Name: _____
Period: _____
Due Date: _____

Meteorology 1 - Density and Ocean Currents

include light ice, heavy water experiment?

_____ I. What is density?

- _____ A. **Density Vodcast**
- _____ B. **Density Labs**
  - _____ **#1**
  - _____ **#2**
  - _____ **#3**
  - _____ **#4**
  - _____ **#5**
- _____ C. **Density Online Practice**
- _____ D. **Density Practice Problems**
- _____ E. *Will it float? Demonstration(s)* (INCLUDE differences w/ salt water)
- _____ F. *Liquid Layers Lab* -
- _____ G. *Human Density Activity*
- _____ H. **Density Ediscio Flash Cards**
- _____ I. **Density Standard Check** _____ Percent Score

_____ II. How are ocean currents created? How do they influence the land?

- _____ A. *Oceans bellringer*
- _____ B. *Bill Nye Oceanography video*
- _____ C. *Oceans Jigsaw*
  1. _____ Group summary
  2. _____ Share summary (voicethread, Google doc, Show Me, etc)
  3. _____ Note taking from jigsaw activity
- _____ D. **Figures Picture Study**
- _____ E. *Wave Properties Lab*
- _____ F. **Brainpop Ocean Currents**
- _____ G. **Oceans Ediscio Flash Cards**
- _____ H. **Oceans Standard Check** _____ Percent Score

I-A. Density Vodcast

Define density –
_____

What two factors affect density of different substances?
_____

What is the formula for calculating density?
_____

What are the units used for labeling density measurements? (include both)
_____

Group members _____

I-B. Density Lab #1 Cubic Density Lab

Purpose: To determine the density of a solid cubed object after carefully measuring objects.

Density Formula: Density(g/cm3 or g/ml) =mass(g)÷volume(ml or cm3)

D=M/V

Procedure: Take and record the following measurements to determine density of objects.

WOOD BLOCK

Measurement of length_____cm
Measurement of width_____cm
Measurement of height_____cm

Volume of cube(lxwxh)_____cm3
mass of cube_____g Density of block _____

CLEAR PLASTIC BLOCK

Measurement of length_____cm
Measurement of width_____cm
Measurement of height_____cm

Volume of cube(lxwxh)_____cm3
mass of cube_____g Density of block _____

COLORED PLASTIC BLOCK

Measurement of length_____cm
Measurement of width_____cm
Measurement of height_____cm

Volume of cube(lxwxh)_____cm3
mass of cube_____g Density of block _____

I-B. Density Lab # 2 (Various Metals)

Density(g/ml) =Mass (g)÷Volume(ml or cm^3)

1. Determine the mass of each cylinder by placing them individually on the scale.

Record your measurement with the correct descriptive name. **Make sure you use the correct label on your measurements.**

	Mass	**grams**	
Dull Silver #1	Metallic Silver #2	Gold #3	Copper #4

2. Now measure the volume of each cylinder and place your answer under its correct cylinder.
   Fill your graduated cylinder to 30 ml. The difference between the new volume and the beginning 30 ml will give you your volume.

Make sure you use the correct label on your measurements.

	Volume	**ml**	
Dull Silver #1	Metallic Silver #2	Gold #3	Copper #4

3.How did your volume measurements compare for each cylinder?

4. With your mass measurement and your volume measurement determine the density of each cylinder.

	Mass (g)	**Volume (ml)**	**Density g/ml**	**Metal Use chart to compare**
Dull Silver #1				
Metallic Silver #2				
Gold #3				
Copper #4				

Based on the **density chart (with the keys),** what do you think the metals are that we have just worked with?

Group members _____

I-B. Density Lab, #3

Density(g/ml) =Mass (g)÷Volume(ml or cm^3)

Purpose: To determine the density of different solids after carefully measuring objects.

Hypothesis (your guess): Which solid will have the highest density? The lowest?

_____

Materials:

A variety of solids Balance Ruler

Procedure:

1. Measure the mass of each solid, using a balance. Record your results in the table.
2. Measure the length, width, and height of each solid. Then multiply l x w x h to calculate the volume of each solid. Record your results in the table.
3. Calculate and record the density of each solid.

Results:

Object	Mass (g)	Length (cm)	Width (cm)	Height (cm)	Volume (cm^3)	Density (g/cm^3)

Conclusion:

1. List your objects in order of density, from least to greatest.

_____

_____

2. What two factors can cause a solid to have more density?

_____

_____

3. Use the density chart provided to identify each of the solids that you have worked with today.

_____

_____

_____

_____

I-B. Density Lab #4

Density(g/ml) =Mass (g)÷Volume(ml or cm^3)

1. Determine the mass of each cylinder by placing them individually on the scale.
2. Record your measurement with the correct descriptive name.

Make sure you use the correct label on your measurements.

Mass grams				
Grey Plastic #1	Shorter White #2	Longer White #3	Gold #4	Metallic Silver #5

3. Now measure the volume of each cylinder and place your answer under its correct cylinder.
4. Fill your graduated cylinder to 30 ml. The difference between the new volume and the beginning 30 ml will give you your volume.

Make sure you use the correct label on your measurements.

****If object floats, use something thin to push it just under the water's surface.**

Volumeml				
Grey Plastic #1	Shorter White #2	Longer White #3	Gold #4	Metallic Silver #5

5.How did your volume measurements compare for each cylinder?

_____

6. Transfer your measurements into the chart below. With your mass measurement and your volume measurement determine the density of each cylinder.

	Mass (g)	**Volume (ml)**	**Density g/ml**	**What are they??** **Use chart to identify (also – be logical w/ answers!)**
Grey Plastic #1				
Shorter White #2				
Longer White #3				
Gold #4				
Metallic Silver #5				

Group members _____

I-B. Density Lab #5

Float or Sink?

A.K.A. Specific Gravity; or comparing densities to the density of water (1 g/mL)

Purpose: To determine, based on density, which solids will float and which solids will sink in water.

Hypothesis (your guess): Which solids will float? Which solids will sink? (See list in table)

Float: _____

Sink: _____

Procedure:

1. Measure the mass of each solid, to the nearest tenth (.1), using a balance. Record your results in the table.
2. Calculate the volume using the formula method. Square or Rectangles = l x w x h Cylinders pi x r^2 x h

RULE: *If the density is **more** than the density of water (1 g/mL) -> solid will sink.*
*If the density is **less** than the density of water (1 g/mL) -> solid will float.*

Results:

Object	Mass (g)	Volume(cm^3)	Density(g/cm^3)	RULE: Float/Sink?	TEST: Float/Sink?
Corkboard					
Graphite					
Acrylic (clear)					
Wood					
Rubber					
Brass (gold)					
Copper					
Steel (dull)					
Aluminum					
Dark plastic					

Conclusion:

1. After placing each solid in water, did your results match with the rule stated in with the Procedures above? _____
2. You have probably seen styrofoam products float. What does this tell you about the density of styrofoam? _____
3. Describe how the particles differ in solids, causing some solids to float and others to sink. _____

Formulas

Square or Rectangles **l * w * h**

Cylinders **Pi * r^2 * h**

I-C. Density Online Practice

Go to http://www.sciencejoywagon.com/explrsci/media/density.htm
Read the directions on this page. Use this opportunity to practice calculating and understanding density.

1. Use the scale to measure mass and the graduated cylinder to find the volume of each object.
2. **Use a calculator to find the density** of each object.
3. Place the appropriate units inside the parentheses.
4. Rank the objects from lowest to highest density.

Description	Mass (_)	Volume (_)	Density (_)	Rank
blue square	_	_	_	_
blue triangle	_	_	_	_
red square	_	_	_	_
red oval	_	_	_	_
pink square	_	_	_	_
purple oval	_	_	_	_
green triangle	_	_	_	_
grey triangle	_	_	_	_
tan rectangle	_	_	_	_
red/black rectangle	_	_	_	_

5. Use the slide bar to set the density of the fluid in the container to each of the densities labeled in the next table. Determine if each object sinks or floats in the container.

Description	Sink or Float? Density = 1 g/ml	Sink or Float? Density = 2 g/ml	Sink or Float? Density = 5 g/ml
blue square	_	_	_
blue triangle	_	_	_
red square	_	_	_
red oval	_	_	_
pink square	_	_	_
purple oval	_	_	_

green triangle	_	_	_
grey triangle	_	_	_
tan rectangle	_	_	_
red/black rectangle	_	_	_

Conclusion – What correlations (patterns) do you see between any of your data about each object and its ability to float? Explain what you notice.

_____

_____

I-D. Density Practice Problems

Density Practice Problems

Directions: Find the density of the following substances. Show work under each problem and write answers to the left in each blank. Label your answers.

_____ 1) A block of aluminum occupies a volume of 15.0 mL and weighs 40.5 g. What is its density?

_____ 2) Mercury metal is poured into a graduated cylinder that holds exactly 22.5 mL. The mercury used to fill the cylinder weighs 306.0 g. From this information, calculate the density of mercury.

_____ 3) A rectangular block of copper metal weighs 1896 g. The dimensions of the block are 8.4 cm by 5.5 cm by 4.6 cm. From this data, what is the density of copper?

_____ 4) A flask that weighs 345.8 g is filled with 225 mL of carbon tetrachloride. The weight of the flask and carbon tetrachloride is found to be 703.55 g. From this information, calculate the density of carbon tetrachloride.

_____ 5) Calculate the density of sulfuric acid if 35.4 mL of the acid weighs 65.14 g.

_____ 6) A block of lead has dimensions of 4.50 cm by 5.20 cm by 6.00 cm. The block weighs 1587 g. From this information, calculate the density of lead.

_____ 7) 28.5 g of iron shot is added to a graduated cylinder containing 45.50 mL of water. The water level rises to the 49.10 mL mark, From this information, calculate the density of iron.

Challenge questions:

_____ 8) What volume of silver metal will weigh exactly 2500.0 g. The density of silver is 10.5 g/cm^3.

_____ 9) What is the weight of the ethyl alcohol that exactly fills a 200.0 mL container? The density of ethyl alcohol is 0.789 g/mL.

_____ 10) Find the mass of 250.0 mL of benzene. The density of benzene is 0.8765 g/mL.

I-E. Will it float? Demonstration(s)

1. The New Coke Challenge

1-a. **Predict** whether the can of ***Coke*** will **sink** or **float** in an aquarium filled with water. Also predict whether you believe the ***Diet Coke*** will sink or float.

_____

1-b. *After you make these hypotheses*, explain **why** some objects float and some objects sink.

_____

1-c. *Density* is dependent on two things: **Mass** and **Volume.**
Of those two things, which caused the two cans to have different densities? How do you know?

_____

1-d. *Why* would a can of Coke have more mass (and therefore a greater density) than a can of Diet Coke?
Think about what they are made of

_____

2. Does it float your boat?

Hypothesis: Will boats and other objects float higher, lower, or at the same level in fresh water versus salty ocean water?

_____

Results and Conclusion: What happened? Why did it happen this way?

_____

I-F. Stacking Liquids Lab

Introduction: Density is the mass of a substance divided by its volume. If we increase the mass of a solution by increasing the salt content (salinity), but leave the volume the same, we increase the density. The more dense a substance is, the heavier it is, so we should be able to "stack" liquids of different densities.

Procedure:

***DO NOT THROW AWAY ANY SUCCESSFUL COMBINATIONS. YOU MAY NEED THEM LATER.

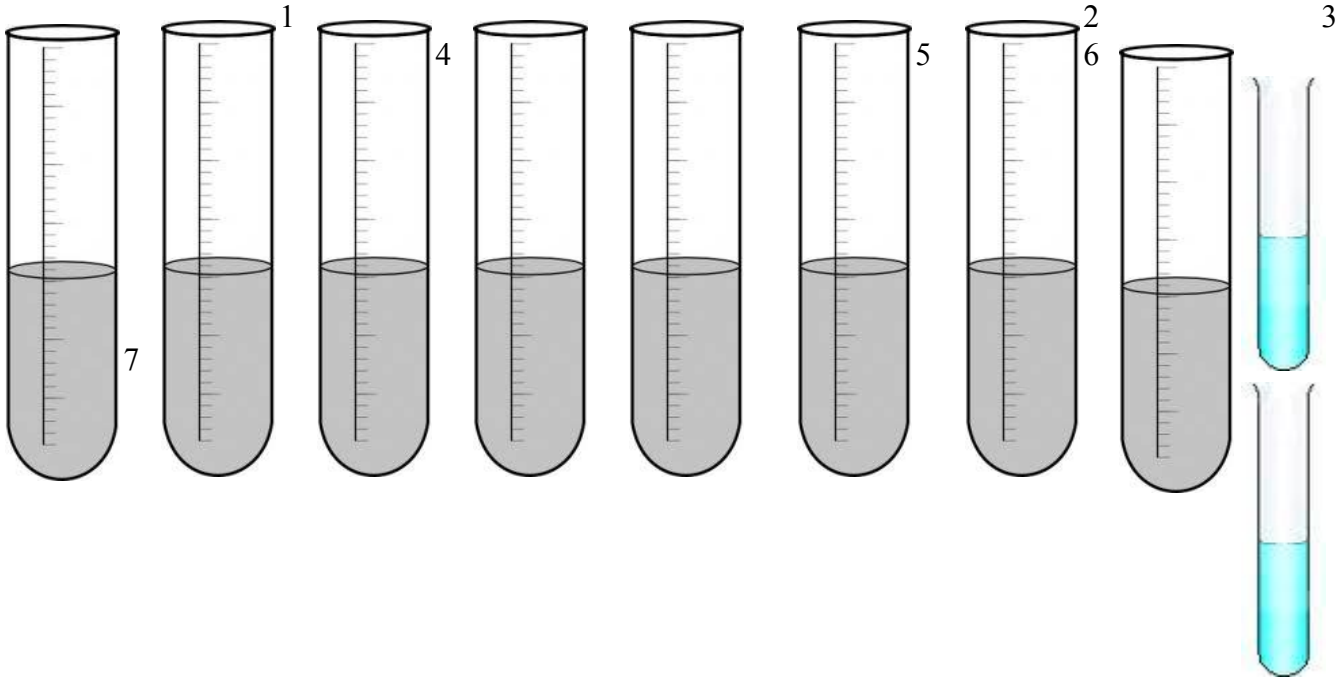
1. Using the eyedropper, put two "squirts" of one solution into one of your test tubes. Combinations are shown in the data section below.
2. Slowly add 2 "squirts" of the second solution. **It works best if you tilt the test tube slightly and let the solution slowly "dribble" down the inside wall of the test tube. Use a different dropper for each color.**
3. Repeat if necessary until you get two layers.
4. Continue procedure with each of the combinations listed below.

Data:

For each of the combinations, **circle the most dense color**.

1. Blue and Yellow
2. Green and Red
3. Blue and Green
4. Blue and Red
5. Red and Yellow
6. Green and Yellow
7. Layer all four solutions

Using colored pencils, show the results of each combination below.



Questions:

1. Which colored solution is the least dense? _____
2. Which colored solution has the greatest mass? _____
3. Which colored solution is the most dense? _____
4. How did you arrive at your answers for questions 1-3? _____

_____

5. Explain the relationship between mass and density if the volume is constant? (In other words, how does changing the mass affect the density?) _____

_____

Clean Up:

1. Do NOT throw away the unused colored solutions. DO leave the droppers in their solutions.
2. DO empty and rinse all test tubes and place them upside down in rack. Do NOT leave a wet, messy lab area.

I-G. Human Density Activity

Hypothesis: Based on what you've learned about density so far, what do you think your own density would be (of your whole body)? Are you so valuable that you are denser than pure gold? Are you so full of hot air that your density is similar to oxygen and nitrogen? Write down a guess.

_____

Data: Write down the data from the human density experiment here, including the final density of your classmate.

Mass of Human: _____

Volume of Human: _____ Density of Human: _____

Conclusion: How close was your estimate? Why do you think the density turned out the way that it did?

_____

I-H. Density Ediscio flash cards

Statistics:

# of flashcards known: _____ # of flashcards unknown: _____

I-I. Density Standard Check

What was your score on this standard check? _____

Which questions did you answer incorrectly? _____

Will you be retaking this standard check? _____

How did/can you master the concepts in this standard check?

_____

II. How are ocean currents created? How do they influence the land?

II-A. *Oceans bellringers*

Describe your experiences and predictions about the ocean by answering these questions.

1. Have you ever been to an ocean? What do you already know about salinity (amount of salt), waves, temperatures and other traits of the ocean?

_____

2. Have you ever visited California coasts compared to being inland in California? Have you ever been to Florida coasts? Have you ever noticed (or heard about) any differences in temperatures when comparing these three locations? Describe what you have noticed.

_____

3. What do you predict causes the different ocean currents? How do you think the oceans have an influence on the land nearby?

_____

II-B. *Bill Nye Oceanography*

1. Heat from the sun makes the water in the ocean _____ but the _____ stays in the ocean.
2. Is very salty water heavier or lighter? How does this cause currents?

   _____
3. How does water help keep England warmer?

   _____
4. What are thermohaline currents? How do they form?

   _____
5. Why do the fish in the aquarium need currents?

   _____
6. Why are the Great Salt Lake and Dead Sea salty?

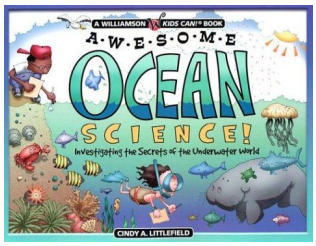
   _____
7. How does heat from the sun cause current?

   _____
8. Which ocean has the most powerful current?

   _____
9. Why can't Mars have oceans?

   _____
10. Many things depend on currents for _____, _____, and suitable _____

II-C. *Properties of the Ocean and How They Influence Currents and Waves*



Group 1: (Ch 13.1 pgs. 374-6) Describe our oceans.

a. Water covers about ___% of the Earth's surface.

b. Earth has four oceans.

The largest is the:_____

The ocean with much of its surface covered by ice is the:_____

The other two are:_____

c. How does the salt in the oceans compare to table salt that we put on our food?

_____

d. Describe ways the salt has gotten into the ocean and stayed there.

_____

e. Compare the density of water in lakes to the density of water in the oceans. Why are the densities different?

_____

Group 2: (Ch 13.1 pgs. 376-7) Describe variables that affect salinity of our oceans.

a. Define salinity: _____

b. Describe how climate affects salinity of the oceans. Give examples.

_____

c. How is the density different in the warm climates verses the cool climates? Why?

_____

d. Describe how water movement affects salinity of the oceans. Give examples.

_____

e. How is the density different in areas where there is less water movement verses areas where there is more water movement? Why?

_____

Group 3: (Ch 14.1 pgs. 417-8) What causes surface currents? (group A)

a. Define surface currents: _____

b. How is blowing gently on a cup of hot chocolate similar to surface currents?

_____

c. How are global winds helpful for ships traveling in the ocean if today's ships do not have sails?

_____

d. Define Coriolis effect: _____

e. How does the Coriolis effect influence surface currents?

_____

Group 4: (Ch 14.1 pgs. 418-9) What causes surface currents? (group B)

a. Define deflect: _____

b. Describe how continental deflections influence surface currents.

_____

c. Describe where warm-water and cold-water currents form.

_____

d. How do most warm-water and cold-water currents change as they travel? Why?

_____

e. Based on Figure 6, why do we see lots of currents that seem to be part of a circular movement? Compare this circular movement to a lava lamp's movement.

_____

Group 5: (Ch 14.1 pgs. 419-21) What causes deep currents?

a. Define deep currents: _____

b. Describe how the density changes when temperature decreases and forms deep currents.

_____

c. Describe how the density changes when water freezes and forms deep currents.

_____

d. Describe how the density changes when evaporation occurs and forms deep currents.

_____

e. Describe how density changes cause surface currents to change into deep currents and vice-versa.

_____

Group 6: (Ch 14.2 pg. 422) How do warm-water currents affect climate?

a. Which is usually warmer, surface currents or deep currents? Why?

_____

b. How do warm-water currents affect climates?

_____

c. Would the locations that are affected by the warm-water currents normally be expected to have the warm conditions? Why or why not?

_____

d. Describe an example of a warm water current that affects the U.S., naming several locations affected and the change in climate that happens in these locations.

_____

Group 7: (Ch 14.2 pg. 423) How do cold-water currents affect climate?

a. How do cold-water currents affect climates?

_____

b. Would the locations that are affected by the cold-water currents normally be expected to have the cool conditions? Why or why not?

_____

c. Describe an example of a cold water current that affects the U.S., naming several locations affected and the change in climate that happens in these locations.

_____

d. What is upwelling?

_____

e. Why is upwelling a valuable process?

_____

Group 8: (Ch 14.2 pgs. 424-5) What is El Nino and why does it matter?

a. Define El Nino: _____

b. How often does El Nino happen? How long can it last?

_____

c. Name examples of what can happen on Earth as a result of El Nino.

_____

d. What is La Nina? Does it have any affect on weather patterns?

_____

e. How do scientists try to predict the next El Nino?

_____

II-D. Figures Picture Study

After reviewing the diagrams and pictures on pages 374-380, answer the following questions.

Figure 1

Why do you think the ocean is depicted in different colors of blue?

_____

Figure 2

What were the names of the land mass and oceans when there were only one of each?

_____

What do you think is the importance of the prefix PAN?

_____

What is the result of the Pacific Ocean getting smaller? What does this tell you?

_____

Figure 3

What is the highest dissolved solid in the ocean water?

_____

What is the second highest dissolved solid?

_____

Why is a pie graph used here and not a line graph?

_____

Figure 4

Why is the color of the map white at the mouth of the Amazon? What is the caus ?_____

Why is the color of the map white at the coast of the Gulf of Mexico? What is the cause?_____

Why is there so much salt in the Sargasso Sea? The Mediterranean Sea?

_____

Figure 6

What colors represent the coolest colors The hottest colors? How do you know?_____

Figure 8

Why is the water moving in the direction it is moving?

_____

Based on what you see in the picture, would it take less energy to sail

from New York to Florida or Florida to New York?

_____

II-E. *Wave Properties Lab*

Purpose:

How are wave characteristics related to each other and to the energy source that causes waves?

Research:

Ocean wave energy impacts coastlines around the world. Understanding wave properties helps scientists predict the movement and effects of waves.

Hypothesis: Describe at least one idea you already know about waves, how they move, why they move, and/or where objects in water will or will not move.

_____

_____

Experiment:

MATERIALS

water tanks	chalk	beaker for water
ruler	straw	aluminum foil ball

PROCEDURES

1. Fill the tank with water to about 2/3 full.
2. Test statement 1 from the table. Hold the straw just above the water. Blow through the straw. Record your observations and how they support statement 1.
3. Test statement 2 from the table. Hold the straw just above the water at one end of the tank. Blow gently and continuously. Use the ruler to compare the wavelengths close to the straw and on the other end of the tank. Record your observations and how they support statement 2.
4. Test statement 3. Drop the chalk piece in the middle of the tank. Hold the straw just above the water at one end of the tank. Blow gently and continuously. Observe any movement of the chalk. Record your observations and how they support statement 3.
5. Test statement 4. Float the aluminum foil ball in the middle of the tank. Hold the straw just above the water at one end of the tank. Blow gently and continuously. Observe any movement of the aluminum foil ball. Record your observations and how they support statement 4.

Results:

Statement	How your observations support statement
1. Wind causes waves.	___
2. Wavelength increases as the distance from the energy sources increases.	___
3. The effects of wave motion are felt relatively close to the surface only.	___
4. Wave energy is transferred through the water: the water itself does not move forward with the wave.	___

Conclusion:

1. **Explain** how wind causes waves to form.

_____

2. **Explain** how you know the effects of wave motion are not felt below a certain depth.

_____

3. How did your observations for statement 4 compare with the fact that water in a wave does not

move forward with the wave?

_____

4. Why do things drift in the water if the water itself is not moving forward with the waves?

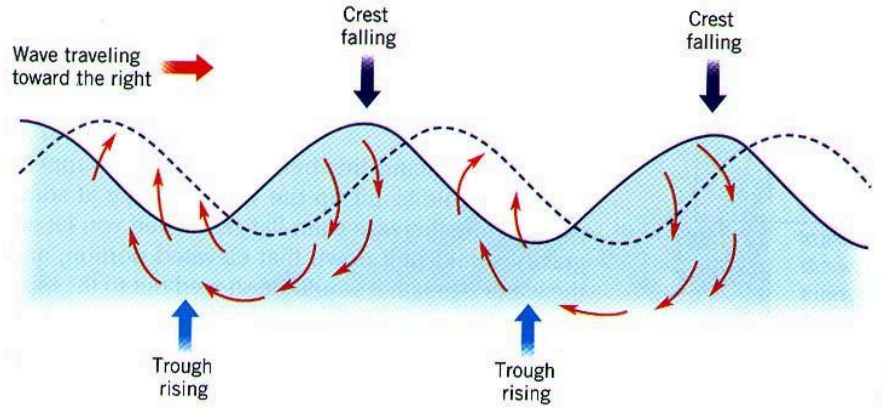
_____

5. **Explain** how surface currents form (Ch. 14.1/notes).

_____

6. **Explain** how deep water currents form (Ch. 14.1/notes).

_____



II-F. Brainpop Ocean Currents

Go to http://www.brainpop.com and log in. The username is "**memmiddle**" and the password is "**brainpop**". Search for the "Ocean Currents" video.

II-G. Oceans Ediscio flash cards

Statistics:

# of flashcards known: _____ # of flashcards unknown: _____

II-H. Oceans Standard Check

What was your score on this standard check? _____

Which questions did you answer incorrectly? _____

Will you be retaking this standard check? _____

How did/can you master the concepts in this standard check?

_____