



## **PHYSICAL OCEANOGRAPHY UNIT**

### **LESSON PLAN 3<sup>rd</sup>-5<sup>th</sup> grade**

#### Topics

Introduction to Physical Oceanography  
Properties of Water  
Tides  
Waves  
Currents & Gyres

#### Objectives

Students will be able to:

- Identify the four branches of oceanography
- Create a density model based on the properties of water
- Explain the differences between high tide and low tide and how they are created
- Compare and contrast different types of currents and what causes them
- Evaluate how wind affects wave action
- Describe the benefits of surface and deeper water current

#### Instructional Materials

Topic Video  
Vocabulary Flash Cards

#### Assessment Materials

Video Reflection Worksheet  
Video Quiz  
Introduction to Oceanography Worksheet (answer PDF available)  
Properties of Water Worksheet (answer PDF available)

- do at home experiment

Tides Worksheet (answer PDF available)  
Waves Worksheet (answer PDF available)

- do at home experiment

Currents & Gyres Worksheet (answer PDF available)

#### Related Materials

Links to videos and reading material that provides additional information on topics.

#### *Topic articles (can adjust lexile levels)*

- [https://newsela.com/read/natgeo-oceanography/id/48143/?collection\\_id=339&search\\_id=5f60783a-ef11-4f37-a155-b752f8b1b62b](https://newsela.com/read/natgeo-oceanography/id/48143/?collection_id=339&search_id=5f60783a-ef11-4f37-a155-b752f8b1b62b)
- [https://newsela.com/read/dream-job-Deep-Sea-Submersible-Pilot/id/36297/?collection\\_id=339&search\\_id=246e5aa6-a055-4e6a-9f56-64679fe5e36e](https://newsela.com/read/dream-job-Deep-Sea-Submersible-Pilot/id/36297/?collection_id=339&search_id=246e5aa6-a055-4e6a-9f56-64679fe5e36e)
- [https://newsela.com/read/natgeo-simulating-global-ocean/id/2000002559/?collection\\_id=339&search\\_id=023f7274-9854-4d8a-b62c-d8ac95079f1e](https://newsela.com/read/natgeo-simulating-global-ocean/id/2000002559/?collection_id=339&search_id=023f7274-9854-4d8a-b62c-d8ac95079f1e)
- [https://newsela.com/read/natgeo-ocean-conveyor-belt/id/50391/?collection\\_id=339&search\\_id=a33051ce-c65c-4bfd-a3e1-9241d6f715d7](https://newsela.com/read/natgeo-ocean-conveyor-belt/id/50391/?collection_id=339&search_id=a33051ce-c65c-4bfd-a3e1-9241d6f715d7)



*Topic articles continued (can adjust lexile levels)*

- [https://newsela.com/read/lib-ocean-currents/id/2001006569/?collection\\_id=339&search\\_id=cb192c53-d14f-4104-ad10-61c5f0be0a27](https://newsela.com/read/lib-ocean-currents/id/2001006569/?collection_id=339&search_id=cb192c53-d14f-4104-ad10-61c5f0be0a27)
- [https://newsela.com/read/lib-nasa-tides-ocean/id/26285/?collection\\_id=339&search\\_id=3bd897c8-7795-405f-8948-65a6d9952347](https://newsela.com/read/lib-nasa-tides-ocean/id/26285/?collection_id=339&search_id=3bd897c8-7795-405f-8948-65a6d9952347)
- [https://newsela.com/read/elem-sci-waves/id/29472/?collection\\_id=339&search\\_id=7a1266d0-4999-4b2d-8366-1d2859a98b59](https://newsela.com/read/elem-sci-waves/id/29472/?collection_id=339&search_id=7a1266d0-4999-4b2d-8366-1d2859a98b59)

### *NOAA Resources*

The National Oceanic and Atmospheric Administration (NOAA) is a partner of SoundWaters. These are additional resources you may use in addition to the other materials included above.

### *Tides*

[https://oceanservice.noaa.gov/education/tutorial\\_tides/tides01\\_intro.html](https://oceanservice.noaa.gov/education/tutorial_tides/tides01_intro.html)  
[https://oceanservice.noaa.gov/education/tutorial\\_tides/tides02\\_cause.html](https://oceanservice.noaa.gov/education/tutorial_tides/tides02_cause.html)  
[https://oceanservice.noaa.gov/education/tutorial\\_tides/tides05\\_lunarday.html](https://oceanservice.noaa.gov/education/tutorial_tides/tides05_lunarday.html)  
[https://oceanexplorer.noaa.gov/edu/learning/10\\_tides/activities/predicting\\_tides.html](https://oceanexplorer.noaa.gov/edu/learning/10_tides/activities/predicting_tides.html)  
<https://www.noaa.gov/education/resource-collections/ocean-coasts-education-resources/tides>

### *Waves*

<https://coast.noaa.gov/data/SEAMedia/Lessons/G4U2L3%20Waves.pdf?redirect=301ocm>  
<https://coast.noaa.gov/data/SEAMedia/Lessons/G4U2L3%20Waves.pdf> \*used for waves experiment  
<https://oceanservice.noaa.gov/education/kits/currents/03coastal1.html>

### *Oceanography*

<https://oceanexplorer.noaa.gov/edu/oceanage/welcome.html> \*careers  
<https://oceanservice.noaa.gov/facts/oceanographer.html>

### *Currents & Gyres*

<https://sos.noaa.gov/sos-explorer/download-sos-explorer-mobile/>  
<https://oceanservice.noaa.gov/education/kits/currents/08affect.html>  
<https://oceanservice.noaa.gov/education/kits/currents/05currents1.html>  
<https://oceanservice.noaa.gov/education/kits/currents/06conveyor.html>  
<https://oceanexplorer.noaa.gov/facts/currents.html>  
[https://oceanservice.noaa.gov/education/pd/tidescurrents/tidescurrents\\_currents.html](https://oceanservice.noaa.gov/education/pd/tidescurrents/tidescurrents_currents.html)  
<https://www.noaa.gov/education/resource-collections/elementary-resources/elementary-resources-physical-science>

### NGSS Standards

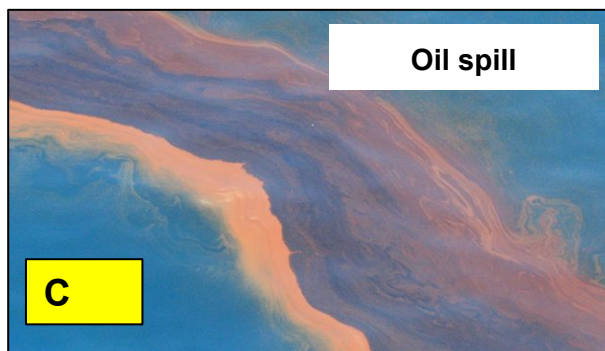
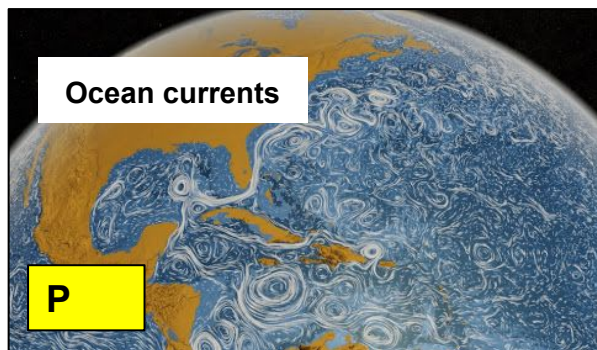
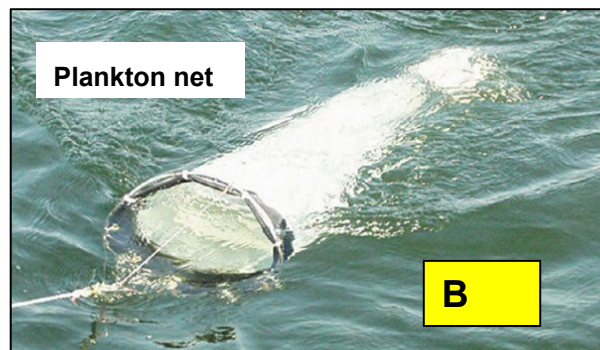
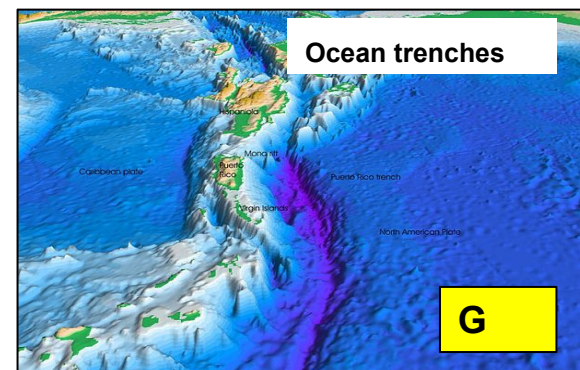
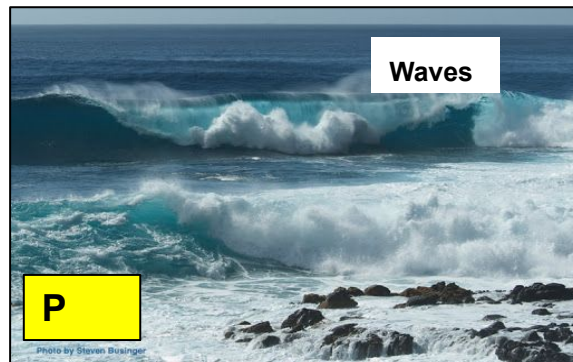
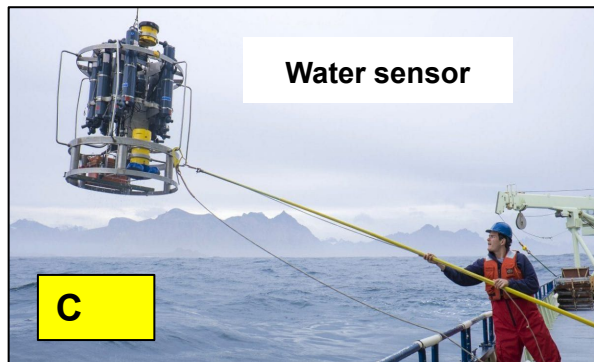
Waves and Information: 4-PS4-1;  
Structure and Properties of Matter: 5-PS1-3  
Earth and the Solar System: 5-ESS1-2

# INTRODUCTION TO OCEANOGRAPHY

## ANSWER KEY

Oceanography is divided into 4 categories, Chemical (C), Biological (B), Physical (P), Geological (G)

Which category does each topic or piece of equipment belong to? Write the letter (C,B,P or G) in the yellow box.



# PROPERTIES OF WATER: DENSITY

## ANSWER KEY

In the video, we learned that the density of water is dependent on what is dissolved inside of it.

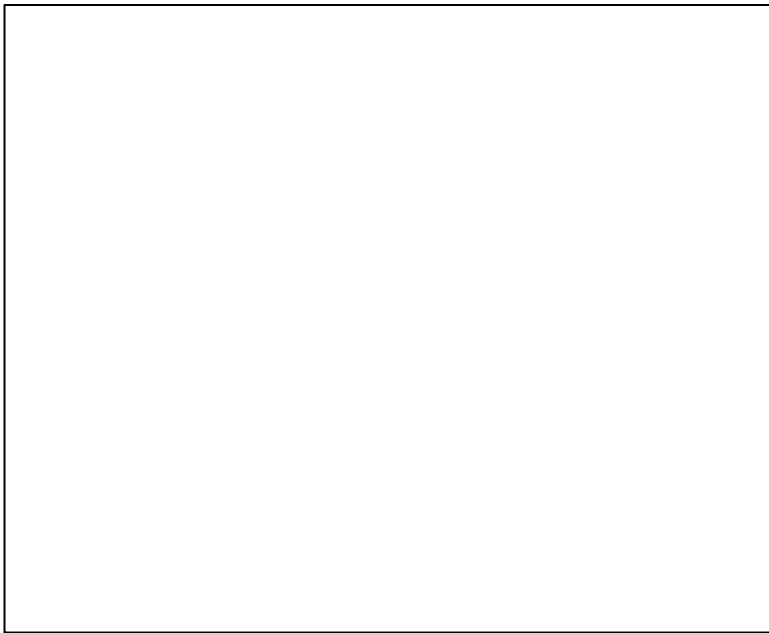
Label the following types of water with how dense they are (most, least, middle)

Fresh least

Salt most

Brackish middle

Create your own stacked water sample at home using the following materials: salt, water, a clear glass, and food coloring. Take a picture and label each of the layers.



Top layer fresh

Middle layer brackish

Bottom layer salt

Now try putting the layers in BACKWARDS, what happens as you try to keep them separated? Explain why.

If you try to put the layers in backwards, the salt and brackish may try to sink below, but most likely they will just all mix and make one color



**SoundWaters**  
Protecting Long Island Sound through Education

**Why is it important for the fisherman who owns this boat to understand what a tide is and how the tides affect him?**



Answers may vary, but some common themes

- The fisherman should understand that the tide causes the water levels to rise and fall throughout the day as the earth turns
- High tide and low tide are several hours apart, so the boat could get stuck and the fisherman can't get to it
- If the fisherman is trying to catch certain types of animals, they may only be available during certain times of the day

# WAVES ANSWER KEY

Conduct your own wave experiment at home to describe how and why a wave changes with the strength of wind.

You will need the following materials:

- A pan or container to make your waves in
- Your breath
- A soda can or a soup can (something cylindrical that you can press into the water)
- A fan (optional)

We are going to examine how the strength of the wind affects the waves that are produced

- 1) Fill the pan about  $\frac{1}{4}$  to  $\frac{1}{2}$  full of water. You may want to put a towel under it or do this outside in case the water splashes. Set it on a flat surface and do not move it.

## What happens when there is no wind?

When there is no wind, the water should be still, not moving

- 2) *Make a guess:* **How do you think the waves will be different when you blow on the water soft and then when you blow on the water harder?**

Some ways you can refer to the waves: number, height, strength, how often

Answers may vary

Number of waves: Less with softer wind

Height: higher with stronger wind

Strength: may hit the sides harder or reach higher up the pan with stronger wind

How often: more frequent with harder wind

## WAVES ANSWER KEY

- 3) **Blow slowly on the surface of the water for 5 seconds. What do you notice about the waves? Make 3 observations**

1)     Answers vary
2)     Answers vary
3) Answers vary

- 4) **Blow harder on the surface of the water for 5 seconds. What do you notice about the waves? Make 3 observations**

1)     Answers vary
2)     Answers vary
3)     Answers vary

## WAVES ANSWER KEY

- 5) **Conclusion:** How did your experiment results compare to what you thought would happen?

Answers vary

- 6) Now pretend there is a tsunami or event with REALLY strong wave action. Using either a fan or the soda/soup can, press down hard into the water on one side of pan. **Make 3 observations on what happened**

1) answers vary

2) answers vary

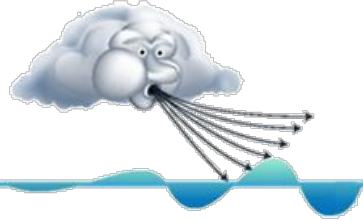
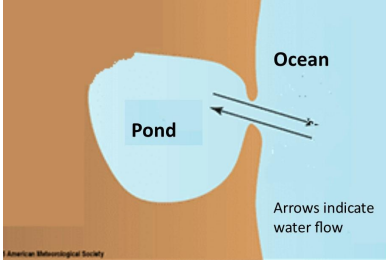
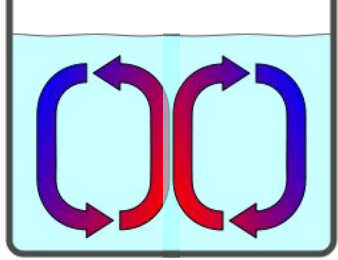
3) answers vary

- 7) **If a strong wave event happened near a coastal city, how would it be affected?**

A strong enough wave could cause a lot of erosion, which could weaken the buildings and enough waves could cause flooding

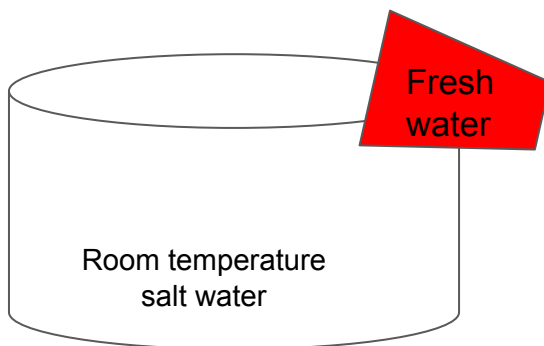
# CURRENTS ANSWER KEY

Match these causes with the correct type of current by putting them in the correct box:

Surface Current	Tidal Current	Thermohaline Current
		

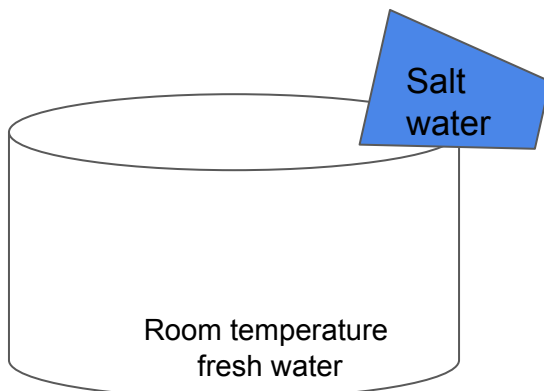
In the video, you learned that the temperature and salinity (salt content) of the water contribute to ocean currents. **What will happen in each of these situations where a cup of water is poured into a larger tank of water ? Explain why**

*red = hot water, blue = cold water*



### The hot fresh water will

Rise to the top of the container because heat rises and so does fresh water. The fresh water is less dense



### The cold salt water will

Sink to the bottom of the container because salt water is more dense. Cold water also sinks.