

### Assignment 3

#### Instructions:

Type your answers, and only your answers (do not copy the questions), in the body of the email to [geog345@gmail.com](mailto:geog345@gmail.com). In the subject line, type "Assignment 3" (without the quotes).

This assignment must be submitted by **Thursday, September 25, 11:59 pm EST** (i.e., before midnight). Late assignments will be deleted. Please only submit your completed assignment once.

1. Type your last, first name
2. Copy and paste the honor pledge:

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment. (Add your initials).

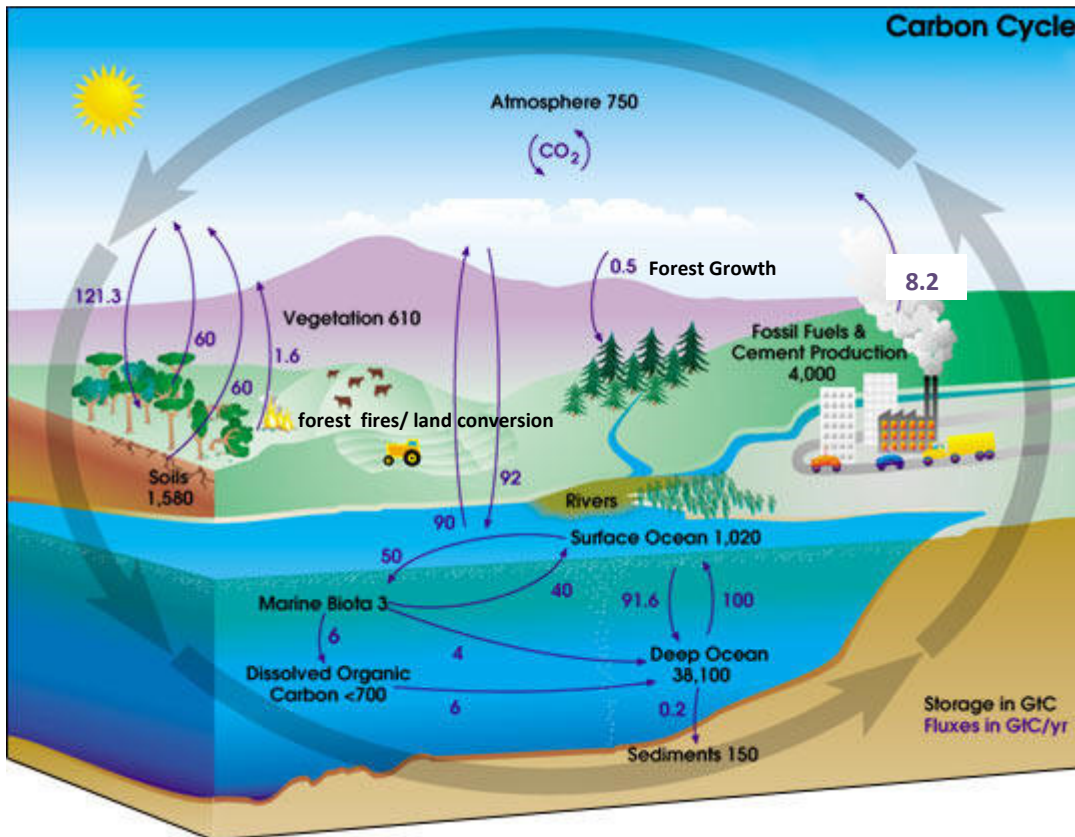


Figure from NASA:

[http://www.nasa.gov/centers/langley/images/content/174212main\\_rn\\_berrien2.jpg](http://www.nasa.gov/centers/langley/images/content/174212main_rn_berrien2.jpg)

Fossil Fuel and Cement Flux was updated from 5.5 GtC/yr to 8.2 GtC/year to reflect the most recent emissions estimates.

Note: 1 GtC/yr = 1 billion metric tonnes of carbon per year = 1 Pg C.

3. What is the total (sum) annual carbon flux into atmosphere? Include your units.
4. What is the total (sum) annual carbon flux out of the atmosphere? Include your units.
5. Is the atmosphere a net sink (growing reservoir) or net source (shrinking reservoir) of carbon? By what net amount per year? Include your units.
6. Assume that the carbon flux into Earth's soil is equal to the carbon flux out of the soil at 60 GtC/yr. What is the residence time for carbon in soil? Round your answer to the nearest tenth and include your units.
7. Assume that humanity stabilizes anthropogenic fossil fuel & cement carbon emissions at 2.2 GtC/yr and all other fluxes and pools stay the same. Calculate the residence time for *all* carbon in the atmosphere. Round your answer to the nearest tenth and include your units.
8. Assume that residence time for fossil fuel carbon is 400 million years and that prior to the industrial revolution, this pool was in a steady state. How much carbon would naturally be released from this reservoir (4000 Gt C) per year? Include your units.
9. How many times larger is the current flux out of the fossil fuel carbon reservoir than what would occur naturally?
10. What is the mass of annual emissions from fossil fuel combustion in terms of Gt CO<sub>2</sub>/yr? Assume all emissions are in the form of CO<sub>2</sub>. Round to the nearest whole number and include your units.
11. BONUS PROBLEM (5 extra credit points): DDT was used extensively as a pesticide in the US in the 1960s before ultimately being banned. In the 1960s, the average concentration of DDT on agricultural land was 0.168 g/m<sup>2</sup> and on non-agricultural land it was  $4.5 \times 10^{-4}$  g/m<sup>2</sup>. The total land in the continental US is  $7.7 \times 10^{12}$  m<sup>2</sup>. The mean residence time of DDT in the soil is 5.3 years. How much DDT in tonnes was being used each year in the US during the 1960s?