General Description of Atmosphere Volcanic eruptions, human activities, and natural processes add gases and particles to the atmosphere. The atmosphere acts as a protective shield that insulates Earth's surface by trapping heat (greenhouse effect). This insulation regulates the rate at which the Earth's surface loses heat, maintaining a stable climate suitable for life. The atmosphere also filters harmful solar radiation, allowing the right amount of sunlight to reach Earth's surface. Oxygen and carbon dioxide within the atmosphere support life through processes like respiration and photosynthesis. Wind patterns and weather systems within the atmosphere distribute heat and moisture globally, influencing climates and ecosystems. Composition of Earth’s Atmosphere The Earth's atmosphere consists mainly of: Nitrogen (78%) Oxygen (21%) Argon, carbon dioxide, neon, and other gases (1%) Water vapor and trace gases, such as ozone, vary in concentration. Composition of Earth’s Atmosphere ● Gases– 78% Nitrogen– 21% Oxygen– 1% other (Ar, CO2, CH4, H2O) ● Atmospheric Dust– Solid particles ● Soil, salt, ash fro fire & volcanic eruptions ● Particulate matter (combustion, skin, hair, clothing bits, pollen bacteria & viruses ● Aerosols (tiny liquid droplets) ● Creates air pressure– Due to gravitational pull– Greatest near Earth’s surface Air Pressure The atmosphere is denser near the Earth’s surface (due to the weight of the air above compressing the lower layers.) Earth’s atmospheric gases are located within 30 km of the surface Why is it harder to breathe at higher elevations? As altitude increases, the atmospheric pressure decreases. This means there are fewer oxygen molecules in each breath, making it harder to get enough oxygen into your bloodstream, leading to shortness of breath. Layers of the Atmosphere Divided into 05 layers based on temperature changes and altitude (Pressure changes): ● The Troposphere: 8–15 km, weather occurs here, temperature decreases with altitude. It contains about 75% of the atmosphere's mass and the majority of water vapor and clouds. ● The Stratosphere: 15–50 km, contains the ozone layer, temperature increases with altitude. This layer is important for protecting life on Earth by blocking harmful UV radiation. ● The Mesosphere: 50–85 km, meteors burn up, temperature decreases with altitude. This is where meteors burn up upon entering Earth's atmosphere due to the increased density of the air compared to higher layers. ● The Thermosphere: 85–600 km, ionosphere present, temperature increases with altitude (reaching up to 2500°C). ● The Exosphere: Above 600 km, atmosphere thins into space. This layer gradually fades into the vacuum of space and contains mainly hydrogen and helium atoms. Earth’s Atmospheric Layers (Ionosphere) Earth’s Atmospheric Layers Energy Transfer in Atmosphere ● Radiation: The emission of energy from an object. ● Conduction: The transfer of heat energy from one object to another. ● Convection: The transfer of heat energy by the vertical movement of air. Radiation Energy Transfer in Atmosphere Solar Radiation (Shortwave): The Sun's energy reaches the Earth's surface as shortwave radiation, warming it. Terrestrial Radiation (Longwave): The Earth radiates this absorbed energy back into the atmosphere as longwave infrared radiation. Conduction Transfer of heat between the Earth's surface and the atmosphere, occurring mainly near the ground where air molecules are in contact with the surface. Convection Warm air rises and cool air sinks, creating atmospheric circulation. Convection transfers heat from the surface upward into the atmosphere. Latent Heat Transfer When water vapor in the air condenses to form clouds, it releases latent heat, transferring energy into the atmosphere. Heating of the Atmosphere Solar energy – electromagnetic radiation(visible light, infrared

radiation, and ultraviolet light) About 1/2 of the solar energy that enters the atmosphere passes through it and reaches the Earth’s surface The rest of the energy is absorbed or reflected in the atmosphere by clouds, gases, and dust Heating of the Atmosphere Solar Radiation: The Sun’s energy heats the Earth's surface, which in turn heats the atmosphere primarily through terrestrial longwave radiation. Conduction: Heat is transferred from the warm Earth’s surface to the cooler air in contact with it, but this process is limited to the lower layers of the atmosphere. Convection: Warm air near the surface rises, transferring heat upward, while cooler air descends, creating atmospheric circulation that distributes heat. Latent Heat: When water vapor condenses into clouds, latent heat is released, contributing to the warming of the atmosphere