**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.