Chapter 4
Global Climates and Biomes

Agenda 1/28

- Decomposition Chamber- Water, Gather Data
- WU & ESCE's
- Review/ NB
- Quiz CH 1 & 2
- HW CH 4 Voc & FRQ Study Guide P.25NB Due Thursday
- HW CH 4 MC Study Guide P.27NB Due Monday
- HW CH 8 MC Study Guide P. 29NB Due Tuesday

1/28 Global Climates CH 4

Obj. TSW understand the different seasons, Climates, Coriolis Effect. P.20 NB

1. List the 5 layers of the Atmosphere, and a characteristic in each.

2. Why is there differential heating on Earth?

3. Explain Figure 4.5 The saturation point of air increases with temperature.

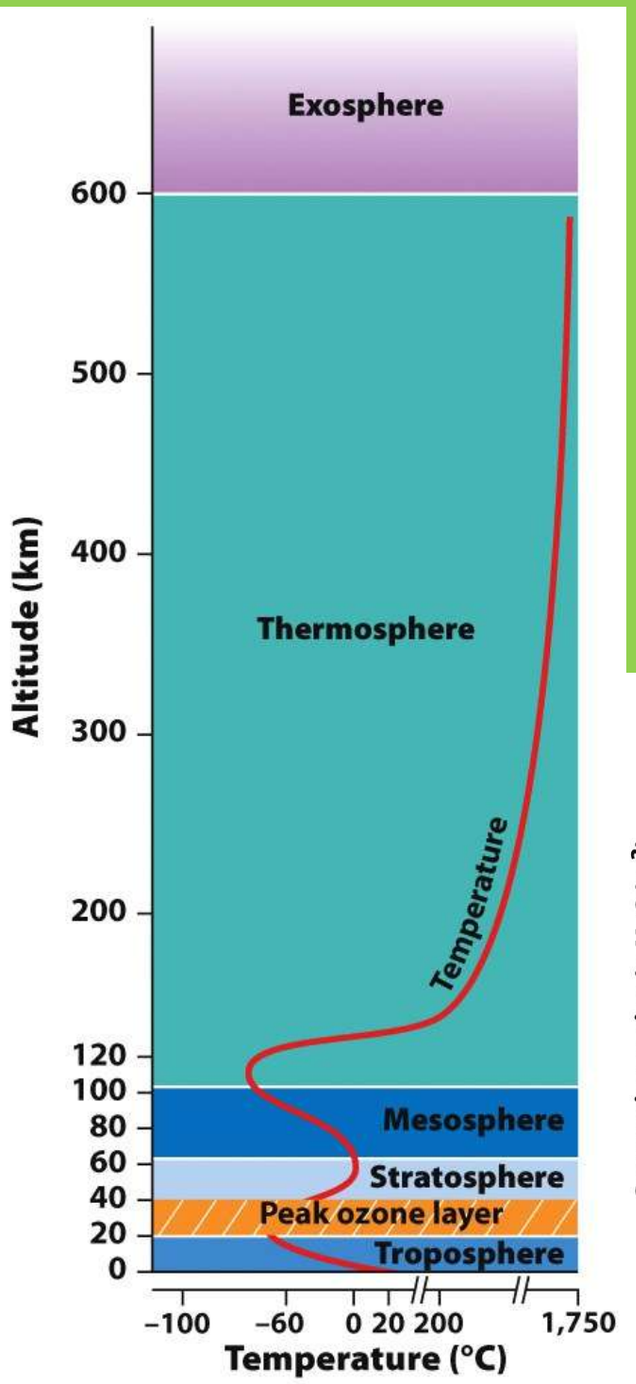


Figure 4.1
Environmental Science

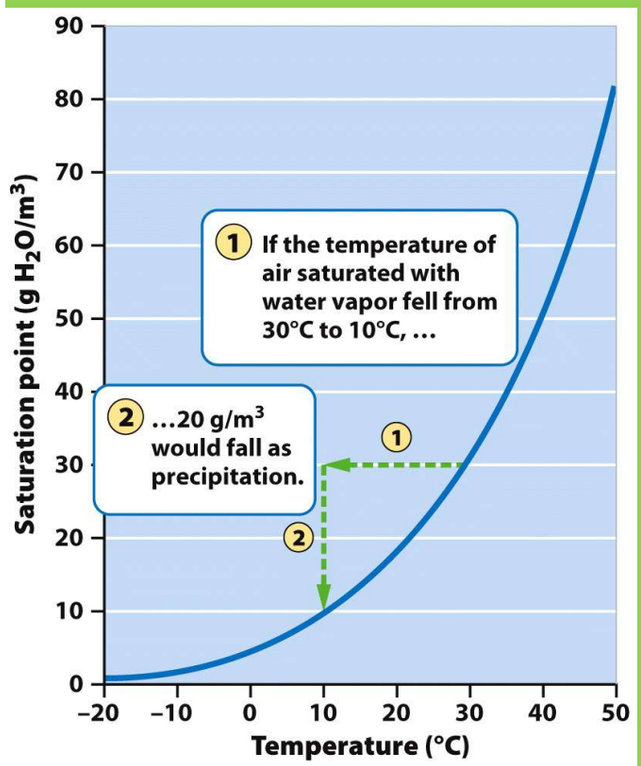


Figure 4.5
Environmental Science

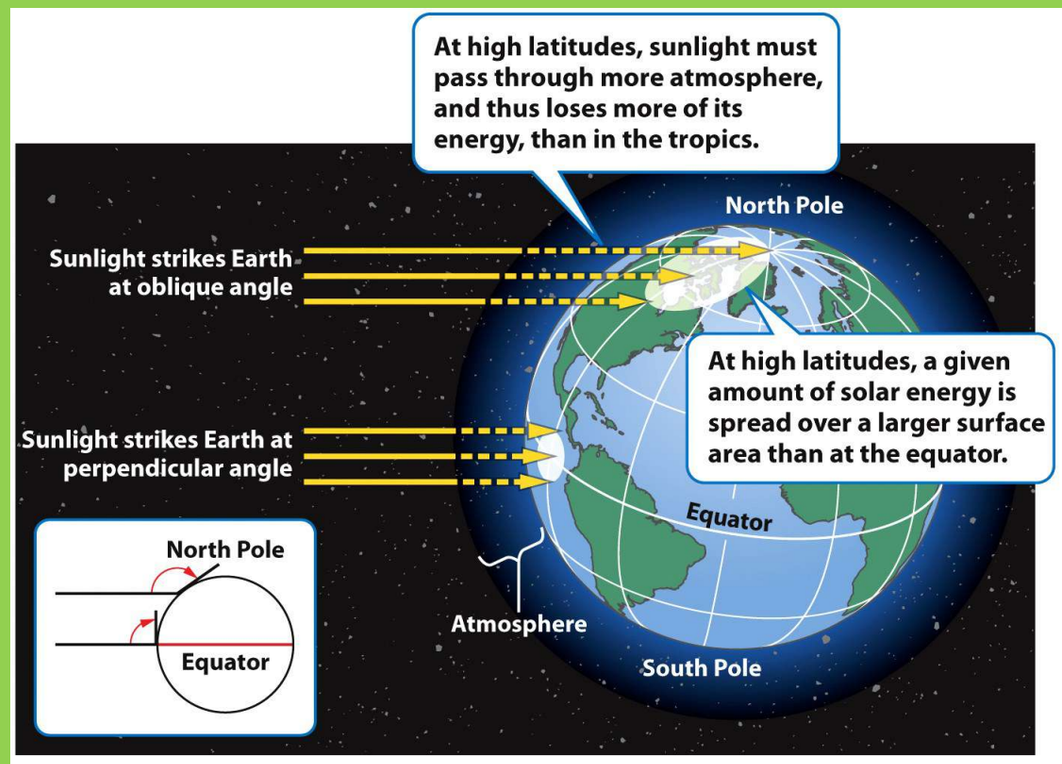


Figure 4.3
Environmental Science

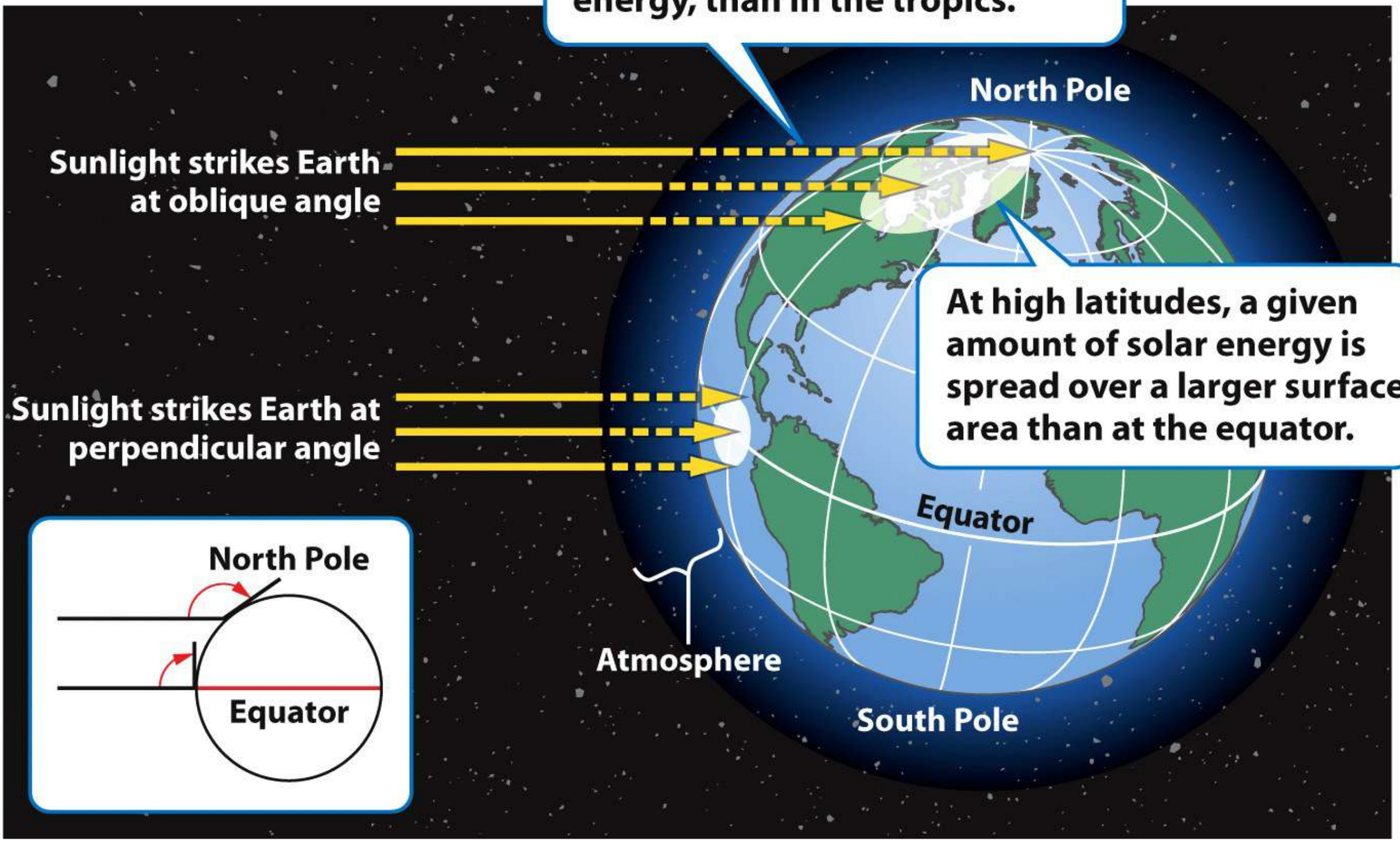


Figure 4.3
Environmental Science

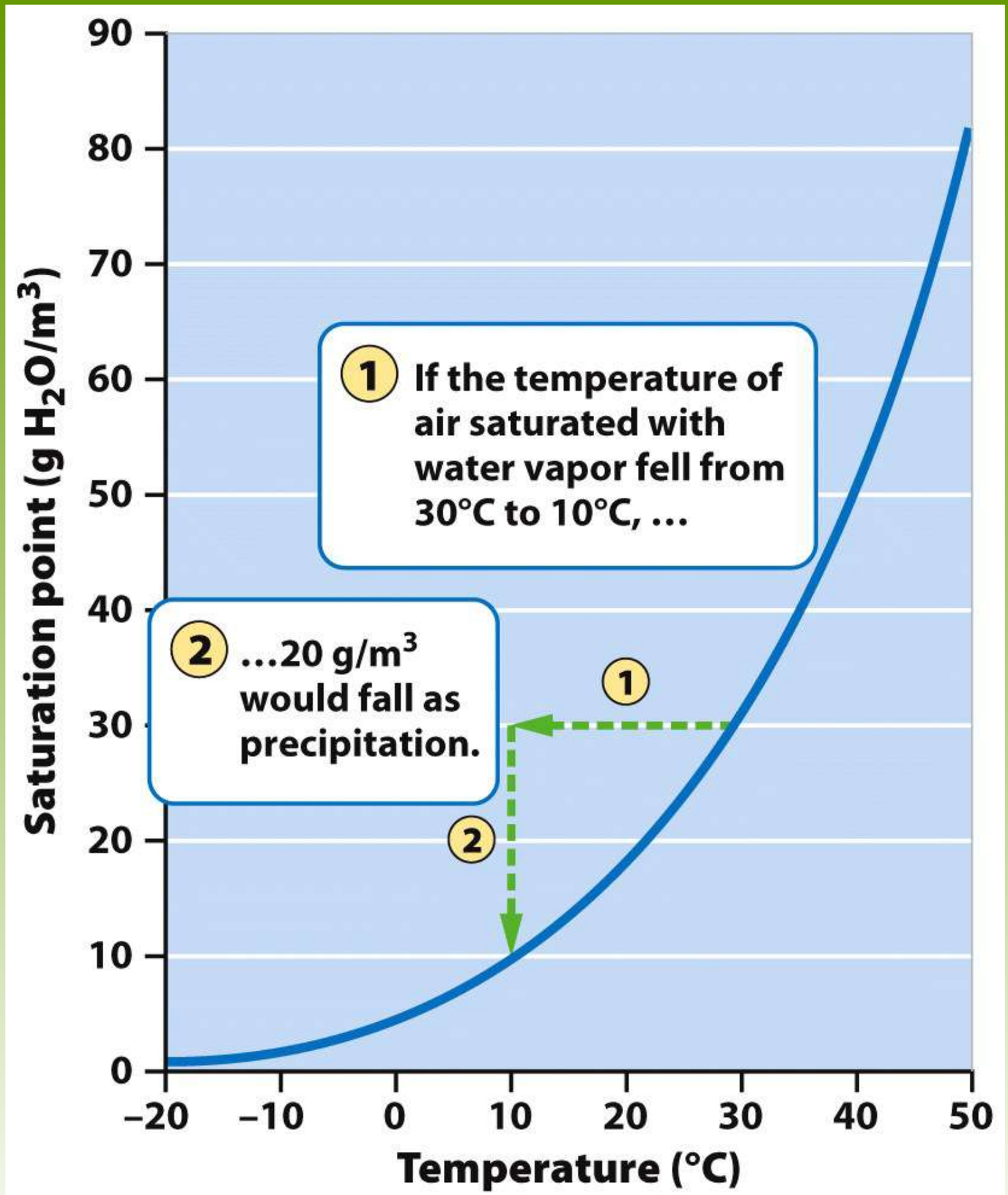


Figure 4.5
Environmental Science

Agenda 1/30

- Gather Data on compost bins – Water them
- AXES Paragraph CH 4 P. 22 NB P. 87 ESBK
- WU -
- Notes
- Coriolis Effect Activity
- Latitude & Cities Activity

1/29 Earth's Rotation & the Coriolis Effect CH 4

Obj. TSW learn how the Albedo, Hadley Cells and the Coriolis Effect on our Biomes. P. 22NB

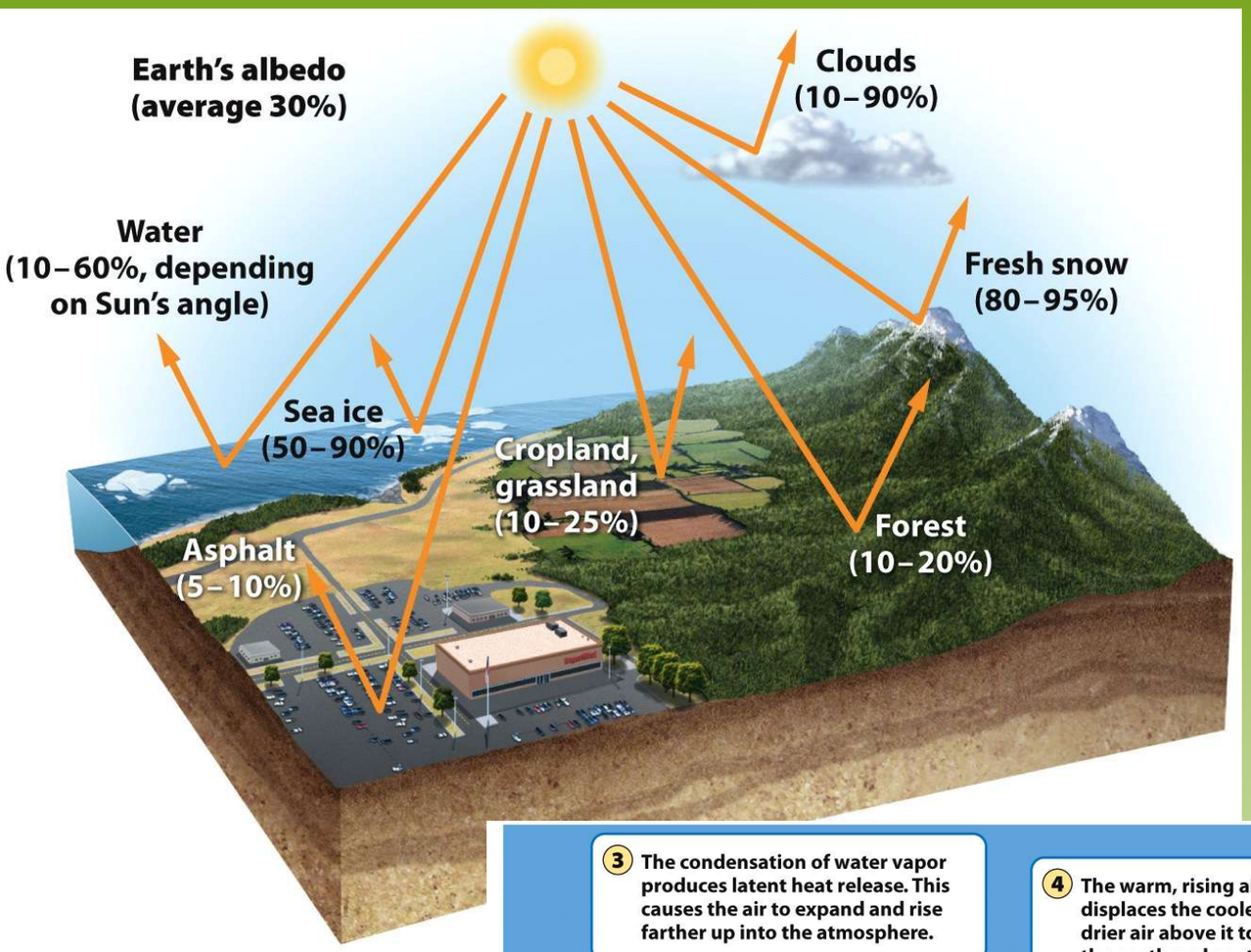


Figure 4.4
Environmental Science

1. Explain Albedo, give an example.
2. Describe a Hadley Cell, List the steps of the cycle.

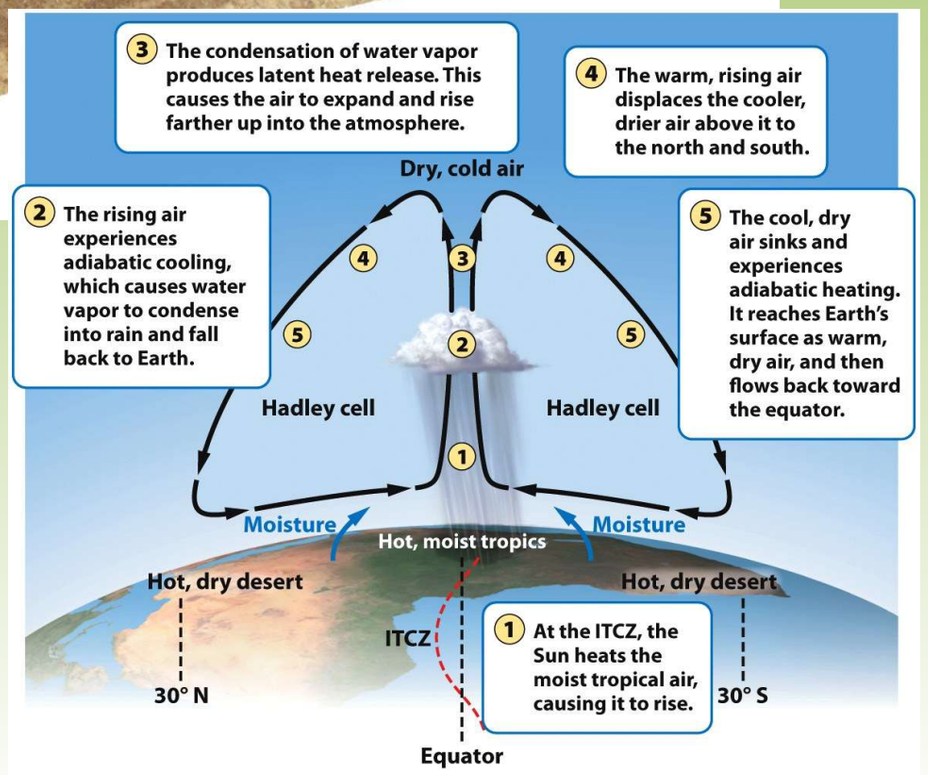
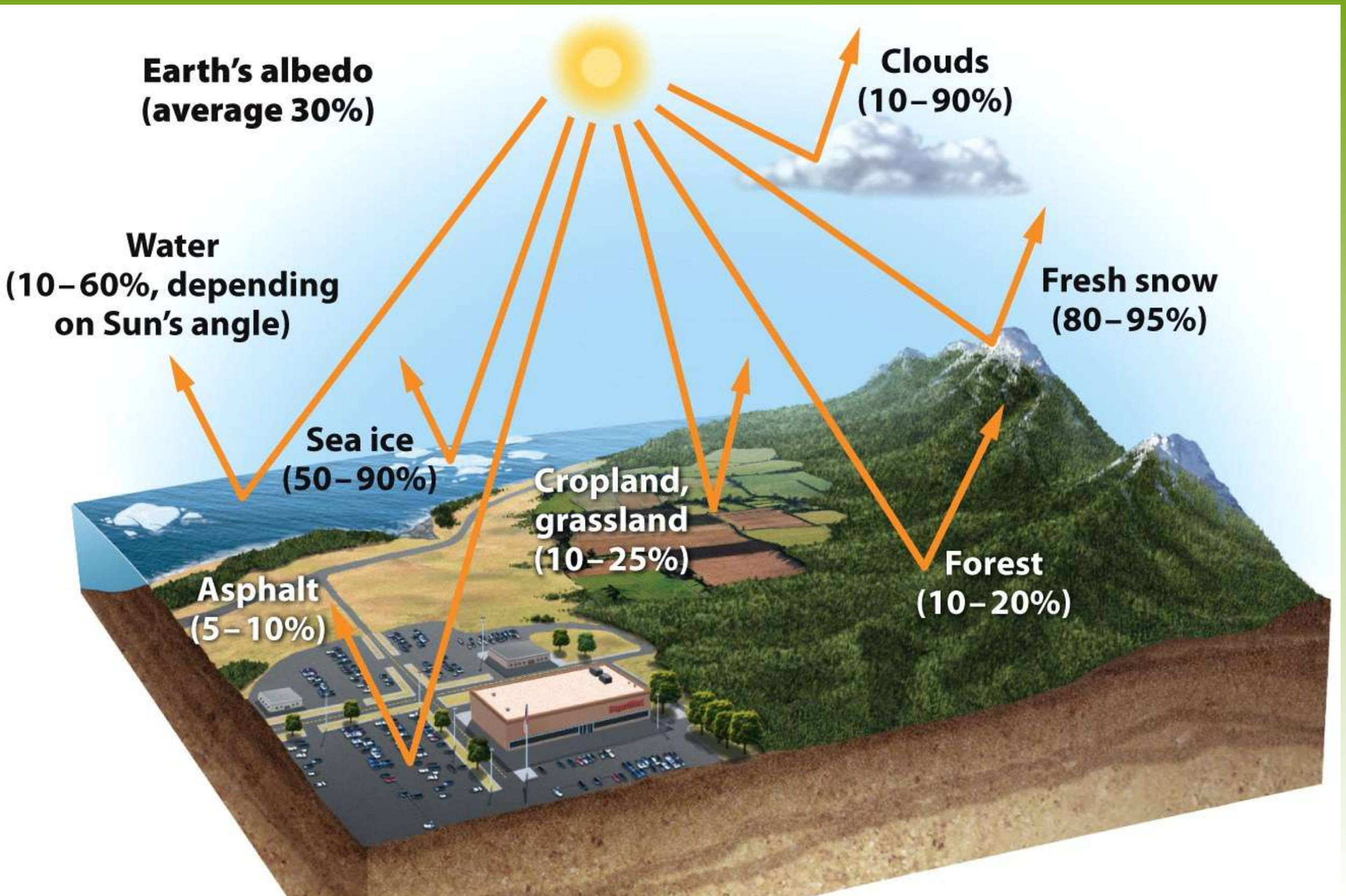


Figure 4.6
Environmental Science

How does the Earth's Rotation & the Coriolis Effect Biomes.


Earth's albedo
(average 30%)
Clouds
(10–90%)
Water
(10–60%, depending
on Sun's angle)
Fresh snow
(80–95%)
Sea ice
(50–90%)
Cropland,
grassland
(10–25%)
Asphalt
(5–10%)
Forest
(10–20%)

Global Processes Determine Weather and Climate

- Weather- the short term conditions of the atmosphere in a local area. These include temperature, humidity, clouds, precipitation, wind speed and atmospheric pressure.

- Climate- The average weather that occurs in a given region over a long period- typically several decades.

Earth's Atmosphere

- Troposphere- the layer closest to Earth's surface extending roughly 16 km (10 miles) above Earth.
- Stratosphere- above the troposphere, this extends from roughly 16 to 50 km (10-31 miles).

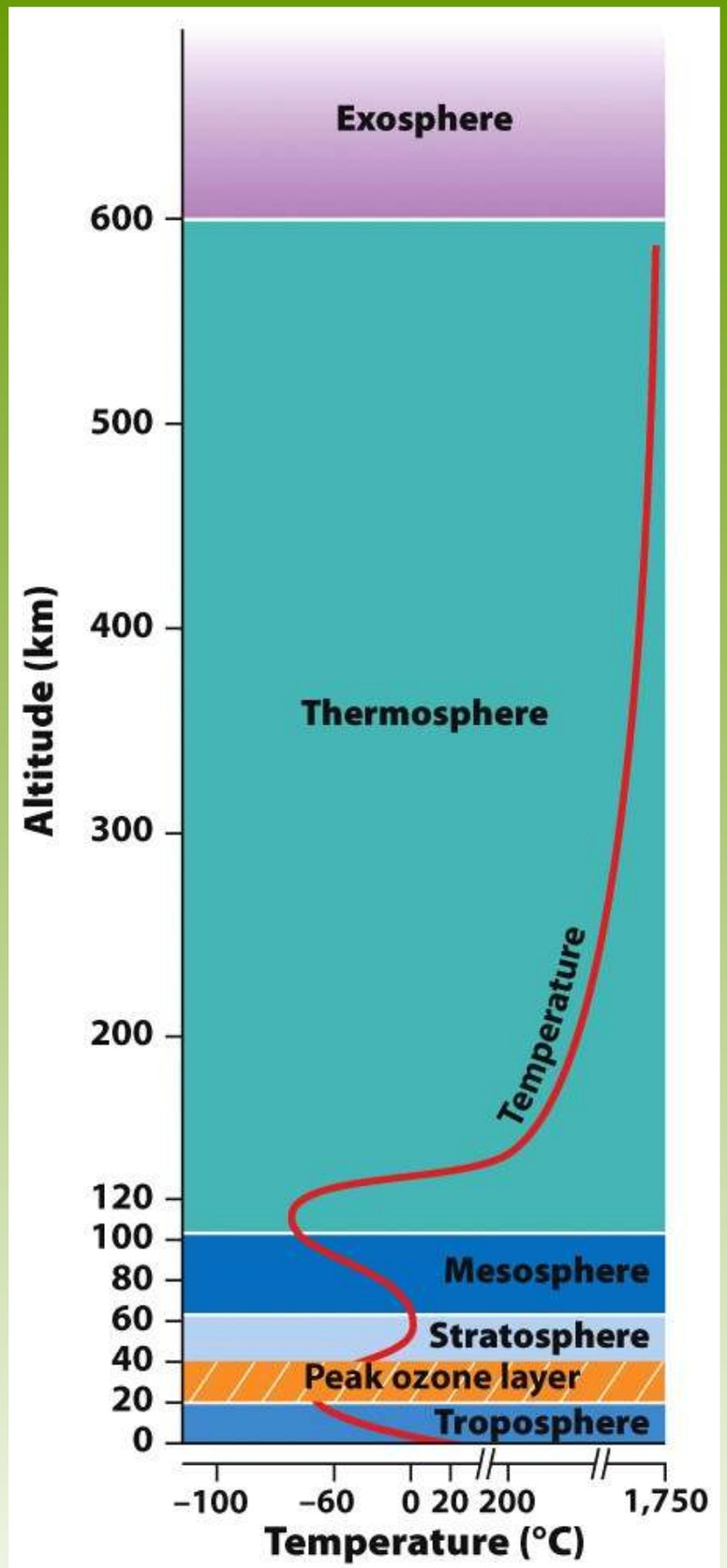


Figure 4.1
Environmental Science

Unequal Heating of Earth

- As the Sun's energy passes through the atmosphere and strikes land and water, it warms the surface of Earth. But this warming does not occur evenly across the planet.

Unequal Heating of Earth

- This unequal heating is because:
  - The variation in angle at which the Sun's rays strike
  - The amount of surface area over which the Sun's rays are distributed
  - Some areas of Earth reflect more solar energy than others. (Albedo)

Atmospheric Convection Currents

- Air has four properties that determines its movement:
  - Density- less dense air rises, denser air sinks.
  - Water vapor capacity- warm air has a higher capacity for water vapor than cold air.
  - Adiabatic heating or cooling- as air rises in the atmosphere its pressure decreases and the air expands. Conversely, as air sinks, the pressure increases and the air decreases in volume.
  - Latent heat release- when water vapor in the atmosphere condenses into liquid water and energy is released.

Formation of Convection Currents

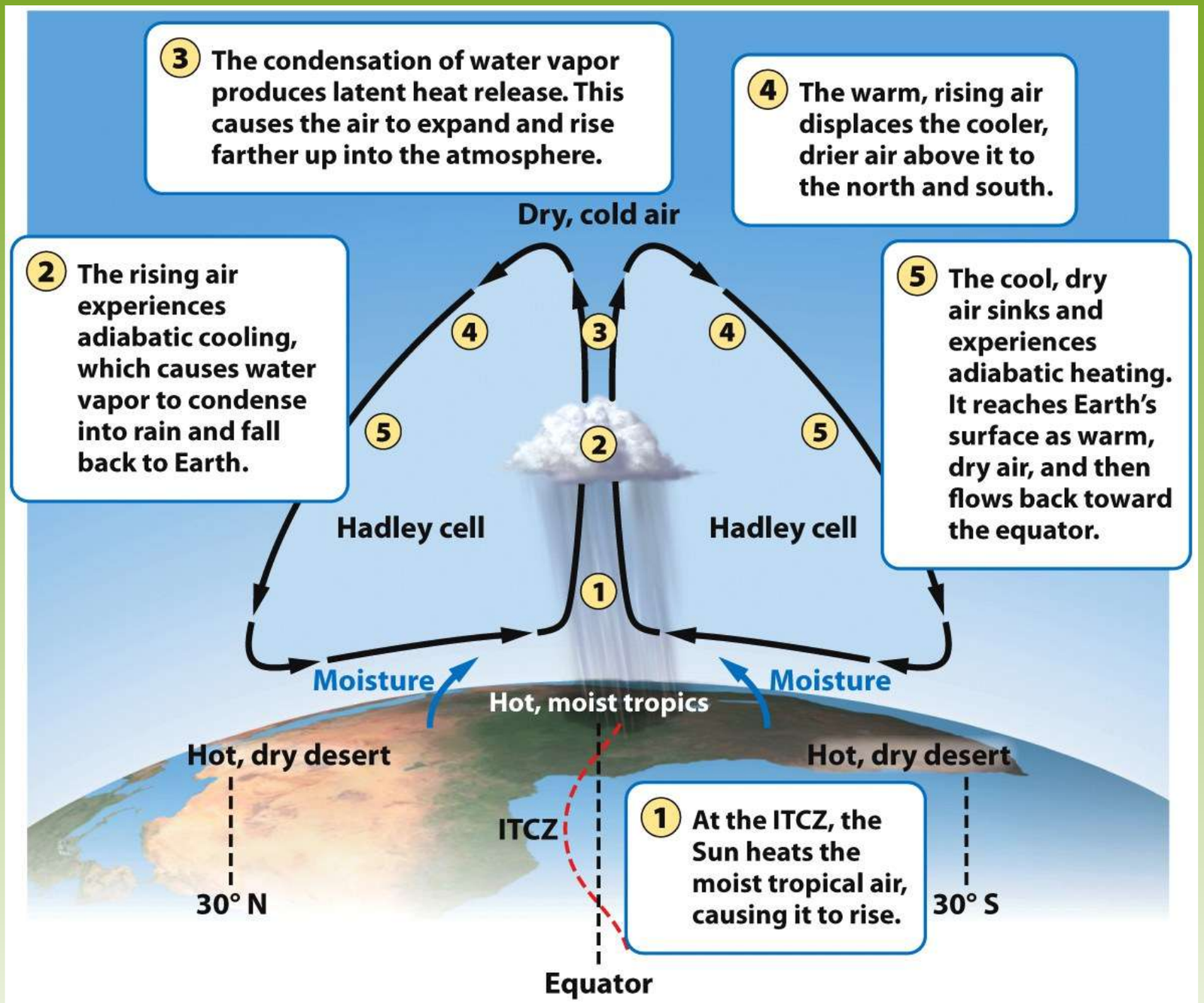
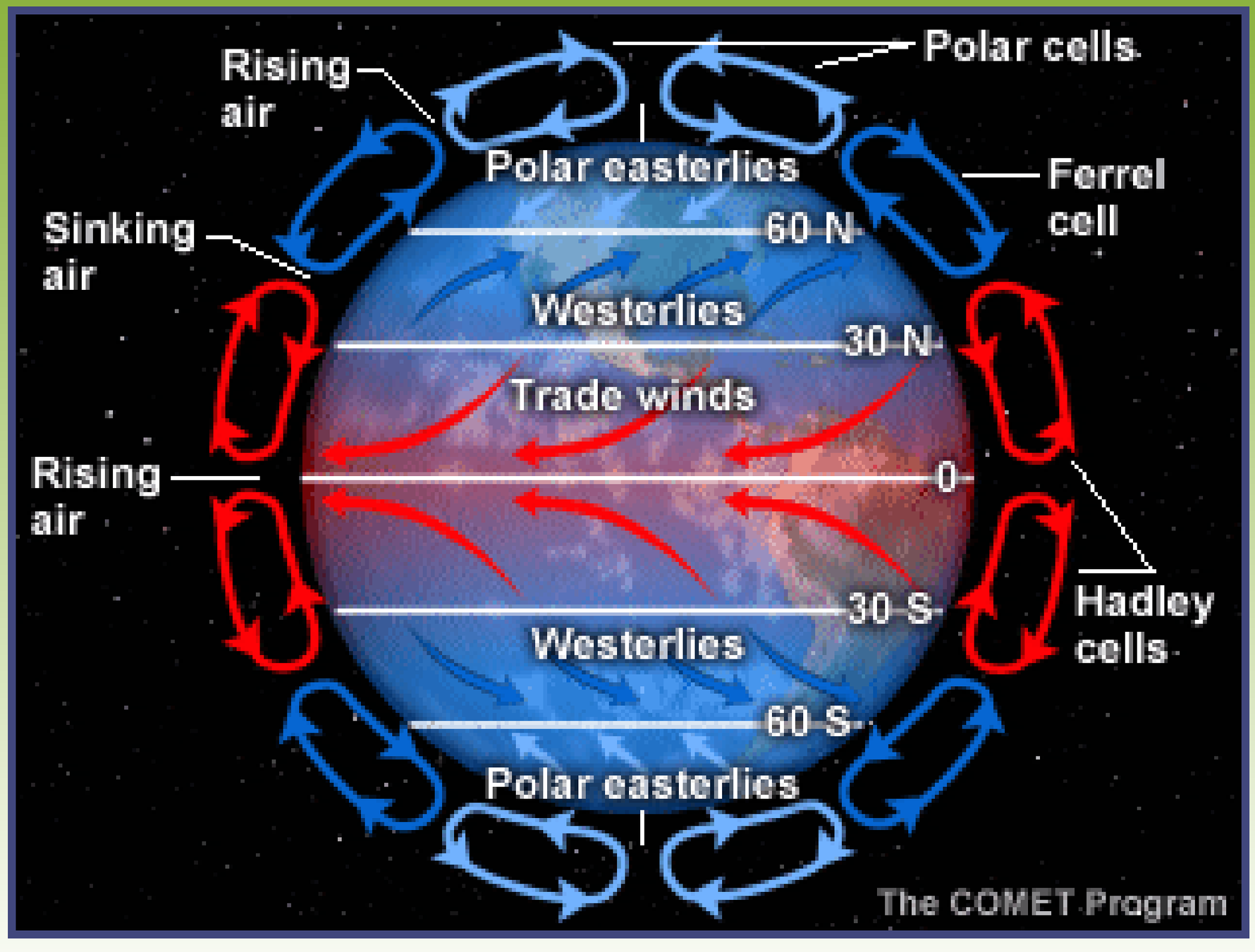


Figure 4.6
Environmental Science

Atmosphere Circulation



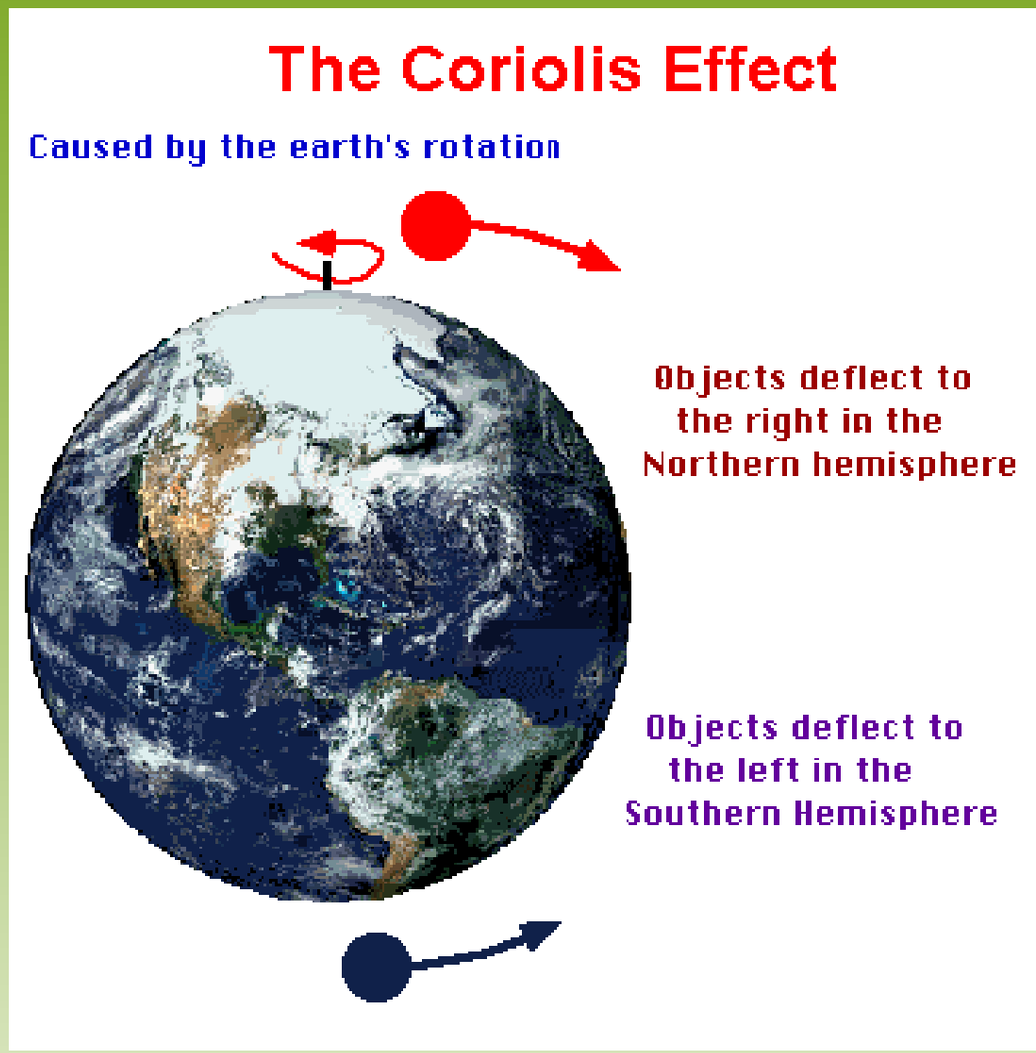
Coriolis Effect & Global Air Circulation

- Effects wind patterns and air currents.
- Three important properties of Air Circulation:
  - Cold air sinks, due to its density
  - Warm air rises, it expands & cools
  - Warm air can hold more water vapor
    - When it cools the vapor phase changes

    To liquid water in the form of rain,

    snow, or fog.
- Air moves from high pressure to low pressure,

WIND.



Coriolis Effect Activity P. 23 NB

- How does the rotation of the Earth affect the wind patterns in the different Hemispheres?

Formation of Convection Currents

- Atmospheric convection currents are global patterns of air movement that are initiated by the unequal heating of Earth.
- Hadley cells- the convection currents that cycle between the equator and 30˚ north and south.
- Intertropical convergence- the area of Earth that receives the most intense sunlight and where the ascending branches of the two Hadley cells converge.
- Polar cells- the convection currents that are formed by air that rises at 60˚ north and south and sinks at the poles (90˚ north and south)

Earth's Rotation and the Coriolis Effect

- As Earth rotates, its surface moves much faster at the equator than in mid-latitude and polar regions.
- The faster rotation speeds closer to the equator cause a deflection of objects that are moving directly north or south.

Coriolis Effect

N. Hemisphere deflects to the west (Counter Clockwise).

S. Hemisphere deflects to the East (Clockwise)

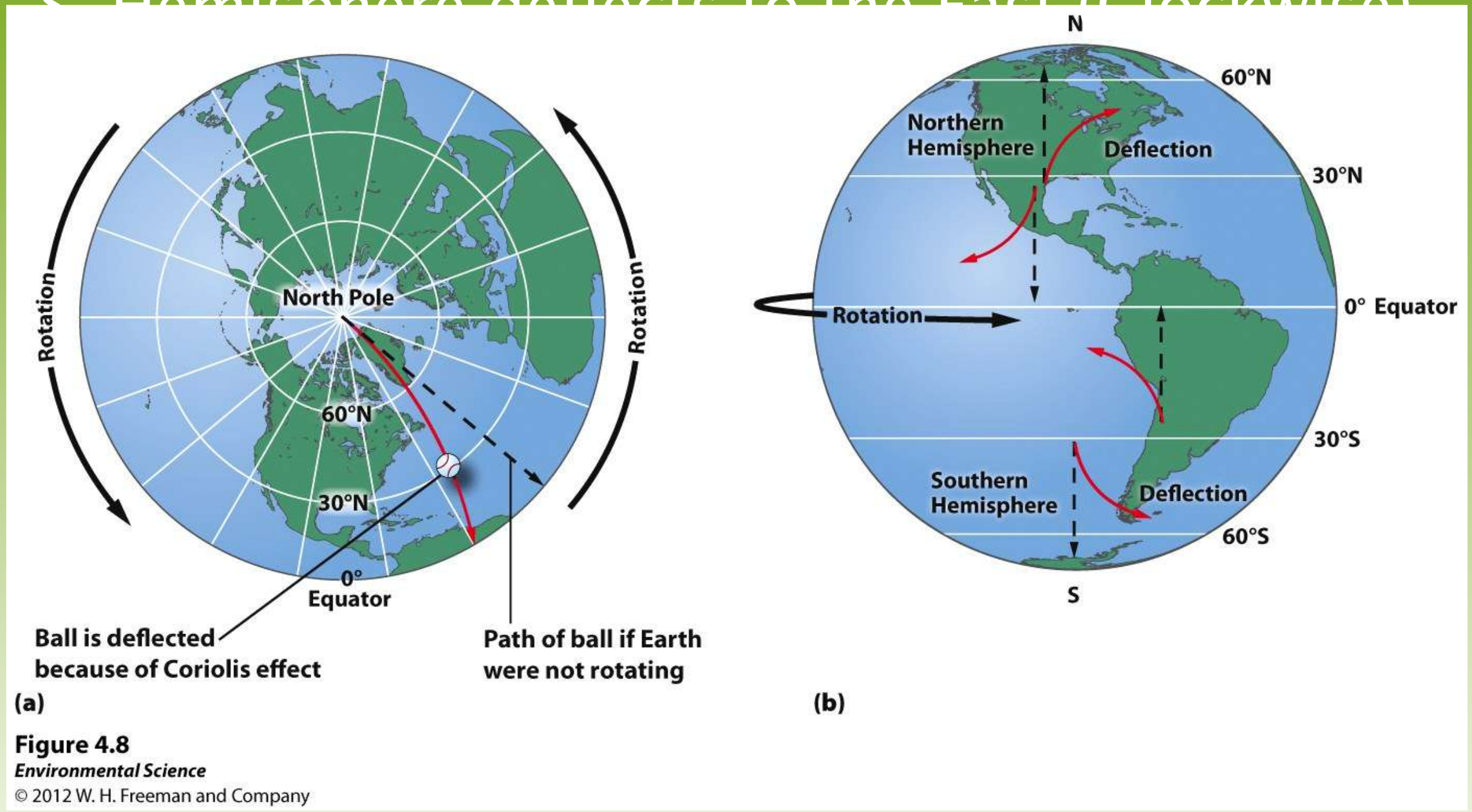


Figure 4.8

Environmental Science

Earth's Rotation and the Coriolis Effect

- Coriolis Effect- the deflection of an object's path due to Earth's rotation.
- The prevailing winds of the world are produced by a combination of atmospheric convection currents and the Coriolis effect.

Working in by yourself, or in pairs or in a group of 3, Find the following Cities:

West Sac.
Tokyo
London,
Dubai,
Buenos Aires

P. 29NB

- What is the Latitude of the City?
- What Climate is that City – Desert, Tundra
- What is the annual rainfall?
- What is the Annual Temperature change?
- How does the Coriolis Effect, Prevailing winds, Earths rotation impact the cities climate?

Prevailing Wind Patterns

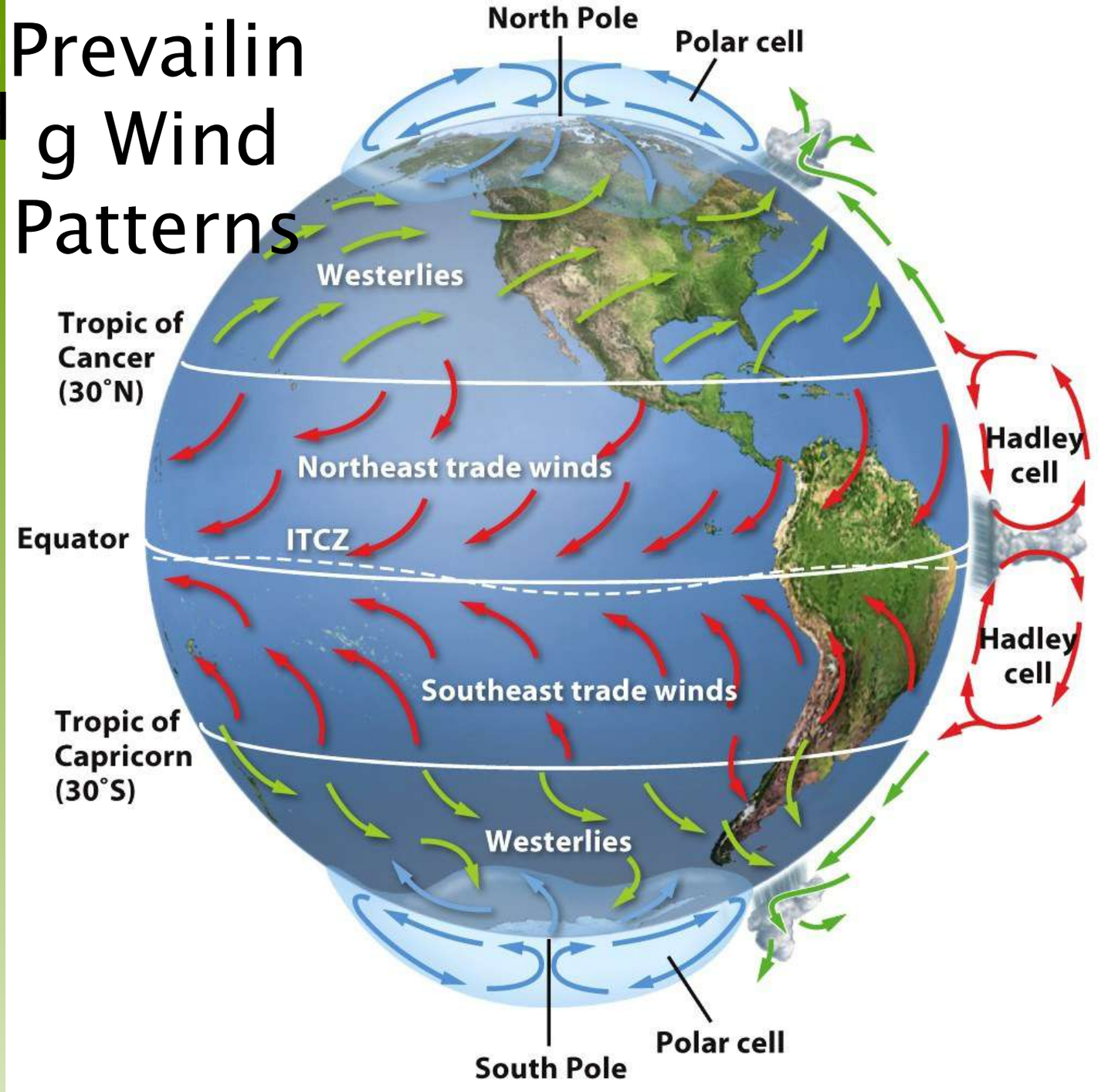
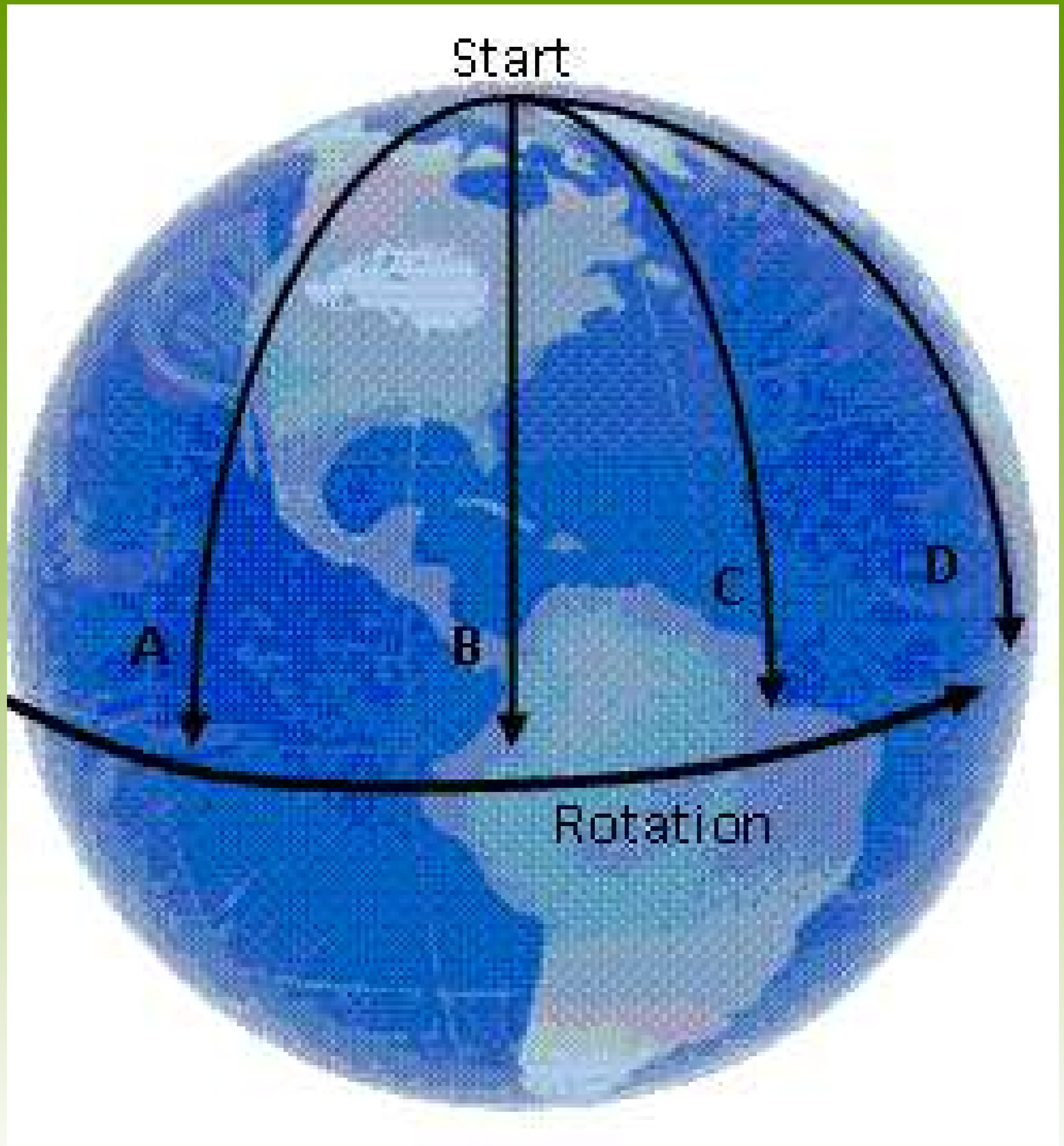


Figure 4.9
Environmental Science


Start
A
B
C
D
Rotation

Earth's Tilt and the Seasons

- The Earth's axis of rotation is tilted 23.5 °.
- When the Northern Hemisphere is tilted toward the Sun, the Southern Hemisphere is tilted away from the Sun, and vice versa.

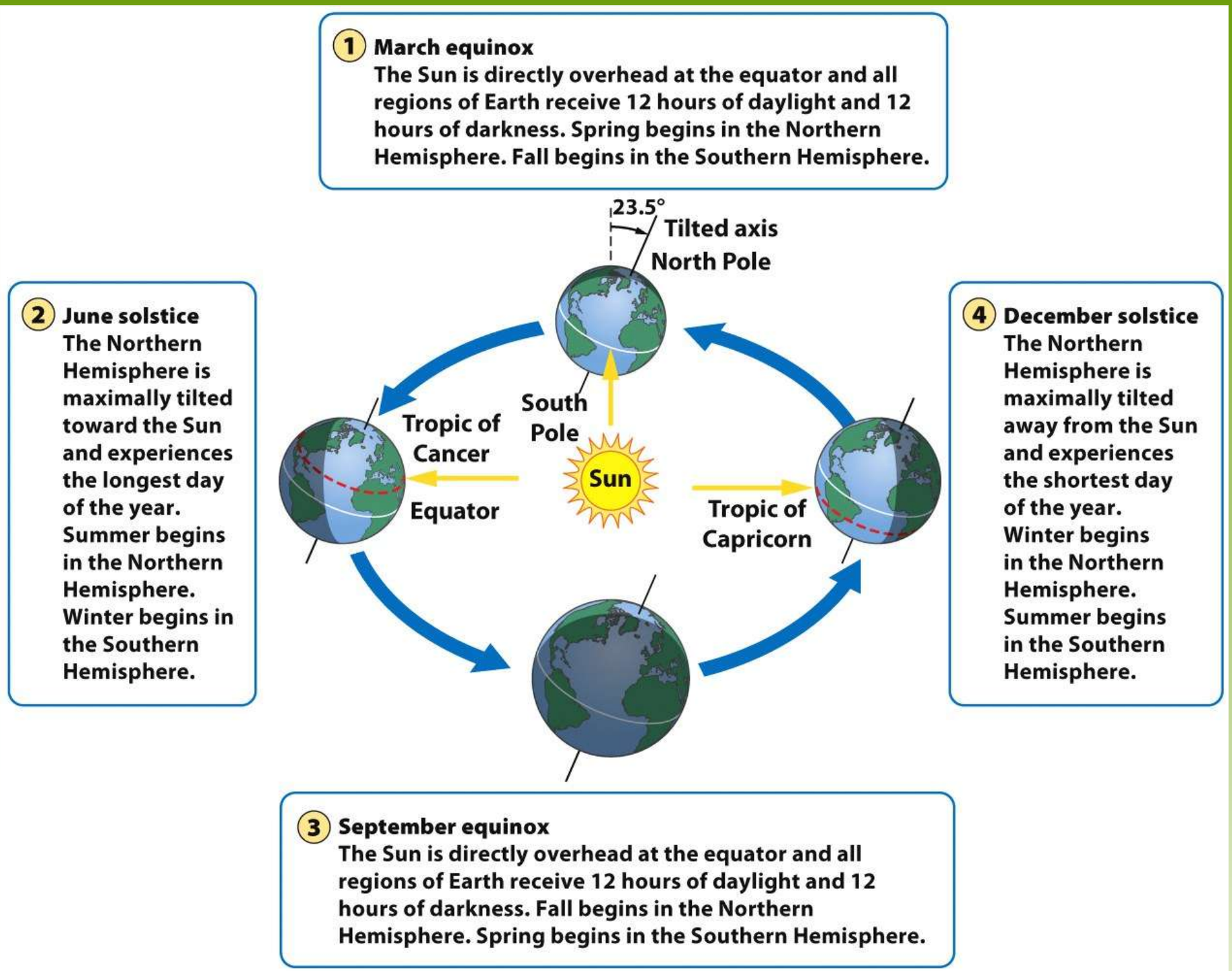


Figure 4.10
Environmental Science

Ocean Currents

- Ocean currents are driven by a combination of temperature, gravity, prevailing winds, the Coriolis effect, and the locations of continents.

- Warm water, like warm air, expands and rises.

- Gyres- the large-scale patterns of water circulation. The ocean surface currents rotate in a clockwise direction in the Northern Hemisphere and a counterclockwise direction in the Southern Hemisphere.

Upwelling

- Upwelling- as the surface currents separate from one another, deeper waters rise and replace the water that has moved away.
- This upward movement of water brings nutrients from the ocean bottom that supports the large populations of producers, which in turn support large populations of fish.

Thermohaline Circulation

- Thermohaline circulation- another oceanic circulation that drives the mixing of surface water and deep water.
- Scientists believe this process is crucial for moving heat and nutrients around the globe.
- Thermohaline circulation appears to be driven by surface waters that contain unusually large amounts of salt.

Thermohaline Circulation

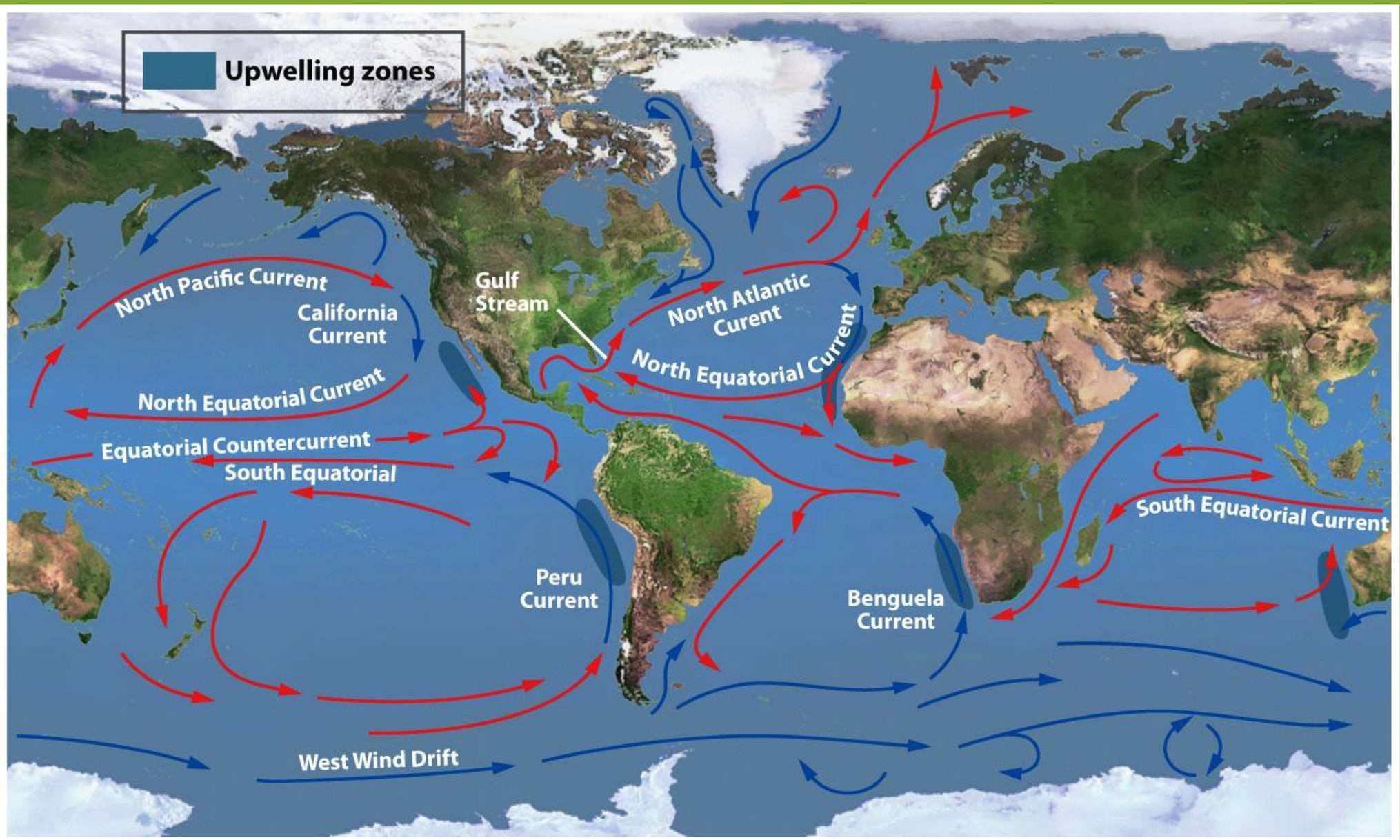


Figure 4.11
Environmental Science

Thermohaline Circulation

- Some of the water that flows from the Gulf of Mexico to the North Atlantic freezes or evaporates, and the salt that remains behind increases the salt concentration of the water.
- This cold, salty water is relatively dense, so it sinks to the bottom of the ocean, mixing with deeper ocean waters.
- These two processes create the movement necessary to drive a deep, cold current that slowly moves past Antarctica and northward to the northern Pacific Ocean.

Heat Transport

- Ocean currents can affect the temperature of nearby landmasses.
- For example, England's average winter temperature is approximately 20 ° C (36°F) warmer than Newfoundland, Canada, which is located at a similar latitude.

1	2	3	4
Warm water flows from the Gulf of Mexico to the North Atlantic, where some of it freezes and evaporates.	The remaining water, now saltier and denser, sinks to the ocean bottom.	The cold water travels along the ocean floor, connecting the world's oceans.	The cold, deep water eventually rises to the surface and circulates back to the North Atlantic.

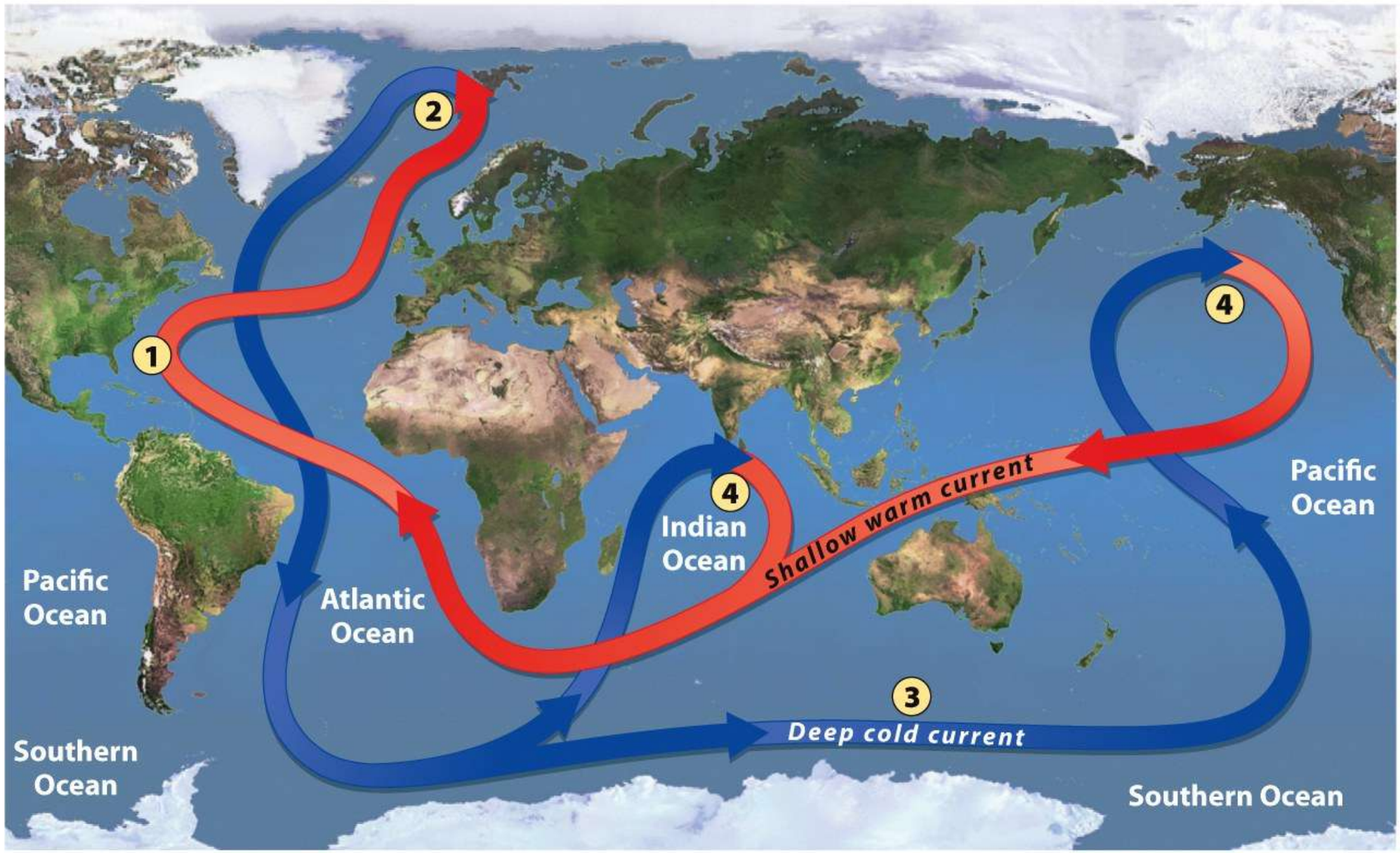


Figure 4.12
Environmental Science

El Nino-Southern Oscillation

- Every 3 to 7 years, the interaction of the Earth's atmosphere and ocean cause surface currents in the tropical Pacific Ocean to reverse direction.

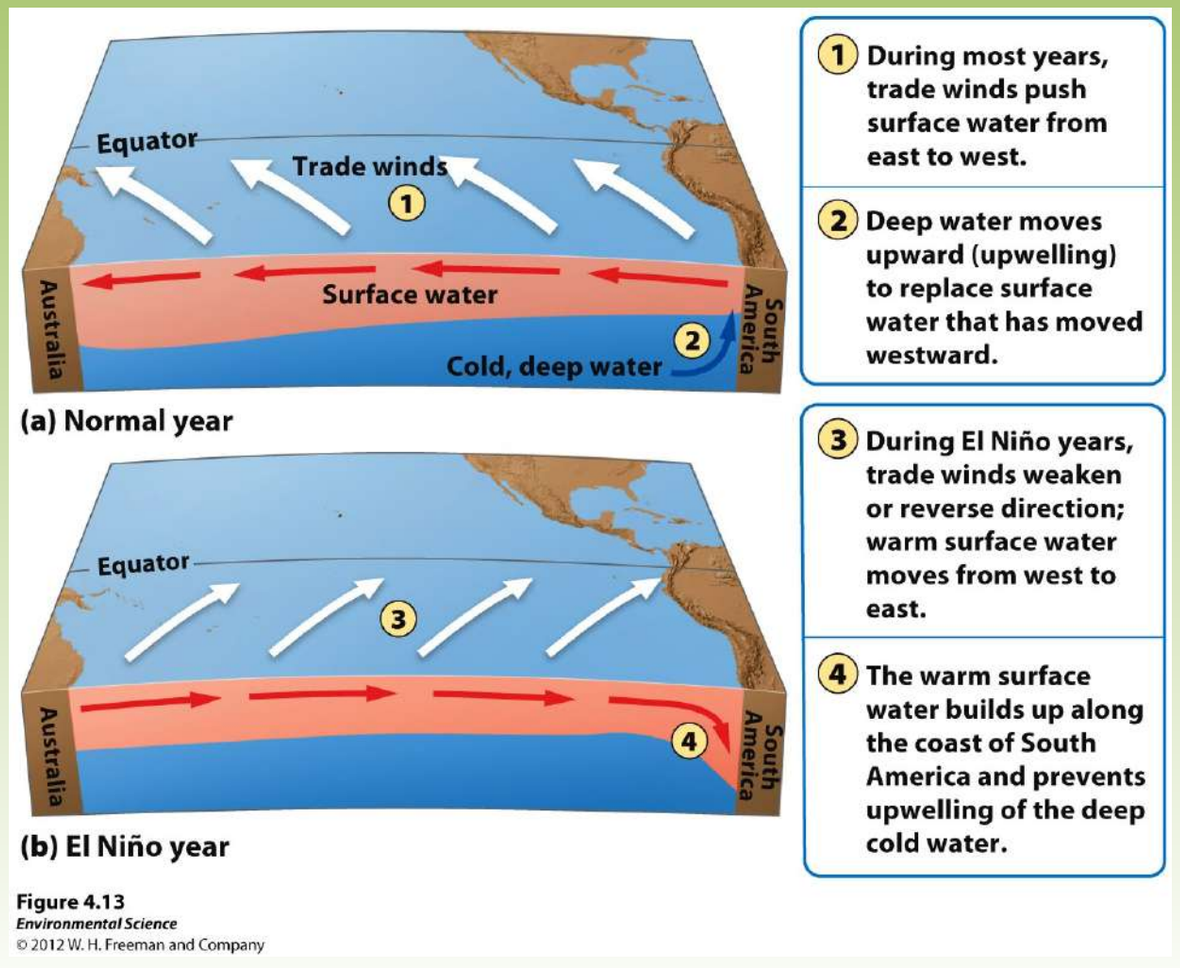


Figure 4.13
Environmental Science

El Nino-Southern Oscillation

- First, the trade winds near South America weaken.
- This weakening allows warm equatorial water from the western Pacific to move eastward toward the west coast of South America.
- The movement of warm water and air toward South America suppresses upwelling off the coast of Peru and decreases productivity there, reducing fish populations near the coast.
- These periodic changes in wind and ocean currents are collectively called the EL Nino-Southern Oscillation, or ENSO.

Rain Shadows

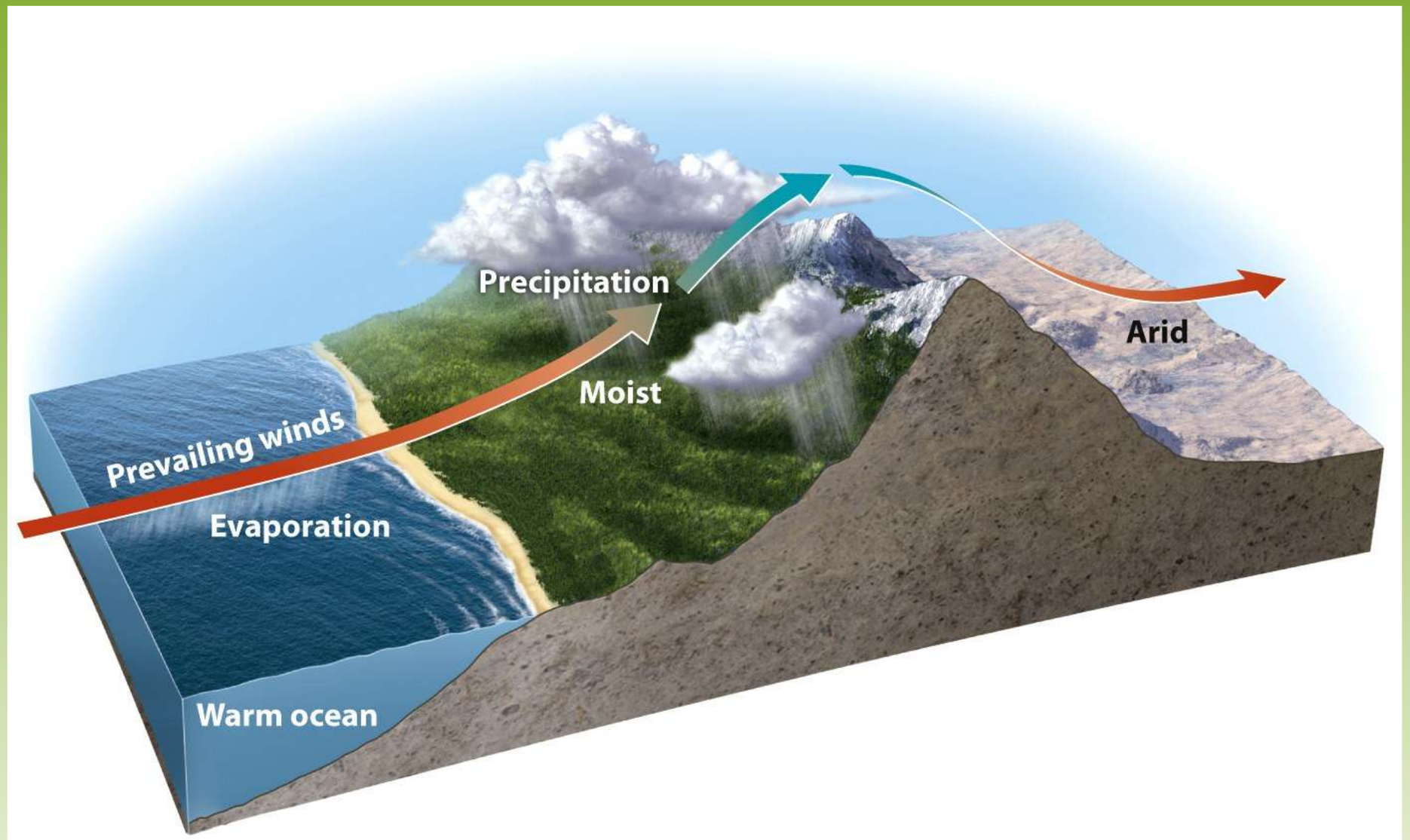


Figure 4.14
Environmental Science

Rain Shadows

- When air moving inland from the ocean that contains a large amount of water vapor meets the windward side of a mountain range (the side facing the wind), it rises and begins to experience adiabatic cooling.
- Because water vapor condenses as air cools, clouds form and precipitation falls.
- The presence of the mountain range causes large amounts of precipitin to fall on its windward side.
- The cold, dry air then travels to the other side of the mountain range (the leeward side), where it descends and experiences higher pressures, which cause adiabatic heating.
- This air is now war and dry and process arid conditions on the leeward side forming the region called a rain shadow.

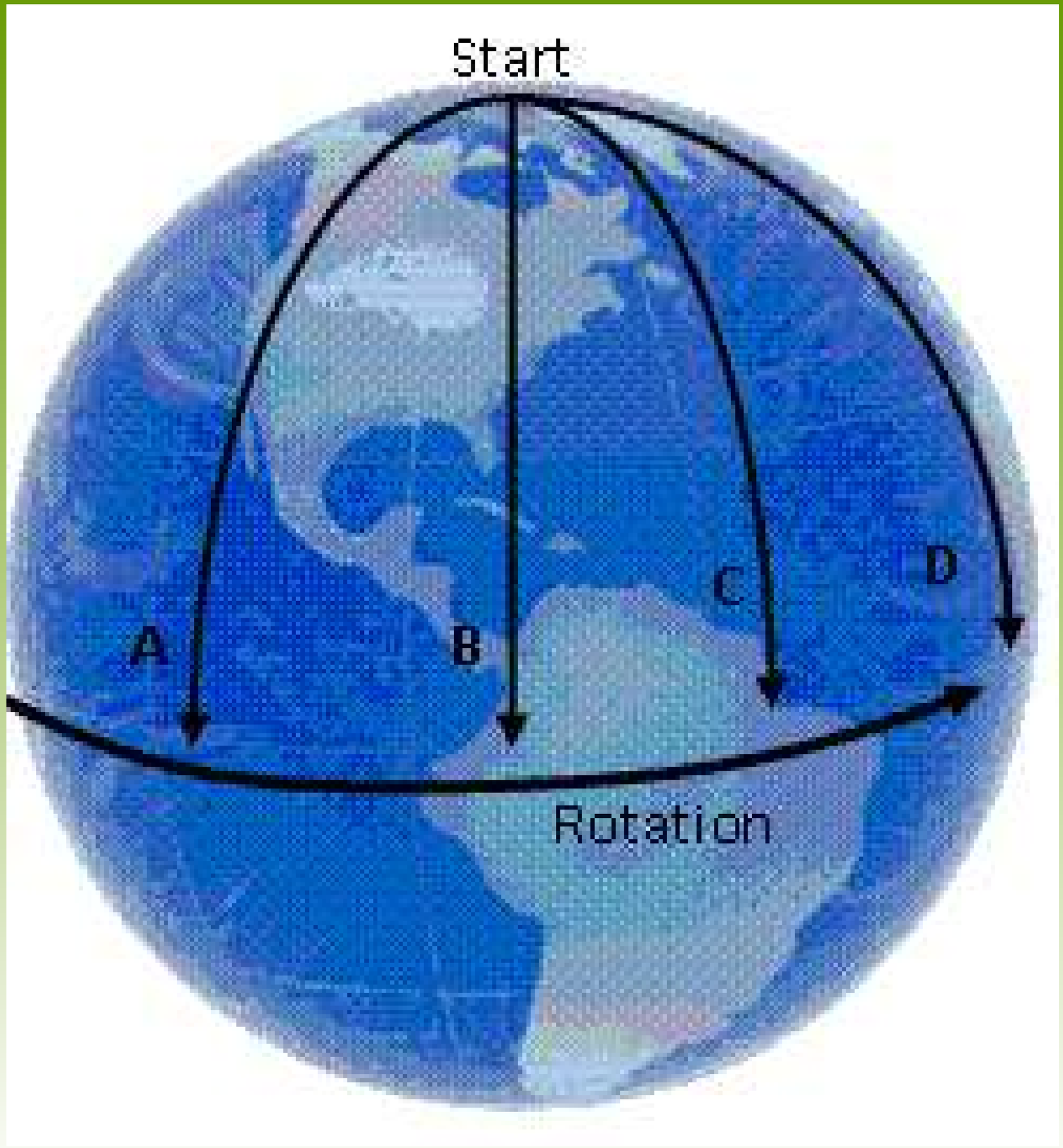
The Open Ocean

- The depth that light can penetrate in the open ocean is dependent on the amount of sediment and algae suspended in the water.
- Photic zone- the zone that receives enough light to allow photosynthesis to occur.
- Aphotic zone- the deeper water that lacks sufficient light for photosynthesis.
- Chemosynthesis- The process that occurs in the aphotic zone when some species of bacteria use methane and hydrogen sulfide to generate energy.

Coriolis Effect Activity

- In teams of 3 get 1 plate and 1 Expo marker.
- Label one side the Northern Hemisphere
- Place the marker at the Pole
- Rotate the plate Counter Clockwise with the pen and draw toward the edge.
- What happens to the line?
- Now Turn the plate over and do the same for the Southern Hemisphere – Rotate clockwise.

(19)



Color me a Watershed

- Compare Map A to Map C
  - How is the topography different?
  - What is the difference in Ecosystem Services?
  - What is the difference in Watersheds?
  - What are their benefits?