Question
How can we minimize the impact to the ocean environment if the energy resources are developed off the coast of Virginia?

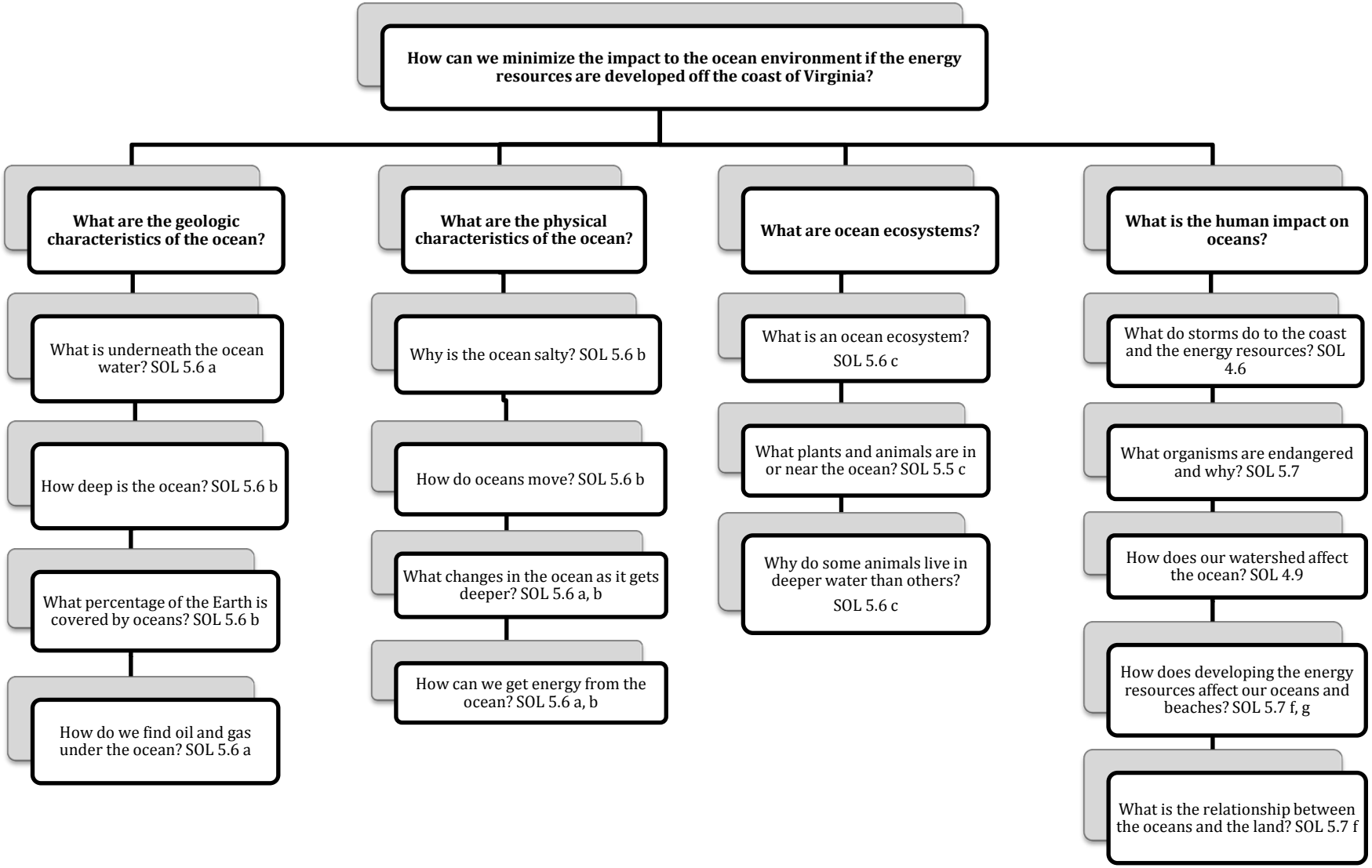
Problem ~ Scenario
Energy resources off the east coast of North America are very valuable. One of the most significant energy issues facing President Obama is whether to allow leasing of offshore land for drilling oil and natural gas, where production has been off-limits. Scientists are investigating areas off the coast of Virginia to develop these resources. Residents and tourists on the east coast are concerned about the development of these energy resources in the Atlantic Ocean. The Bureau of Ocean Energy Management (BOEM) will offer leases for drilling of oil and natural gas, and will also offer for auction the development of wind or tidal turbine farms off the east coast. The Virginia Department of Environmental Quality (DEQ) is enlisting you and your team to determine how to minimize the impact of these energy resources on our environment. As a member of the DEQ advisory task force you will investigate the issues, evaluate the impacts of the different energy options, and inform the public.

Task ~ Culminating Project
Develop a report for the Virginia Department of Environmental Quality. Your report could include presentations, videos, interviews, and other forms of communication to address concerns, trends, and workable solutions for the impact of offshore energy resources.

Student Role (research job)
Oceanographers/Oceanologists hired by DEQ: cover a wide range of topics including marine life and ecosystems, ocean circulations, plate tectonics and the geology of the sea floor, and the chemical and physical properties of the oceans.

<table>
<tr><th colspan="2">Unit Title: COMMOTION IN THE OCEAN PBL SOL 5.6
OVERVIEW</th></tr>
<tr><td colspan="2">Level 3 Question(s) Addressed:
• How oil and natural gas is found and extracted & how wind and tidal power is utilized & discourse findings (NOS)
• How energy resources currently being utilized and those being proposed by the government.</td></tr>
<tr><td>Content Standard(s):
• Standard 4.6
• Standard 4.9
• Standard 5.6 a, b, c
• Standard 5.7 f, g</td><td>NOS Aspects
• The natural world is understandable
• Science demands evidence
• Scientific ideas are durable
• Science is a blend of logic & imagination
• Science is creative</td></tr>
<tr><td colspan="2">Student Objective(s) for this lesson:
The student will research how oil and natural gas is found and extracted & how wind and tidal power is utilized & discourse findings (NOS).</td></tr>
<tr><td colspan="2">Safety Concerns in this lesson:
o Safety 1: Addressed in activities</td></tr>
</table>

Ocean Problem Based Unit Question Map



DAY 1 – Introduce problem, scenario, and brainstorm questions for question map

MATERIALS: Poster paper, Post-it Notes, Markers

DAY 2 – Discuss question map (teacher created) and brainstorm ideas for culminating activity

Research how oil and natural gas is found and extracted & how wind and tidal power is utilized & discourse findings (NOS)

Discuss the energy resources currently being utilized and those being proposed by the government.

MATERIALS: Computers, BOEM website, Curriculum map

<table>
<tr><th colspan="2">Unit Title: COMMOTION IN THE OCEAN PBL SOL 5.6</th></tr>
<tr><td colspan="2">Level 3 Question(s) Addressed:
• What are the geologic characteristics of the ocean floor?
• What is underneath the surface of the water?
• How deep is the ocean?</td></tr>
<tr><td colspan="2">Date(s) Days 3 - 5</td></tr>
<tr><td>Content Standard(s):
• Standard 5.6a
• Standard 5.7e</td><td>NOS Aspects
• The natural world is understandable
• Science demands evidence
• Scientific ideas are durable
• Science is a blend of logic & imagination</td></tr>
<tr><td colspan="2">Student Objective(s) for this lesson:
• The student will investigate and understand geologic characteristics of the ocean environment.
• The student will investigate and understand how Earth’s surface is constantly changing due to plate tectonics.</td></tr>
<tr><td colspan="2">Misconceptions to address in this lesson:
• Misconception 1: the continental shelf has a very steep slope
• Misconception 2: the ocean is same depth everywhere
• Misconception 3: the percentage of Earth covered by H_2O
• Misconception 4: islands float
• Misconception 5: there are many separate oceans
• Misconception 6: the seafloor is flat</td></tr>
<tr><td colspan="2">Safety Concerns in this lesson:
o Safety 1: None</td></tr>
</table>

Activities Days 3 – 5	
#1	Introduce ocean floor vocabulary using Smartboard lesson and foldable
Time	Approximate time to complete this activity: 1 day (class period)
Materials	• Letter size plain paper to create foldable • Notes and other graphics showing the ocean floor • Scissors • Pencil • Color pencils • Science journal

Guiding Questions

1. What does the ocean floor look like?
2. How deep is the ocean floor?
3. Does the depth of the ocean change?

Plan

- Plans for activity:
  - **Construct** a small foldable that demonstrates the ocean floor by folding a piece of plain paper in half using the hot dog fold.
  - Using a combination of information found in your notes and in the other graphics of the ocean floor in the graphics review section, **draw** the ocean floor. Your drawing on the front should cover the entire length of the paper. Your drawing must include the following features: *Continental slope, continental shelf, continental rise, abyssal plain, mid-ocean ridge with a rift valley, seamounts, guyots, islands and a trench*
  - **Cut** the top part of the foldable to make flaps for each feature.
  - Under each feature **write** the name of the feature under the flap and on the other side of the fold, **describe** that feature.
  - **Add** color as desired.
- Guiding Questions to ask during this part of the activity:

1. What does the ocean floor look like?
2. Did you find different representations that were confusing?
3. How deep is the ocean?

- Anticipated Student Responses to guiding questions:

1. Discourse.

Differentiation	Strategy 1: Students will have a variety of resources to assist in
ELL Modification	Modification: give an example of the foldable and show an example of pictures
Check for Understanding	Check in with students throughout this activity for comfort with the Gizmos activity and graphing the ocean floor. Assist as needed.

Activities Days 3 – 5	
#2	Create a model of the ocean floor and points for a topographical map
Time	Approximate time to complete this activity: 1 day (class period)
Materials	o 1 box such as a shoe box or small rectangular box, with a lid if possible o Aluminum foil or heavy paper to use for a box lid, if box is without a lid o Clay, rocks, gravel, sand and/or other materials to create a sea floor and features o Ruler o Black felt tip marker o Paper that is the size of the top of the box o Masking tape o Scissors

Guiding Questions

1. What does the ocean floor look like?
2. Are there any ocean feature you can identify?

Plan

o Plans for part 1 of activity:
- Create a model of the ocean floor and points for the topographical map
- Detailed instructions and materials can be accessed at:
- http://seagrant.uaf.edu/marine-ed/curriculum/images/stories/grade6/model_seafloor_instructions.pdf
- http://seagrant.uaf.edu/marine-ed/curriculum/grade-6/investigation-3.html
- http://seagrant.uaf.edu/marine-ed/curriculum/images/stories/grade6/grid_model_seafloor_boxtop.pdf

o Guiding Questions to ask during this part of the activity:
- What does the sea floor like?
- Do you notice any features that you can identify?

o Anticipated Student Responses to guiding questions:
1. The ocean floor is not flat. It gradually slopes from the coast, then drops dramatically down to the abyssal plain. There are mountains rising from the ocean floor.

o Plans for part 2 of activity:
2. On student models label energy sites (tidal, wind, oil, gas) that are currently being utilized from discussion and research on Day 2.
- Guiding Questions to ask during this part of the activity:
- What are the most common sources energy being developed off the coast of Virginia?
- Anticipated Student Responses to guiding questions:
  - o The ocean floor is not flat. It has mountains and trenches.
- There are parts that are shallow and other parts that are very deep, use names of ocean floor.

Differentiation	Strategy 1: Students will work with partners that have been chosen for them to utilize strengths.
ELL Modification	Modification: Student will work with another student with whom she/he works well.
Check for Understanding	How you will assess or check for student understanding throughout this activity. Quick assessment: Label an example of the ocean floor.

Activities Days 3 – 5	
#3	Graphing the Sea Floor
Time	Approximate time to complete this activity: 1 day (class period)
Materials	• Computers and internet • Graph paper with some points filled in • Data sheet

Guiding Questions

- How do scientists know about the topography (vocabulary word) of the ocean floor?
- How does sonar work?
- What physical features do you think youwill recognize that you learned about when studying plate boundaries and volcanoes?

Plan

- Plans for part 1 of activity:
- Show sonar Gizmo on Smartboard, or have students work in pairs on computers on Gizmo.
- Students will graph seafloor on Gizmo. See: http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=373
  - Students will write a reflection in their notebooks on their results.
  - Guiding Questions to ask during this part of the activity:
  - How do scientists know about the topography (vocabulary word) of the ocean floor?
  - How did the sonar work?
  - Anticipated Student Responses to guiding questions:
- Scientists use sonar to help them know the topography of the ocean floor.
- Sonar is a sound that reflects off of the ocean floor.
- Plans for part 2 of activity:
  - Students will graph Atlantic ocean floor. See http://www.beaconlearningcenter.com/documents/336_01.pdf
  - Guiding Questions to ask during this part of the activity:
- What characterisitcs do you see upon graphing the ocean floor?
- Do you recognize any physical features that you learned about when studying plate boundaries and volcanoes?
  - Anticipated Student Responses to guiding questions:
  - Discourse – Guide discussion toward the use of sonar and ocean floor features.

Differentiation	• Strategy 1: For the graphing of an accurate model of the ocean floor, have part of the graph filled in.
ELL Modification	• Modification: Pair student with another student with whom he/she can work well.
Check for Understanding	Check in with students throughout this activity for comfort with the Gizmos activity and graphing the ocean floor. Assist as needed. Collect graph to assess understanding.

Unit Title: COMMOTION IN THE OCEAN PBL SOL 5.6	
Level 3 Question(s) Addressed: • What are the physical characteristics of the ocean?	
Date(s)	Day 6-Day 13
Content Standard(s): • Science 5.1 • Science 5.6	**NOS Aspects** • All: demanding evidence, social activity, without bias, ideas are durable,
Student Objective(s) for this lesson: A. We will investigate the physical characterisitics of the ocean. B. We will discuss how these physical characterisitics would effect the energy resource development off the coast of Virginia.	
Misconceptions to address in this lesson: 3. Waves, tides, and currents are all caused the same way and have the same effect on the water's movement.	
Safety Concerns in this lesson: o Be cautious of eyes during labs o Be careful of the electrical circuit created during water turbine challenge	

Activities Days 6 – 13	
#1	Making Waves and Tides
Time	Two 45 min sessions at least
Materials	• one clear water bottle for each student, blue food coloring, small shells or trinket, lots of baby oil, cooking oil, Dawn detergent fan, water, aluminum pan, premade wave bottle in a 2L bottle for the teacher • internet access
Guiding Questions 4. What causes waves? 5. What are tides? 6. How does the ocean move?	
Plan Part 1 of the activity:Wave demonstration- place water in a pan with a fan going across it on low, change the speed to high- discuss what the students observe happening Students will create a wave bottle. Have students draw their wave bottles in their notebooks. Have a wave bottle made to model for the group- what happens if detergent or cooking oil is added-use the teacher's model not the students' so theirs is not ruined. Discuss what happens to the wave. • Guiding Questions to ask during this part of the activity: How does the wave move? What does the movement remind you of? What happened once the cooking oil was added? How do you think this would effect the ocean water? The creatures in it? Part 2 of activity:Tides- show students images of the Bay of Fundy and how drastic the tides are there, at least a 30 foot difference Gizmo on Tides (there are 2 students may have time to go thru both); Discourse about gizmo; write reflection about how tides form. Research on tidal energy at: http://www.renewablegreenenergypower.com/tidal-energy-tidal-power-facts-for-kids/ • Guiding Questions to ask during this part of the activity: what causes tides and what does high tide/low tide look like? How would tides make in difference in being able to develop resources at the coast?	
Differentiation	• Give written step bt step directions if needed

ELL Modification	• Shows pictures of waves and high/low tide with vocab words
Check for Understanding	Listen to responses to questions, read responses in notebooks, listen to discourse

Activities Days 6 – 13	
#2	Temperature and Depth
Time	45 min
Materials	• tall cylinder- could be a large graduated cylinder, black paper, salt, ice, hot and cold water, 2 **long** thermometers, salt, 2 large beakers, red and blue food coloring, tiny bottles glued onto 2 tongue depressors, 4 beakers of any size, graph paper, book on SONAR, student models of the ocean floor, or a raised map of the ocean floor, copies of the lab sheet, internet
Guiding Questions	
7. What changes as the ocean gets deeper?	
Plan	
Plans for part 1 of activity: Watch "Telling Temp" at studyjams.com Review how to read a thermometer. Students will answer T/F activities and create a line graph of data by going to 4 stations. (See lab sheet) Station 1-the teacher sets up cylinder with salt and ice in the bottom. Put black paper around to cover this area of the cylinder. Slowly pour in water ¾ way to top. The students measure the temp at the ¾ mark and record, then again at the very bottom and record. Station 2- the teacher sets up 2 large beakers of room temp water, and glues two small bottles to two tongue despressors-one with super cold blue water and one with hot red water. The student SLOWLY lowers the tongue depressor submerging the bottle of water into the large beaker and observes then do the second one. Station 3- have students' models, flipbooks, maps, SONAR info, etc available. Students use these materials to answer the question. Station 4- the teacher sets up the 4 beakers of water/ice/salt. The students take the temps of each and complete the lab sheet. • Guiding Questions to ask during this part of the activity: Plans for part 2 of activity: Discourse of the findings o Guiding Questions to ask during this part of the activity:	
Differentiation	• Give a nonparticipatory student a specific statement to share during discourse or checklist to mark how often those words were heard
ELL Modification	• Vocab words on index cards
Check for Understanding	Collect lab sheets and listen to resposes during discourse

Activities Days 6 – 13	
#3	Water Turbine Challenge and Currents
Time	Two 45 min sessions anda one hour session for the design challenge
Materials	• wooden wheels (flat or like tinker toys), plastic spoons, dowel rods, straws, spools, motor, alligator clips, corks, digital multi meter, popsicle sticks, bottle caps, egg cartons, tongue depressors, any other items that could use for the paddles, sink or hose for running water current, plastic or glass box to hold water in the sink • rectangular aluminum pie pans, water, pepper shakers, straws, rocks, copies of the article, copy of blank world map, gluesticks
Guiding Questions	
8. How do oceans move? 9. How could we get energy from the ocean?	
Plan	
Plans for part 1 of activity: Make water turbines- There are many video tutorials to watch on youtube for the instructor to watch to help with your comfort level. You may also want to show pictures of waterwheels above ground to give the students a direction. • Guiding Questions to ask during this part of the activity: How could we use the motion of the ocean to get energy from the ocean? What could you do to the turbine to make the voltage higher? What happens if you change the turbine part? Plans for part 2 of activity: Currents (AIMS activity and ducks in a flow) Aims Activity in: Horizontal Ocean Currents.pdf This may be a good spot to read in your science text about currents Ducks in the Flow (read story druing reading or read short article): http://www.windows2universe.org/teacher_resources/ocean_education/currents_main.html Students are to draw in warm and cold water currents onto the world map then glue into notes • Guided questions to ask during this part of the activity: How are the currents effecting where the items travel to? How will this effect the harnassing of energy? Plans for Part 3 of activity: Discourse of the water turbine design challenge and currents activities If time: work on culminating activity	
Differentiation	• Give students needing more guidance a way to participate in the discourse time, assign a buddy during the challenge if needed
ELL Modification	• Vocab cards with pictures to match
Check for Understanding	Read reflections in notebooks, listen to comments during challenge, Check world map

Activities Days 6 – 13	
#4	Salinity Lab and Water Pressure
Time	Two 45 min sessions
Materials	• salt, water, 2 containers per group, thermometers, 2 plastics eggs per group, playdough, permanent marker Note: You will need to create the salt water solution ahead of time. (35 g of salt to 1000g of water works best) • balances-1 per group, gram weights, empty soup cans-1 per group, water, 2 styrofoam cups, objects to fill one cup, water bottles with top, rubberbands, multicolored paper clips, straws

Guiding Questions

10. Why is the ocean salty?
11. How does the ocean move?
12. What changes as the ocean gets deeper?

Plan

Plans for part 1 of activity: Salinity lab- Before giving the students the plastic eggs mark several cm increments above and below the middle of the egg with a permanent marker. Each group has one container of fresh water and one container of salt water. Place the eggs into the containers and record observations. Discuss the variables of the types of containers being the same, the amount of the liquid being the same, the eggs, and the placement of the egg into the water being either pointy end in first or the rounded end first. Both float. Now add playdough to the first cm mark of both eggs and replace into the water. Discuss observations. Add play dough to the next mark and repeat. Why does the egg in the salt water mix not sink as far as the egg in the fresh water? Read why the ocean is salty in textbook or at: http://chemistry.about.com/od/waterchemistry/f/why-is-the-ocean-salty.htm

1. Guiding Questions to ask during this part of the activity: what are your observations and inferences about why one egg sinks more than the other?

Plans for part 2 of activity: Have students use balance to find the mass of a can filled halfway with water then find the mass with the can filled almost to the top with water. Discuss how it would feel to be under that can or under a lot of water. The weight increases as does the pressure . Model for group; have two styrofoam cups with lids if possible, one empty and one full of pennies, poker chips, or cm cubes. Crush the empty one with a book. Then try to crush the other using the same force. It cracks but doesn't crush due to its density. Make cartesian divers with small water bottle instead of 2L:.http://www.sciencetoymaker.org/diver/assembl.html

2. Guiding Questions to ask during this part of the activity: what will have to be done to the mechanisms we are putting in the water to extract the energy to account for water pressure?

Differentiation	• Provide a checklist for the lab
ELL Modification	• Have salt for the student to touch
Check for Understanding	Quiz on how ocean water moves and the term salinity Read reflections

Unit Title: The Commotion in the Ocean PBL SOL 5.6	
Level 3 Question(s) Addressed: • What are ocean ecosystems?	
Date(s) Day 14-16	
Content Standard(s): • SOL 5.6 • SOL 5.1	**NOS Aspects** • Science demands evidence • Natural world is understandable. • Social activity • Scienctific knowledge is durable
Student Objective(s) for this lesson: C. TSW describe key functions of an ocean ecosystem. D. TSW construct and interpret a model of a marine food web. E. TSW identify how the characteristics of the ocean affect where organisms live.	
Misconceptions to address in this lesson: 13. Marine organisms live at the bottom of the ocean 14. Marine life is the same throughout the ocean	
Safety Concerns in this lesson: o None	

Activities Days 14 – 16	
#1	What is an ocean ecosystem?
Time	One 45 min. class session
Materials	• Copies of student worksheet *Ocean Life* • Post-it notes • Chart paper • computers
Guiding Questions	
15. What type of organisms live in the ocean? 16. Why is it important to study ocean ecosystems? 17. How do energy resources affect ocean life?	
Plan	
o KWL chart – What do you know about ocean ecosystems? What do you want to know? o Watch Bill Nye *Ocean Life,* http://www.youtube.com/watch?v=_IgmdlmD1p0 o Guiding Questions to ask during this part of the activity: What did you learn from watching the video? How does learning about ocean ecosystems help us minimize the impact of the energy resources? o Students complete corresponding *Ocean Life* worksheet o Interactive My Ocean game from National Geographic o Guiding Questions to ask during this part of the activity: What did you observe from this activity about ocean life? What were your findings? What new things did you learn about marine organisms? • Discourse- How did what we learn from the video help us to better understand how to minimize the energy impact on the ocean environment?	
Differentiation	• Give modified worksheet with fill-ins
ELL Modification	• Students can partner with an English speaking student to help with the computer activity
Check for Understanding	Students completion of video worksheet and responses during discourse.

Activities Days 14 – 16	
#2	What plants and animals live in or near the ocean? Life in the Food Chain (DOE)
Time	One 45 min class session
Materials	o A game set of 64 cards from the attached food chain game cards "Food Chain Game 1 Cards" consisting of 8 cards of *each* of the 8 different food-chain organisms (plants or animals). o A game set of 64 cards from the attached food chain game cards "Food Chain Game 2 Cards" consisting of 8 cards of *each* of the 8 different food-chain organisms (plants or animals). o Masking tape

Guiding Questions

Where does the energy flow always begin in a food chain?
Where does the energy flow always end in a food chain?
How does understanding maringe food webs help us to minimize the impact of the energy resources in the ocean environment?

Plan

Opening Set:

1. Display one set of the "Food Chain Game 1 Cards" out of sequence, and discuss with the class each organism shown.
2. Have the students help you arrange the cards in the correct sequence in the chain so that the students understand how they fit into the chain. Emphasize that the sun is the beginning (or starts the flow of energy) of all food chains and that its energy flows through the entire chain.

Procedure:

1. Mark out a "tidal trading pool" area on the floor with masking tape, making it large enough for 8 students at a time to be inside it.
2. Sort students into 8 teams of 2-4 students each. Give each team a set of 8 cards showing *the same* ocean organism. They will be playing a game about food chains. The object of the game is to collect all 8 cards showing the complete food chain by trading them.
3. Place each team on a home base, located around the edge of the classroom, with the "tidal trading pool" in the center.
4. Each student will run into the trading pool, holding one card face-down. He or she will yell, "Trade!" The students in the pool must exchange cards without looking at them; then they may run back to their home bases. All cards must be held face-down in the trading pool. If a student breaks this rule, he or she must stay in the pool for an extra 10 seconds before going back to home base, which will reduce the team's trading time.
5. When the newly traded card arrives back at home base, the team looks at it and decides either to keep it or to trade it. Then, another student from the team takes one card face-down into the trading pool and trades it. Students may trade only one card at a time.
6. The team that collects all 8 cards first yells, "Food chain!" and trading stops.
7. Once all trading has stopped, the team must create a food chain with the cards they have. They will receive 10 points for each card placed in the correct location in the food chain.
8. Repeat the game until all students have demonstrated an understanding of food chains. Then, play the game with the "Game 2" cards.
9. Have each student select another ocean animal. Have them conduct research about their animal and determine the food chain for their animals, noting where their animals fit in the food chain.
10. Have students share their food chains with the class.

Conclusion

Have students write an exit ticket by providing an example of a marine food chain that is different from

one of the examples they just formed.	
Differentiation	• Start with two to three cards at first and discuss with the students why the animals in a food chain are dependent on each other. Gradually add in other links in the chain and have the students explain to you where they go in the chain and why.
ELL Modification	• Allow student to use dictionary or encyclopedia to research the organisms first.
Check for Understanding	Writing: Draw a picture of the food chain and describe it in a paragraph. What would happen to the food chain if one link was extinct? Explain. Other Options: • Give students a list of marine organisms, and have them work individually to place them into a food chain. • Have students draw and label their own marine food chain.

Activities Days 14 – 16	
#3	Why do some animals live in deeper water than others? What lives in different ocean zones? (Disneynature Oceans Educators Guide)
Time	One 45 min. class session
Materials	• Copies of ocean zones (p. 24 Disneynature_Oceans) • Copies of ocean creatures p. 27 • Computers • Glue or tape • crayons
Guiding Questions	
What are the different ocean zones? Why can some organisms survive in certain zones? What are the characteristics of each zone?	
Plan	
o Divide students into groups of 3-4. Tell them they will be studying the animals that live in the different ocean zones. o Give each group a copy of pg. 24, the diagram that shows the five zones that make up the ocean depths and pg. 27, which has line drawings of different ocean creatures. o Students cut out the ocean creatures and use the laptops to research where the organisms live. They will then glue or tape them in the correct zone. Be sure to remind students that some creatures move from one zone to another. Students can color the creatures if time allows. o Groups present their completed diagrams and explain why they chose the zone where they put the creature. o Guiding Questions to ask during this part of the activity: What are the characteristics of each zone? Why are some creatures able to live in more than one zone? o Discourse o Why can some organisms live in certain zones? How does understanding the different ocean zones help to minimize the impact of energy resources?	
Differentiation	• Using pictures will assist students with learning disabilities
ELL Modification	• Students will work with another students to look for research
Check for Understanding	Students present their diagrams and check for understanding.

Unit Title: The Commotion in the Ocean PBL SOL 5.6	
Level 3 Question(s) Addressed: • What is the human impact on oceans? • What do storms do to the coast and to the energy resources located there?	
Date(s) Day 17-21	
Content Standard(s): • SOL 5.6c • SOL 5.1b,d,l,j,k • SOL 5.7f,g • Review of SOL 4.9a	**NOS Aspects** • Science is social • Science is a blend of logic/imagination • The natural world is understandable • Science demands evidence
Student Objective(s) for this lesson: F. TSW review the different types of storms. G. TSW construct a model of a coastline(continental shelf) including energy resources H. TSW mimic a storm and collect/record data from storm model. I. TSW infer the effects of the storm on the coastline	
Misconceptions to address in this lesson: 18. Hurricanes only do damage on land. 19. Hurricanes form over land.	
Safety Concerns in this lesson: o Blowing sand	

Activities Days 17 – 21	
#1	Coastline storm damage
Time	Two 45 minute sessions at most
Materials	• Chart paper to record types of storms • Web site: Hurricane Sandy: Super Storm Slams East Coast States (YouTube) • Tin pans, sand, water, wind turbines(pinwheels) and oil well(toothpicks), fan • Digital anemometer, data sheet
Guiding Questions 20. How did Hurricane Sandy affect the beaches? 21. What damage did you observe? Be specific 22. What could have been done to minimize the damage? 23. What damage occurred to your coastline at the low wind speed/high wind speed? 24. How can you link your model damage to the damage seen on the video? Be specific. 25. What could you do to your model to minimize the damage?	
Plan Plans for part 1 of activity o Students write the 3 guiding questions- A, B, C in their Science notebook prior to watching the video. After viewing the video, the questions are answered and discussed in Discourse. Plans for part 2 of activity o Questions D, E, F are written in student's Science notebooks. o Working in groups of 3 or 4, students build a coastline with sand and water in a tin pan. Models of wind turbines(pinwheels), oil wells(toothpicks)are included along the coastline(continental shelf). An anemometer reading is recorded with the fan at low speed, and again with the fan at high speed. The remaining questions are answered and discussed in Discourse.	
Differentiation	• Give written step-by-step instructions. • Simplify the guiding questions.

ELL Modification	• Group student with English speaking students.
Check for Understanding	Listen to responses during Discourse.

Activities Days 17 – 21	
#2	Endangered Ocean Organisms
Time	One 45 minute session
Materials	• Internet Access • List of endangered organism clips
Guiding Questions	
26. What does endangered mean? 27. What ocean organisms are endangered and why? Be specific. 28. What can we do?	
Plan	
Plans for activity • Students copy Question G in their Science notebook and answer it. Share definitions of endangered. • Students copy Question H in their notebook. Students work with partners and view the following clips: http://library.thinkquest.org/06aug/01219/will%20stuff.htm http://keranakisocean.blogspot.com/2011/04/endangered-species-of-atlantic-ocean.html http://www.slideshare.net/FreeRadicalsBU/top-9-endangered-marine-mammals-in-the-atlantic • After viewing the clips, Questions H and I are answered. • Answers discussed in Discourse.	
Differentiation	• Simplify questions
ELL Modification	• Student works on the computer with English speaking student.
Check for Understanding	• Students write a definition for endangered and list several endangered ocean organisms.

Activities Days 17 – 21	
#3	Oily Mess
Time	Two 45 minute sessions
Materials	• Internet access • Needed for each group-2 aluminum foil pie tins, water, used motor oil, dropper, cotton balls, nylon, string, paper towels, dishwashing liquid, feather
Guiding Questions	
How does developing the energy resources affect our oceans and beaches?	
Plan	
Plans for part 1 of activity • Students write questions K and L in Science notebook and view http://safeshare.tv/w/pitkHWZeyc and https://www.youtube.com/watch?v=BEWMqK5H4Z0 29. What did the oil spill do to the animals and thesurrounding areas? 30. How will the oil spill affect our ocean and beaches? After viewing the videos students will answer the two questions. Plans for part 2 of activity • Students pair up to complete the Oily Mess lab at https://drive.google.com/a/ccpsd.k12.va.us/?tab=mo#all and answer the questions found in the lab.	
Differentiation	• **Simplify the lab**
ELL Modification	• Pair student with English speaking student.
Check for Understanding	Listen to responses in Discourse

Activities Days 17 – 21	
#4	Land and Ocean Relationships
Time	Four 45 minute sessions
Materials	• Stream table with buckets and stage, water, sediment, rocks of various sizes, sheet of heavy-duty aluminum foil, clay, toothpicks The lab may be found at: http://www.cposcience.com/home/Portals/2/Media/post_sale_content/PES/PES_Chap_23/StudentRecordSheets/PES_INV_AS_23B.pdf

Guiding Questions

1. What is the relationship between the oceans and land?

Plan

Plans for part 1 of activity – Coastal Erosion

1. Set up your stream table so that it is on the lowest rung of the stand.
2. Fill the top third of the stream table with a layer of sand that is nearly to the top of the stream table's walls.
3. Adjust the spigot at the end of the stream table so that water will not drain from it.
4. Use the buckets and fill the bottom portion of the stream table with water so that it just reaches the sand.
   Note: The water level should not be more than half the thickness of the sand.
5. Shape out a unique coastline in the stream table using your hands. If necessary wet the sand a bit to help shape your coastline.

Students make the prediction and answer the question for Part 1. Discourse on Part 1

Plans for part 2 of activity

1. Draw the shape of your original coastline in Table 1.
2. Use the plastic trough and generate waves in the stream table. Observe and draw the resulting eroded coastline in Table 1
3. Students will sketch and describe the coastline before waves and after the waves. Discourse

Plans for part 3 of activity – Breakwaters

1. Using the rocks, create a wall that extends just above the level of the water and runs parallel to half of your coastline. (Make your breakwater about 3–4 cm away from the shoreline.
2. What do you think will happen to the coastline when you start generating waves? Make a prediction about the coastline behind the breakwater, and the coastline not behind the breakwater in Table 2.
3. Use the plastic trough and begin generating waves. Watch what happens to the shoreline behind the breakwater and also along the coastline that is not behind the breakwater. Record your observations in Table 2.
4. Sketch the new eroded shape of the coastline with the model breakwater in your stream table in Table 2. Discourse

Plans for part 4 of activity – Seawalls

1. Remove your breakwater. Refer to your sketch in Table 1 to reshape the coastline as close as possible to the original coastline.
2. The piece of aluminum will serve as your model seawall. Fold it over upon itself several times until your piece is about 10 centimeters tall. Insert the seawall down
3. into the sand so that at least 5 centimeters of aluminum sticks up above the sand. Place the seawall 15 cm landward from the edge of the water.
4. Make a prediction and sketch a side view (not a birds-eye view as used with the breakwater example) of what will happen to the part of the coast in front of the seawall and the beach behind the seawall. Record your prediction in Table 3.

5. Use the plastic trough and begin generating waves.
6. Observe and record what happens to the coast in front of the seawall and the beach behind the seawall in Table 3.
7. Sketch a side view of the new eroded shape of the coastline with the seawall in your stream table in Table 3. Discourse

Plans for part 5 activity – Houses

1. Remove your seawall. Reshape the coastline as close as possible to the original coastline you shaped.
2. Make 2 to 3 miniature houses with the clay. Stick toothpicks in each corner of the bottom of your houses. Insert these "stilt houses" near the edge of your coastline.
3. Make a prediction and sketch a side view of what will happen to the sand on the coastline that is supporting the three stilt houses, and the sand where there are no houses. Record your prediction in Table 4.
4. Use the plastic trough and begin to generate waves in your model. Observe the erosion in areas where houses have been built in the coastline and areas where there are no houses. Record your observations in Table 4.
5. Sketch a side view of the new eroded shape of the coastline with houses in your stream table in Table 4. Answer questions included in the lab. Discourse

Differentiation	• **Simplify the lab**
ELL Modification	• Pair student with English speaking student.
Check for Understanding	• Listen to responses in Discourse and read answers to the questions in the lab. Look over the sketches.