

## AP Biology FRQ Ecology

Name \_\_\_\_\_ # \_\_\_\_\_

Answer the following 4 questions in essay form. Be clear and concise. Be sure to pay attention to the **bold** words. Compose your answers in the order of the questions.

1. Living organisms play an important role in the recycling of many elements within an ecosystem. **Discuss** how various types of organisms and their biochemical reactions contribute to the recycling of **either** carbon **or** nitrogen in an ecosystem. **Include** in your answer **one** way in which human activity has an impact on the nutrient cycle you have chosen.
2. The diagram below shows the succession of communities from annual plants to hardwood trees in a specific area over a period of time.
  - a. **Discuss** the expected changes in biodiversity as the stages of succession progress as shown in the diagram above.
  - b. **Describe and explain three** changes in abiotic conditions over time that lead to the succession, as show in the diagram below.
  - c. For **each** of the following disturbances, **discuss** the immediate and long-term effects on ecosystem succession.
    - i. A volcano erupts, covering a 10-square kilometer portion of a mature forest with lava.
    - ii. A 10-square kilometer portion of a mature forest is clear cut.



3. Eastern tent caterpillars live in sizable groups in silk nests, or tents, which they construct in cherry trees. They are among the first insects to become active in the spring, emerging very early in the season—a time when daily temperature fluctuates from freezing to very hot. Observing a colony over the course of a day, you observe striking differences in group behavior: Early in the morning the black caterpillars rest in a tightly packed group on the east-facing surface of the tent. In midafternoon, the group is found on the tent undersurface, each caterpillar individually hanging from the tent by just a few of its legs. **Propose a hypothesis to explain this behavior. How could you test your hypothesis?**

4. *Question sections a-c on next page.* Circadian rhythms are controlled by both genetics and environmental conditions, including light. Many species have circadian rhythms that exhibit a 24-hour cycle. Researchers investigated the effect of light on kangaroo rat behavior by using a running wheel with a motion sensor to record activity on actograms, as shown in Figure 1.

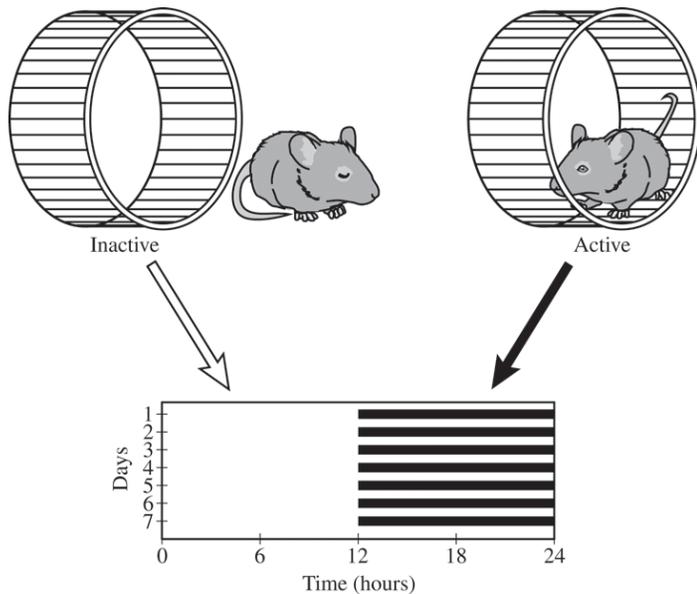


Figure 1. When a rat is active on the running wheel, the activity is recorded as a dark horizontal line on an actogram. When the rat is inactive, no dark line is recorded.

For the investigation, adult male rats were individually housed in cages in a soundproof room at 25°C. Each rat was provided with adequate food, water, bedding material, and a running wheel. The rats were exposed to daily periods of 12 hours of light (L) and 12 hours of dark (D) (L12:D12) for 14 days, and their activity was continuously monitored. The activity data are shown in Figure 2.

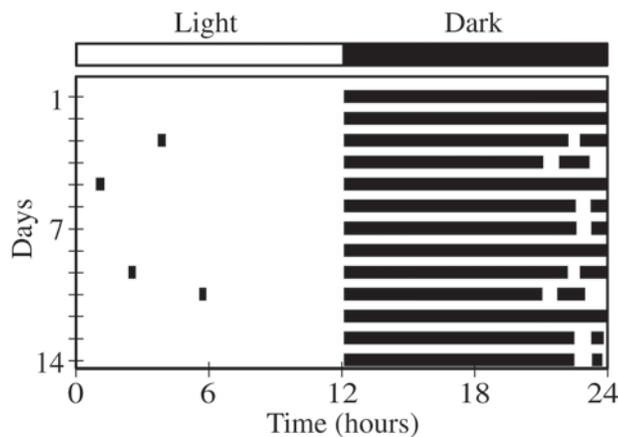


Figure 2. Actogram of rat activity under L12:D12 conditions. Each row represents a 24-hour period, and the dark horizontal lines represent activity on the running wheel.

After 14 days in L12:D12, the rats were placed in continuous darkness (DD), and their activity on the running wheel was recorded as before. The activity data under DD conditions are shown in Figure 3 below.

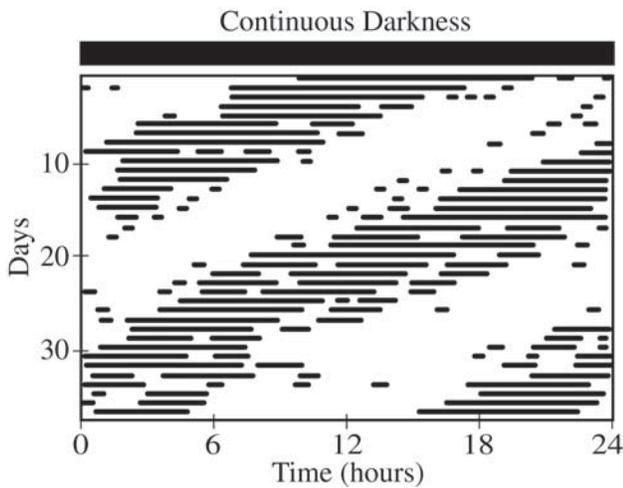


Figure 3. Actogram of rat activity under DD conditions. Each row represents a 24-hour period, and the dark horizontal lines represent activity on the running wheel.

- (a) Based on an analysis of the data in Figure 2, **describe** the activity pattern of the rats during the light and dark periods of the L12:D12 cycle.
- (b) The researchers claim that the genetically controlled circadian rhythm in the rats does not follow a 24-hour cycle. **Describe** ONE difference between the daily pattern of activity under L12:D12 conditions (Figure 2) and under DD conditions (Figure 3), and use the data to **support** the researchers' claim.
- (c) In nature, rats are potential prey for some predatory birds that hunt during the day. **Describe** TWO features of a model that represents how the predator-prey relationship between the birds and the rats may have resulted in the evolution of the observed activity pattern of the rats.



