seasonal changes.	

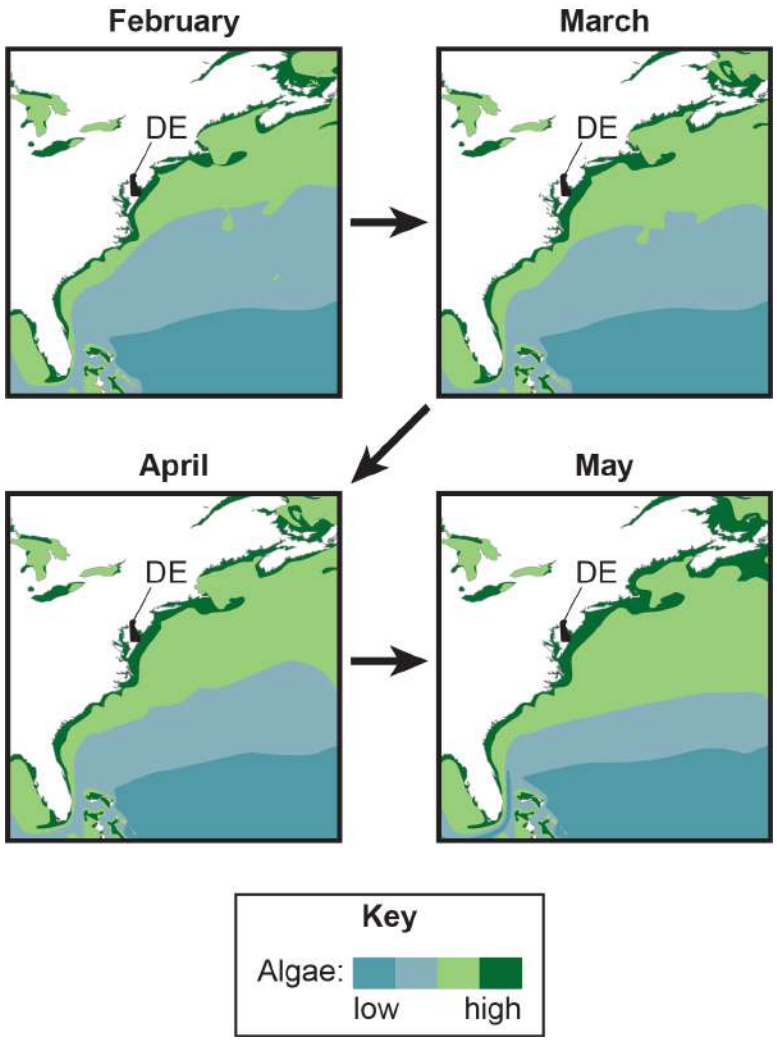
Question 4. Which statement explains what the diagram shows about algae?

A. Algae move toward the Northern Hemisphere throughout the year.
B. Algae move away from places where there is too much energy from the Sun.
C. Algae grow in both hemispheres at the same rate throughout the year.
D. Algae grow better in places where they have more energy from the Sun.*

Seasonal Changes in Energy and Matter in the North Atlantic Ocean

The scientists made the maps below to show how the amount of algae in the North Atlantic Ocean changes from February to March to April and to May. The location of Delaware is shown on each map.

Algae in the North Atlantic Ocean



Item: 5	**Item Format: EBSR (MC/MS)**
Grade: 5	
PE/PE Bundle: 05-PS3-1	**Total Points:** 2
Dimensions: SEP: MOD, DATA, E/S **DCI:** PS3.D **CCC:** E/M	**Key(s): Part A:** D **Part B:** B,C,E
Focus: Explain population changes over time as they relate to seasonal changes in energy and matter.	

Question 5.

Part A
Based on the information in the four maps, when will the scientists **most likely** find whales near Delaware?

A. February
B. March
C. April
D. May*

Part B
Which statements explain why scientists are **most likely** to find whales near Delaware in the month you selected in Part A?

Select the **three** correct answers.

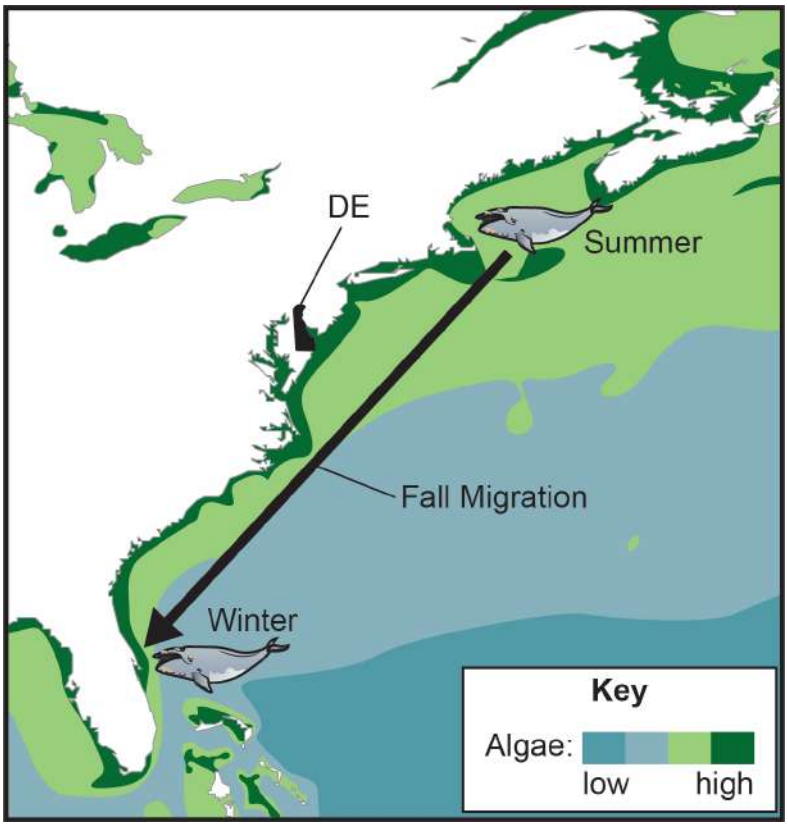
A. Less sunlight is available near Delaware during that month.
B. More energy is available for algae near Delaware during that month.*
C. More matter is stored in algae near Delaware during that month.*
D. Less energy is stored in algae near Delaware during that month.
E. More matter is available for whales near Delaware during that month.*

Fall Migration

Right whales migrate along the coast as the amount of energy and matter in an area changes.

The diagram below shows the location of the whales during the summer, their path as they migrate south in the fall, and their location during the winter. The whales are much bigger when they leave their summer location than when they first arrived. Their bigger size helps the whales migrate during the fall.

Fall Migration of Right Whales



Item: 6	**Item Format: CR**
Grade: 5	
PE/PE Bundle: 05-PS3-1	**Total Points:** 2
Dimensions: SEP: MOD, E/S **DCI:** PS3.D **CCC:** E/M	**Key(s):** Rubric
Focus: Matter and energy from food are used to help the body grow.	

Question 6. Use your knowledge of energy and matter to construct an explanation of why the whales are much bigger at the end of summer than when they first arrived. Support your explanation with evidence from the diagram.

{response space is provided in student version}

Scoring for Question 6

Two points total:

- One point for explanation of why whales do not need to eat
- One point for evidence from the diagram/model(s) to support the claim

Sample Student Response: The whales are larger at the end of summer because they spend the summer eating. The matter and energy in food is an energy source that the whales use to help them grow. My evidence is that the map of May shows that there is lots of energy and matter (algae) where the whales are in summer. Since they are bigger at the end of summer, this means that whales ate a lot of algae and used the extra energy and matter to help their bodies grow.