

# Science Notes: Chapter 2

# 2.1

- 1. The atmosphere is a mixture of gases that surrounds the Earth.
- 2. The oxygen in the air only makes up about 21% of the atmosphere.
- The nitrogen in the air only makes up about 78% of the atmosphere.





➤ The atmosphere contains small particles like:

- Dust

- Volcanic ash

- Sea salt

- Dirt


- Smoke

➤ 3. Most of the water in the atmosphere exists as invisible gas called water vapor.



- When the atmospheric conditions change, the water vapor can turn into a solid.
- 4. The solid form of water vapor can be:
  - Liquid -- rain
  - Solid – sleet, hail, or snow



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- 5. The atmosphere is held around the Earth by gravity.
  - 6. Air pressure is the measure of the force with which air molecules push on a surface.
  - The atmosphere pushes down on the earth at a pressure of 15 lb per in<sup>2</sup>.
  - As altitude increases, air pressure decreases.






➤ The layers of the atmosphere are:


- 1) Troposphere
- 2) Stratosphere
- 3) Mesosphere
- 4) Thermosphere
- 5) Exosphere

➤ 7. The lowest layer of the atmosphere, which lies next to the Earth's surface, is called the troposphere.




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- 8. Almost all the Earth's carbon dioxide, water vapor, clouds, air pollution, weather, and life-forms are in the troposphere.
  - The atmospheric layer above the troposphere is called the stratosphere.
  - 9. The stratosphere contains the ozone layer.
  - The ozone layer protects life on Earth by absorbing harmful ultraviolet radiation.



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- The mesosphere is the middle layer of the atmosphere.
  - **10. The mesosphere is the coldest layer.**
  - The uppermost atmospheric layer is called the thermosphere.
  - The atoms in the thermosphere absorb solar radiation making it the hottest layer.
  - **11. Electrically charged particles are called ions.**






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- In a part of the thermosphere, there are many ions forming a layer called the ionosphere.
  - **12. In the polar region these ions radiate energy as shimmering lights called auroras.**
  - The ions in the ionosphere reflect AM radio waves.
  - This causes the AM radio signals to bounce back to earth, allowing you to listen to a radio station very far away.



# 2.2

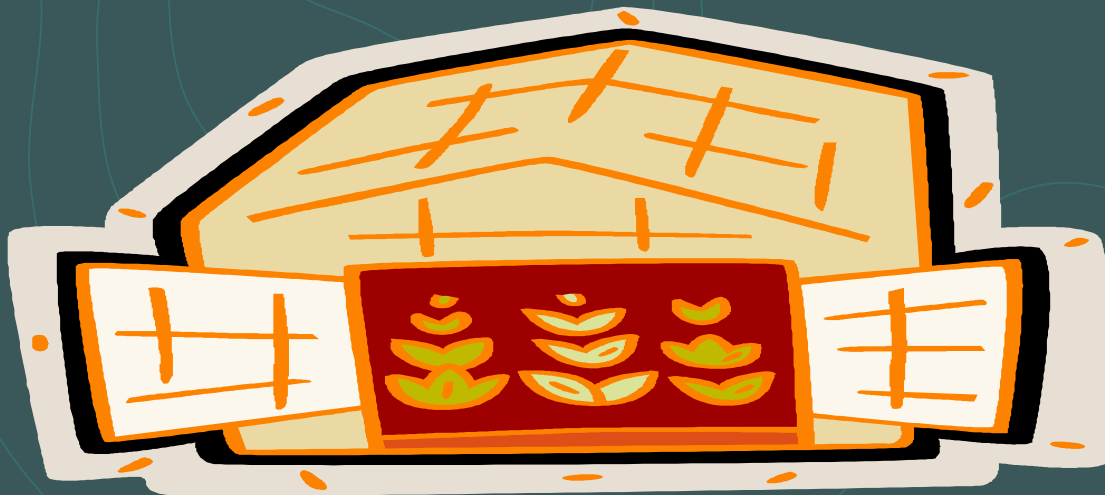
- The earth receives energy from the sun by radiation.
- 1. Radiation is the transfer of energy as electromagnetic waves.
- About fifty percent of the energy that reaches the earth from the sun is absorbed by the earth's surface.
- 2. Thermal conduction is the transfer of thermal energy through a material.




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- Thermal energy is always transferred from warm to cold areas.
  - **3. Convection is the transfer of thermal energy by the circulation or movement of a liquid or gas.**
  - When the air is heated it becomes less dense and rises.
  - When the air is cooled it becomes more dense and sinks.



- 4. The cycle of warm air rising and cool air sinking causes a circular movement of air called a convection current.
- The greenhouse effect is the process by which gases in the atmosphere, such as water vapor and carbon dioxide, absorb thermal energy and radiate it back to the earth.



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- The balance between incoming energy and outgoing energy is known as the radiation balance.
  - 5. The increase in the average global temperatures is called global warming.
  - Greenhouse gases are gases that absorb thermal energy in the atmosphere.




- Human activity such as burning fossil fuels and deforestation may be increasing levels of greenhouse gases in the atmosphere like carbon dioxide.
- Scientists are still debating the effects of global warming.



# 2.3


- 1. The movement of air caused by differences in air pressure is called wind.
- The greater the difference in air pressure, the faster the wind moves.
- Differences in air pressure are generally caused by unequal heating of the earth.



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- 2. Air travels in many large, circular patterns called convection cells.
  - Convection cells are separated by pressure belts, bands of high pressure and low pressure found about every 30° of latitude.
  - The winds are not able to travel in a straight line because the earth is rotating.
  - 3. The apparent curving of the path of winds and ocean currents due to the earth's rotation is called the Coriolis effect.







➤ The combination of convection cells found at every 30° of latitude and the Coriolis effect produces patterns of air circulation called global winds.

➤ **4. The three major global wind systems:**


1) **Polar easterlies**

2) **Westerlies**

3) **Trade winds**

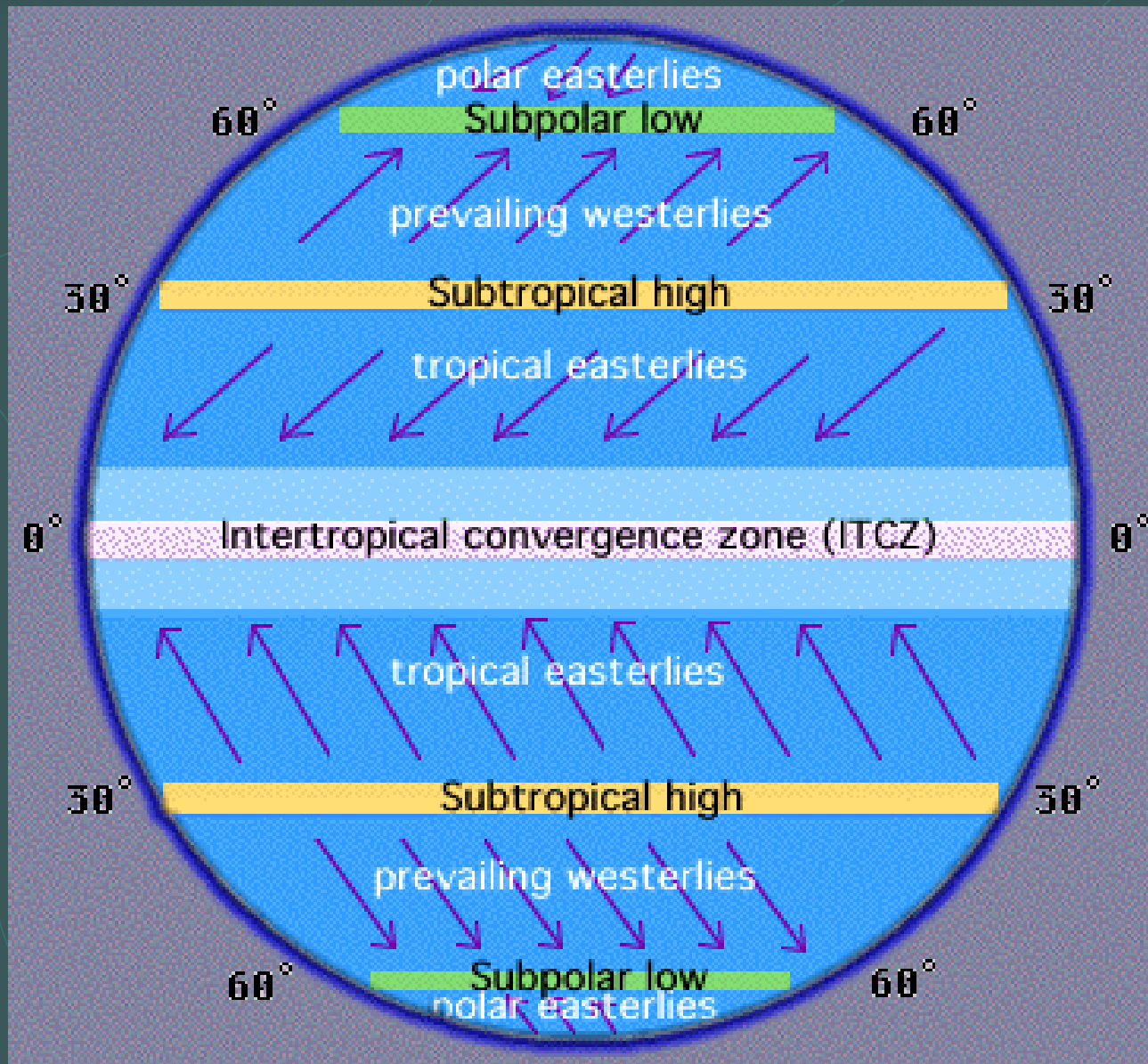
➤ The wind belts that extend from the poles to 60° latitude in both hemispheres are called the polar easterlies.




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- 5. The wind belts found between  $30^{\circ}$  and  $60^{\circ}$  latitude in both hemispheres are called the westerlies.
  - 6. In both hemispheres, the winds that blow from  $30^{\circ}$  latitude almost to the equator are called trade winds.
  - The westerlies carry moist air over the United States producing rain and snow.
  - Early traders used the trade winds to sail from Europe to the Americas.




# Global Winds



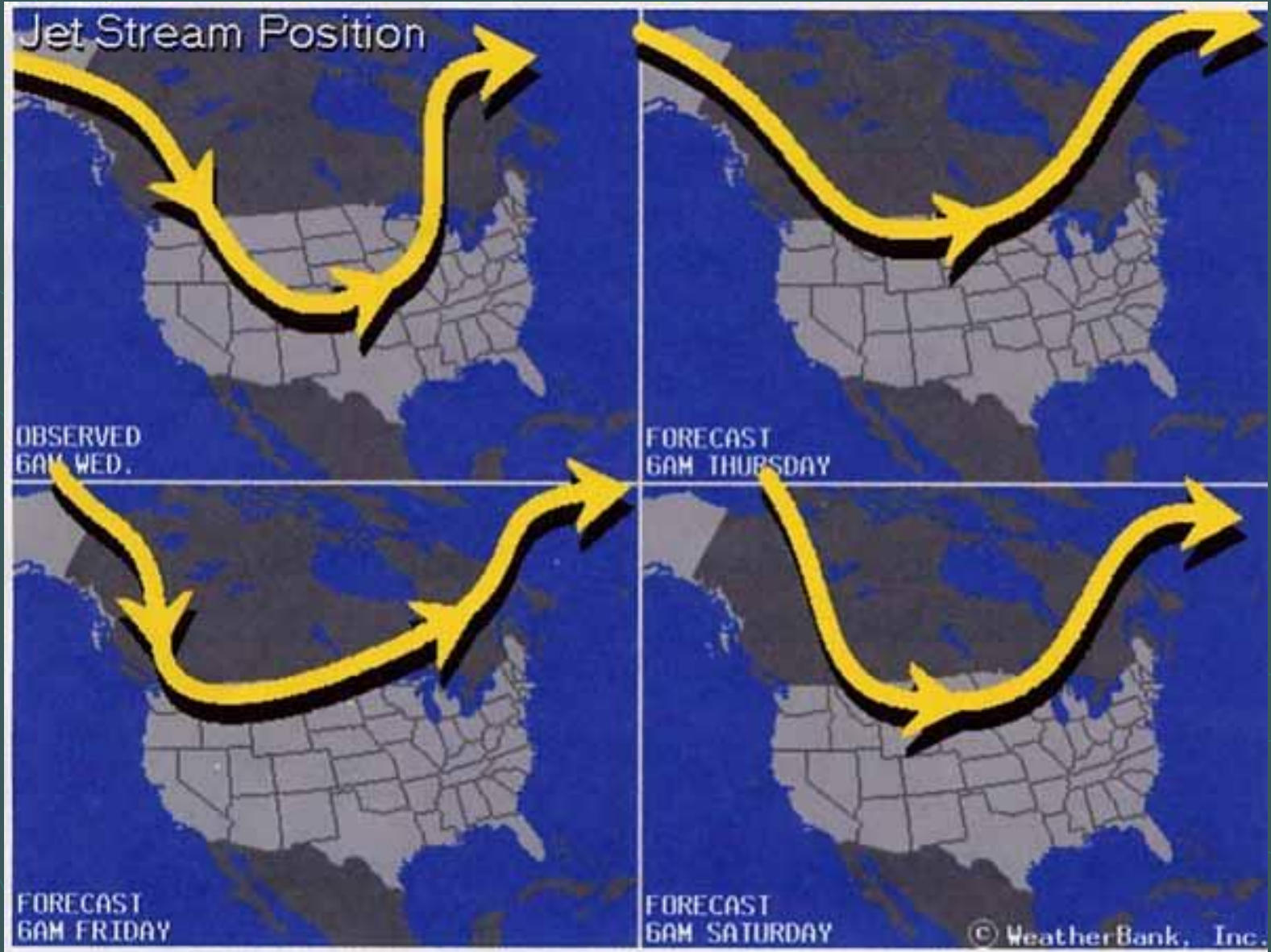
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- 7. The trade winds of the Northern and Southern Hemispheres meet in an area around the equator called the doldrums.
  - At about 30° north and 30° south latitude, sinking air creates an area of high pressure with weak winds called the horse latitudes.
  - Most of the world's deserts are located in the horse latitudes because the sinking air is very dry.




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- 8. The jet streams are narrow belts of high-speed winds that blow in the upper troposphere and lower stratosphere.
  - The jet stream winds reach speeds of 400 km/hr or 250 mph.
  - The jet stream travels west to east across the United States but not in a set pattern like the global winds.



# Jet Stream



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- Pilots study the jet stream to make trips across the United States quicker.
  - 9. Meteorologists study the jet stream to predict the path of storms.
  - Near the ocean, the land heats up and cools down quicker than the water creating local winds.



# 2.4

- 1. Air pollution is the contamination of the atmosphere by the introduction of pollutants from human and natural sources.
- The two classifications of air pollution:
  - 1) Primary pollutants
  - 2) Secondary pollutants
- Pollutants that are put directly into the air by human or natural activity are primary pollutants.








➤ Examples of natural primary pollutants:

- Dust
- Volcanic gases and ash
- Smoke from forest fires
- Pollen


➤ Examples of human primary pollutants:

- Vehicle exhaust
- Smoke
- Chemicals



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- Pollutants that form when primary pollutants react with other primary pollutants or with naturally occurring substances are secondary pollutants.
  - Smog is an example of secondary pollutants.
  - **2. The two classifications of pollutants:**
    - Point-source pollutants
    - Non-point source pollutants



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- 3. Point-source pollutants are pollutants that are released from a single source.
  - Examples of point-source pollutants:
    - Smoke from burning brush
    - Chemical wastes
  - 4. Non-point source pollutants are pollutants that come from many different sources and are often difficult to identify.





➤ Examples of non-point source pollutants:

- Smog
- Haze

➤ Cars contribute about 10% to 20% of the human-caused air pollution in the United States.

➤ Many industries burn fossil fuels and release large amounts of air pollutants.






➤ Many houses also contain air pollution.

➤ Causes of indoor air pollution:


- Car or lawn mower exhaust
- Household cleaners
- Kerosene heaters
- Wood stoves

➤ 5. Ventilation is the mixing of indoor air and outdoor air.




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- 6. Precipitation such as rain, sleet, or snow that contains acids from air pollution is called acid precipitation.
  - Acid precipitation has damaged large areas of forests.
  - Forests in the northeastern United States and in eastern Canada have also been affected by acid precipitation.



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- Aquatic life has adapted to live in a certain range of acidity.
  - 7. A rapid change in a body of water's acidity is called acid shock.
  - Acid shock can kill a large number of fish in a lake or river.
  - The effects of acid precipitation are worst in the spring when the acidic snow that built up in the winter melts and acidic water flows into the lakes and rivers.



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- To reduce the effects of acid precipitation on aquatic ecosystems, some communities add powdered limestone to acidified lakes.
  - Acid precipitation can cause toxic metals to be released from the soil to be taken in by plants and animals.
  - If humans eat these animals or plants, the toxic metals can cause health problems.







# 2.5

- There are short-term and long-term effects from air pollution.
- Some short-term effects:
  - Headaches
  - Coughing
  - Irritation to your eyes, nose, and throat
- Some long-term effects:
  - Lung cancer
  - Heart disease



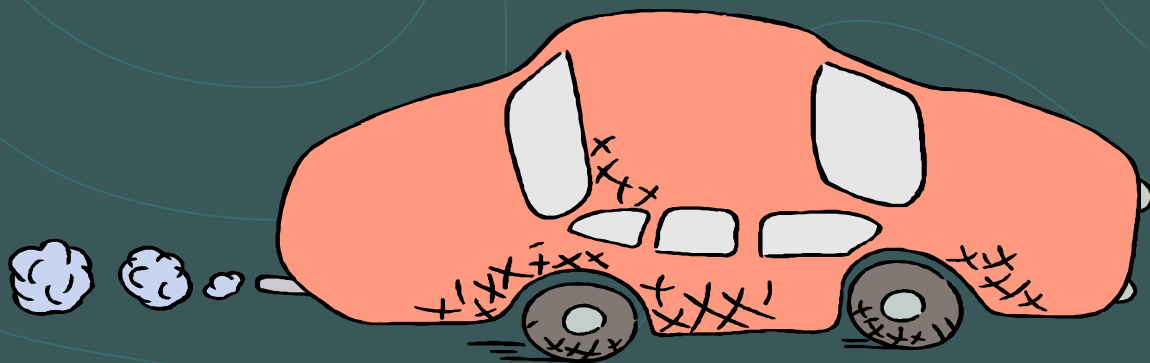
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- 1. The abbreviation EPA stands for Environmental Protection Agency.
  - In 1970, congress passed the Clean Air Act that gave the EPA the power to regulate the amount of air pollutants that can be released from cars and factories.
  - The EPA has primary and secondary standards.




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- Primary standards protect against the effects of air pollution on human health.
  - Secondary standards protect against the effects of air pollution on crops, vegetation, and buildings.
  - **2. The abbreviation AQI stands for Air Quality Index.**
  - The color ratings of the AQI is not unhealthy are green and yellow.



- 3. The color rating of the AQI for hazardous is maroon.
- 4. A scrubber is a device that is used to remove some pollutants before they are released by smokestacks.
- Devices such as catalytic converters remove any pollutants from exhaust and help cars reduce pollutants.



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- Cleaner fuels and more-efficient engines have helped reduce air pollution.
  - Hybrids, which are cars that use gas and electricity, also reduce air pollution.
  - Ways to reduce air pollution:
    - Car pooling
    - Public transportation
    - Walking or biking to your destination
    - Keeping your car in good condition
    - Conserving electricity

