

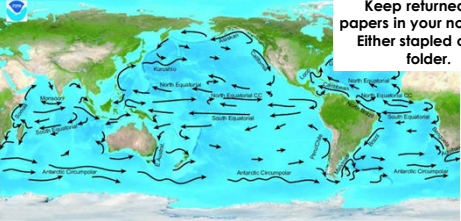
1 January 26, 2015

## Warm-Up

Today you will need your notebook, dry erase marker and colored pencils.

- Review: How do ocean currents form?

**Remember:**  
Keep returned lab papers in your notebook! Either stapled or in a folder.




2 January 26, 2015

## Warm-Up

Today you will need your notebook and colored pencils.

- Review: How do ocean currents form?

The currents are generated from the forces acting upon the water like the earth's wind, the temperature and salinity differences (as well as earth's rotation and the gravitation of the moon.)



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## Review Video: How Currents Form

- [https://www.youtube.com/watch?v=Hu\\_Ga0JYFNq](https://www.youtube.com/watch?v=Hu_Ga0JYFNq)
- <http://pmm.nasa.gov/education/videos/aquarius-ocean-circulation>
- Aquarius satellite is used to measure global sea surface salinity to better predict future climate conditions
- Uses radiometers to detect changes in the oceans microwave thermal emissions frequencies due to salinity.

# Climate and Specific Heat

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January 26, 2015

## Today...

- Goal:
  - Explain how coastal climates are moderated by water in comparison to inland climates.
- Outline:
  - Introduction to climate
  - Introduction to specific heat
  - Analyze temperature data
  - Link climate and the specific heat of water

## Climate vs. Weather

Whiteboards!

How would you describe the difference between climate and weather?

- Climate** is the average weather in a place over many years
- Weather** is what the forecasters on the TV news predict each day.
- While the weather can change in just a few hours, climate takes hundreds, thousands, even millions of years to change.

**Whiteboards!**

**What differences do you notice about the data for the two cities?**

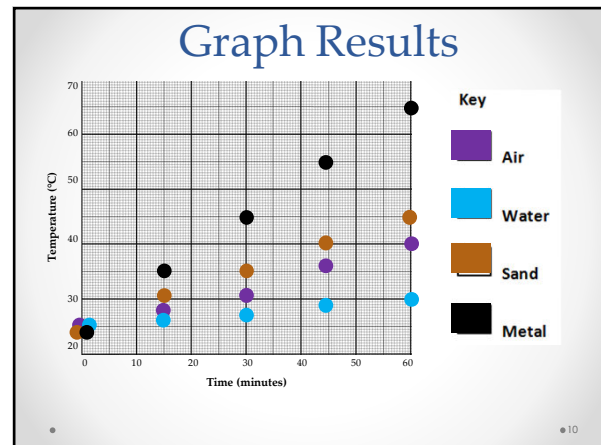
San Francisco, California	Wichita, Kansas
Winter: 50°F Spring: 56°F Summer: 59°F Fall: 61°F	Winter: 38°F Spring: 55°F Summer: 93°F Fall: 63°F
Average annual rainfall: 19 inches Average annual snowfall: 0 inches	Rainfall: 30 inches Snowfall: 15.5 inches

## Specific Heat

- Specific Heat:
- The amount of heat energy required to raise the temperature of 1 gram of a substance by 1° C.
- Each substance has a specific heat capacity.
- Example:
  - It takes 1 calories of energy to raise 1 gram of water by 1° C
  - 1 cal/g°C is water's specific heat

## Let's Graph It!

- On your paper, graph the substances air, water, sand and metal
- Answer the questions with your group
- We'll gather together as a class to discuss your findings and link climate to specific heat



## Discussion Questions

1. Put the four substances in order of the time required to heat them from slowest to fastest.  
**Water, Air, Sand and Metal**
2. Which do you think will cool the fastest? Explain your reasoning.  
**Metal – It takes little heat to warm, so it'll take little cold to cool**
3. When you boil water in a pot on the stove, which heats faster, the metal pot or the water?  
**The metal pot**

## Discussion Questions

4. Which substance has the highest specific heat capacity?  
**Water**
5. Which substance has the lowest specific heat capacity?  
**Metal**
6. Here are the heat capacities of the four substances: 0.10cal/g°C, 0.25 cal/g°C, 1.0 cal/g°C, and 0.2 cal/g°C. Match each substance with its specific heat capacity.  
**Metal = 0.1 cal/g°C      Air = 0.25 cal/g°C**  
**Sand = 0.2 cal/g°C      Water = 1.0 cal/g°C**

## Discussion Questions

7. Which will heat faster, a swimming pool or the ocean? Explain your thinking.  
 A swimming pool because it has less water than the ocean.
8. How do you think specific heat affects the weather?  
 The air and water(oceans) heat at different rates.
9. In the late afternoon after the sun has been shining, what do you think happens to the temperature of the air as it moves from the ocean to the land? Explain.  
 The water in the ocean evaporates into the air, warming the air. As the air moves inland it cools and the water falls as rain.

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10. Use specific heat capacity to explain why some regions have very mild climates and other regions have severe climates with a wide range of temperatures.

It takes many warm days to warm the ocean and many cold days to cool the ocean. The ocean can transfer heat to the air and it can also evaporate placing more water vapor in the air.



Water vapor is water in the gas phase.



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\*The winds blow from west to east across the USA. Use this fact to explain why the west coast city of San Francisco is warmer in the winter and cooler in the summer than the East Coast city of Washington, DC. Both are at the same latitude.

The ocean is still warm in the winter due to water's high specific heat. The wind is warmed by the Pacific Ocean and blows over San Francisco. By the time the wind reaches DC most of the "extra" warmth is gone.



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## Summarize



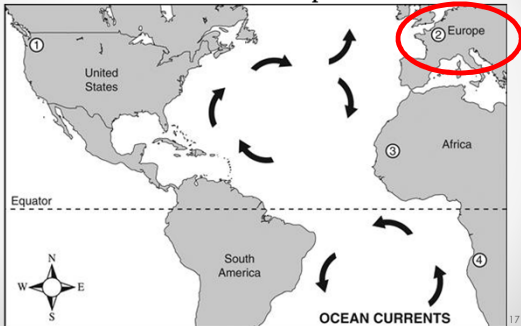
- Explain how coastal climates are moderated by water in comparison to inland climates.  
The ocean is able to absorb, store, and transport heat from the sun due to water's high specific heat.  
Warm water/currents heat the wind that blows over coastal cities making warm winters.

The ocean's heat transfer compensates for the sun's unequal heating of the Earth, in which the equator regions receive more energy from the sun than the poles. Were it not for the moderating effects of ocean currents on air temperatures, the tropics would be much hotter than they are and the polar regions even colder.

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Whiteboards!

Ocean currents affect climates around the world. Based on the map, which area (#) most likely has a warmer climate than expected?



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