Teacher Information Sheet: The Major Earth Spheres

The Earth's physical environment is divided into several major parts: the solid Earth or **lithosphere**; the water portion or **hydrosphere**; the Earth's gaseous envelope, the **atmosphere**; the ice caps and glaciers, or the **cryosphere**, and the totality of life forms on the planet, or the **biosphere**. The environment is highly integrated and is not dominated by any one biotic or abiotic factor. Rather, it is characterized by continuous interactions as air comes in contact with rock, rock with water, and water with air. The myriad of life forms in turn extend into each of these realms and are an equally integral part of the Earth.

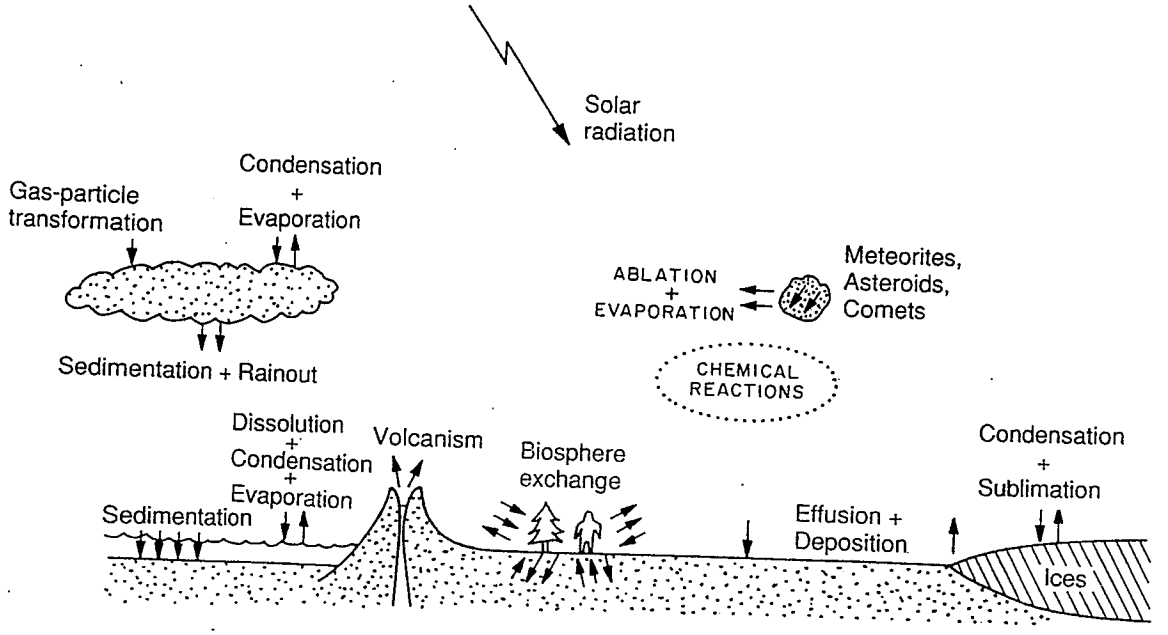

Diagram of the intricate relationships involved in the Earth's system.

The lithosphere is the slowest acting regime in the Earth system and rides on continental structures that evolve over time periods of millions of years as a consequence of the tectonic movements of the continents. The lithosphere is divided into three principal units: the dense **core**, the less dense **mantle** and the **crust**, which is the light and very thin outer skin of the Earth. The crust averages only about 20 kilometers in thickness and varies from less than 5 kilometers in the ocean basins to more than 35 kilometers on the continents. When we consider the fact that the distance from the Earth's surface to its center is about 6400 kilometers, this thin layer may seem relatively insignificant. However, in reality, the crust is of supreme importance: it is from this outermost layer that we derive the energy and mineral resources so basic to our modern world. Moreover, knowledge of the crust is fundamental to understanding the history and nature of the planet.

The Earth is surrounded by a gaseous envelope called the atmosphere. This blanket of air, hundreds of kilometers thick, not only provides the air that we breath, but also acts to protect us from the Sun's intense heat and dangerous radiation. The energy exchanges that occur continually between the atmosphere and the Earth's surface and between the atmosphere and space produce our weather. Of the five major Earth spheres, the atmosphere is the most rapidly varying. It responds quickly to external forces, such as the daily cycle of surface heating or changes in regional or global circulation. From a scientific standpoint, the atmosphere is the simplest of the Earth's sphere's to study, perhaps because it permits relative isolation of the chemical constituents from one another, so their actions can be determined with some degree of precision. It receives water, gases and particles from the Earth's surface, performs physical and chemical transformations on them and then deposits them on the surface driving many physical and chemical processes.

The biosphere includes all life on Earth and extends into the regions of the lithosphere, hydrosphere and atmosphere where living organisms can be found. It is closely linked to the atmosphere. Seasonal changes in vegetation affect the albedo or reflectivity, of a region, as well as its hydrologic cycle. Plants and animals depend upon the physical environment for the basics of life and through countless interactions, help to maintain and alter the physical environment. Without life, the makeup and nature of the lithosphere, hydrosphere and atmosphere would be very different. Noting that humankind is also a part of the biosphere, we recognize that changes wrought by humanity such as deforestation, agriculture and urbanization can also have profound effects on the Earth system as whole.

The dynamic mass of liquid that comprises the hydrosphere is continuously on the move, from the oceans to the air and back again. The global ocean is obviously the most prominent feature of the hydrosphere, blanketing nearly 71 per cent of the Earth's surface and accounting for about 97 per cent of the Earth's water. However, the hydrosphere also includes the freshwater found in streams, rivers, lakes, and groundwater. The hydrosphere influences the temperature and circulation on time scales of seasons to centuries. The oceans absorb the bulk of the solar radiation that falls upon Earth; that energy vaporizes water, which moves up into the atmosphere and releases the absorbed energy as heat when the water vapor condenses to form clouds. Ocean currents serve to transfer heat from tropical regions, where the Sun is most intense, to the polar regions.

RESERVOIR	VOLUME (10^6 km^3)	PERCENTAGE OF TOTAL
Oceans	1350	97.3
Glaciers	29	2.1
Aquifers	8	0.6
Lakes and rivers	0.1	—
Soil moisture	0.1	—
Atmosphere	0.013	—
Biosphere	0.001	—

Reservoirs of Available Water (liquid equivalent) on Earth

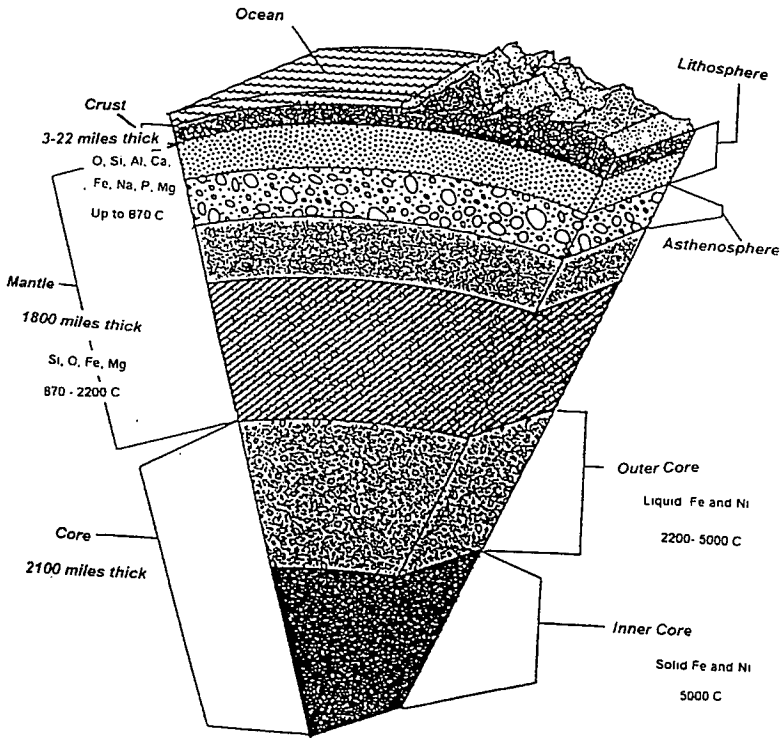

Diagram of the parts of the Earth's lithosphere

The fifth sphere in the Earth system is the cryosphere, that portion of the Earth's surface with average temperatures below the freezing point of water. The bulk of the cryosphere is at or near the poles, but cryospheric regions occur atop mountain ranges on all continents. Snow and ice are much better reflectors of radiation than are uncovered land and sea, and they have a significant effect on surface heating. Changes in the cryosphere occur annually, but major variations in the cryosphere occur on a time scale of centuries to millenia.