Lessons 6 & 7

Stage 1 – Desired Results

Established Goals:
8-4-04 Identify factors that can work individually or in combination to affect ocean currents. Include: convection, Coriolis effect, prevailing winds, position of continents. GLO: D5, E2

Understandings:	**Essential Question:**
Students will understand that… Cold water and warm water move in different ways. How the Coriolis Effect works. The importance of the Antarctic Circumpolar current.	What are the unique characteristics of fresh and salt water and how do they affect the Earth's climate?
Students will know… That there are set currents that the ocean follows.	**Students will be able to…** Identify why the ocean currents move in the way that they do.

Stage 2- Assessment Evidence

Performance Tasks:	**Other Evidence:**
Students will make predictions and then apply the learning to determine what the ocean currents look like.	Completion of questions and partner work

Materials Required

Ice cubes (tray)	Overhead projector
Red food colouring	Handouts (BLM Lesson 5 #1-3)
Overhead of Ocean Currents (BLM #4)	Pepper
Clear glass baking pan	

Stage 3 – Learning Plan

Lesson 6
*Prepare ice cubes with a couple of drops of red food colouring ahead of time
Fill the baking pan with warm water.
Place baking pan on overhead so students can see what happens.
Sprinkle some pepper on the surface of the water to see how the water moves.
Ask students to predict what will happen when the red ice cube is placed in the water.
Put one red ice cube into the baking pan and observe the water movement (on BLM#1).
Empty the pan and re-fill with warm water.
Predict any changes that might occur with one ice cube at each end of the pan (on BLM#1).
Record observations.
Answer questions on handout (BLM #1).

Lesson 7
In partners, get students to review Ocean Currents Facts and The Antarctic Circumpolar Current (BLM #2).
Prep students for the Ocean Current prediction by explaining that currents move in a circular motion and that every ocean has a set current as well as in the Gulf Stream.
In partners, get students to apply the learning from the experiment and the fact sheet to answer the questions (BLM #4) and determine the Earth's Ocean Currents (BLM #3)** and use BLM #2** to assist in understandings. An engaging way to do this is to cut out each fact (see BLM 6.6) and place all around the room to get the students moving and recording their information.
Discuss answers from previous lesson and compare students predictions of the Ocean currents with that of the one on the Overhead (BLM #5)** get them to record the actual currents in a different colour than used in their predictions, and record on the map which colour is the one that accurately depicts the currents.
Discuss answers at end of class. Have students hand in answer sheets to confirm completion.

**(adapted from* Hot and Cold Moves - http://coe.west.asu.edu/explorer/MiscUnits/team3/Hot-Cold_Moves.html)

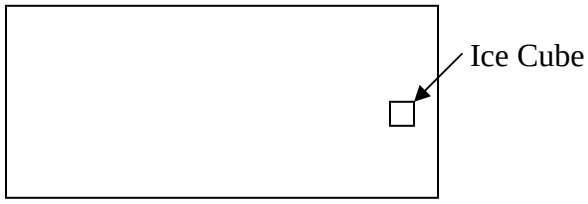
Homework Learning Activities
Continue to work on water consumption chart

Hot and Cold Currents (6.1 page 1 of 2)

Experiment 1 – Single ice cube

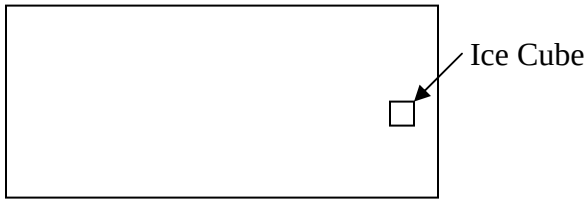
Prediction of how the water will move when an ice cube is added to warm water

1. Which direction will the cold water move? _____
2. Draw a picture of how you expect the water to move in the baking pan.



After the Experiment

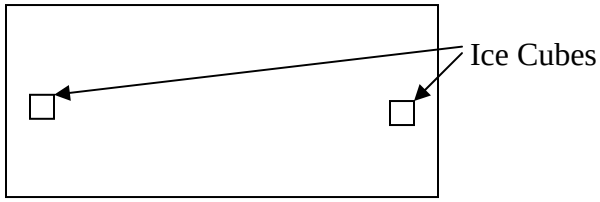
3. Which direction did the cold water move? _____
4. Draw a picture of how the water moved in the baking pan.



Experiment #2

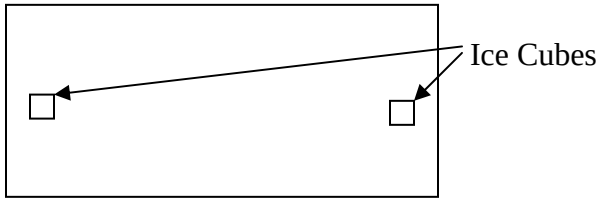
Prediction of how the water will move when two ice cubes are added to warm water

5. Which direction will the cold water move? _____
6. Draw a picture of how you expect the water to move in the baking pan.



After the Experiment

7. Which direction did the cold water move? _____
8. Draw a picture of how the water moved in the baking pan.



Questions

1. What happened to the cold water as it warmed up?

_____

_____

_____

_____

2. How did the surface water move as the cold water moved along the bottom?

_____

_____

_____

_____

3. How do you think this relate to the currents in the oceans?

_____

_____

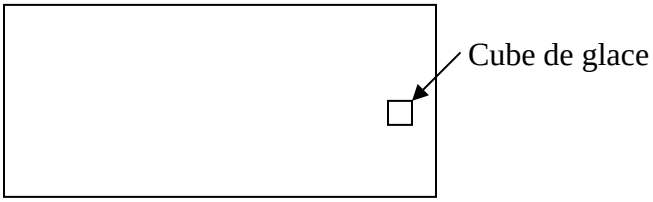
_____

_____

Courants chauds et froids (6.1 page 1 de 2)

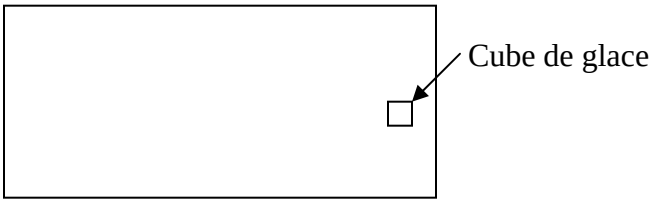
Expérience 1 – Un seul cube de glace
Prédiction sur comment l'eau bougera quand on ajoute un cube de glace à de l'eau chaude

1. Dans quelle direction l'eau bougera-t-elle? _____
2. Faites un croquis de vos attentes du mouvement de l'eau dans le plat.



Après l'expérience

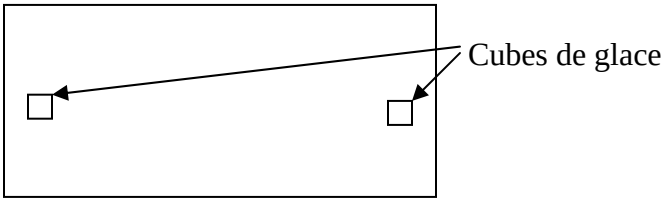
3. Dans quelle direction est-ce que l'eau froide a bougé? _____
4. Faites un croquis de comment l'eau a bougé dans le plat.



Expérience #2

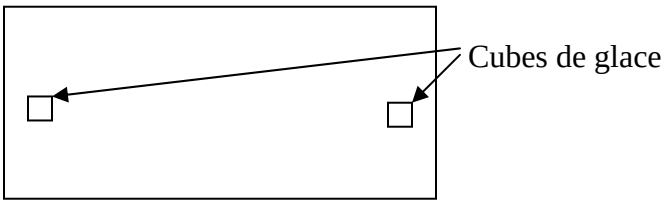
Prédiction sur comment l'eau bougera quand on ajoute deux cubes de glace à de l'eau chaude

5. Dans quelle direction l'eau froide bougera-t-elle? _____
6. Faites un croquis de vos attentes du mouvement de l'eau dans le plat.



Après l'expérience

7. Dans quelle direction l'eau froide a-t-elle bougé? _____
8. Faites un croquis de comment l'eau a bougé dans le plat.



Questions

1. Qu’est-il arrivé à l’eau froide à mesure qu’elle se réchauffait?

_____

_____

_____

_____

2. Comment l’eau à la surface bougeait-elle pendant que l’eau froide bougeait le long du fond?

_____

_____

_____

_____

3. Comment pensez-vous que ceci se rapporte aux courants des océans?

_____

_____

_____

_____

Facts About Ocean Currents (6.2 page 1 of 2)

Facts about Ocean Currents

• Ocean waters are constantly on the move. How they move influences climate and living conditions for plants and animals, even on land.

• Currents flow in complex patterns affected by wind, the water's salinity and heat content (density), bottom topography, the position of continents, and the Earth's rotation (Coriolis effect).

• The ocean is layered. It is cold at the bottom and warmer on top.

• Warm surface currents invariably flow from the tropics to the higher latitudes, driven mainly by atmospheric winds and the Earth's rotation.

• Cold surface currents come from polar and temperate latitudes, and they tend to flow toward the equator, driven mainly by atmospheric forces.

• Our planet's rotation produces a force on all bodies of water moving relative to the Earth. That force is greatest at the poles and least at the equator. It is called the Coriolis effect, and it causes the direction of winds and ocean currents to be deflected. Water is deflected clockwise, or to the right, in the northern hemisphere, and counterclockwise, or to the left, in the southern hemisphere.

• Ocean water at the surface is warmed at the tropics and moves toward the poles where it loses heat, becomes saltier and denser, and sinks.

• The cold bottom layer of ocean water circulates through the oceans, taking up to 1,000 years to circulate completely throughout the oceans of the Earth.

• The Gulf Stream surface current is one of the strongest currents. It is warm, deep, fast, and relatively salty.

• Organisms move from one layer of the ocean to another, and plant and animal remains containing nutrients "rain" down. Upwelling stirs the oceans and brings nutrients that have settled in deep water back to the surface, providing a rich source of nutrients for marine organisms, particularly fish. Coastal upwelling occurs against the western sides of continents in the Atlantic, Indian, and Pacific Oceans. There, colder water rises to replace

warm surface water blown out to sea by strong winds. Upwelling supports about half of the world's fisheries.

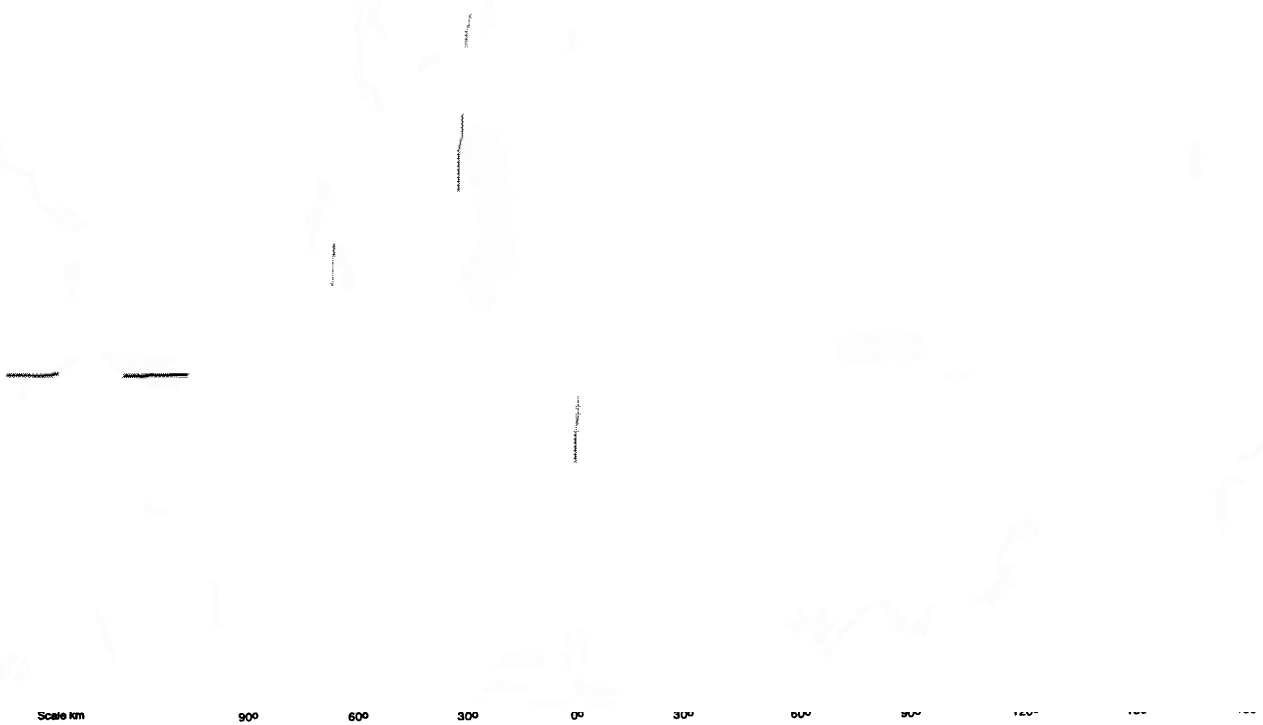
The Antarctic Circumpolar Current

• The Southern Ocean is the only ocean that circles the globe without being blocked by land. It contains the Antarctic Circumpolar current and is the world's largest ocean current.

• The Antarctic bottom water (cold, salty, and dense) sinks into the deep sea, spills off the continental shelf, and travels northward hugging the ocean floor beneath other water masses. This is a huge amount of water that pushes the warmer water out of the way, usually by flowing underneath it, causing new flows and currents in other directions. It travels as far as the North Atlantic and North Pacific Oceans. The bottom water flowing away from Antarctica has to be replaced by other water, so the warmer waters in the north tend to flow southward to fill the gap. Then they cool down and the cycle keeps going.

• The Antarctic Circumpolar current has a powerful influence on much of the word's climate as it redistributes heat, influencing patterns of temperature and rainfall.

6.3
Name:



Source:
Manitoba
Education and Training.

Names: _____

Facts About Ocean Currents (6.4)

State the most interesting fact from the points listed	
List 3 additional pieces of information in your own words	
Draw a diagram to explain the Coriolis effect	
Answer the following questions	
How does upwelling affect the economy?	
What does density have to do with ocean currents?	
Why does the Antarctic Circumpolar current have a powerful influence on the rest of the world?	

Faits au sujet des courants océaniques (6.4)

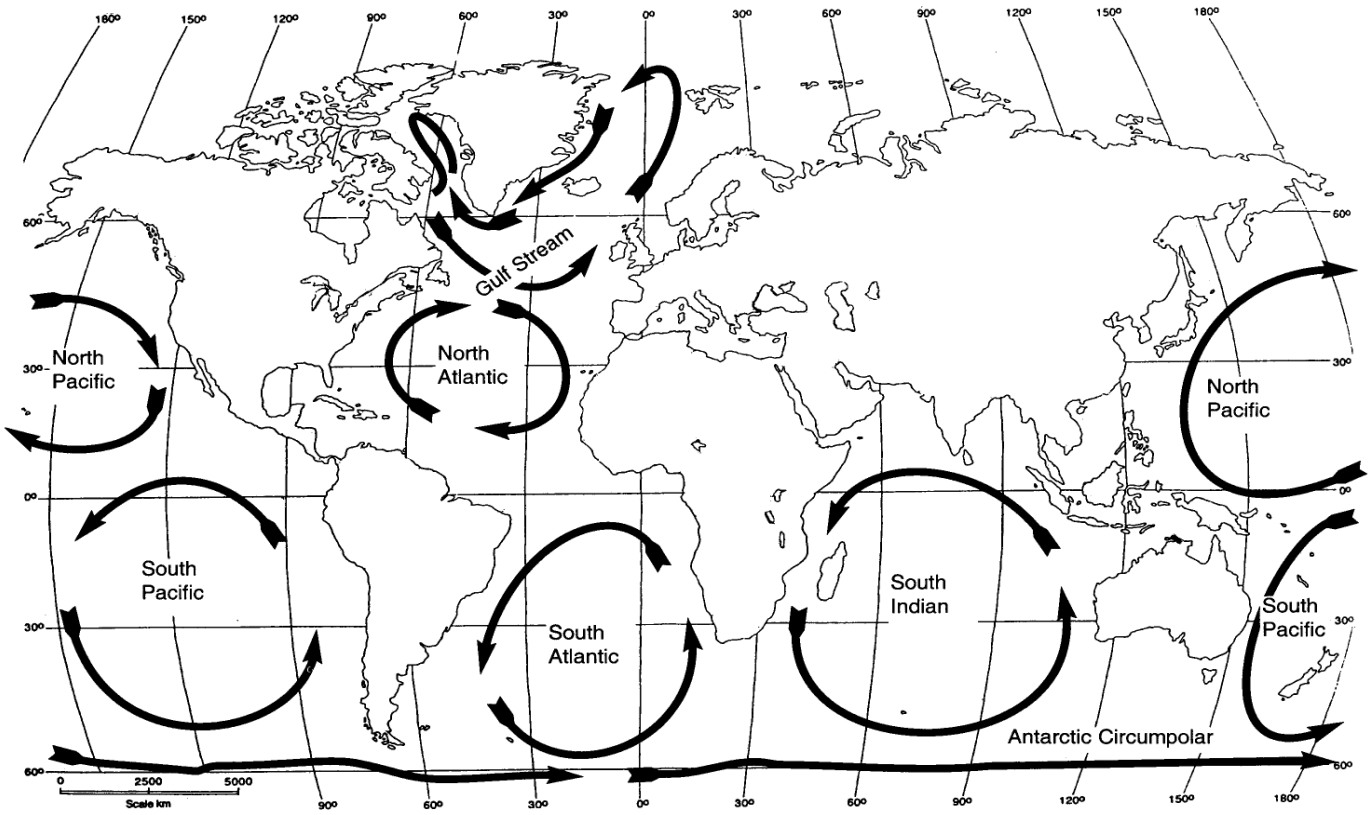
Indiquez quel fait tiré de la liste de points est le plus intéressant	
Indiquez 3 renseignements additionnels dans vos propres paroles	
Dessinez un diagramme qui explique l'effet Coriolis	
Répondez aux questions suivantes	
Comment la remontée de l'eau froide des océans affecte-t-elle l'économie?	
Quelle relation y a-t-il entre la densité et les courants océaniques?	
Pourquoi le courant qui coule autour de l'Antarctique exerce-t-il une si grande influence sur le reste du monde?	

Facts About Ocean Currents Key(6.4)

State the most interesting fact from the points listed	Dependant on student
List 3 additional pieces of information in your own words	Dependant on student
Draw a diagram to explain the Coriolis effect	
Answer the following questions	
How does upwelling affect the economy?	Upwelling stirs the ocean and brings nutrients “up” to the surface for marine organisms. It supports the fishing industry.
What does density have to do with ocean currents?	The cold dense water sinks into the deep sea and pushes great amounts of warm water up. This creates a cycle.
Why does the Antarctic Circumpolar current have a powerful influence on the rest of the world?	Due to the cycling of cold and warm water this current influences much of the world’s climate as it redistributes heat and influences temperature patterns and rainfall.

OH 6.5

World Map: Ocean Currents



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L'eau de mer est en mouvement constant. Sa façon de se déplacer influence le climat et les conditions de vie pour les plantes et les animaux, même sur terre.	Les courants se déplacent selon des modèles complexes, affectés par le vent, le montant de sel et de chaleur de l'eau (la densité), la topographie du fond, la position des continents et la rotation de la terre (l'effet Coriolis).	L'océan est stratifiée. Elle est froide au fond et plus chaude en surface.
Les courants chauds en surface coulent nécessaire- ment des tropiques aux latitudes plus élevées, poussés surtout par les vents atmosphériques et la rotation de la terre.	Les courants froids en surface viennent des latitudes polaires et tempérées, et tendent à couler vers l'équateur, poussés surtout par les forces atmosphériques.	L'eau de mer en surface se réchauffe dans les tropiques et se dirige vers les pôles Où elle perd sa chaleur, devient plus salée et dense, et coule.

La rotation de notre planète produit une force qui agit sur toutes les masses d'eau qui bougent relativement à la terre. Cette force est plus grande aux pôles et moins grande à l'équateur. Elle s'appelle l'effet Coriolis, et elle du sud. océaniques. L'eau est déviée dans le sens de l'horloge, ou vers la droite, dans l'hémisphère du nord, et dans le sens contraire de l'horloge, ou vers la gauche, dans l'hémisphère fait dévier la direction des vents et des courants	L'océan du sud est le seul océan qui encercle le globe sans être bloqué par la terre. Il contient le courant antarctique circumpolaire qui est le océanique du monde. plus grand courant.
Les organismes se déplacent d'une couche océanique à une autre, et les restes des plantes et des animaux qui contiennent des éléments nutritifs 'pleuvent' vers le fond. La remontée brasse les océans et rapporte les éléments nutritifs reposant près du fond jusqu'à la surface, fournissant une source riche en éléments nutritifs aux organismes marins, surtout aux poissons. La remontée côtière a lieu le long du côté ouest des continents dans les océans Atlantique, Indien et Pacifique. Là, l'eau froide monte pour remplacer l'eau chaude en surface qui est poussée loin en mer par des vents forts. La remontée appuie à peu près la moitié des poissonneries du monde.	

L’eau de fond antarctique (froide, salée et dense) s’abaisse dans la mer profonde, s’envole en glissant du plateau continental et voyage vers le nord en s’accrochant au fond de l’océan sous d’autres masses d’eau. Ceci représente un directions. Il voyage aussi loin que le nord de l’Atlantique de son chemin, généralement en passant dessous, ce qui énorme montant d’eau qui repousse l’eau plus chaude hors de son chemin, généralement en passant dessous, ce qui cause de nouvelles déviations et des courants dans d’autres directions. Il voyage aussi loin que le nord de l’Atlantique et le nord du Pacifique. L’eau de fond qui s’éloigne de l’Antarctique doit être remplacée par d’autre eau, alors les eaux plus chaudes du nord tendent à couler vers le sud pour remplir le vide. Puis elles se refroidissent et le cycle continue.	Le courant antarctique circumpolaire a une puissante influence sur une grande partie du climat mondial, puisqu’il redistribue la chaleur, ce qui influence les modèles de température et de précipitation.
La couche d’eau froide au fond des océans circule à travers les océans. Elle peut prendre jusqu’à 1000 ans pour circuler complètement à travers les océans de la terre.	Le courant du Golfe à la surface est un des courants les plus puissants. Il est chaud, profond, rapide et relativement salé.