

March 4 Weather and Climate Stations 5-8

Station 5: Hurricane Warning Reading

Directions: Read the text about hurricanes, then answer the multiple-choice questions that follow.

- 1 Earth, the Blue Planet. What makes Earth blue? It has to do with all of the water on Earth. This water exists not only in the vast oceans but also in the atmosphere. High up in the atmosphere, water may be found in the form of water vapor and ice crystals. Lower in the atmosphere, water may be found as clouds and precipitation such as rain. All of this water is constantly cycled between the ground and the atmosphere, driven by gravity and the Sun's energy. It is all this water that makes our planet look blue from space.
- 2 Water has properties that allow it to absorb and release energy as it changes from one state to another. Water on Earth can absorb large amounts of the energy from the Sun. For example, as the liquid water in the oceans gets warmer, it begins to evaporate into the atmosphere. Its gas form is known as water vapor. After the water changes from a liquid to a gas, it will rise higher in the atmosphere. It will cool as it rises and lose some energy. As this happens, the water in the atmosphere will start to condense and fall to the ground or into the oceans as rain. Once the water on the ground gains enough heat energy, it will again evaporate into the atmosphere, and so the cycle goes. This constant cycle of evaporation and precipitation creates a circulation of water in both the oceans and the atmosphere. This cycle also transports water all around the globe.
- 3 As you can imagine, this constant cycle of water between the ocean and the atmosphere is one of the major factors that determines local weather patterns. This movement of water is very complex. It depends on the amount of sunlight that reaches certain areas. It depends on how masses of circulating water within the atmosphere affect each other. It also depends on the temperatures of the oceans. As almost 97% of all of the water on Earth is found in the oceans, they play a huge role in the circulation of water. The warmer the oceans, the more water evaporates into the atmosphere. The more water in the atmosphere, the more precipitation can occur. This cycle is exactly what happens during the formation of hurricanes. Let us look at this phenomenon in more detail, particularly the role that water in the atmosphere plays in these incredible storms.
- 4 Hurricanes are extremely violent storms that occur around the globe. In some places these storms are known as typhoons or cyclones. The scientific name for this kind of storm is tropical cyclone. However, the tropical cyclones that occur over the Atlantic Ocean are always called hurricanes. As the name implies, these storms always form in hot tropical areas on either side of the equator (but not at the equator). Why do these storms always form in tropical areas? Hurricanes require warm air and a huge amount of moisture. The oceans in these tropical areas are very warm, as they gain a lot of energy from the Sun. This causes a lot of evaporation, which releases large amounts of moisture into the atmosphere. Warm air is lighter than cool air. Another way to say this is that warm air is less dense than cool air. This means that warm air rises and cool air falls. Therefore, as the air near the tropical oceans gets warmer, it begins to rise, and it takes all of the moisture along with it.

5 So, we have warm temperatures and lots of moisture. Are the conditions right for hurricane formation? Almost. The third critical factor in hurricane formation is wind, and it has to be just the right amount of wind. Remember that warm air rises and cool air falls. As the tropical oceans heat up during the summer months, the large amounts of moisture in the air cause thunderstorms. These thunderstorms allow the moisture in the air to rise further into the atmosphere. If the winds in the upper atmosphere are light enough, then the moisture can rise very high. This creates a region of very low pressure near the surface of the ocean, pulling air from the surrounding areas to fill it. Remember that moving air is wind. Therefore this zone of rising air and the resulting low pressure create wind. The winds blow along the surface of the ocean. They move from the outside of the storm to the center. As they blow, the rotation of the Earth causes the winds to deflect, eventually forming a circular rotation around the center, or eye, of the hurricane. The winds pick up a lot of heat and moisture on their journey to the eye. Once they get there, they will rise, strengthening the low pressure. This creates a pattern of air circulation, of moisture from evaporation and heat from the ocean's surface, that can form a hurricane.

6 Hurricanes in the Atlantic Ocean typically form off of the coast of West Africa during the summer months. It is at this time of year that the water in the ocean can reach temperatures of 80°F. The main winds in the area, known as the trade winds, move from east to west. Small thunderstorms form near the coast and are pushed out to sea by the trade winds. Once over the ocean, the storms gain energy from the warm water. As the storms build, more and more wind flows in to rise at the center. The storm will begin to circulate around the area of low pressure created by the rising warm air. The air that has risen will flow outward above the storm. This does two things. It pulls more air from the ocean surface, and it creates increasing amounts of moisture in the air.

7 When they first form, these storms are known as tropical depressions. These types of storms are usually weak and unorganized. If the winds of a tropical depression reach 39 mph, then it becomes a tropical storm. Tropical storms have more energy, and the circulating pattern of the storm begins to take shape. If the winds reach 74 mph, then it becomes a hurricane. Hurricanes are very strong and organized storms with a distinct shape. All of the hurricanes in the northern hemisphere have a counterclockwise rotation with a calm center, the eye of the hurricane. These storms can be hundreds of miles across and cause a lot of damage. Therefore, it is a good thing that most hurricanes do not last for long. As soon as it moves over either cooler water or land, the storm weakens and breaks apart. High winds in the upper atmosphere can also break a hurricane apart. Now you know how circulating water in the atmosphere creates hurricanes.

1. Why do we call Earth the Blue Planet? What makes it look blue from space?

- A The water in the oceans only.
- B The water in the atmosphere only.
- C The water in the oceans and atmosphere.
- D None of the above.

2. Which of the following does NOT determine local weather patterns?

A The cycle of water between the oceans and the atmosphere.

B How masses of circulating water in the atmosphere affect each other.

C The temperature of the oceans.

D The temperature in outer space.

3. What is the correct name for circulating storms with winds over 74 mph in the Atlantic Ocean?

A Tropical storms

B Hurricanes

C Typhoons

D Cyclones

4. Which of the following is not a factor that is required for the formation of hurricanes?

A Very high winds in the upper atmosphere.

B Ocean temperatures of at least 80°F.

C Low winds in the upper atmosphere.

D Warm, moist air.

5. Why do Atlantic hurricanes typically form during the summer months?

A The trade winds push small storms out to sea.

B The temperature of the ocean is over 80°F.

C Small storms gain energy as they move out to sea.

D All of the above.

6. While hurricanes can be violent storms that cause millions of dollars of damage, they fortunately do not last very long. There are several things that may cause the breakup of a hurricane. Which of the following would NOT cause the breakup of a hurricane?

A The hurricane moving to sea from West Africa.

B The hurricane moving over land.

C If there were very high winds at high altitudes.

D The hurricane moving over cooler water.

Station 6: Open-Ended Response Questions

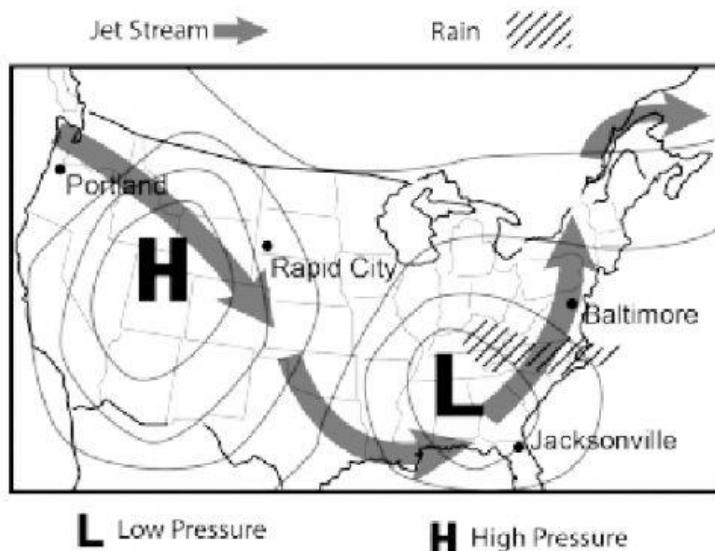
Directions: Answer each question in 3-5 complete sentences.

1. What are the major forces that drive patterns of atmospheric movement?
2. Describe some global patterns of atmospheric movement that might influence local weather.
3. Describe how global patterns of atmospheric movement affect local weather. Include the concepts of air pressure and temperature.

Station 7: Multiple Choice Quiz

Directions: Answer each question to the best of your ability. Use your notes!!

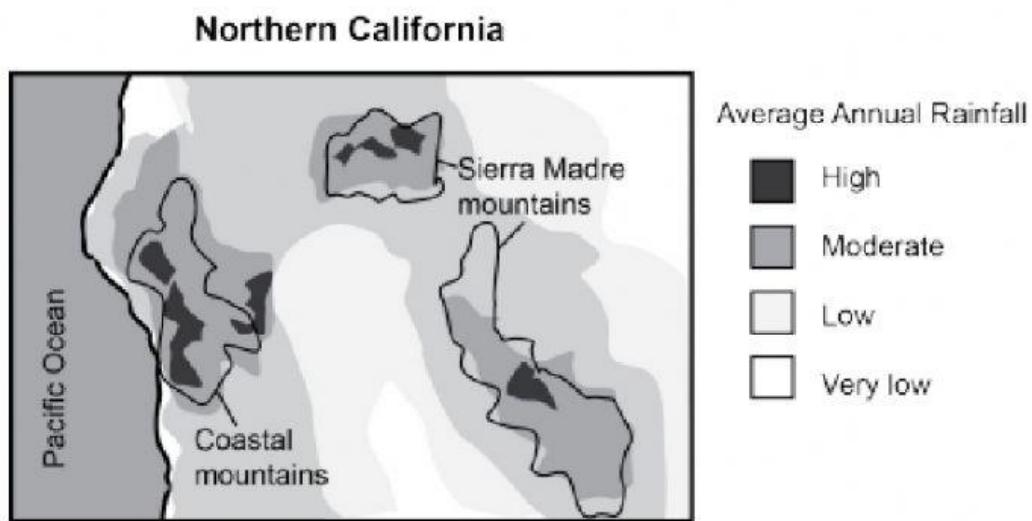
- 1 Which of the following observations provides evidence that oceans play a major role in weather patterns on land?
 - A Most of the major ocean currents are driven by wind patterns and are changed by the shape of the continents.
 - B Weather patterns are similar along the coast of a continent but different as they move from the coast to the center of a continent.
 - C Large bodies of water like the Pacific Ocean have very little land to interfere with the movement of ocean currents.
 - D Differences between the temperature of the atmosphere and the temperature of seawater generate very windy conditions over the oceans.
- 2 The jet stream is a wind current that pushes air masses and weather patterns across the United States.



According to the information on the weather map, which city is likely to experience an increase in precipitation?

- A Portland
- B Rapid City
- C Jacksonville
- D Baltimore

3 This map of northern California shows some features, along with annual rainfall.



The map provides evidence that rainfall on land is influenced by—

- A temperature of the ocean.
- B elevation of the land.
- C proximity to the equator.
- D low-pressure systems.

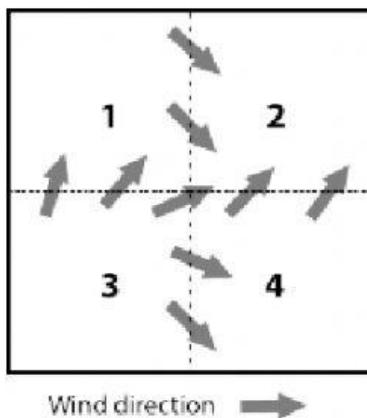
4 The jet stream is a wind current that pushes air masses and weather patterns across the United States.



In a laboratory investigation, students observed that moisture in the air condenses when the temperature of the air decreases. Given this information and the information on the weather map, which city is likely to experience an increase in local cloud cover?

- A** Nashville
- B** Bismarck
- C** Albany
- D** San Diego

5 This map provides data on the direction of winds blowing in a certain area that has been divided into four regions, labeled 1 through 4.



Given this information on the winds, what are the most likely locations of high-pressure and low-pressure zones?

- A** Low in region 2; high in region 3
- B** Low in region 3, high in region 4
- C** Low in region 1, high in region 2
- D** Low in region 2; high in region 4

Station 8: Writing about Weather and Climate

Directions: Answer the prompt using the RACE strategy.

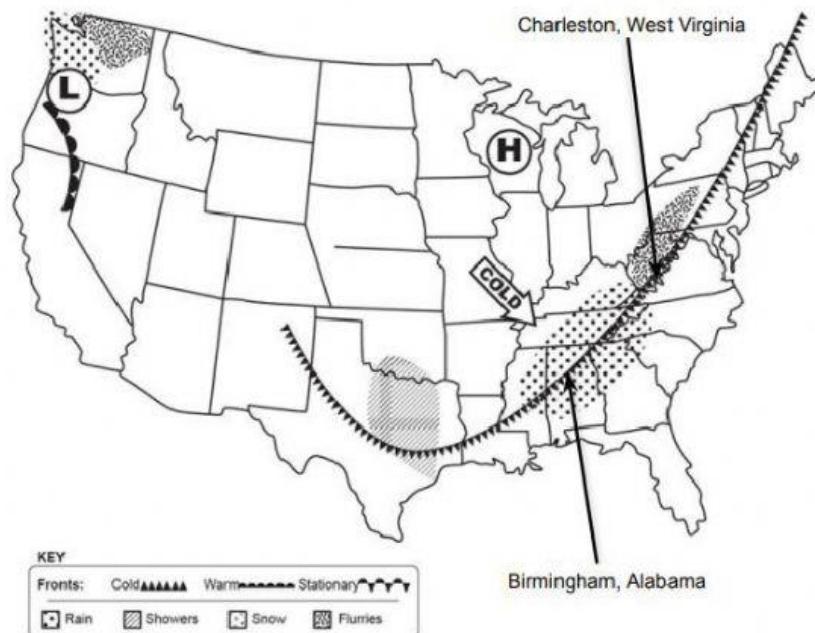
R- reword the question in the form of an answer

A-answer the question

C-cite your evidence

E-explain your answer

Scenario: The map below shows the weather for today. There are cold and warm air masses that are colliding in the southeast.



Prompt: Using the map provided, how could somebody determine that Charleston, West Virginia is experiencing colder weather than Birmingham Alabama?

R-

A-

C-

E-