CORNELL NOTES
Directions: You must create a minimum of **5 questions** in this column **per page** (average). Use these to study your notes and prepare for tests and quizzes. Notes will be turned in to your teacher at the end of the Unit for scoring.

UNIT 4: Earth Science
Chapter 17: Weather and Climate (pages 516-547)

I. Earth's Atmosphere

A. Atmospheric composition

1. Your body uses only _____, but air is mixture of gases

a. **78%** _____

b. **21%** _____

c. Most of remaining **1%** is inactive gas **argon** and _____ _____

1). The remaining portion is mixture of **trace gases**

2). Includes **methane**, _____, **nitrous oxide**

2. Biological processes

a. **Cellular** _____- produces **water vapor** and **carbon dioxide (CO_2)**

b. _____- Use **carbon dioxide** and produce almost all **oxygen** in atmosphere

c. Organisms _____ levels of certain gases

1). **CO_2** altered at different _____

2). **Microorganisms** in swamps produce _____ and _____

3). **Microorganisms** in digestive tract of termites, cows, and sheep produce _____

3. Formation of atmosphere

a. Earth's early atmosphere mostly _____ and _____- eventually lost

b. Replaced by gases from _____ eruptions- **water vapor** and **CO_2**

c. **Photosynthetic** organisms produced increased levels of _____

d. **Solar radiation** converted oxygen into _____

1). **Ozone** layer shielded Earth from _____ **rays**

2). Allowed organisms to move onto _____

B. Atmospheric Structure

1. Atmosphere extends more than _____ **miles** above Earth's surface

2. _____- extends from Earth's surface to 30 km

a. _____ takes place here

b. Temperature normally _____ with height

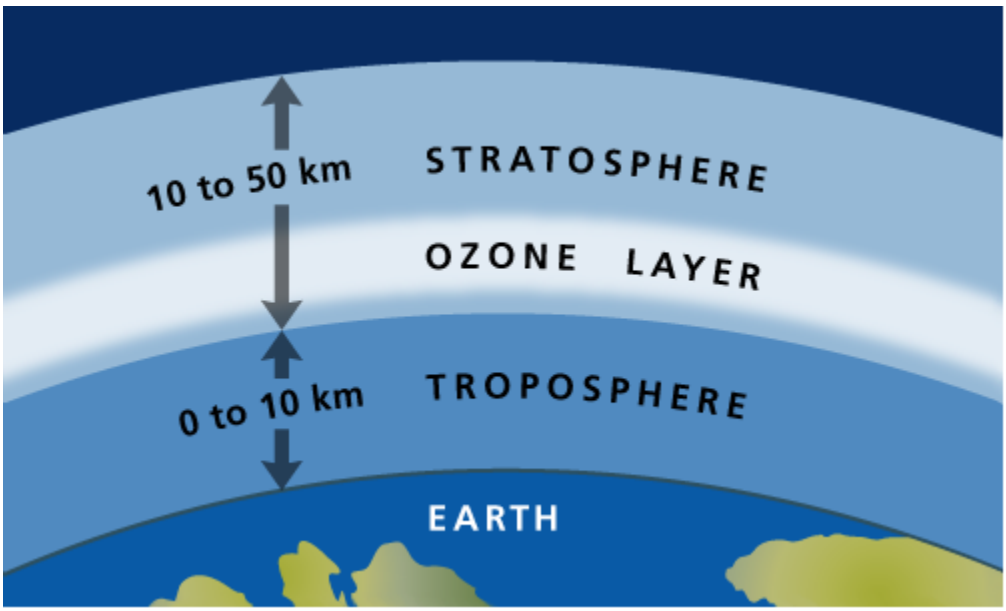
c. **Temperature inversion**- when temperature _____ with height

1). Air becomes **very** _____

2). Resists rising motion needed to form **clouds** or disperse air _____

3. _____- lies above troposphere

a. Extremely _____ and rich in **ozone**



b. **Temperature** always _____ with height creating permanent temperature inversion

1). _____- place where temperature inversion begins

2). Acts like _____ that keeps air in troposphere from rising into stratosphere

4. **Mesosphere** and **Thermosphere**- _____ layers

a. Very low in _____

b. Do not affect _____

C. Heating in the Atmosphere

1. _____ provides energy to heat atmosphere

2. **Ozone** produced in stratosphere when solar rays split _____ molecules into single atoms

a. **Oxygen atoms** react with **oxygen molecules** to form _____

b. **Ozone** absorbs nearly all _____ radiation

3. Remaining solar rays pass to Earth's surface

a. Either _____ or _____ back to atmosphere

b. _____ **effect-** gases such as carbon dioxide and water vapor bounces some infrared radiation back to Earth

c. **Conduction**, **convection**, and **latent heat** also contribute to _____ Earth's atmosphere

D. A Varied Surface

1. Atmosphere is heated _____ because Earth's surface not **uniform**

2. **Snow**, **ice**, **water**, **vegetation**, and **bare soil** _____ different amounts of solar radiation

E. Water in the Atmosphere

1. Uneven **heating** produces currents of air that carry **water vapor** aloft and form _____

2. Air generally rises over _____ surfaces and sinks over _____ surfaces

a. As air rises it expands and _____

b. **Clouds** form when moist air _____

3. **Precipitation**- formation of _____

a. Two basic cloud types produce different types of rain

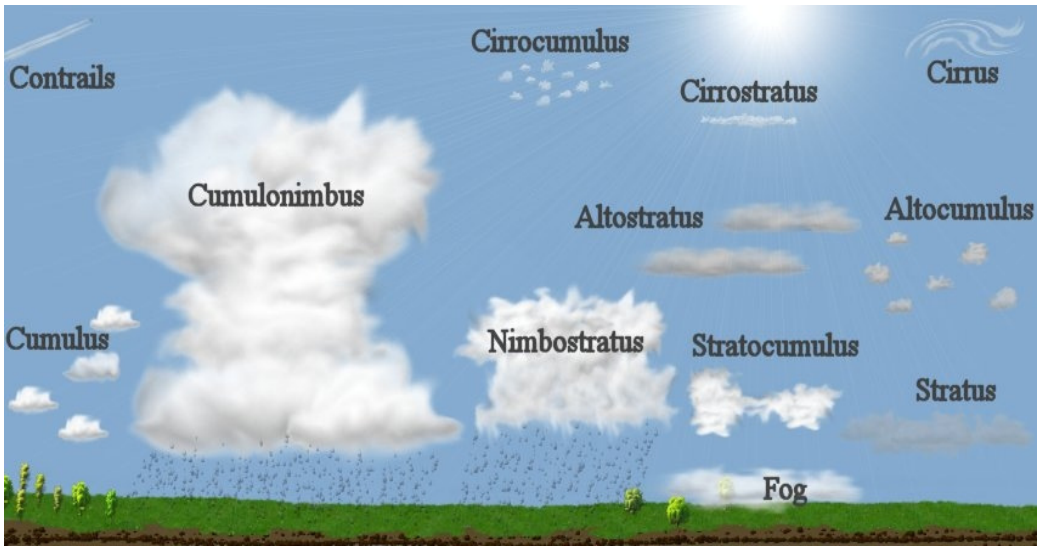
1). _____ **clouds**- puffy clouds formed by rising air produce brief showers

2). _____ **clouds**- flat, elongated clouds produced layers of air rise gently. Produce drizzle or long-lasting rain

c. Many in-between cloud forms exist

1). _____- also called "thunderheads" form from unstable air and usually bring intense rain

2). _____ clouds- high altitudes



II. Weather

A. _____ **Pressure**- pressure of the atmosphere pushing down on you (**1 kg/cm^2**)

1. Pressure caused by gas **molecules** _____ with each other

a. **Pressure** decreases with _____

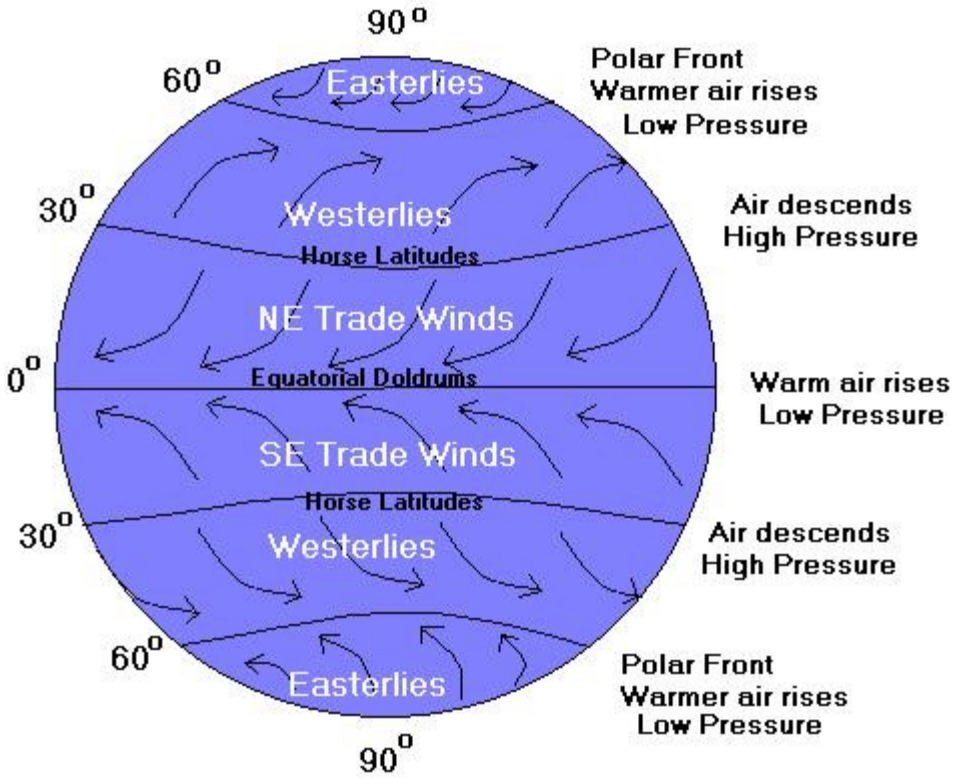
b. Air molecules decrease as altitude increases ("_____")

2. Global Winds and Pressure Systems

a. **Weather patterns** result from complex global patterns of _____ and _____

b. _____- Winds that blow from the west in the middle latitudes

c. _____- Winds that blow east in the tropics



d. Two factors produce these **global patterns**

1). **Unequal** _____ between equator and poles

2). _____ of the Earth

e. **Warm** air rising at equator and **cold** air sinking over the poles creates general **north-south wind** _____

f. Earth's _____ produces east-west deflection of this general circulation

3. _____ **Streams**- high, fast winds that occur at higher altitudes and travel in excess of 500 km/hr

B. High and Low Pressure Systems

1. Several large-scale **weather systems** effect the United States.

a. _____ **highs**- relatively stable belt of high pressure near latitudes of 30°

b. **Subpolar lows & Westerlies**- Meander as small cells of high and low _____ develop.

2. Specific patterns of weather associated with **high** and **low** _____ **cells**

a. Caused by way air flows around them

b. **Northern hemisphere**- winds blow _____ around **lows** and _____ around **highs**

c. **Southern hemisphere**- direction _____

d. _____ associated with rainfall and storms

e. _____- associated with calm winds and clear skies

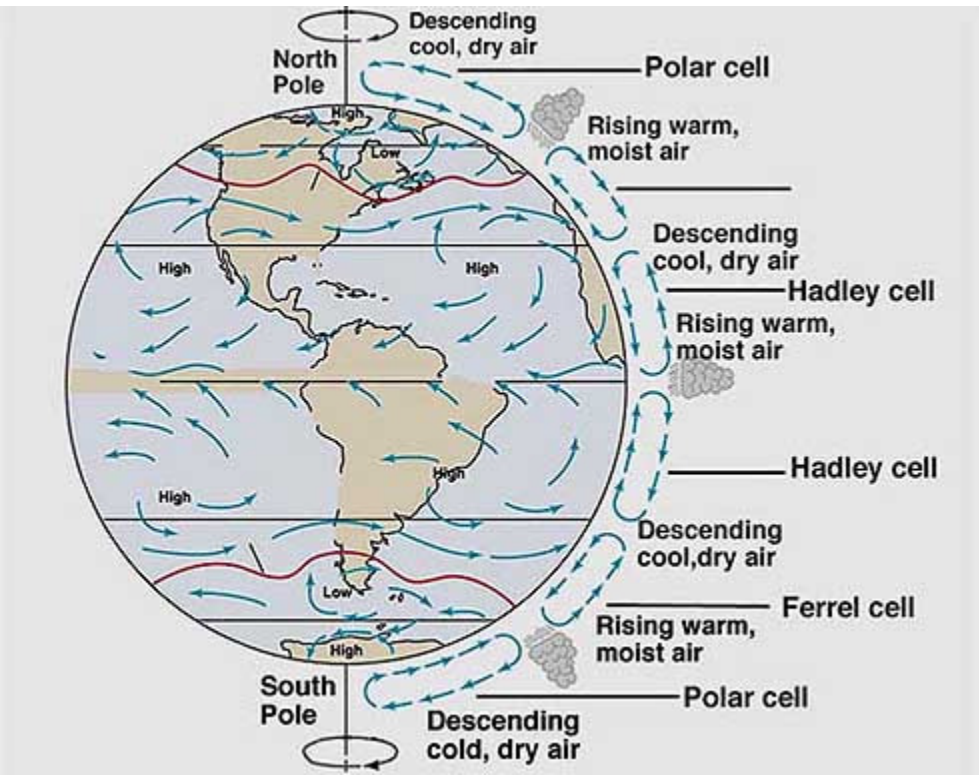
3. _____ **Effect**- airflow around low or high pressure areas resulting from net forces acting on air

a. **Pressure gradient**- _____ air toward low pressure

b. **Coriolis effect**- apparent _____ deflects air flows perpendicular to line of equal pressure.

1). Near the surface- **friction** slows air and turns it slightly **towards low-pressure** centers and slightly **away** from **high-pressure** centers

2). Causes air to rise in center of **lows** and sink in center of **highs**



C. Air Masses and Weather Fronts

1. **Air masses**- lare units of air with relatively uniform _____ and _____

a. These form when air remains _____ for a time

b. Air take on charateristics of the surface

1). _____ **air masses**-

2). _____ **air masses**-

3). _____ **air masses**- originates over land. Relatively dry and can be extremely warm or cold

4). _____ **air masses**- originate over ocean and are very moist

2. **Weather** around low-pressure cells produced by interaction of _____ **masses**

3. **Weather** _____- zones where air masses interact

a. **Warm** and **cold fronts** create different types of _____

1). _____ **front**- warm air rises gently above cold alir

a). Usually forms layered _____**-type** clouds or **fog**

b). Produce only **drizzle** or **steady** _____

b.. _____ **front**- cold air pushes the warm air aloft in a random and chaotic fashion

1). Foms _____ clouds

2). Often produce **showers** and _____

D. Severe Weather

1. **Thunderstorms**- cumulonimbus clouds formed from _____ air

a. Has _____ **crystals** near its top

b. Sometimes ice crystals act as **nuclei** to trigger further growth of **cloud** _____

c. **Turbulence** adds layers of ice during many cycles of sinking and rising forming _____

2. Downdrafts and Squalls

a. **Force** of falling precipitation in thunderstorm may **pull** _____ **air burst** from higher in the cloud

b. Why often feels _____ after thunderstorm

c. Sinking current of air called _____

d. When downdraft hits the surface it spreads out in series of windy gusts called _____

3. Downbursts

a. Cold air downdrafts can produce even more severe forms of weather

b. **Downburst**- extreme form of _____ **shear**

1). _____ **air** descends from thunderstorm and hits ground

2). When it hits, it **bursts** _____ like spokes on a wheel

c. Rapid change in wind speed and/or direction can be dangerous for _____

4. Tornadoes and Hurricanes

a. _____- intense, short-lived, localized storms in the mid-latitudes

1). _____ in **cumulonimbus** clouds under special conditions

2). In United States, form when _____ **air** from deserts of Mexico and southwest overrides _____**, moist air** from Gulf of Mexico

3). Happens frequently in **Great** _____, **lower Midwest**, and parts of the **south**

4). Form **twisting**, _____ shaped tornado cloud

5). Can move at **50 km/hr** with winds at up to _____ **km/hr**

b. _____- tropical storms that cover vast areas and last for days

1). Those affecting United States begin as **tropical depressions** over the _____ waters of southern Atlantic off coast of Africa

2). When winds exceed **118 km/hr**, storm

called _____

3). Consist of **vast cloud bands** that **spiral inward** toward center (called _____)

4). Western Pacific hurricanes called _____

III. Climate

A. Climate and Weather

1. **Climate**- long term _____ of weather conditions

a. Includes- wind, temperature, precipitation, moisture, and other aspects of weather

b. Climate also describes annual _____ of these conditions

2. **Climate System**- best considered as part of whole Earth system (interaction of ___ factors)

a. _____- includes air around us

b. _____- everything organic including plants and animals

c. _____- liquid water in oceans, lakes, rivers, soil, and underground

d. _____- frozen water in snow, ice, and glaciers

e. _____- the solid Earth, including its soil, rocks, and mantle

3. Sphere Interactions- **Gases**, **water**, **soluble materials**, **energy** and **particulates** _____ among systems

1). Each sphere _____ all other spheres

2). Forms complex interactions

B. What causes climate?

1. _____ is primary factor

a. Amount of _____ from Sun and

prevailing **circulation** depend on latitude

b. Other factors include high _____, location on **continents**, and distance from **major bodies of** _____

2. Causes of Mean Temperature

a. **Surface temperatures** vary greatly from _____ to _____

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b. **Temperature** decreases greatly with **increasing** _____

c. **Reflection** of solar radiation from _____ and _____ adds to decrease

d. In **summer**- temperature decrease less pronounced because **sunlight** strikes at higher _____ and **daylight** _____

e. **Temperature differences** help create _____ and **severe weather**

3. Ocean and Land Influence

a. **Oceans** and **ocean currents** _____ basic **climate**

b. Areas with little direct ocean influence called _____ **climates**- have steep temperature gradients

c. _____ **climate**- produce cooler **summers** and warmer **winters**. Daily temperature varies less

4. **Precipitation**- determined by _____ and _____ patterns

a. **Humid climates** associated with _____ pressure areas in tropics and middle latitudes

b. _____ **climates**- common where high pressure prevails

c. **Prevailing winds**- _____ of winds explains many climates

5. Influence of **Mountains**

a. **Mountains** act as barriers, blocking **weather systems** and altering patterns of _____

b. **Lee Rain Shadow**- occurs on eastern side of mountain ranges and results in _____ **precipitation**

6. Influence of **Water**

a. **Coasts** and **lakeshores** can affect regional _____

b. In winter, _____**-effect snow** often results in regions around Great Lakes

c. **Sea** _____ (or lake breeze)

1). Blows from water toward the land in _____

2). Reverse happens at _____

7. Climate Scale- climate can vary greatly locally

a. _____- variations within small distances

b. Buildings, pavement, pollution, alter _____

C. Types of Climate

1. Classify climates with ____ **major divisions**

a. **Cold or** _____- cold, dry winters

b. **Arid and semi-arid**- _____ and grasslands

c. **Climates with adequate** _____ **and** _____- includes temperate, subtropical, and tropical climates

2. **Climate zones** influences the types of _____ that will grow there

IV. Earth's Changing Climates

A. Seasonal changes

1. Occurs as Earth _____ around Sun

a. **Summer**- when Earth tilted _____ Sun

b. **Winter**- tilted _____ from Sun

2. **Seasonal changes** magnified in mid-latitudes by temperature contrast between _____ and _____

B. Long-Term Changes

1. **Cycles of** _____ (**ice ages**)- represent long-term climatic change

a. Last _____ _____-**18,000 - 22,000 years ago**

b. Global temperature ____**C cooler**

2. World climate reached current pattern about _____ **years ago**

3. Causes of Climate Change

a. Influenced by numerous factors

1). _____ **building** over millions of years

2). **Continental** _____

3). _____ **currents**, **temperatures**, and **snow** and **ice cover**

b. Changes in **tilt of Earth's** _____ altered amount and distribution of solar radiation (now 23.5°, but varied from 21.5° to 24.5°)

c. _____ **activity**- affect amount of radiation received by Earth

d. _____ **activity**- produce large amounts of dust that can block sunlight for years

4. The Human Factor

a. Burning of **fossil** _____ and **deforestation**

1). Modify _____ **heating**

2). Affect _____ and _____ **cycles**

b. Increase atmospheric concentrations of trace **gases**, **dust** and **air** _____

5. **The** _____ **Cycle**- cycle of carbon among ocean, land, and atmosphere

a. Carbon basis of all _____ **matter**.

b. _____ effects carbon cycle in <u>two</u> ways

1). <u>Less</u> **carbon dioxide** <u>absorbed</u> from atmosphere during _____

2). **Burning** of wood _____ **carbon dioxide** to atmosphere

6. **Trace Gasses**- Human activities have increased gasses such as carbon dioxide, methane, nitrous oxide which are important in _____ **atmosphere**

7. _____ _____- increase in the average global temperature of Earth

a. Has <u>increased</u> over the last century by ___**℃**

b. **Understanding** of global warming _____

8. The Ozone Hole

a. Chemical compounds (_____- **chlorofluorocarbons**) used in refrigeration, and aerosol sprays **destroys ozone**

b. Produced **large** _____ in Earth's Ozone over Antartica

c. **Ozone** <u>protects us</u> from _____ **radiation**

d. Agreed to _____ the use of these chemicals

9. The Land Surface

a. Humans change the land surface by draining _____, plowing fields, and building cities

b. May effect local or regional _____

c. _____- end product of many types of changes that make land **unusable**

1). **Over grazing** of _____

2). **Deforestation**, and irrigation of crops may contribute to process

C. El Niño and La Niña

1. ___ _____- climatic event that involves the atmosphere and oceans

a. The flow of _____**-water** is reversed

b. Nutrient rich cold water no longer upwelled and nutrient-poor water remains at the surface

c. _____ **fish** and **marine life** can be supported

d. **Rainfall** in western **Pacific** _____

e. **Heavy rain** and **flooding** occur on normally dry coast of _____

f. Can lead to **flooding** and **mudslides** in _____

g. Lead to _____ in **India**, **Australia**, and parts of **Africa**

h. Can **dramatically alter global** _____ **patterns**

2. **La Niña**- _____ of **La Niño**

a. Can cause _____ in **Southern United States**

b. **Excess rainfall** in _____