8th Study Guide for Final Exam

Please review all note pages, diagrams & Review worksheets!

1. What Causes Climate:

Climate – average, year-after-year conditions of temperature, precipitation, winds and clouds in an area.

2 main factors are used to describe a region's climate:
1. Precipitation
2. Temperature

What affects temperature?
- Latitude
- Altitude
- Distance from large bodies of water
- Ocean currents

Temperature Zone	Latitude	Sun rays angle	temperature
Tropics	23.5^0 N to 23.5^0 S	Nearly direct all year long	Warm to hot all year
Temperate	23.5^0 N to 66.5^0N 23.5^0 S to 66.5^0S	Nearly direct in summer to a low angle in winter	Warm to hot and cool to cold depending on the latitude within the zone
polar	66.5^0 N to 90^0N 66.5^0 S to 90^0S	Nearly parallel in the summer/almost non-existent in the winter	Cool to cold all year

Altitude – temperature's decrease as altitude increases within a temperature zone.

Distance from large bodies of water – large bodies of water moderate (reduce extremes) of temperature because water cools and heats much more slowly than land; therefore, extremes in temperatures are less likely in coastal regions than in continental regions (land-locked regions).

Ocean currents – as an example, warm ocean currents moving from the tropics toward the poles bring warm air with it. Gulf Stream – warm water originating from the warm Gulf of Mexico crosses the North Atlantic bringing mild, humid air to Ireland and Southern England.

Seasons: seasons are caused by the constant tilt of the earth's axis as earth travels around the sun (23.5^0).

Solstice and Equinox:

Date	Northern hemisphere	Southern hemisphere
March 21	Vernal equinox Both hemispheres experience equal amounts of sunlight	Autumnal equinox
June 21	Summer solstice: Longest day of the year N.H. tilted as much towards the sun as possible	Winter solstice: Shortest day of the year Southern H tilted away from the sun as much as possible
Sept 22	Autumnal equinox Both hemispheres experience equal amounts of sunlight	Vernal equinox
Dec 21	Winter solstice N.Pole receives 6 months of darkness	Summer solstice S. pole receives 6 months of day

2. Earth in Space

Orbit of Earth:

What is the shape of the Earth's orbit? - Elliptical

Who discovered this? Johannes Kepler

Is the Earth always an equal distance from the sun? No

- **Orbit** – a path a body travels around another body
- **Rotation** – the spinning of a body on its axis (spinning of the Earth)
- **Earth's axis** - an imaginary line that goes through the center of the Earth from the North Pole to the South Pole.
- Earth is tilted towards the sun by 23.5 degrees from perpendicular
- The Earth **orbits** the sun
- **Revolution** – one complete trip along an orbit; Earth's is equivalent to one year

3. Gravity and Motion

Our Sun:

- middle-aged star; mostly made of hydrogen and some helium
- about 150 million km from Earth; 1 million Earth's could fit inside the sun

Why does the Earth stay in orbit around the sun?

Two Reasons: Combination of Gravity and Inertia

Recall **Newton's Law of Universal Gravitation** – all objects exert a gravitational force on all other objects in the universe.

The strength of the Gravitational F between two objects depends on two factors:

1. **Mass** of each object (mass is the amount of matter in an object)

2. **Distance** between the objects – F of gravity (g) decreases rapidly as distance between the objects increases

Therefore, the sun and earth exert a gravitational F on each other – the sun's pull on the earth is stronger since the sun is so much more massive.

So, why doesn't the Earth crash into the sun?

The Earth's **Inertia** - the tendency of an object to resist a change in motion – the greater an object's mass the greater its inertia – the Earth resists a change in its motion (which is moving at a constant speed in a straight line).

Recall **Newton's 1st Law of motion** – an object at rest will stay at rest and an object in motion will stay in motion unless an unbalanced force acts upon it.

Is an unbalanced force acting upon the Earth? YES - **GRAVITY** – The only force acting upon the Earth – The gravitational pull of the Sun keeps pulling the Earth toward it, preventing the Earth from moving in a straight line; at the same time, the Earth's **inertia** resists this pull. Together, the pull of gravity and the Earth's resistance to that pull results in an elliptical

orbit around the sun.

Who was the first person to figure this out? Isaac Newton. **Who figured out that the Earth's orbit is NOT circular but elliptical?** Johannes Kepler.

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4. Energy in Earth's Atmosphere

How Earth's Atmosphere Is Heated

Nearly all E in the atmosphere comes from the sun

E travels to the Earth as Electromagnetic (EM) Radiation from the sun

Only 3 forms of EM radiation pass through Earth's Atmosphere:

1. Visible light	**2. Infrared radiation**	**3. UV light**
Light humans can see	We feel it as heat	High energy radiation Causes sunburn and cancer

Electromagnetic Radiation has 3 synonyms that all refer to the energy emitted by the sun:

1. Electromagnetic waves
2. Light energy or just light
3. Photons - a single unit of EM radiation; a particle of light

The **ozone layer** in the **stratosphere** absorbs the highest energy EM radiation – x-rays, gamma rays and most UV light - that would kill living things if it reached earth's surface

EM Radiation from the sun must pass through the atmosphere of the Earth to heat the troposphere

↓	↓	↓	↓
20% of infrared is absorbed by water vapor, carbon dioxide, dust and clouds	30% is reflected back to outer space by clouds, air particles and reflective surfaces	50% passes to the surface: 50% is absorbed by the Earth's surface 5% is reflected back into the atm	Visible light is **scattered** by dust and gases in the atmosphere – blue light is scattered the most during the day so we see blue skies

What happens to the radiation that is absorbed by the Earth?

↓

Radiation absorbed by earth's surface releases the energy and much of it is then absorbed by greenhouse gases (water vapor, carbon dioxide and methane) in the troposphere

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Causes the **Greenhouse Effect** – gases hold heat in the troposphere:

Greenhouse gases absorb and release infrared light into the troposphere

Keeps Earth's temperatures in a range that supports life and allows the Earth to have water in a liquid state (necessary for most life)

5. Earth's Atmosphere

Most of the earth's gases are in the troposphere; the layer above is the stratosphere

Most common gases: nitrogen, oxygen and carbon dioxide

Air density – the mass of the air divided by the amount of space it is taking up (aka its volume)

- **Air pressure decreases as altitude increases; as the density of air decrease so does air pressure decrease.**
- **As you increase your altitude, the density of air (# of molecules in a given area) decreases and the distance between air molecules increases** (see diagram).

Pressure – the force pushing on an area or surface.

Air pressure – the result of the weight of a column of air pushing down on an area:

- the column of air extends upward through the entire atmosphere
- the atmosphere is heavy
- Air molecules push in all directions which is why you are not crushed by the column of air above you.
- Amount of air pressure in an area changes frequently
- Denser air (more air molecules in a given space) exerts more pressure than less dense air.

6. Stars

1. Main determinate of a star's lifespan? It's mass (higher the mass the shorter the life span)
2. What is a nebula? Vast region of gases and dust in outer space
3. What force causes a nebula to eventually become a protostar? gravity
4. What is the difference between a protostar and a star? Protostar has a high density like a star, but it is not a star until nuclear fusion begins
5. What is the last stage of a small-mass star's lifespan? – black dwarf
6. What is the last stage of a large-mass star's lifespan? – black hole or neutron star