

3. Quiz (Nov. 3, 2005)

(multiple correct answers are possible!)

(name)

Fall 2005 *Global Biogeochemical Cycles Class*

Covering: Terrestrial and Oceanic biogeochemical cycling

1. Order the following biomes by increasing residence time of SOM (1 = shortest τ):

- 3 boreal forest
- 1 tropical rain forest
- 4 tundra
- 2 mid-latitude deciduous forest

This goes essentially with temperature/latitude.

2. True or false: Most plant debris (“litter”) gets microbially respired to CO_2 in the uppermost layer (O or L) of the soil, regardless of biome.

- TRUE FALSE

3. The average C:N ratio of green plant leaves is ...

- 150
- 10
- 50
- 500

4. During the microbial decomposition of plant litter, nitrogen gets released into the soil as ...

- NO_3^- (nitrate)
- organic N in amino acids
- N_2 (nitrogen gas)
- NH_4^+ (ammonium)

Decomposition releases N in the same oxidation state than in the plant, -III.

5. As a first cut, global terrestrial NPP is accurately estimated by global temperature and precipitation distributions. However, nutrient availability is a limiting factor. Which of the following nutrients is/are commonly in short supply.

- K P Ca N none of the above

P is often “occluded”, N is constantly lost in small amounts to the atmosphere via nitrification/denitrification and via infiltration and surface runoff

6. True or false: Humanity is now altering global NPP ($\sim 110 \text{ Pg C yr}^{-1}$) and the biogeochemical cycles of carbon and nitrogen to measurable extends.

TRUE

FALSE

see the reading assignments!

7. Ocean water circulation (horizontal and vertical mixing) has direct influences on

residence times in the ocean

wind direction and speed in the overlying atmosphere

primary productivity in the surface waters

ocean heat transport

Causality: Wind direction and speed influences ocean currents, not vice versa ...

8. Ocean Primary Productivity happens in the thermocline, an ocean surface layer of water of max. ~1000 m depth with increasing temperature and decreasing ...

salinity

density

nutrient availability

oxygen partial pressure, pO_2

carbon dioxide partial pressure, pCO_2

... towards the surface.

Salinity can be increasing or decreasing! Increasing temperature decreases density.

Photosynthesis (highest near surface) releases O_2 and consumes CO_2 !

9. Ocean Primary Productivity relies on solar radiative input. However light is attenuated in ocean waters to less than ~1% at a depth of ...

1000 m

500 m

100 m

... and is used for photosynthesis mostly (average >95% globally) by ...

zooplankton

phytoplankton

small fish

10. Ocean pH is buffered by calcium carbonate (dissolution and precipitation). However, which non-equilibrium process is slowly changing ocean pH?

increased ocean Primary Productivity with an increased carbon deposition to sediments

increasing fossil fuel CO_2 atmospheric accumulation and subsequent dissolution in the oceans

increased river water pH

The other two I invented ... Recall how deep the anthropogenic CO_2 has penetrated?