	24.1 Atmospheric Moisture
Phases of Water	▪Water in the atmosphere exists in three states, or *phases*. ▪One phase is known as a gas called *water vapor.* ▪The other two phases of water are the solid phase known as *ice* and the liquid phase known as *water.* ▪Water changes from one phase to another when heat energy is absorbed or released.
Latent Heat	**latent heat**: the heat energy that is absorbed or released by a substance during a phase change ▪When liquid water evaporates, the water absorbs energy from the environment. ▪When water vapor changes back into a liquid through the process of *condensation,* energy is released into the surrounding air and the molecules move closer together.
Evaporation	▪Most water enters the atmosphere through evaporation of ocean water near the equator. ▪However, water vapor also enters the atmosphere by evaporation from lakes, ponds, streams, and soil. ▪Plants release water into the atmosphere in a process called transpiration. ▪Volcanoes and burning fuels also release small amounts of water vapor into the atmosphere.
Sublimation	**Sublimation:** the process in which a solid changes directly into a gas ▪Ice commonly changes into a liquid before changing into a gas. ▪When the air is dry and the temperature is below freezing, ice and snow may sublimate into water vapor.
Humidity	▪Water vapor in the atmosphere is known as *humidity*. ▪Humidity is controlled by rates of condensation and evaporation. ▪When the air holds as much water as possible, the air is said to be "saturated." ▪The rate of evaporation is determined by the temperature of the air. ▪The higher the temperature is, the higher the rate of evaporation is. ▪The rate of condensation is determined by vapor pressure. ▪When vapor pressure is high, the condensation rate is high.
Specific Humidity	**specific humidity:** the actual amount of water vapor per unit volume of air that contains the water vapor, usually expressed as grams of water vapor per cubic meter of air. Specific humidity is **NOT** affected by temperature changes.

Relative Humidity **Equation for relative humidity**	**relative humidity:** the ratio of the amount of water vapor in the air to the amount of water vapor needed to reach saturation at a given temperature ■If the temperature does not change, the relative humidity will increase if moisture enters the air. ■Relative humidity can also increase if the moisture in the air remains constant but the temperature decreases.
Dew Point	■Dew point is the temperature to which air must be cooled to reach saturation. ■Air may cool to its dew point by *conduction* when the air is in contact with a cold surface. ■The resulting form of condensation is called *dew*. ■If the dew point falls below the freezing point of water, water vapor will change directly to ice crystals called **frost**.

Section 25.1 Objectives ◆**Explain** how an air mass forms. ◆**List** the four main types of air masses. ◆**Describe** how air masses affect the weather of North America.	25.1 Air Masses Section 25.1 Objectives ◆Differences in air pressure are caused by unequal heating of Earth's surface. ◆Equatorial regions receive more solar energy than polar regions. ◆Cold air near the pole sinks and creates high-pressure centers. ◆Differences in air pressure at different locations on Earth create wind patterns. ◆Air moves from areas of high pressure to areas of low pressure. ◆So… there is a general, worldwide movement of surface air from the poles toward the equator.
Air Masses	**air mass** a large body of air throughout which temperature and moisture content are similar ◆Air pressure differences affect air movement. ◆Air masses that form over frozen polar regions are very cold and dry. Air masses that form over tropical oceans are warm and moist.
Types of Air Masses	◆Air masses are classified according to their source regions. ◆The source regions for cold air masses are polar areas. The source regions for warm air masses are tropical areas. ◆Air masses that form over the ocean are called *maritime*. Air masses that form over land are called *continental.*
Continental Air Masses	There are two types of continental air masses: *continental Polar* (cP) and *continental Tropical* (cT). ◆continental Polar air masses are cold and dry. ◆continental Tropical air masses are warm and dry. ◆Air masses can stay over its source region for days or weeks. Eventually, the air mass will move into other regions because of global winds.
Maritime Air Masses	Maritime air masses bring precipitation and fog. ◆The two different maritime air masses are *maritime Polar* (mP) and *maritime Tropical* (mT). ◆maritime Polar air masses are moist and cold. ◆maritime Tropical air masses are moist and warm.
Polar Air Masses	Maritime polar Pacific air masses form over the North Pacific Ocean and are very moist. ◆In winter, these maritime polar Pacific air masses bring rain and snow to the Pacific Coast. ◆In summer, they bring cool, often foggy weather. ◆Maritime polar Atlantic air masses move generally eastward toward Europe. But they sometimes move westward over New England and eastern Canada. ◆In winter, they can bring cold, cloudy weather and snow. ◆In summer, these air masses can produce cool weather, low clouds, and fog.
Tropical Air Mass	◆Continental tropical air masses form over the deserts of the Southwestern United States. ◆These air masses bring dry, hot weather in the summer. They do not form in the winter. ◆Maritime tropical air masses form over the warm water of the tropical Atlantic Oceans. ◆Maritime tropical air masses also form over the warm areas of the Pacific Oceans.

	25.2 Fronts
Section 25.2 Objectives ◆**Compare** the characteristic weather patterns of cold fronts with those of warm fronts. ◆**Describe** how a midlatitude cyclone forms. ◆**Describe** the development of hurricanes, thunderstorms, and tornadoes.	
Fronts	◆A <u>cool air mass</u> is dense and <u>does not mix</u> with the less-dense air of a warm air mass. ◆a *front* is a boundary that forms between air masses. ◆Middle-latitude weather changes usually take place along the various types of fronts. ◆Fronts do not exist in the Tropics because no air masses that have significant temperature differences exist there.
Cold & Warm Fronts	**cold front** the front edge of a moving mass of cold air that pushes beneath a warmer air mass like a wedge ◆If the warm air is moist, clouds will form. **warm front** the front edge of advancing warm air mass that replaces colder air with warmer air ◆A warm front generally produces precipitation over a large area and may cause violent weather.
Stationary and Occluded Fronts	◆**stationary front** a front of air masses that moves either very slowly or not at all ◆**occluded front** a front that forms when a cold air mass overtakes a warm air mass and lifts the warm air mass off the ground and over another air mass
Polar Fronts	◆The boundary where cold polar air meets the tropical air mass of the middle latitudes, especially over the ocean, is called the *polar front*. ◆Waves commonly develop along the polar front. ◆A *wave* is a bend that forms in a cold front or stationary front.
Wave Cyclones (midlatitude cyclones)	**midlatitude cyclone** an area of low pressure that is characterized by rotating wind that moves toward the rising air of the central low-pressure region ◆Waves are the beginnings of low-pressure storm centers called midlatitude cyclones or *wave cyclones.* ◆These cyclones strongly influence weather patterns in the middle latitudes.
Thunderstorms	◆**thunderstorm** a usually brief, heavy storm that consists of rain, strong winds, lightning, and thunder ◆T-storms develop in three distinct stages. ◆The t-storm dissipates as the supply of water vapor decrease.

Lightning	◆During a t-storm, clouds discharge electricity in the form of ***lightning***. ◆The released electricity heats the air, and the air rapidly expands and produces a loud noise known as ***thunder***. ◆For lightning to occur, the clouds must have areas that carry distinct electrical charges.
Hurricanes	◆**hurricane** a severe storm that develops over tropical oceans and whose strong winds of more than 120 km/h spiral in toward the intensely low-pressure storm center ◆A hurricane begins when warm, moist air over the ocean rises rapidly. ◆When moisture in the rising warm air condenses, a large amount of energy in the form of ***latent heat*** is released. This heat increases the force of the rising air.
Tornadoes	**tornado** a destructive, rotating column of air that has very high wind speeds and that maybe visible as a funnel-shaped cloud ◆The smallest, most violent, and shortest-lived severe storm is a tornado. ◆A tornado forms when a thunderstorm meets high-altitude horizontal winds. These winds cause the rising air in the thunderstorm to rotate.