

## Study Questions—Week 3 *Water & Carbon Cycle*

Due Mon Jan 24

1. Exploring the edge effect. This was inspired by your answers to last week's quiz question. Calculate the length of perimeter for a 100 km<sup>2</sup> parcel of forest if the shape of the parcel is as outlined below. Possibly helpful info. Circles: area =  $\pi r^2$ , circumference =  $2\pi r$ , Triangles: area = 0.5 x base x height.
  - a. A circle
  - b. A square
  - c. A rectangle that is twice as long as wide
  - d. A parcel with a zig-zag edge (popular on last week's quiz). You can construct your parcel however you wish. It might be helpful to draw it out. One possible solution is to sketch a parcel made of squares.
  - e. Which parcel has the least amount of perimeter (edge)?
  - f. Are there any benefits to an irregular boundary (like the zig-zag)?
2. Starch and cellulose are both polymers of glucose molecules. What are some possible reasons that plants evolved to use starch as a storage compound and cellulose as a structural material instead of vice versa?
3. If C<sub>4</sub> plants are more efficient than C<sub>3</sub> plants, why don't they dominate the landscape?
4. It is possible for a suspension of chloroplasts in the dark to synthesize glucose using CO<sub>2</sub> and H<sub>2</sub>O, but at least two other compounds must be added. What are they?
5. Consider a corn (C<sub>4</sub>) and a geranium (C<sub>3</sub>) plant growing together hydroponically in an illuminated, gas-tight container. What happens? Do the plants compete or collaborate? If they compete, which plant wins, and why? List the processes that generate and consume CO<sub>2</sub> in each plant and outline how the relative rates of these processes change over time.
6. Dinitrophenol is a toxic chemical that sits in cell membranes (both internal and external membranes) and will transport H<sup>+</sup> across the membrane in response to a gradient. What specific process might be affected by this chemical? Why?
7. The rains last week delivered 2.4 inches of rain in Olympia in one 24-hour period. In an intact forest, there was no surface runoff. However, in a local development where 2 acres of forest was removed and replaced with a combination of store and parking lot, all of this rain became surface run off. How many gallons of run off was produced by this rain event? 1 acre = 43,560 ft<sup>2</sup>, 1 gallon=0.13368 ft<sup>3</sup> If all this rain were stored in a cubical tank, how big would this tank be?

**Quiz Questions—Week 3**  
**Forests Through Time and Space**  
**This is due next Wed (Jan 26)**

1. Suppose you wished to study the effects of urbanization/ industrialization on stress experienced by a forest ecosystem over the past 100 years. Explain how stable carbon isotope analysis might help you do this. Outline the processes within the plant/atmosphere that permit stable carbon isotope analysis to work and explain what results you would expect during stressed and unstressed times.
  
2. How does an intact forest canopy affect soil moisture content before, during, and after a rain event? Compare/contrast with an area where the forest has been removed (clear cut). What process(es) have been affected? How do they differ between the intact forest and the clear cut.