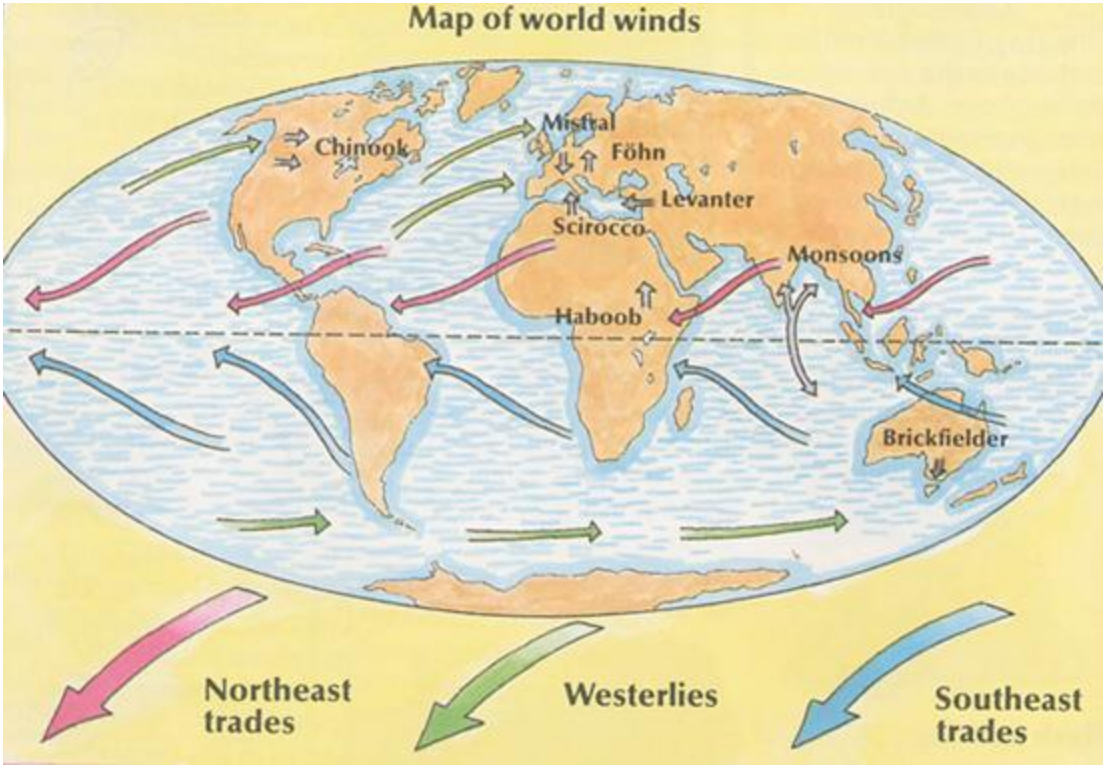
Science 20F

Winds / Ocean Currents

Lesson # 8



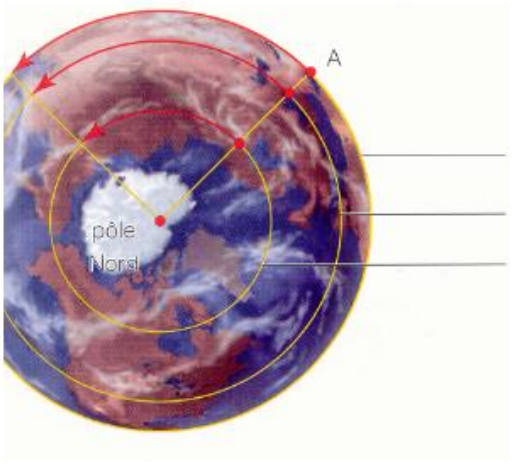
Date: _____

Explain effects of heat transfer within the atmosphere and hydrosphere on the development and movement of wind and ocean currents. Include: Coriolis effect/convection, prevailing westerlies, jet streams, El Niño.

Review:

1. We have learned that heat is not evenly distributed on Earth (hot regions and cold regions)
2. We know that warm air rises and **expands,** and cold air is more **dense** than warm air.
3. Air moves from **regions of high pressure** to **region of low pressure**
4. Cold air moves under warm air pushes it upwards.

Today's Lesson: Winds



Equator
30°N
60°N

Where is the speed of rotation going to be the greatest on earth?

At the North and South Pole, the speed is almost **almost Zero!**

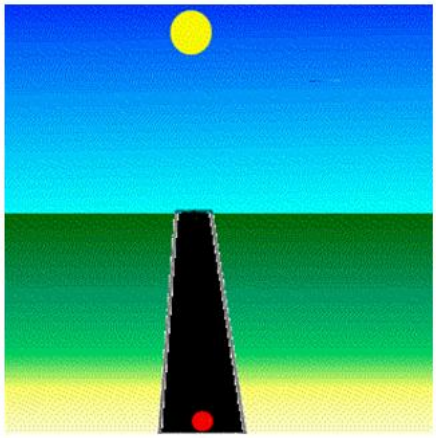
At the equator, the speed of the earth's rotation is approximately **1700 km/hr.**

As you move away from the equator the speed of rotation increases/decreases ???

The speed of the earth's rotation at Winnipeg is approximately **1000 km/hr.**

The Coriolis Effect

Here is an airplane travelling from Alaska to Miami in a straight line...
Will the plane reach its target? The Answer.... No!!



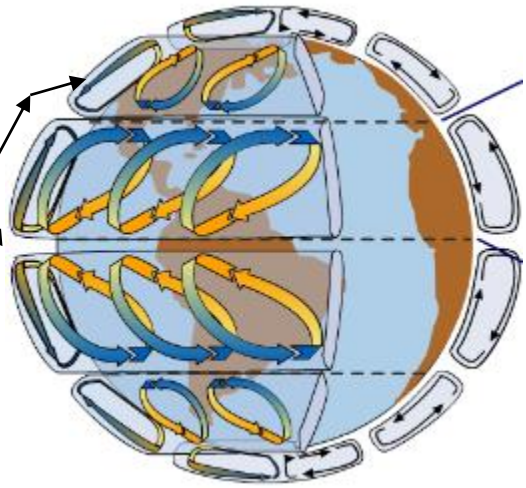
The plane follows a straight line but it **doesn't reach** its destination because during the plane's flight the **target rotates away**. The earth's rotation causes the object moving on the Earth's surface to move towards the **right** in the northern hemisphere and the **left** in the southern hemisphere.

An object moves away from the equator in an **easterly** which explain why winds and movement are reversed in the **southern hemisphere.**

What is the Coriolis Effect?

It is a force that causes **moving objects** like airplanes, birds and air masses to move towards the right in the northern hemisphere which would normally travel in a straight line. The Coriolis Effect causes the winds to blow in **a right curved** direction in the northern hemisphere.

Global Winds



The Coriolis Effect causes the winds in the northern hemisphere to blow from the west to the east. These winds are called the **hurricanes to turn in a counter-clockwise direction.**

Jet Stream

The jet stream is fast moving air that is found in near the top of the troposphere. They are caused by the mixing of cold and warm air.

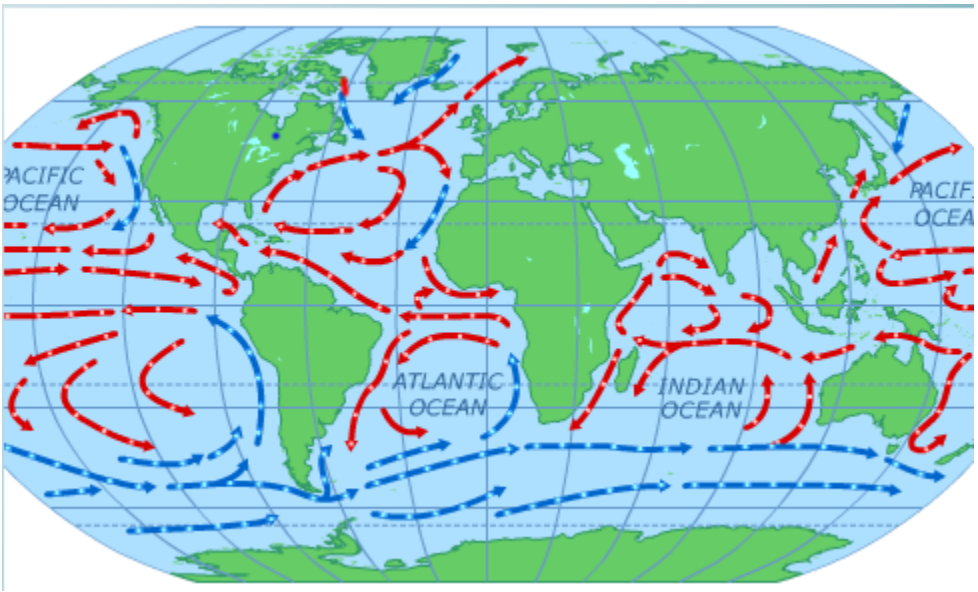
- The jet stream travels up to 180km/hr
- It was discovered during WWII
- They are 2-3km in thickness
- How does it affect air travel?

Eastward travel time is decreased while westward travel is increased.

Figure 14.14 Jet streams often dip south below the prairies or sometimes south of the Great Lakes.

Ocean Currents

Surface winds can also create ocean currents at sea which carry warm water from the equator all the way to the Arctic Ocean.



Oceans and surface currents Questions *page 469/470*

Questions are answered, but it would be good for you to look in your textbook as if you were trying to answer these questions and see if the answers make sense or require some additional reading.

1. What is the name of the ocean current that brings warm water from the Gulf of de Mexico to the Atlantic Ocean providing a mild climate for the provinces and states on the east coast of North America?

Gulf Stream

2. Including the wind, there is two other big factors that influence the directions and movements of oceanic currents, name them both:

- **Continents**
- **Coriolis Effect**

3. The oceanic currents turn in a **Clockwise** (to the right) **in the northern hemisphere** and in a **Counter clockwise** (to the left) **in the southern hemisphere.**

4. What do you call a pattern of neatly circular currents? **Gyres**

5. Explain why the climate of Peru is mainly dry and arid with desert like conditions. Explain why Japan and England have a mild / moist climate.

Desert Climate: Cold water currents (with cool air above). Cool/cold air holds less moisture (less humidity) than warm air does, therefore when cool air over oceans meets land it does not create clouds and does not rain! – Desert-like Dry regions: like Peru

Mild Climate: Warm water currents (with warm moist air above). Warm, humid air contains lots of water vapour, therefor when it come up over land and is forced to rise, it creates clouds and rain will fall! – Humid / tropical regions: like Indonesia or Japan

6. Which one ocean current is not at all affected by the continents?

West Wind Drift

7. Name the largest continuous ocean current, represented in figure 14.19

Great Ocean Conveyor

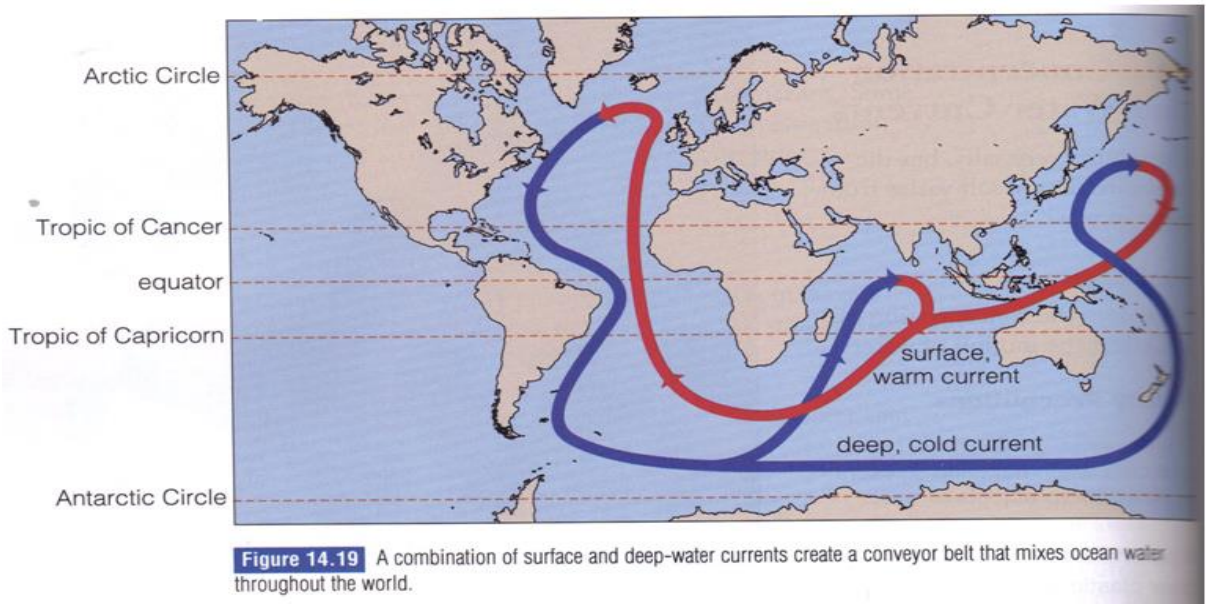


Figure 14.19 A combination of surface and deep-water currents create a conveyor belt that mixes ocean water throughout the world.

8. Explain "El Nino" p.475-476

El Nino - The Christ Child

Normal Years:

- **Trade winds** are flowing from South America towards Indonesia (westerly direction) along the equator.

•water along coast of Peru is **cold** but good for fishing!

•water along coast of Australia and Indonesia is **warm** but brings...

•lots of **rain** to Australia and Indonesia as the moisture evaporates into the atmosphere.

El Nino Year

•A phenomenon that occurs every **3-8** years

•The trade winds **weaken** and begin blowing in an easterly direction towards Peru.

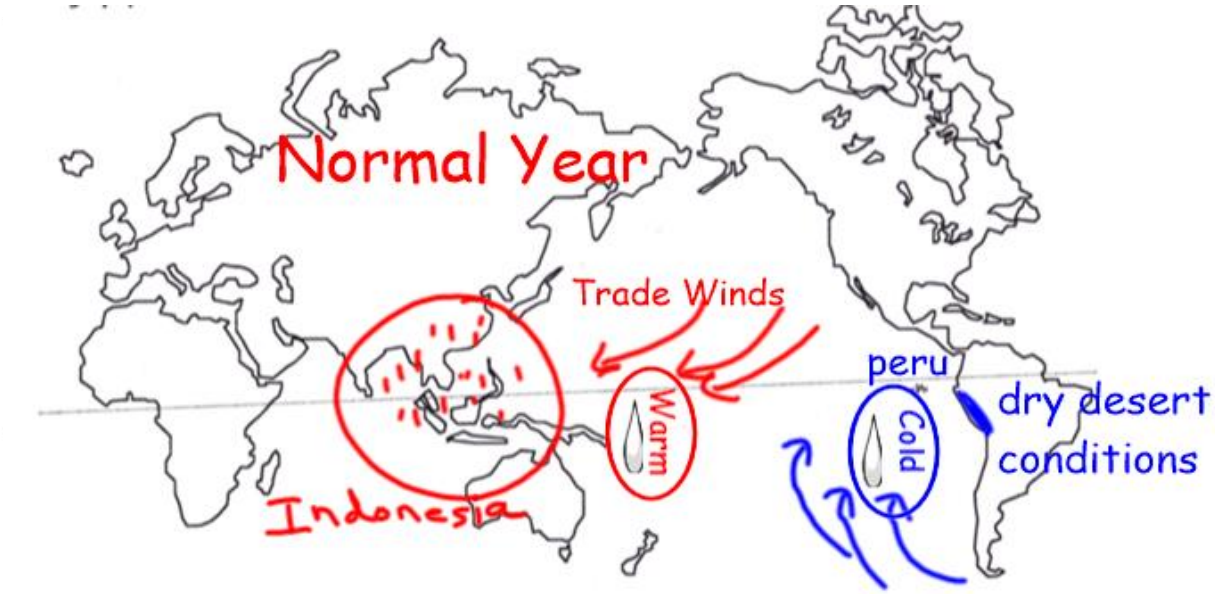
•The warm ocean currents begin to flow towards Peru, carrying lots of **Moisture**.

- Fishing in Peru is **poor** and the weather is **rainy**
- Droughts **form** in Australia and Indonesia

El Nino Effect:

Use the map below to label Peru, Indonesia, warm ocean water and cold ocean water and the direction of the trade winds.

Normal Year



Use the map below to label Peru, Indonesia, warm ocean water and cold ocean water and the direction of the trade winds.

El Nino Year