

2.A Formative FRQ's

1.

Water is important for all living organisms. The functions of water are directly related to its physical properties.

(a) **Describe** how the properties of water contribute to TWO of the following.

- transpiration
- thermoregulation in endotherms
- plasma membrane structure

(b) Water serves as a reactant and a product in the carbon cycle. **Discuss** the role of water in the carbon cycle.

(c) **Discuss** the impact of one human activity on the water cycle.

2.

In most aquatic environments, primary production is affected by the light available to the community of organisms.

Using measurements of dissolved oxygen concentration to determine primary productivity, design a controlled experiment to test the hypothesis that primary productivity is affected by either the intensity **or** the wavelength of light. In your answer, be sure to include the following.

- A statement of the specific hypothesis that you are testing
- A description of your experimental design (Be sure to include a description of what data you would collect and how you would present and analyze the data using a graph.)
- A description of results that would support your hypothesis

3.

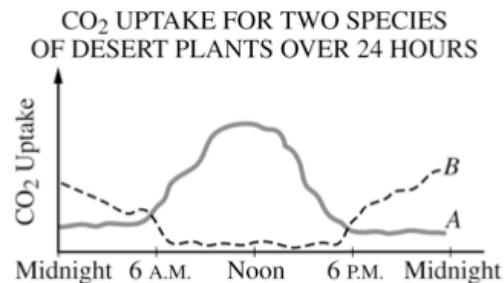
In many ways, all organisms in a food web can be said to be solar-powered. The producer level of the food web is responsible for the transformation of the solar energy into a form that can be used by other living organisms.

- (a) Discuss the role of green plants in transforming the Sun's energy into a form that can ultimately be used by heterotrophs.
- (b) Discuss the flow of energy from producers through top carnivores in a food web in terms of the laws of thermodynamics.

4.

Compared with other terrestrial biomes, deserts have extremely low productivity.

- (a) **Discuss** how temperature, soil composition, and annual precipitation limit productivity in deserts.
- (b) **Describe** a four-organism food chain that might characterize a desert community, and **identify** the trophic level of each organism.
- (c) **Describe** the results depicted in the graph. **Explain** one anatomical difference and one physiological difference between species *A* and *B* that account for the CO₂ uptake patterns shown. **Discuss** the evolutionary significance of each difference.



2.A Formative FRQ's

5.

The energy flow in ecosystems is based on the primary productivity of autotrophs.

- Discuss** the energy flow through an ecosystem and the relative efficiency with which it occurs.
- Discuss** the impact of the following on energy flow on a global scale.
 - Deforestation
 - Global climate change

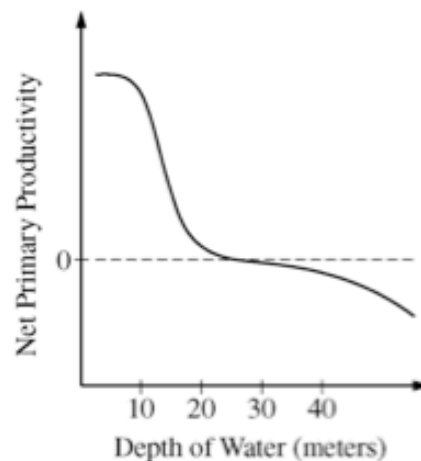
6.

Consumers in aquatic ecosystems depend on producers for nutrition.

- Explain** the difference between gross and net primary productivity.
- Describe** a method to determine net and gross primary productivity in a freshwater pond over a 24-hour period.

In an experiment, net primary productivity was measured, in the early spring, for water samples taken from different depths of a freshwater pond in a temperate deciduous forest.

NET PRIMARY PRODUCTIVITY IN A FRESHWATER POND ECOSYSTEM DURING SPRING

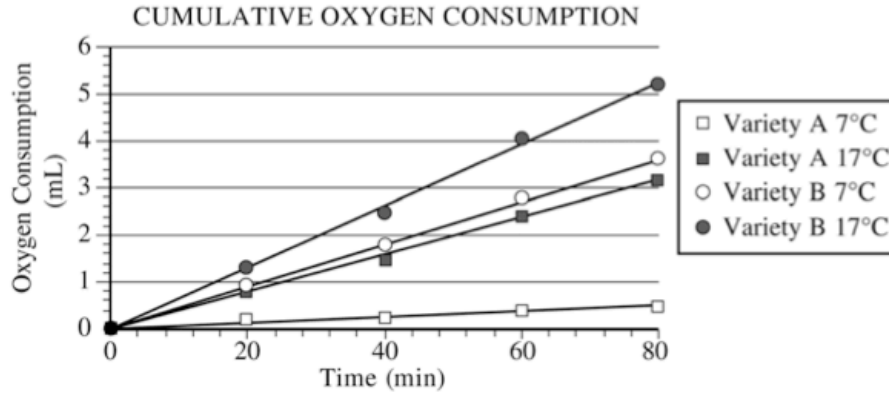


- Explain** the data presented by the graph, including a description of the relative rates of metabolic processes occurring at different depths of the pond.
- Describe** how the relationship between net primary productivity and depth would be expected to differ if new data were collected in mid-summer from the same pond. **Explain** your prediction.

2.A Formative FRQ's

7.

An agricultural biologist was evaluating two newly developed varieties of wheat as potential crops. In an experiment, seedlings were germinated on moist paper towels at 20°C for 48 hours. Oxygen consumption of the two-day-old seedlings was measured at different temperatures. The data are shown in the graph below.



- Calculate** the rates of oxygen consumption in mL/min for each variety of wheat at 7°C and at 17°C. **Show** your work (including your setup and calculation).
- Explain** the relationship between metabolism and oxygen consumption. **Discuss** the effect of temperature on metabolism for each variety of seedlings.
- In a second experiment, variety A seedlings at both temperatures were treated with a chemical that prevents NADH from being oxidized to NAD⁺. **Predict** the most likely effect of the chemical on metabolism and oxygen consumption of the treated seedlings. **Explain** your prediction.