

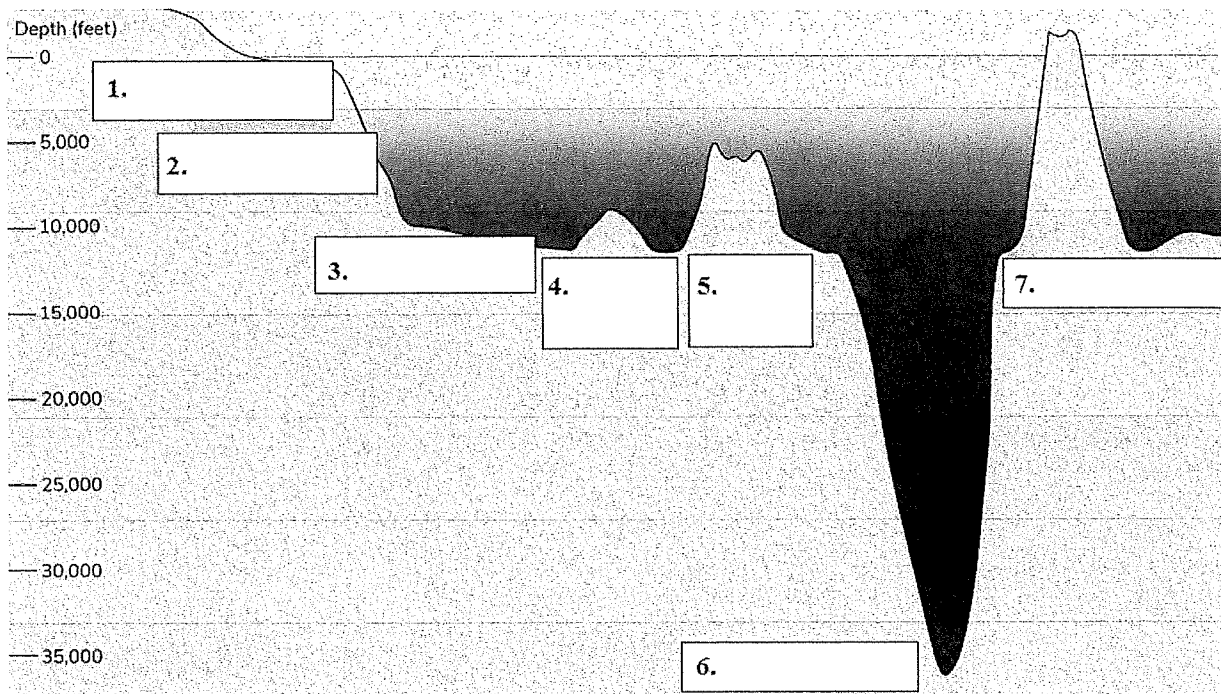
Name: \_\_\_\_\_



# Oceans Unit

## Underwater Land Forms of the Ocean

Please fill in the numbered boxes using your **notes** and the **word bank** below



This graphic shows several ocean floor features on a scale from 0-35,000 feet below sea level. The following features are shown at example depths to scale, though each feature has a considerable range at which it may occur: continental shelf (300 feet), continental slope (300-10,000 feet), abyssal plain (>10,000 feet), abyssal hill (3,000 feet up from the abyssal plain), seamount (6,000 feet up from the abyssal plain), ocean trench (36,000 feet), and volcanic island (above sea level). (NOAA Office of Education)

### Word Bank:

**Continental Shelf    Seamount (Guyot)    Ocean Trench    Abyssal Plain**  
**Volcanic Island    Continental Slope    Abyssal Hill**

Ocean Floor Feature:	Description:
<b>Continental Shelf</b>	
<b>Shelf Break</b>	
<b>Continental Slope</b>	
<b>Continental Rise</b>	
<b>Abyssal Plain</b>	
<b>Mid-Ocean Ridge</b>	

<b>Seamount</b>	
<b>Guyot</b>	
<b>Ocean Trench</b>	

### **Methods of Mapping the Ocean Floor:**

The properties of the ocean floor are determined both by direct observations and by remote sensing. Describe in detail one example of **direct mapping** and one example of **remote mapping**. If possible, draw a diagram.

## Water Salinity & Temperature Lab:

In small groups you will be completing two experiments to see how temperature and salinity affect water density. Send one member of your group to the front of the class to collect your supplies.

### Part 1: Temperature

#### **Materials:**

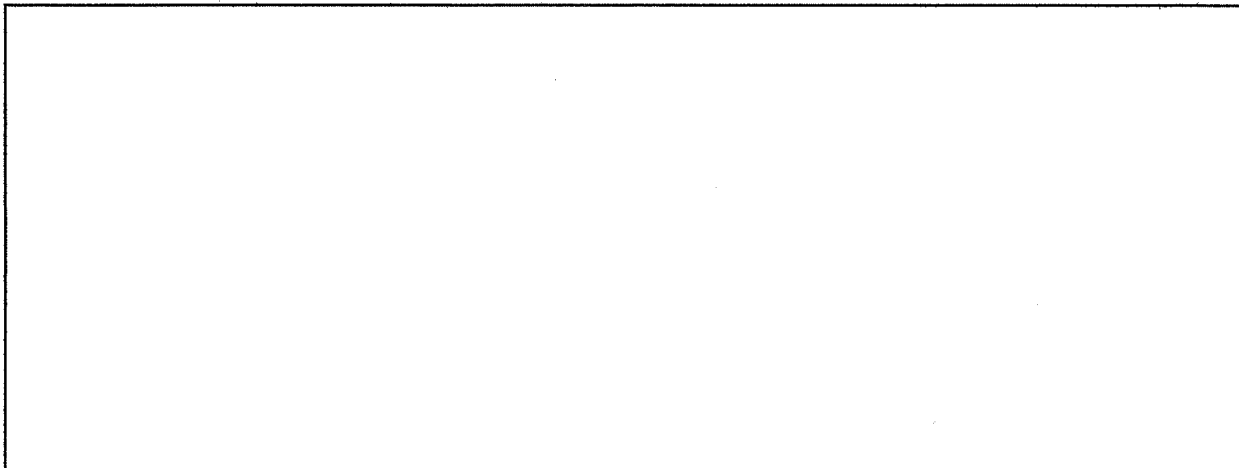
- 2 small glasses
- 1 large clear tub filled with clear room temperature water
- Warm water
- Cold water
- Blue dye
- Yellow dye

Once you have picked up your materials head back to your station and begin the experiment with the following steps below:

#### **Set Up:**

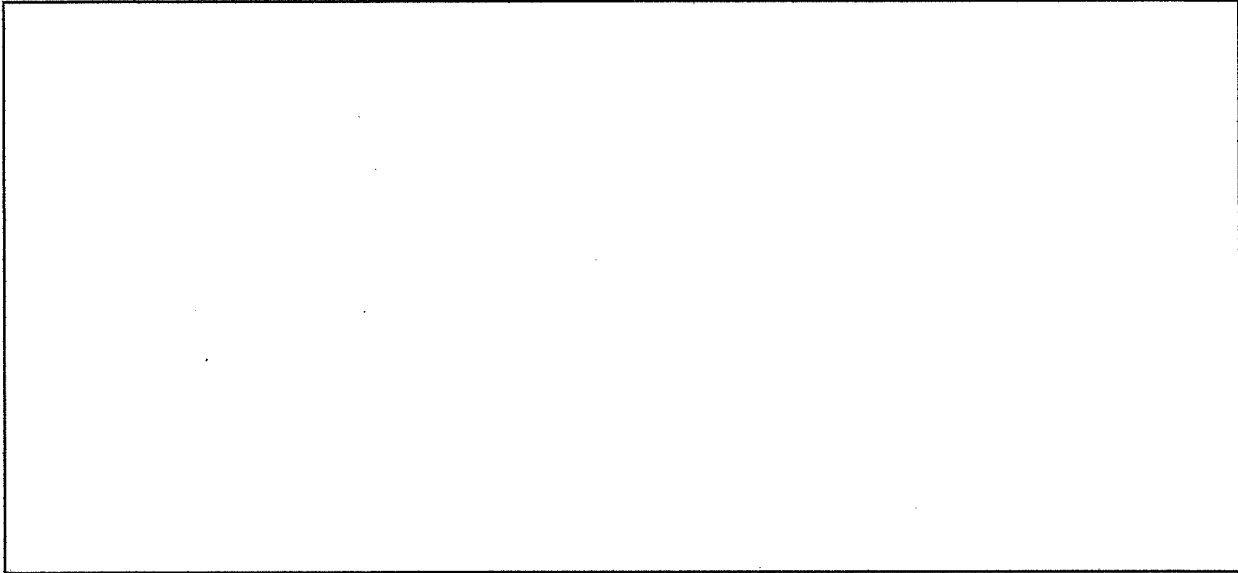
1. Fill one small glass with warm water and add 5 drops of yellow food dye. Mix well.
2. Fill the second small glass with cold water and add 5 drops of blue food dye. Mix well.

**Hypothesis:** In the box below, draw what you think will happen if we place the two glasses, at the same time, upright at the bottom of the large tub of water.



**Observations:**

Slowly place the two glasses upright at the bottom of the tub of water. Draw what is happening in the box below.

**Analysis:**

As a group, compare both of your drawings and discuss why you think this is happening. Did your observations match what you were expecting to see? Explain why or why not. Write down all your thoughts and explanations below.

## **PART 2: Salinity**

### **Materials:**

- 2 small glasses
- Room temperature water
- Salt
- 1 large clear tub filled with clear room temperature water
- Green dye
- Red dye

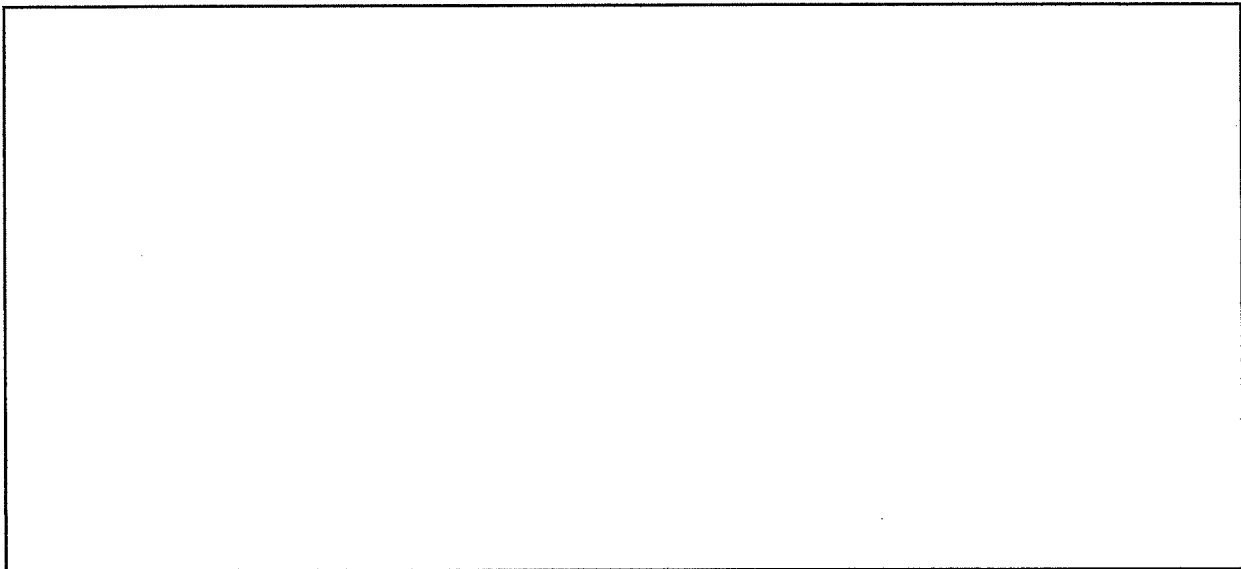
Once you have picked up your materials head back to your station and begin the experiment with the following steps below:

### **Experiment Set Up:**

1. Fill one small glass with water and add 5 drops of green dye. Mix well.
2. Fill the second small glass with a spoonful of salt, water, and 5 drops of red dye. Mix well.

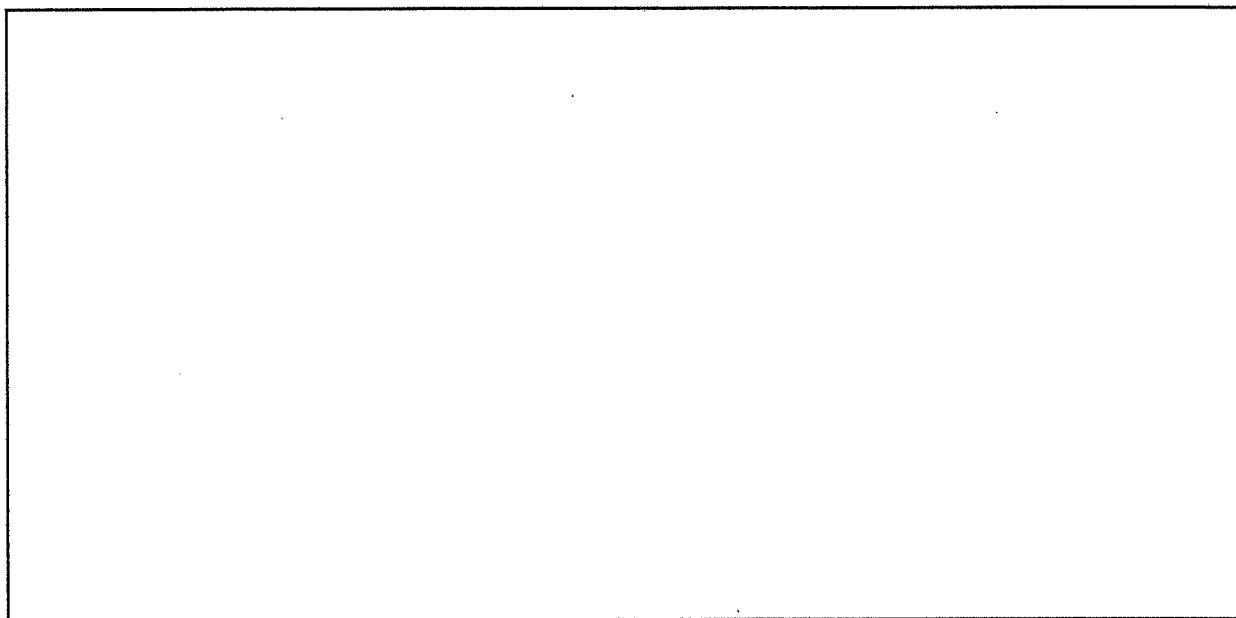
### **Hypothesis:**

In the box below, draw what you think will happen if we place the two glasses, at the same time, upright at the bottom of the large tub of water.



**Observations:**

Slowly place the two glasses upright at the bottom of the tub of water. Draw what is happening in the box below.

**Analysis:**

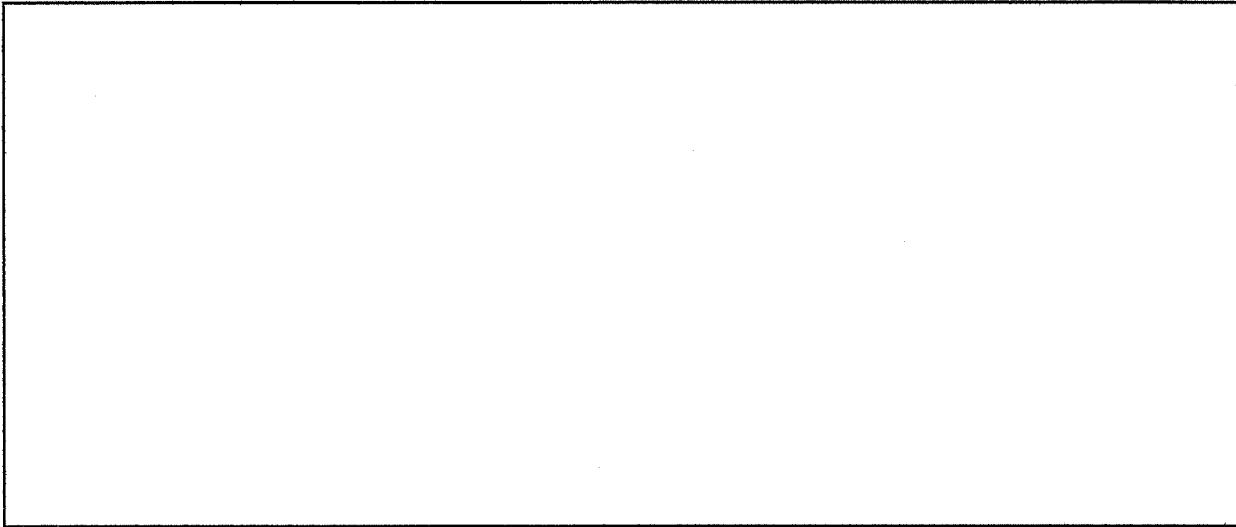
As a group, compare both of your drawings and discuss why you think this is happening. Did your observations match what you were expecting to see? Explain why or why not. Write down all your thoughts and explanations below.



### **Part 3: Class Demo - Temperature & Salinity**

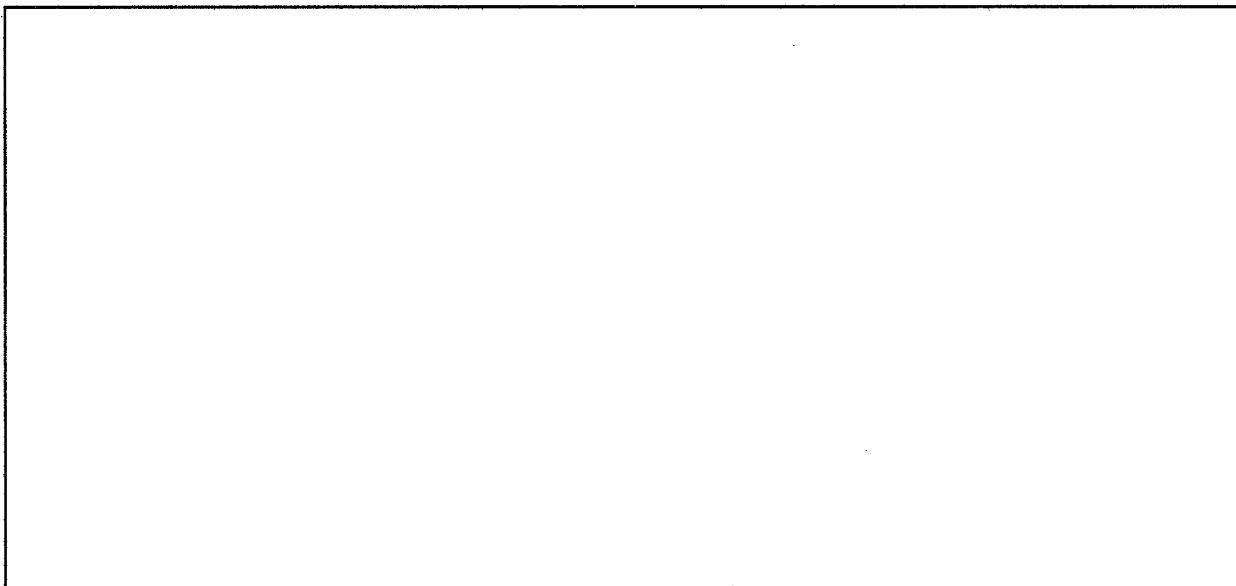
#### **Hypothesis:**

In the box below, draw what you think will happen to the water in the glasses if one glass contains cold and salty water (colored blue) and the other glass contains warm and un-salted water (colored red).



#### **Observations:**

In the box below, draw what happens to the water in the glasses when they are placed in the large tub of water.



### Analysis & Conclusion Questions:

1. Did your observations match what you were expecting to see? Explain why or why not.

2. Do you think that ocean water is always at the same temperature and salinity? Explain why or why not.

*Hint: If you measured the temperature and salinity of the Ocean near the North Pole would the measurements match those taken near the Equator?*

3. How do you think temperature and salinity affect ocean currents? Explain your thoughts based on the observations you made in this lab.

## **Properties of Ocean Water**

### **Salinity:**

*What is salinity?*

*How is salinity measured?*

*Where do ocean salts come from?*

*What affects salinity levels?*

### **Temperature:**

*What is a Thermocline?*

### **Density:**

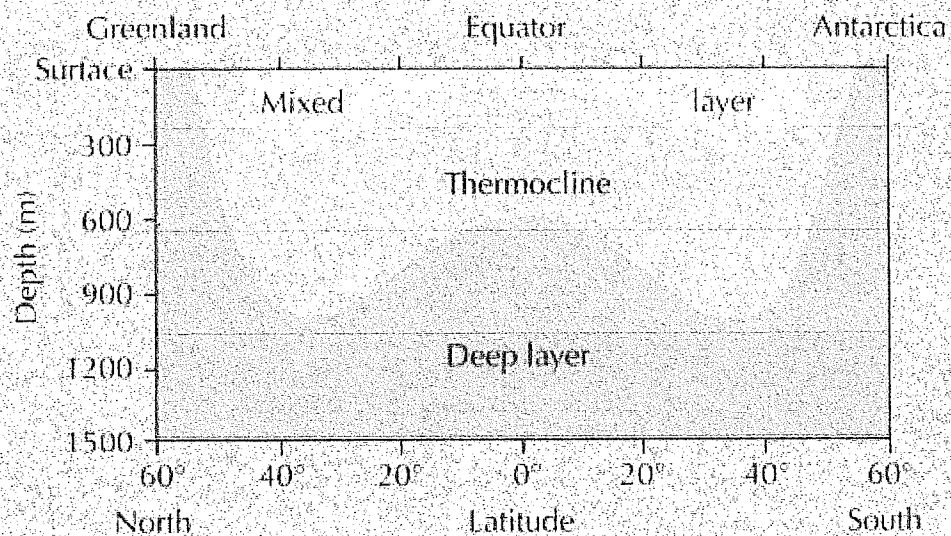
*How do we calculate water density?*

*What water property affects its density?*

## Ocean Layers

*The ocean is divided into three temperature and density layers, which vary in their characteristics depending on latitude and depth. Add a description for each of the layers below:*

Layer	Temperature	Density
Surface, Low Latitude		
Middle, Low Latitude		
Deep Water and Poles		



## Oceans Technology-Art Project

We know more about space than we do about our own oceans! However, technology is fast evolving and making significant impacts to what we know, and how we're contributing to saving oceans from climate change/human impact.

**Your task:** Inquire into the technology that drives our knowledge and exploration of the oceans by focusing in on one category and one type of technology. Find out what we do know, what we are still trying to learn, and/or what we are doing about the damages we've caused?

- ☐ Step 1: Choose one of the following four categories
  - Climate Change: what is the impact of climate change on our oceans, how can we predict/model these changes, etc.
  - Weather: how is our weather impacted by our oceans, how can we predict/model these changes, etc.
  - Ocean Exploration: deep ocean exploration, discovering new species and/or places, etc.
  - Ocean Solutions: solutions to problems in the ocean such as: plastic islands, coral bleaching, etc.
- ☐ Step 2: Choose a technology, this may require a little researching! Find **one** piece of technology/technological development that you wish to learn more about.
- ☐ Step 3: Decide how you will share your findings **artistically**. This could be a model, sculpture, film, collage, music, painting, poster, etc.)

The **category** I have chosen is: \_\_\_\_\_

The **technology** I will research is: \_\_\_\_\_

List one website or resource where you have found some starting information below

My artistic product will be: \_\_\_\_\_

Signed by Ms. Clark \_\_\_\_\_

- ☐ Step 4: Research. You must include the following information in an **artist's statement** along with your artistic creation:
  - In what ways has our **understanding** of the oceans **changed over time** since the invention of your technology? What is the impact of your technology on our understanding of oceans and/or your category.
  - What are some of the social, ethical, economic, and/or environmental **impacts** of your technology, specifically in relation to our oceans.
  - *You can refer to the attached Artist Statement Flow Chart to help you write out your artist statement.*

## Oceans Technology-Art Project Grading Rubric

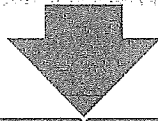
7	6-5	4-3	2-1	0	
**	Creative piece clearly demonstrates the topic/technology. It is complete and relevant	Creative piece is complete, and relevant.	Creative piece is complete.	Student does not meet any of the descriptors	<b>Construct, models, and/or diagrams</b>
**	<b>Describe</b> the ways in which our understanding of oceans has changed over time with reference to your technology	<b>Summarize</b> the ways in which our understanding of oceans has changed over time with reference to your technology	<b>Outline</b> the ways in which our understanding of oceans has changed over time with reference to your technology	Student does not meet any of the descriptors	<b>Consider changes in knowledge over time as tools and technologies have developed</b>
**	<b>Discuss</b> the implications of your technology with reference to our oceans	<b>Summarize</b> the implications of your technology with reference to our oceans	<b>Outline</b> the implications of your technology with reference to our oceans	Student does not meet any of the descriptors	<b>Consider social, ethical, and environmental implications of the findings</b>
Sources are <b>completely documented</b> (including both a reference list and in-text citations)	<b>Most</b> sources are documented <b>correctly</b>	Sources are <b>sometimes</b> documented <b>correctly</b>	Sources are documented, <b>with limited success</b>	Student does not meet any of the descriptors	<b>Critically analyze the validity of information in primary and secondary sources</b>

\*\* You have an opportunity to tell me, how you went above and beyond the level 6-5 criteria. *Explain* how you think you went beyond what was explicitly asked for to earn the full level 7.

## Artist Statement Flow Chart

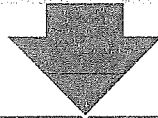
### 1. Describe your artwork

Some questions to consider: What does your artwork look like? What is the subject matter? What is the title of your work? What elements or principles are most obvious in your work?



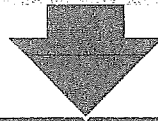
### 2. How did you create your art?

Some questions to consider: What media is your artwork made from? What tools, techniques or processes did you use to create your artwork?



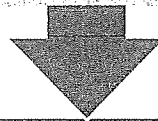
### 3. What is the big idea behind your artwork?

Some questions to consider: What or who inspired your artwork? Does your work express a personal or social issue? What emotions did you try to show in your artwork?



### 4. What were your goals for this artwork?

Some questions to consider: What are your goals as an artist? Did this piece help you reach your goals? Why or why not?



### 5. What are your overall thoughts of your artwork?

Some questions to consider: What did you learn in creating this artwork? Is the final piece what you imagined? How so? How will this piece influence your future artworks?

## Ocean Currents

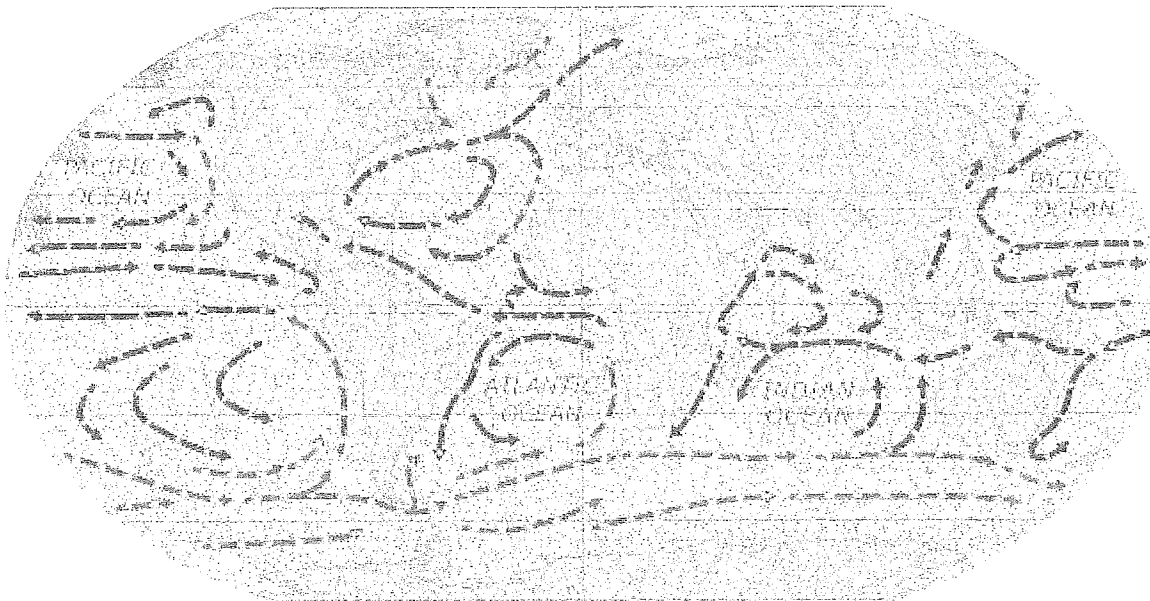
### Ocean Surface Currents:

*What is the causes ocean surface currents?*

*Most ocean surface currents in the world follow a circular motion movement called a \_\_\_\_*

*Why do you think ocean currents move in a circular movement?*

*Do surface ocean currents affect coastal climates?*





## **Deep-Ocean Circulation – the Ocean Conveyor:**

*Deep-Ocean circulation is caused by the vertical displacement of water in the ocean. What causes this vertical displacement?*

*Describe the steps of Thermohaline circulation:*

In high latitudes, \_\_\_\_\_ water on the surface of the ocean gets \_\_\_\_\_ as water \_\_\_\_\_ due to wind. When sea ice forms, it pulls pure water out of the ocean, leaving salt behind making the ocean water even \_\_\_\_\_. This saltier colder water is now \_\_\_\_\_ so it sinks deep into the ocean and moves along the depths until it can rise to the \_\_\_\_\_.

Heat from the \_\_\_\_\_ eventually \_\_\_\_\_ the cold water at the \_\_\_\_\_, where \_\_\_\_\_ makes the water saltier. This warm salty water is carried northwards by large powerful \_\_\_\_\_ ocean currents like the Gulf Stream, up the U.S. East coast, then into the North Atlantic region where it releases heat into the \_\_\_\_\_ and warms Western Europe. This water becomes very \_\_\_\_\_ and \_\_\_\_\_ again, sinks to the deep ocean, and the cycle continues.

*What does the abbreviation "AMOC" stand for?*

*How does AMOC affect climate?*

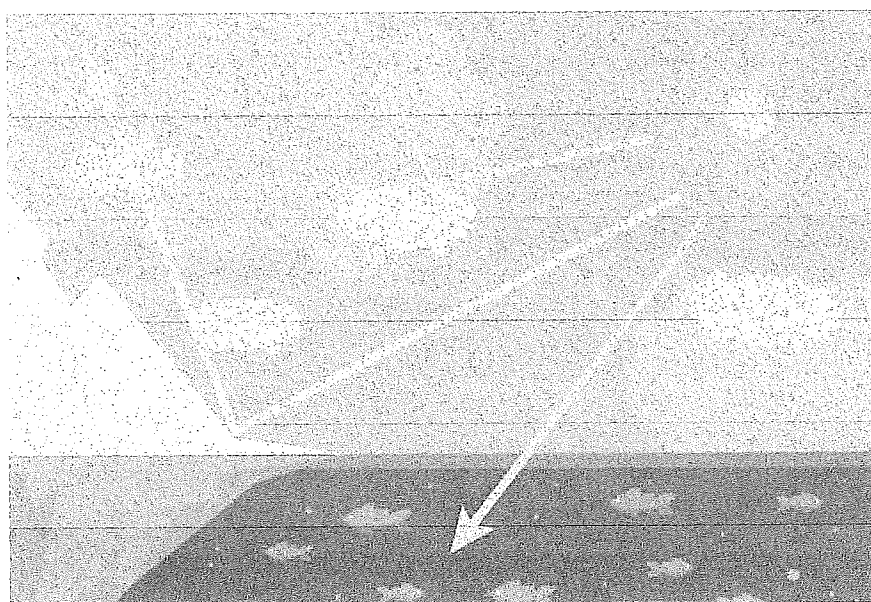
*What climate change effect could disrupt the deep-ocean circulation cycle? How so?*

## Oceans and Climate

### Albedo Effect:

Albedo is the ability of a surface to reflect sunlight (heat from the Sun)

- \_\_\_\_-coloured surfaces return a large part of the sunrays back to the atmosphere -> \_\_\_\_ albedo
- \_\_\_\_-coloured surfaces absorb the sunrays -> \_\_\_\_ albedo



Most of the Sun's radiation is \_\_\_\_\_ by the ocean.

The ocean doesn't just store solar radiation, it also helps to distribute \_\_\_\_\_ around the globe.

Ocean water is constantly \_\_\_\_\_, increasing the temperature and humidity of the surrounding air to form \_\_\_\_ and \_\_\_\_\_ that are then carried by trade winds. Almost all rain that falls on land starts off in the ocean. The tropics are particularly rainy because heat \_\_\_\_\_, and thus ocean evaporation, is highest in this area.

Outside of Earth's equatorial areas, weather patterns are driven largely by \_\_\_\_\_. Ocean currents act much like a conveyor belt, transporting warm water and precipitation from the equator toward the \_\_\_\_\_ and cold water from the poles back to the \_\_\_\_\_. Thus, ocean currents regulate global \_\_\_\_\_, helping to counteract the uneven distribution of solar radiation reaching Earth's surface. Without currents in the ocean, regional temperatures would be more \_\_\_\_\_ — super \_\_\_\_\_ at the equator and \_\_\_\_\_ toward the poles.

### **El NIÑO:**

*What is El NIÑO?*

*What causes an El NIÑO event? Describe what happens.*

*How often to El NIÑO events take place?*

*What kind of effects does El NIÑO cause?*

## Climate Change Indicators: Ocean

*Read through the following article and fill in the table below accordingly:*

<https://www.epa.gov/climate-indicators/oceans>

	Description
<b>Ocean Heat</b>	
<b>Sea Surface Temperatures</b>	
<b>Sea Level</b>	
<b>Ocean Acidification</b>	
<b>Coastal Flooding</b>	

# INTRODUCTION

Átl'ka7tsem/Txwnéwu7ts/ Howe Sound is a coastal fjord ecosystem in the Salish Sea. It is a vital area to First Nation communities, providing natural resources that allowed Indigenous peoples to thrive for generations before colonization. Following colonization and years of destructive human activity, such as industrial and coastal development, efforts are currently underway by government, industry groups, and local communities to transition the Sound's marine ecosystem from crisis to recovery. Indigenous communities, in particular, are working hard to restore life and traditional practices for generations to come.

To restore and maintain the ongoing health of the coastal ocean environment we need to understand its species and habitats, the impact of human activities on this biodiversity, and adaptation actions to succeed despite the effects of climate change.

In 2021, Átl'ka7tsem/ Txwnéwu7ts/ Howe Sound was designated as an UNESCO Biosphere Region due to its global ecological significance as well as the collaborative efforts of First Nations, government, industry groups, and other community members towards sustainable management and restoration. A year prior to the designation, Ocean Wise released an extensive report on the state of the Howe Sound ecosystem with health ratings, key issues, and action plans for important species and geography across the Sound. In this kit, students will be encouraged to utilize the 2020 report to discover more about the biodiversity, sustainable resource management, and climate action specific to this area.

Using Átl'ka7tsem/ Txwnéwu7ts/ Howe Sound as a case study, students can recognize how ecosystems, species, human impact, and climate change are interconnected. This work is essential for students to make informed decisions as the future stewards of our planet.

# ATL'KITSEM / TEXWNÉWETS' HOWE SOUND MARINE CONSERVATION ASSESSMENT

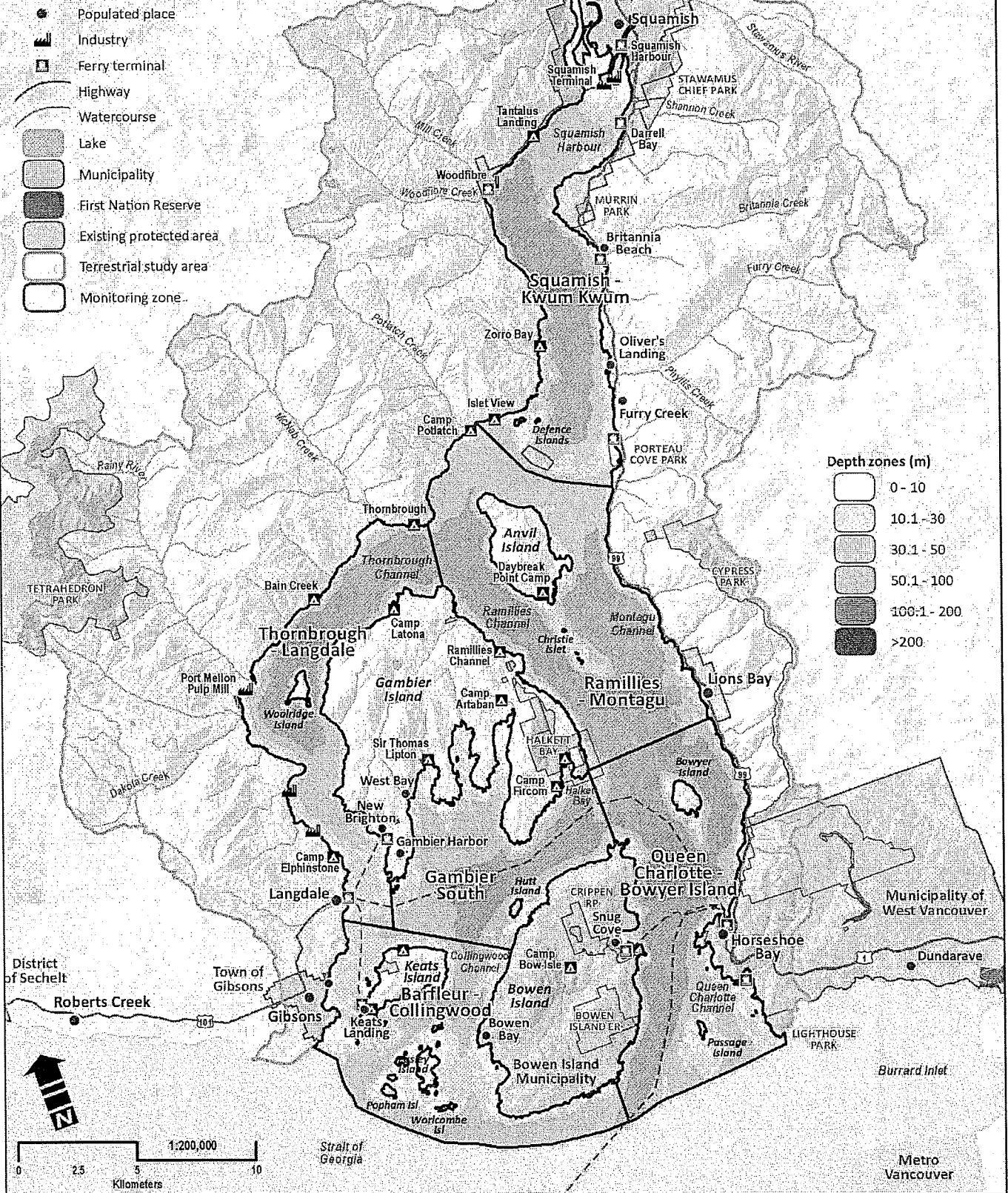


figure 1. Átl'ka7tsem/Txwnéwu7ts /Howe Sound, depicted by the gray lines. The watershed that feeds into Átl'ka7tsem/Txwnéwu7ts/ Howe Sound extends north – east and is therefore not shown in its entirety. From: Beaty F, van Riet W, Wareham B, Schultz J. Howe Sound/Átl'ka7tsem/Txwnéwu7ts Map. Ocean Wise and David Suzuki Foundation; 2019. Available from: <http://howesoundconservation.ca>

## HOWE SOUND REFLECTION QUESTIONS

1. What are the most powerful ways Átl'ka7tsem/ Txwnéwu7ts/ Howe Sound can be protected from the ongoing impacts of climate change?
2. What are the most impactful ways to reduce greenhouse emissions at the individual, local, provincial, national, and global level?
3. What are some examples of how scientific understanding enables humans to respond and adapt to climate change?