**10.1 – Earth’s Supply of Water**

* Fresh Water and Salt Water
  + Water is an excellent solvent
  + In fact it is called a universal solvent because it can dissolve more substances than any other solvent.
  + It is very good at dissolving salt.
  + Even fresh water contains some dissolved salts, but the concentration is very low, less than 1 percent.
  + The concentration of salt in ocean water is 3.5 percent.
  + This makes sea water denser than fresh water.
* The Three States of Water
  + Water is the only substance found on Earth naturally in all three forms: solid, liquid, and gas.
  + Salt water exists mainly on Earth mostly in its liquid state
  + Ice in Oceans is mostly fresh water
* Surface Salt Water
  + Sea is a body of salt water that is partially surrounded by land.
  + Brackish water - Many areas on Earth have water which is neither fresh nor saline but a combination of both.
  + Estuary – where a river meets the ocean
    - Here salt water marshes are created due to the sediment being deposited which was carried by the river.
    - Special habitats are created here due to the plants and animals being challenged by the salinity changes in their environment.
* Surface Fresh Water
  + Lakes – lake basins can be formed due to the movement of the Earth’s crust or other events that caused changes in the land surface. (e.g.: Crater Lake in Oregon formed in the crater of a volcano; Great Lakes are glacial lakes formed by the granite surface was scoured by the passing glaciers to form their basins.)
  + The Great Lakes – Erie, Huron, Ontario, Michigan, Superior
    - Largest Surface Area of fresh water in the world
    - Contains 20% of world’s fresh water supply
    - Industry and agriculture depend on these lakes
      * Hydra electricity
      * Transportation of products and people
  + Wetlands: Nature’s Water Filters – these form wherever the land is too flat and low to drain properly.
    - These are not as beautiful looking as a lake but they are extremely important.
    - They supply food and shelter for wildlife.
    - The vegetation in here naturally filters and purifies water and helps to control flooding.
    - Types of plants found in here are: rushes, reed grasses, cattails and sedges.
    - Swamp – wetland that contains trees
    - Marsh – wetland covered with grass like plants
    - Bog – wetland where normal decay does not occur and over hundreds of years the remains of dead plants build up to form thick layers called *peat.*
    - Human-Made Reservoirs –Can be made by building dams, water towers and underground water tanks. Designed to hold water for specific purposes such as:
      * Provide power for hydroelectricity
      * Irrigate farmland
      * Store water for firefighting
      * Assist with navigation on waterways
      * Control flooding
* Underground Fresh Water – These aquifers are of great importance
  + Oak Ridges Moraine (GTA)
  + Paskapoo Formation (Southwestern Alberta)
  + Annapolis-Cornwallis Valley Aquifers (Nova Scotia)
  + Nubian Sandstone Aquifer System (under the deserts of Libya, Egypt, Chad and Sudan)
  + Guarani Aquifer (South America, divided between Brazil and Argentina)
  + Ogallala Aquifer (under eight states in the American Great Plains)
  + Great Artesian Basin (Australia)
* Watersheds or drainage basins –
  + Made up of rivers, lakes, forests, wetlands and ground water.
  + All of the water in one watershed carries sediment and dissolved materials to the same body of water, such as a lake, river or coast.
  + Five main ocean watersheds of Canada
    1. Arctic Ocean
    2. Atlantic Ocean
    3. Gulf of Mexico
    4. Hudson Bay
    5. Pacific Ocean
* Atmospheric Water
  + Water vapour enters the atmosphere from the evaporation of rivers, lakes, oceans etc.
  + Sublimation – when water directly goes from the solid to the gaseous state.
* Types of water
  + ***Salt water*** has a concentration of dissolved salts averaging 3.5%.
  + ***Fresh water*** has less than 1% dissolved salts.
* ***Salinity*** refers to how much salt is dissolved in water.
* Earth is a watery planet (p.281, Fig 10.5 & 10.6)
  + About 70% of the planet is filled with water
  + About 97% of that water is salt water
  + Fresh water represents only 3% of the Earth's total water supply, even that we can't use easily.
  + Most of the fresh water is in the form of ice and snow or moves through the ground below the surface.
  + Therefore, although water is abundant on Earth, the water that is readily available to use is in much smaller supply.

Three states of water

1. Liquid Water – Liquid water is found above and below the ground.

* ***Surface Water***
  + Surface fresh water is a common sight everywhere in Canada.
  + Fresh water is collected in human-made reservoirs such as artificial lakes and water towers.
* ***Underground Water*** (p.282, Fig 10.7)
  + Most of Canada's fresh water exists and is found underground than on surface.
  + This underground water is called ground water.
  + About one third of the world's fresh water lies underground.
  + When rainwater falls, it soaks into the soil and flows down between the soil particles.
  + It continues draining downward through more soil and rocks until it reaches a layer that is hard for the water to pass through.
  + This may be a layer of rock or a very compact layer of clay.
  + The area where water fills all the air spaces in the soil and in the tiny cracks in the rocks is called ***groundwater zone***.
    - The upper surface of the groundwater zone is called the ***water table***.
  + Some rock and soil layers in the ground allows large amounts of water to collect within them naturally.
    - This is type of underground fresh water reservoir is called an ***aquifer***.
    - ***Wells*** are long, hollow shafts drilled down into an aquifer to obtain fresh water.
  + Ground water is always moving slowly out of our sight. Eventually it will reach to the level of the lakes and rivers.

1. Solid Water

* All of the solid water on Earth is fresh water.
* Salt water needs a colder temperature than fresh water to freeze. (p.283, Fig 10.8)
* In Earth's Polar Regions and on the tops of its high mountains, most fresh water exists in a solid state as ice and snow.
* Most glaciers and ice sheets contain more than 40 million km3 of frozen fresh water.
* ***Mountain Glaciers***
  + In mountain regions, temperatures are below freezing for most of the year and so the snow that falls never melts.
  + The snow accumulates over time, producing a mass of snow that become heavier and thicker.
  + By that time, the snow in the lower layers becomes more compacted.
  + As this happens, the compacted snow begins to change into a solid mass of ice.
  + So a ***glacier*** is a mass of ice and overlying snow that moves slowly down a mountain shape under the influence of gravity. (p.283, Fig 10.9)
* ***Ice Sheets***
  + An ***ice sheet*** is a particularly large glacier that covers the land.
  + Only two ice sheets exists on Earth:
    - One in Greenland
    - One in Antarctica (p.284, Fig 10.10)
    - The term polar icecap is sometimes used to refer to these big ice masses at the poles.
  + ***Ice Shelf*** is the floating ice sheet on water (ocean).
  + ***Iceberg*** is the broken piece of an ice shelf

1. Gaseous Water

* When liquid water evaporates from oceans lakes and rivers it becomes water vapour.
* You cannot see water vapour but you can feel the humidity of it in the air.
* Warm water can bring in more water vapour than cold water that is why we feel more humidity during the summer time.
* When the water vapour is carried upwards then it becomes colder which makes into small droplets of water that become clouds. (p.284, Fig 10.11)
* Plants and animals also put water vapour into the atmosphere.
  + ***Transpiration*** is the process of water evaporation from plant leaves.
  + ***Respiration is when*** animals exhale water vapour. (p.284, Fig 10.12)

***The Cycling Nature of Water***

* The water on Earth is constantly changing state. (p.285, Fig 10.13)
  + Somewhere in the world right now, water vapour is freezing into snowflakes, icebergs are melting, and puddles of rainwater are evaporating under the bright shining sun.
* The process by which water changes state as it moves from Earth's surface into the atmosphere and back to the Earth again is called the water cycle.
* The water cycle is a non-stop circulation.
* The Sun provides the thermal energy that drives the whole cycle.

***Watersheds***

* ***Watershed*** is an area of land where all the water eventually drains into one main water body such as a lake, river, and or wetlands.
* Many smaller watersheds connect to larger watersheds and finally empty into an ocean.
* North America has five ocean watersheds: Atlantic, Arctic, Gulf of Mexico, Hudson Bay, and Pacific. (p.286, Fig 10.14)
* Since water cannot flow upwards high points in the land such as mountain ridges create natural divides.
* These are boundaries that direct where water flows.
  + For example the Rocky Mountains act as a divide and are often referred to as the great or continental divide.
    - If you are west of the Rockies much of the water flows to the Pacific Ocean.
    - If you are on the east side it flows to the other main watersheds.