7.1: Earth's Climate System Cheat Sheet

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Earth's Climate System

Atmosphere: A layer of gases that surrounds a planet or moon

Climate: The characteristic pattern of weather conditions within a region, including temperature, wind velocity, precipitation, and other features, averaged over a long period of time

The atmosphere regulates temperature on Earth

Weather describes the condition of the atmosphere (wind, temperature, moisture) at a specific place at a specific time

The Atmosphere and Climate

Greenhouse effect: The natural warming caused when gases in the Earth's atmosphere absorb thermal energy that is radiated by the Sun and Earth

The greenhouse effect helps keep temperature fluctuations within a certain range

Winds

Wind is the movement of air from an area of high pressure to an area of lower pressure

Begins as a result of uneven heating on the Earth's surface

The movement of wind affects ocean currents and therefore transfers thermal energy

Winds blow in fairly constant directions called; these air currents are called *prevailing winds*

When air masses interact, one air mass is usually pushed above the other → this air mass cools and condenses to form precipitation

Jet streams are high altitude winds that travel long distances at high speeds → may carry warm, moist air and create precipitation or vise-versa

Human Activity and Climate

Climate change is at least partially *anthropogenic*

Anthropogenic: Relating to or resulting from the influence of humans

The *Industrial Revolution* led to an increased use of fossil fuels

The burning of fossil fuels leads to the release of gases and other pollutants which affect the greenhouse effect

Earth and the Sun

Energy from the Sun is the most important factor that affects climate on Earth

The intensity of the energy that reaches Earth affects the temperature of the air, water, and land → temperature produces winds, rains, and other features

Changes in Solar Activity

Irregular fluctuations occur in the amount of radiation produced

A sunspot cycle occurs every 11 years → these variations differ by 0.1%

Changes in Earth's Rotation, Orbit, and Tilt

Throughout its orbit, Earth remains in the same orbital plane

Earth's orbit, tilt, and rotation vary cyclically → these variations change the amount and location of solar radiation; produces changes in climate

Eccentricity

Earth's orbit cycles between circular and elliptical over a period of 100000 years

Due to the gravitational influence of other planets

There is less variation in the amount of radiation the Earth receives in a circular orbit than an elliptical one

Affects the length and intensity of seasons

Tilt

Earth and the Sun (cont)

Earth's axis of rotation is tilted about 23.5° from its orbital plane

Angle of tilt varies by 2.4° between 22.1° and 24.5° over a period of 41000 years

The greater the tilt, the greater the temperature difference between summer and winter

Wobble

Known as *precession* - varies cyclically over 26000 years

Affects the amount and intensity of solar energy received by the northern and southern hemispheres at different times

Latitude

Climates differ due to the angle that the Sun's rays hit the Earth's surface

The concentration of solar energy is greater at lower latitudes than higher ones

The Hydrosphere and Climate

Hydrosphere: The collective mass of water found on, under, and over the surface of Earth in the form of liquid water, ice, and water vapour

Water transfers heat around the planet

Oceans and Lakes

Large bodies of water have a large *specific heat capacity* → the amount of heat required to raise the temperature of one gram of a substance by a degree celsius

A large quantity of energy is needed to raise the temperature of water compared to land → the temperature of large bodies of water changes slowly and by smaller amounts

Ice and Snow

Snow and ice reflect solar radiation due to their light colour → they have high *albedo*

The Hydrosphere and Climate (cont)

Albedo: The fraction of incident light or electromagnetic radiation that is reflected by the surface of an object

Fresh snow can reflect 80%-90% of incident light

The distribution of ice, water, and land greater affects the average global temperature

Tectonic Plates and Climate

Earth's outer layer is composed of 12 major *tectonic plates*

The changing distribution of land and water affects air and water circulations patterns and the transfer of thermal energy

Tectonic plate: A piece of Earth's lithosphere that moves slowly on the asthenosphere

The formation of mountains affect wind and precipitation patterns

Volcanic Eruptions

Volcanic eruptions spew *aerosols* into the atmosphere

Aerosols reflect solar radiation → have a cooling effect on the global climate

May last from a few years to a decade; lasts until the particles are removed from the atmosphere by precipitation and settling

Some types of volcanic eruptions may release greenhouse gases