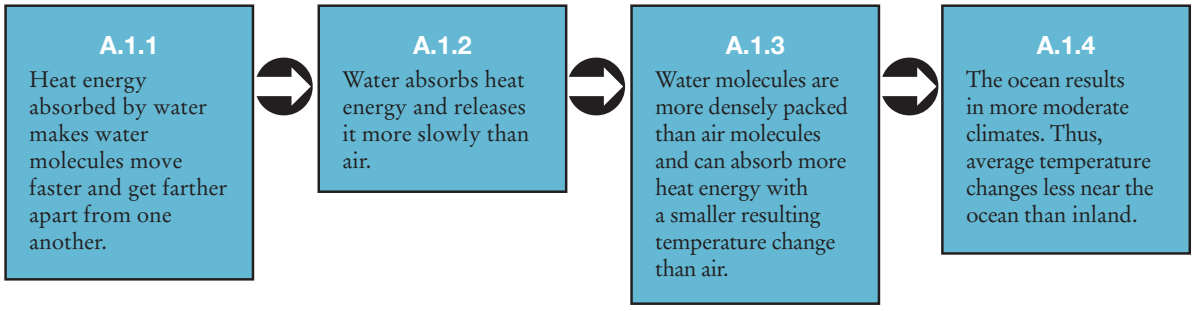
OCEAN SCIENCES SEQUENCE FOR GRADES 6–8
ASSESSMENTS: DESCRIPTION, PURPOSE, AND DESIGN

The assessments for *Ocean Sciences Sequence for Grades 6–8* (OSS) are composed of pre- and posttests, both of which are integral to determining how students' understanding of critical pieces of knowledge change over the course of their engagement with the curriculum. The assessment items are designed to closely reflect the content of the curriculum and include multiple opportunities for students to show what they have learned—both through assessing different levels of understanding about a concept, as well as asking questions about a concept or topic in multiple ways.

These assessments were designed to provide information about what students *know*, as well as where they may need *additional experiences* to better grasp the concepts. With this in mind, teachers can use this information to understand how their students' thinking progresses over time, reflecting the value of using the OSS assessments as both formative and summative assessments to guide teaching.

The importance the curriculum places on teasing out and better understanding what students know about a concept and what they are still struggling with is reflected by designing the assessments around *progress variables*. These progress variables describe how students' conceptual understanding is likely to develop as they experience the OSS curriculum for each of the major ocean science topics. Each progress variable is composed of a "big idea" or concept and a series of attributes that denote pieces of knowledge identified as being critical to understanding that particular concept or topic. The attributes describe increasingly complex understandings of the topic or concept.

The assessment team worked closely with curriculum developers and scientists to create and finalize a set of progress variables for each OSS unit. Because the project's progress variables are closely tied to moments in the curriculum, when you use the pre- and posttests as formative assessments, you can analyze your students' growth over the course of the unit. You will have evidence-based feedback about specific concepts or attributes that you may want to revisit to help students improve their understanding. You will also have evidence not only about what students don't know, but perhaps more importantly, what they *do* know.



Example: **Progress Variable with Four Attributes (A.1.1–1.4) for Ocean as a Heat Reservoir**

DESIGN PROCESS

The curriculum and assessment teams designed well over 100 assessment items, each of which reflects one or more of the progress variables' attributes. Following field testing and analysis of student results, the teams selected only the best-performing items. This evidence-based feedback also informed curriculum developers' decisions as they reviewed and revised specific lessons for the commercially published version of the curriculum. The following chart lists each of the progress variables (e.g., A.1) with attribute descriptions (e.g., A. 1.1) for Unit 1. See pages 4 and 6 for Unit 2 and Unit 3, respectively.

UNIT 1: HOW DO THE OCEAN AND ATMOSPHERE INTERACT?

A.1	Ocean as a Heat Reservoir
A.1.1	Heat energy absorbed by water makes water molecules move faster and get farther apart from one another.
A.1.2	Water absorbs heat energy and releases it more slowly than air. [not assessed; A1.3 assesses this in a bit more complex way]
A.1.3	Water molecules are more densely packed than air molecules and can absorb more heat energy with a smaller resulting temperature change than air.
A.1.4	The ocean results in more moderate climates. Thus, average temperature changes less near the ocean than inland.

A.2	Density and Movement of Air and Water Currents
A.2.1	Student conceives of density as mass or weight per unit volume only AND recognizes that substances that are more dense sink below substances that are less dense.
A.2.2	Student conceives of density in terms of packing of molecules.
	and/or Student recognizes that warmer water is less dense than colder water.
	and/or Student recognizes that salt water is more dense than fresh water.
A.2.3	Student explains vertical currents in terms of packing of molecules, temperature and density.
	and/or Student explains vertical currents in the ocean in terms of water temperature.
A.2.4	Student explains vertical ocean currents with reference to differences in molecule packing and density AND horizontal ocean currents with reference to wind.

A.3	Heat Reservoir and Air Currents *(not assessed)*
A.3.1	Students can use their knowledge about how the ocean absorbs a lot of heat energy before it warms up and how it takes awhile for all the energy it has absorbed to leave (the ocean releases heat energy more slowly than air) to predict air currents near the coast in daytime and at nighttime.

A.4	Interactions between Heat, the Water Cycle, and the Atmosphere
A.4.1	Adding heat energy to water leads to evaporation. [not assessed; A4.2 assesses this in a bit more complex way] and/or Removing heat energy from water leads to condensation.
A4.2	Student can identify what leads to evaporation and/or condensation; and explains the movements of molecules during these processes.
A.4.3	Student explains that clouds result from condensing water vapor in the atmosphere.
	and/or Student explains that rain results from condensed water vapor in atmosphere.
A.4.4	Student explains the water cycle: clouds result from condensing water vapor in the atmosphere.
	and Student explains that rain results from condensed water vapor in atmosphere falling to Earth.
A.4.5	Student can explain the water cycle that results in cloud formation and rain; and explains the movements of molecules during these processes.

The following chart catalogs all the assessment items for Unit 1 according to the attribute they were designed to measure and the session(s) that focus(es) on that attribute.

Assessment Items for Unit 1			
Question Number	**Answer**	**Measures Attribute**	**Taught in Session(s)**
1	A	A.1.1	1.1, 1.2
2	J	A.4.2	1.10
3	B	A.1.4	1.3, 1.4
4	H	A.2.1	1.5, 1.6
5	C	A.2.2	1.5, 1.6
6	G	A.2.2	1.5, 1.6
7	A	A.2.3	1.7, 1.8
8	H	A.2.3	1.8
9	D	A.2.3	1.5, 1.6, 1.8
10	J	A.2.4	1.8, 1.11
11	B	A.4.1	1.10
12	G	A.4.1	1.1, 1.2
13	D	A.1.1	1.1, 1.2, 1.6
14	F	A.1.3	1.2, 1.3
15	B	A.2.1	1.5, 1.6
16	F	A.2.2	1.5, 1.6
17	B	A.2.3	1.7, 1.8
18	H	A.2.4	1.11
19	A	A.2.3	1.7, 1.8
20	J	A.2.4	1.8, 1.11
21	B	A.4.3	1.10
22	H	A.4.2	1.10
23	C	A.4.4	1.10
24	J	A.4.5	1.10

For additional information about how concepts build throughout OSS, see the Conceptual Progressions by unit beginning on page 41 and the At-a-Glance chart for each unit beginning on page 25 of the Ocean Sciences Sequence for Grades 6–8: Introduction, Science Background, Assessment Scoring Guides.

UNIT 2: HOW DOES CARBON FLOW THROUGH THE OCEAN, LAND, AND ATMOSPHERE?

B.1	Carbon Reservoirs
B.1.1	Student knows that carbon can be found in many different reservoirs on Earth (ocean, atmosphere, living and once living things).
B.1.2	Student knows that while carbon can be stored in different reservoirs, the total amount of carbon in Earth is always the same.
B.1.3	Student understands that as the amount of carbon in one reservoir changes over time, this will affect the amount of carbon in other reservoirs.
B.1.4	Student knows that the burning of fossils fuels specifically increases carbon in the atmosphere and ocean (rate of change).

B.2	Effect of Ocean Acidification
B.2.1	Student knows that as the ocean becomes more acidic, some shelled organisms will have a harder time making shells and corals will have a harder time making skeletons.

B.3	Tracking Carbon Flows
B.3.1	Given an example of carbon flowing from one reservoir to another, student can describe a mechanism or direction for that flow.
B.3.2	Given an example of carbon flowing from one reservoir to another, student can describe a multi-step mechanism and direction for that flow (in multiple ways).

The following chart catalogs all the assessment items for Unit 2 according to the attribute they were designed to measure and the session(s) that focus(es) on that attribute.

Assessment Items for Unit 2

Question Number	Answer	Measures Attribute	Taught in Session(s)
1	A	B.1.2	2.7
2	J	B.1.1	2.1
3	A	B.1.4	2.7, 2.8
4	G	B.3.1	2.3, 2.4
5	A	B.3.1	2.2, 2.4
6	H	B.3.1	2.7
7	A	B.3.1	2.6
8	J	B.3.2	2.6
9	D	B.3.2	2.5
10	H	B.1.3	2.7
11	B	B.1.3	2.7, 2.8
12	J	B.3.2	2.3, 2.6, 2.7
13	A	B.1.4	2.7, 2.8
14	J	B.1.4	2.7, 2.8
15	A	B.2.1	2.9
16	F	B.3.1	2.3
17	B	B.3.1	2.7, 2.8
18	J	B.3.2	2.2, 2.3, 2.6
19	B	B.1.3	2.7
20	F, H, J, K, L, R, T	B.1.1	2.1

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UNIT 3: WHAT ARE THE CAUSES AND EFFECTS OF CLIMATE CHANGE?

C.1	Human Activity and CO_2
C.1.1a	Human activity has increased the amount of CO_2 in the atmosphere from the burning of fossil fuels.
C.1.1b	CO_2 is a heat-trapping gas.
C.1.2	Human activity has led to climate change since CO_2 is a heat trapping gas and human activity has increased the amount of CO_2 in the atmosphere.
C.1.3	Student understands that as the amount of carbon in one reservoir changes over time, this will affect the amount of carbon in other reservoirs.
C.1.4	Student knows that the burning of fossils fuels specifically increases carbon in the atmosphere and ocean (rate of change).

C.2	Increased Temperature Affects Ocean
C.2.1	Higher global temperatures affect the ocean (i.e., currents, sea level…).

C.3	Cause and Effect Relationships between CO_2, Temperature, Climate Change, and Effects on Organisms
C.3.1	Human industry puts more CO2 into the atmosphere, raising global temperature, affecting the ocean and Earth's climate.

C.4	Defining Climate Change
C.4.1	Students know that climate change is a change in global weather patterns over a long period of time.

The following chart catalogs all the assessment items for Unit 3 according to the attribute they were designed to measure and the session(s) that focus(es) on that attribute.

Assessment Items for Unit 3			
Question Number	**Answer**	**Measures Attribute**	**Taught in Session(s)**
1	C	C.1.1a	3.3, 3.4, 3.6
2	G	C.1.1b	3.3, 3.4
3	D	C.2.1	3.5, 3.6
4	G	C.2.1	3.7
5	A	C.1.1b	3.3, 3.4, 3.6, 3.9
6	G	C.4.1	3.4
7	B	C.2.1	3.4, 3.5, 3.6
8	F	C.3.1	3.3, 3.5, 3.6
9	A	C.3.1	3.3, 3.5, 3.6
10	J	C.4.1	3.4, 3.5
11	A	C.1.1a	3.2, 3.3
12	G	C.1.1b	3.3
13	C	C.1.2	3.3, 3.4
14	F	C.2.1	3.5, 3.6
15	D	C.2.1	3.7
16	F	C.2.1	3.5, 3.6, 3.9
17	B	C.1.2	3.3, 3.4
18	G	C.3.1	3.5, 3.6, 3.9

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