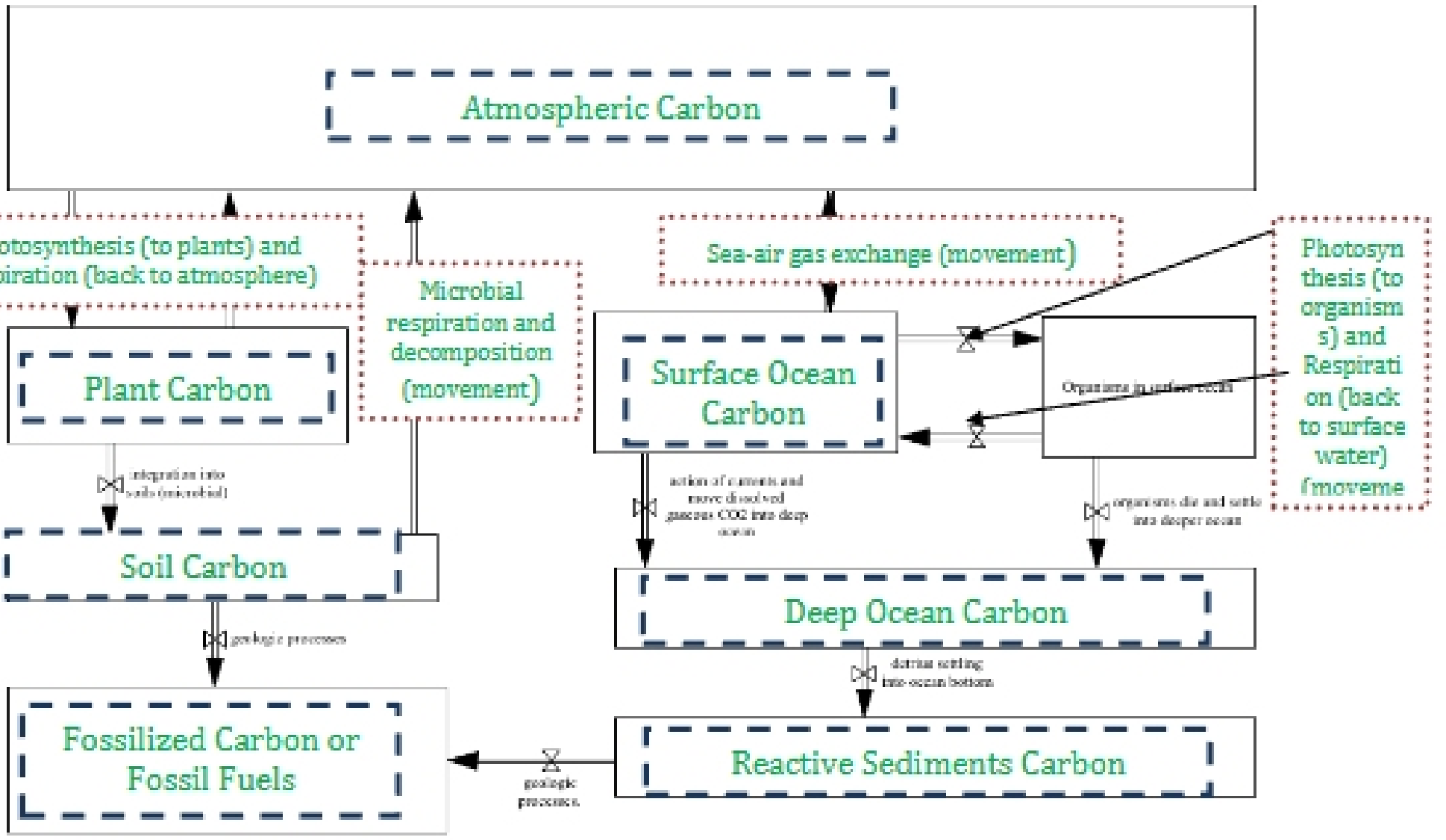
POGIL 2.1: The Carbon Cycle (1)

Review Version

***Read Chapter 2.0 and 2.1 of the E-text and then complete this part of the POGIL worksheet.*

**Please fill out worksheet in a different font or text color (green or blue) so it is easy to distinguish your answer from the questions.

EQ1. Using Figure 2.1.2 The Carbon Cycle (in the e-text), label the components of the carbon cycle on the stock and flow diagram below. Note the flows are the movement of carbon from one storage to another, Stocks are "storages" think of them as containers of carbon.



EQ2. Carbon in the surface waters of the ocean includes dissolved gaseous carbon and carbon in the bodies of ___Organisms_____.

EQ3. List the stocks of carbon in order of magnitude from largest to smallest. (You many combine dissolved gaseous carbon and carbon in organisms as one stock in the surface water).
See interactive diagram in the E-text above, it give the concentrations in G.Tons of carbon.
1. Deep Ocean (37,000 Giga Tons)
2. Fossil Carbon (10,000 Giga Tons)
3. Soil Carbon (2300 Giga Tons)

EQ4. The flows of carbon between stocks operate at very different time scales. What is an example of a flow that would happen quickly? photosynthesis and respiration What is an example of flow that would happen very slowly? Reactive sediments or soil carbon becoming fossilized carbon

READ THIS: ***The earth in its entirety is a complex closed ecosystem bounded by the upper limits of the atmosphere. Aside from incoming meteorites and a few highly charged ions leaking into space, the mass of the earth remains constant over time. The only thing that is added to the closed ecosystem is energy from the sun. Thus, the carbon atoms in your body and in all plants and animals were originally in the stellar material that formed the planet 4 billion years ago. Carbon atoms form what some call the "duck tape of life" because carbon bonds are what hold life together. Carbon has four bonding sites and through photosynthesis it bonds with oxygen and hydrogen to form the carbohydrates that we eat and incorporate into our tissues. In addition, these bonds have stored energy that originated from the sun in a form that can be utilized for the metabolic processes necessary for life.***

The carbon that plants and animals utilize today comes from atmospheric carbon dioxide (CO_2) that has been incorporated into plants through photosynthesis. Algae, phytoplankton and plants convert atmospheric carbon dioxide into carbohydrates or simple sugars through the process of photosynthesis. The by-product of this reaction is oxygen (O_2). The chemical formula $C_6H_{12}O_6$ is a simple sugar, but is used here as a generic form of carbohydrates (carbo = carbon; hydrate = oxygen and water). Algae, plankton and plants utilize the products of photosynthesis to create complex sugars and carbohydrates, and with the addition of nitrogen and trace minerals create amino acids, proteins, and fats.

IQ5. Fill in the chemical equation for photosynthesis.

$$6CO_2 + 6H_2O + \text{Energy} \longrightarrow C_6H_{12}O_6 + 6O_2$$

$6CO_2$	$6H_2O$	Energy	$C_6H_{12}O_6$	$6O_2$
from the atmosphere	from the soil	from the sun	Carbohydrates stored in plants and phytoplankton	to the atmosphere

IQ6. The laws of thermodynamics state that energy cannot be created or destroyed; it may only change forms. If the energy from sunlight is used for photosynthesis, where does the energy go?

The energy goes into the plant as a carbohydrate for the plant to use.

READ THIS: ***The production of energy-laden carbohydrates is called <u>primary production</u> because these carbohydrates form the base of the food chain. The process through which organisms utilize carbohydrates (food) for energy is called respiration. When we eat food, our digestive enzymes break the carbon bonds in our food to release the energy stored in those bonds. In addition to energy, the process of respiration creates the CO_2 and H_2O that we release from our bodies when we exhale.***

IQ7. Fill in the chemical equation for respiration.

$$C_6H_{12}O_6 + 6O_2 \xrightarrow{\text{Metabolic enzymes}} 6CO_2 + 6H_2O + \text{Energy}$$

$C_6H_{12}O_6$	$6O_2$	$6CO_2$	$6H_2O$	Energy
carbohydrates	from the atmosphere	to the atmosphere	to the atmosphere	used for metabolism

IQ8. The laws of thermodynamics state that energy cannot be created or destroyed; it may only change forms. If the energy from food is released through respiration, where does the energy go? (What do organisms use it for?)

To do their activities, grow biomass! Which then another animal can eat to obtain that energy for themselves