AP® Biology
2002 Sample Student Responses

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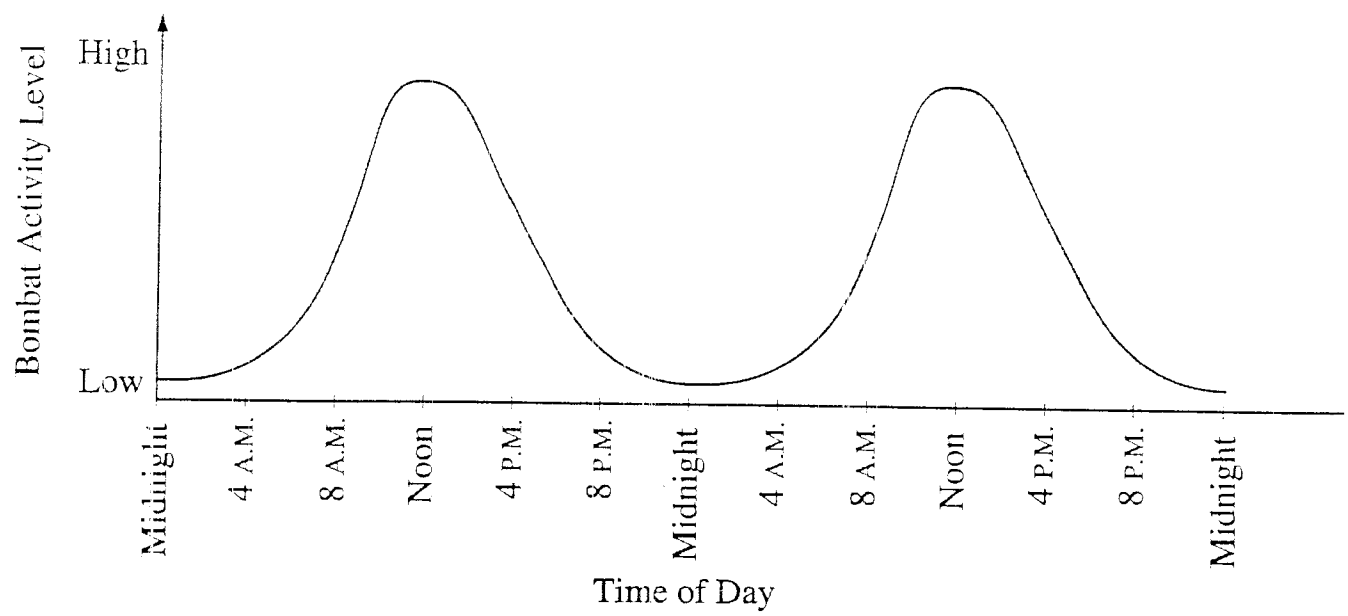
2R1

2. The activities of organisms change at regular time intervals. These changes are called biological rhythms. The graph depicts the activity cycle over a 48-hour period for a fictional group of mammals called pointy-eared bombats, found on an isolated island in the temperate zone.



(a) **Describe** the cycle of activity for the bombats. **Discuss** how **three** of the following factors might affect the physiology and/or behavior of the bombats to result in this pattern of activity.

- temperature
- food availability
- presence of predators
- social behavior

(b) **Propose** a hypothesis regarding the effect of light on the cycle of activity in bombats. **Describe** a controlled experiment that could be performed to test this hypothesis, and the results you would expect.

(A.) The lowest point of activity occur consistently at midnight. As the day progresses the activity continues to increase until it peeks around noon time. Then after that the activity begin a steady decline until its lowest point at midnight. One reason that may cause this is food availability. Since many organisms are inactive during the night the bombats wouldn't be able to acquire a lot of food and would just waste energy finding it. However, as the day wears on activity increases, which means the prey the bombat hunts also increases its activity. The high point for both is around noon, and continues to decrease after that as night begins to approach.

The second factor could be temperature. During the night it is cooler and the sun is not out. That means that organism

2R2

ADDITIONAL PAGE FOR ANSWERING QUESTION 2

sleep to conserve body heat and energy. ~~As the day begins~~ As the sun begins to rise temperature goes up and more and more organisms ~~are~~ begin to move about. When the sun is at its highest point around noon the temperatures are high and ~~they are~~ organisms are now everywhere. This means that it is easier for Wombats to find food and they expend less energy keeping warm because the suns rays do it for them. As temperature begin to cool down organisms begin to retreat back into their homes and activity decreases.

The last factor could be predator. The organisms that hunt Wombats may be nocturnal and hunt them at night. The Wombats activity decreases so that they have a better chance of NOT getting captured by a predator. Since most nocturnal animals sleep during the day the Wombats are most active then because their chances of getting killed are less. As night approaches they slow down their activity because predators will be around and more and more of them will become active during the night so again, decreasing their activity at night lowers their chances of dying.

(5) The problem is whether or not light has an effect on the activity of Wombats. One testable hypothesis is that ~~the amount of light in the day affects the~~ more light helps the Wombats see their prey better, which would account for their increased activity during the hours around noon time.

2R3

ADDITIONAL PAGE FOR ANSWERING QUESTION 2

One way to test this is to first select an area of land where ~~the~~ lombats and their prey are living. ~~Next capture and mark a group of lombats.~~ For the control group monitor how effectively the lombats can capture prey during certain times of the day and record results. It will be necessary to mark about 30 individuals and monitor their progress only over a period of about 3 days.

For the experiment group, catch a new group of 30 lombats and mark them. Use another plot of land with the same / near same condition as the other one. Record results for how effectively this group of lombats can capture prey for three days using the same method as before. For the variable, at night set up large flood-light as light source. Then record the amount of prey caught by the lombats for three more days. ~~Recording~~ Recording the results would be displayed best on a bar graph. The x-axis would be the time of day and the y-axis would be the amount of prey caught. If the light did have an affect on improving the lombats sight then the amount of prey caught in the ~~experimental~~ experimental group should be higher.

Thus, if the results proved the hypothesis, then that means that light does have an ~~affect~~ effect on lombats catching their prey. This would also prove why they hunt more during the day time then at night.

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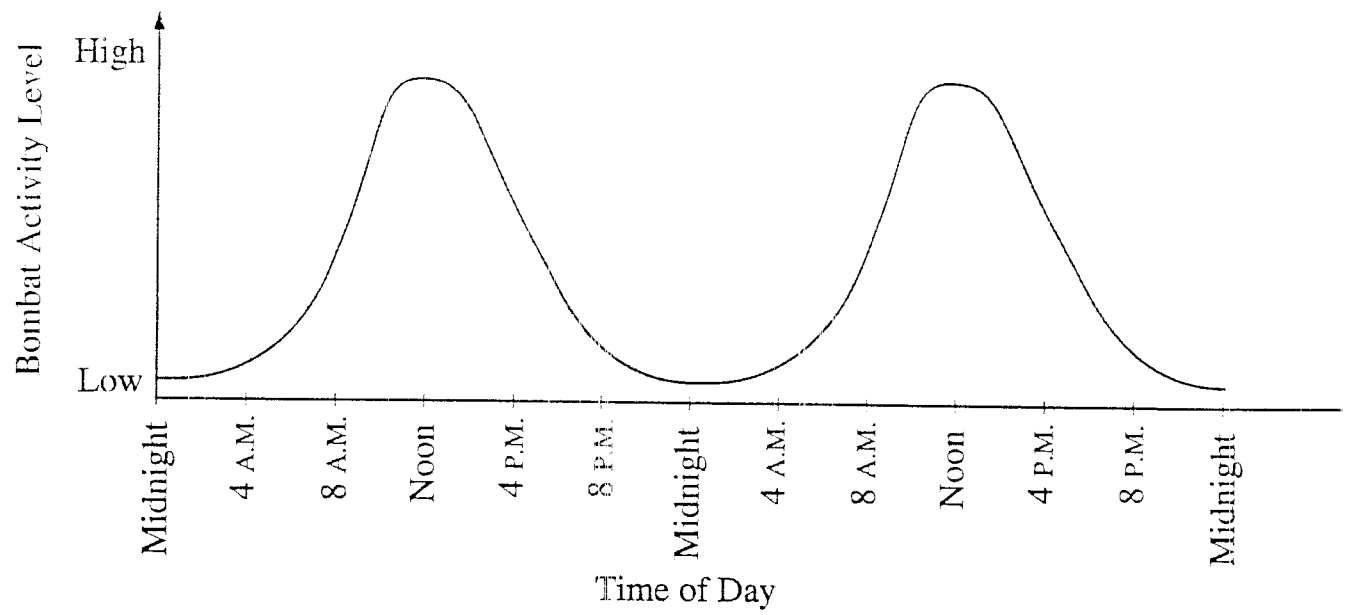

(a) **Describe** the cycle of activity for the bombats. **Discuss** how **three** of the following factors might affect the physiology and/or behavior of the bombats to result in this pattern of activity.

- temperature
- food availability
- presence of predators
- social behavior

(b) **Propose** a hypothesis regarding the effect of light on the cycle of activity in bombats. **Describe** a controlled experiment that could be performed to test this hypothesis, and the results you would expect.

A) The bombats ~~are~~ probably have physiological adaptations to deal with warmer temperatures that would be present when they are most active, in the middle of the day. Sweat glands, panting, large ears (by cooling blood circulated through them) can help the bombats to deal with warmer temperatures during their active time.

The food that the bombats eat is probably more readily available in the middle of the day. If the bombats are carnivorous, (eating other animals) those animals might be active during the day, so the bombats would find more

ADDITIONAL PAGE FOR ANSWERING QUESTION 2

food. If they are herbavores (eating plants) the plants might be easier to find in the daylight or taste better then.

Predators of the bombats might hunt at night, ~~so~~ so ~~it~~ it would be better for the bombats to be hiding in their nests/homes. If the predators are out in the daytime, the bombats would be more able to see them (they probably do not have good night vision) and get away

B) If there is a greater intensity ~~and duration of~~ light in a bombat habitat where bombats live, then the bombats will be more active than in a darker habitat.

I would set up 4 bombat habitats in seperate areas and place one bombat in each habitat. Each habitat would have the same aspects (water availability, foliage, soil content, temperature) but they would be exposed to light differently:

Habitat #1: no light

Habitat #2: dim light

Habitat #3: moderate light

ADDITIONAL PAGE FOR ANSWERING QUESTION 2

Habitat #4: bright light

I would expose the bombats to these light amounts for 12 hours, and monitor their activity (movement, eating, sleeping) durin that time. I would do this for one week and keep a record of the bombat activity. The other 12 hrs. would be spent in darknes

I would expect the bombat in the bright light habitat to be the most active, since bombats are most active at noon. I would expect the bombat in the dark to be least active and possibly suffer ill effects of the constant darkness, because naturally bombats are not active at all in the dark.

2 T1

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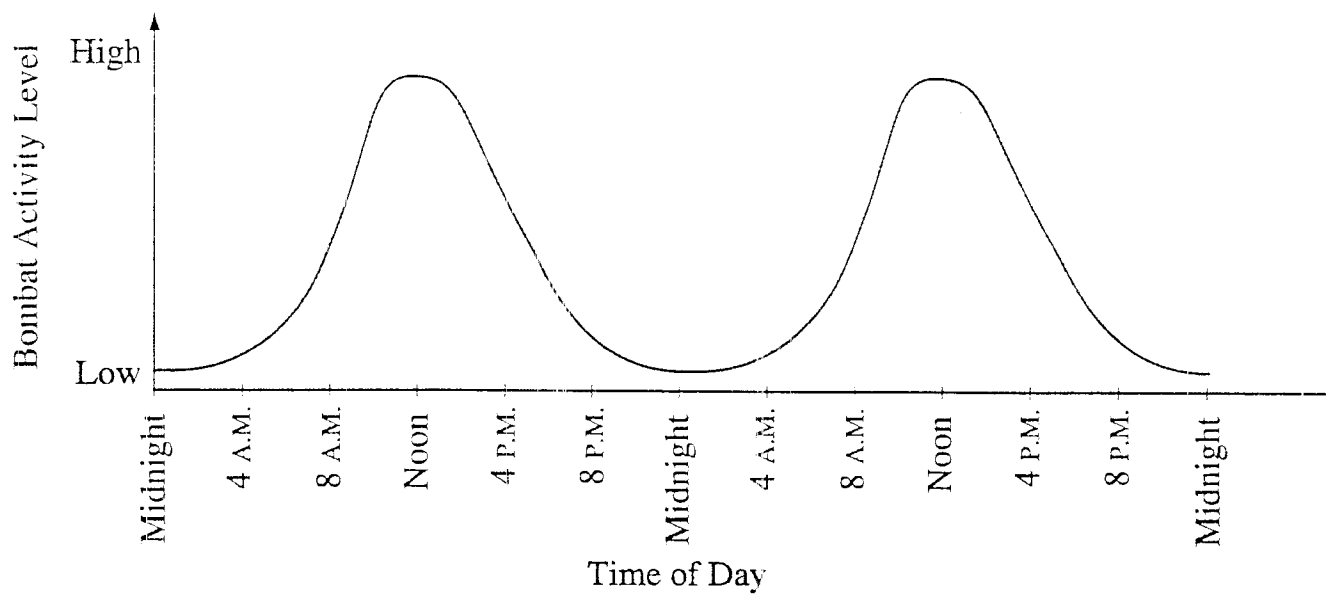


(a) **Describe** the cycle of activity for the bombats. **Discuss** how **three** of the following factors might affect the physiology and/or behavior of the bombats to result in this pattern of activity.

- temperature warm at noon
- food availability most light. can see food
- presence of predators
- social behavior

(b) **Propose** a hypothesis regarding the effect of light on the cycle of activity in bombats. **Describe** a controlled experiment that could be performed to test this hypothesis, and the results you would expect.

A) The activity cycle of the bombats is pretty clear. These animals sleep through the night, wake up near first light, have a peak activity time at about noon, & then their activity winds down until they fall asleep, at about sunset. This cycle takes place within 24 hours.

The temperature of the bombats habitat can greatly affect their activity cycle. Primarily, it is possible that temperature affects the rate at which the bombats move. When the temperature is low, the bombats don't move as much so as to conserve what heat they can. But, as the day warms up & the temperature rises, the bombats can move freely & not fear losing any body heat because their surroundings

GO ON TO THE NEXT PAGE.

2T2

ADDITIONAL PAGE FOR ANSWERING QUESTION 2

are warm enough. The data supports this by showing an increase in activity when the sun is more likely to be high in the sky, at noon. When the sun is not visible, (midnight) we see that the rate of activity is at its lowest point.

Food availability can also affect the activity levels of bombats. When there is a lot of light, at about noon, the bombats are better able to see their food, whether it be the fruits from certain plants or small animals. If the bombats could see their food best when there is light, they would go hunting/searching at noon, and this would account for the high level of activity. Also, just when the sun rises & just when it sets, the levels of light would be low, making it difficult for the bombats to see their food & thus they are less likely to be searching for food which means they would be doing less activities.

Presence of predators also affects bombat activity. Because the predators of bombats are nocturnal the bombats have scheduled their time for being away from their shelter when there is light out, so as to avoid any unpleasant encounters w/ hungry predators. Also, if any predator is awake & hunting when there is light out the bombats will be able to see the predator because the light will

2T3

ADDITIONAL PAGE FOR ANSWERING QUESTION 2

cause the bombats to be clearly visible.

B) Hypothesis: If temperature were to remain constant, the bombats ~~activity~~ level of activity would be a straighter line than the graph of previous data. There wouldn't be such peaks & valleys of activity.

Variable: temperature. the bombats should be kept at 72° F for 144 hours or (6 days), instead of allowing the temperature to fluctuate as it does naturally.

Control: One set of bombats should be left in conditions where temperature does follow the pattern that occurs naturally.

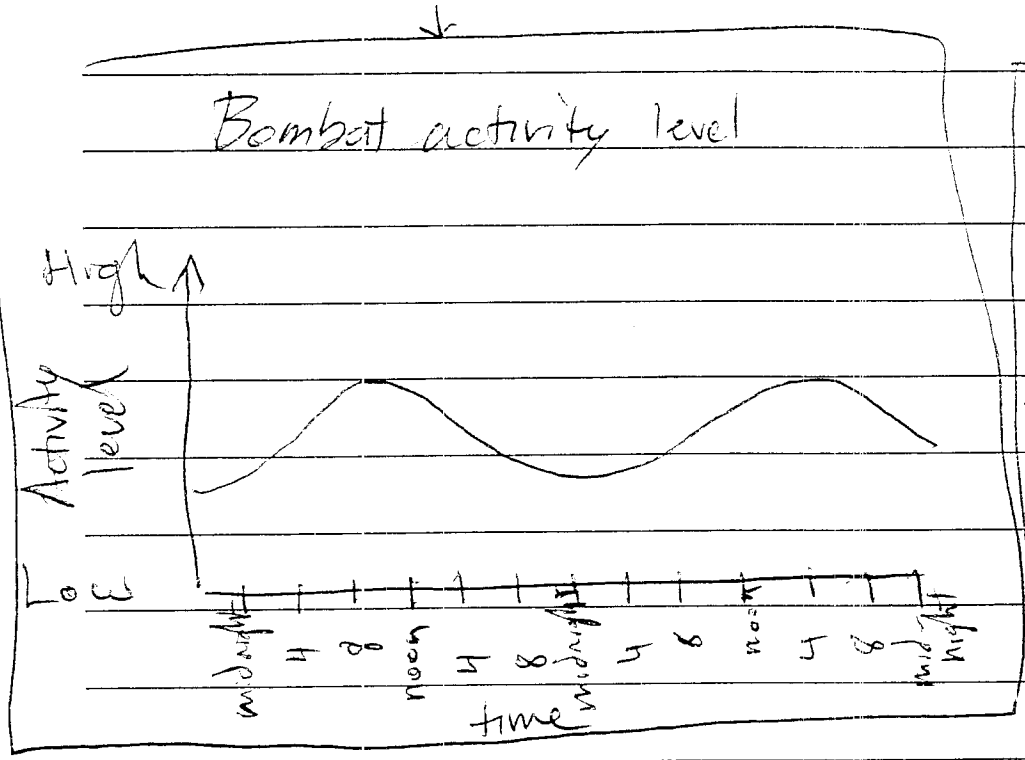
Procedure: Record the level of activities of two sets of bombats. One set must be kept at a constant temperature of 72° F, while the other set must be kept in a habitat that allows the temperature to fluctuate as it does naturally with the rising & the setting of the sun.

Repeat the experiment numerous times so as to eliminate experimental error / human error when conducting the experiment.

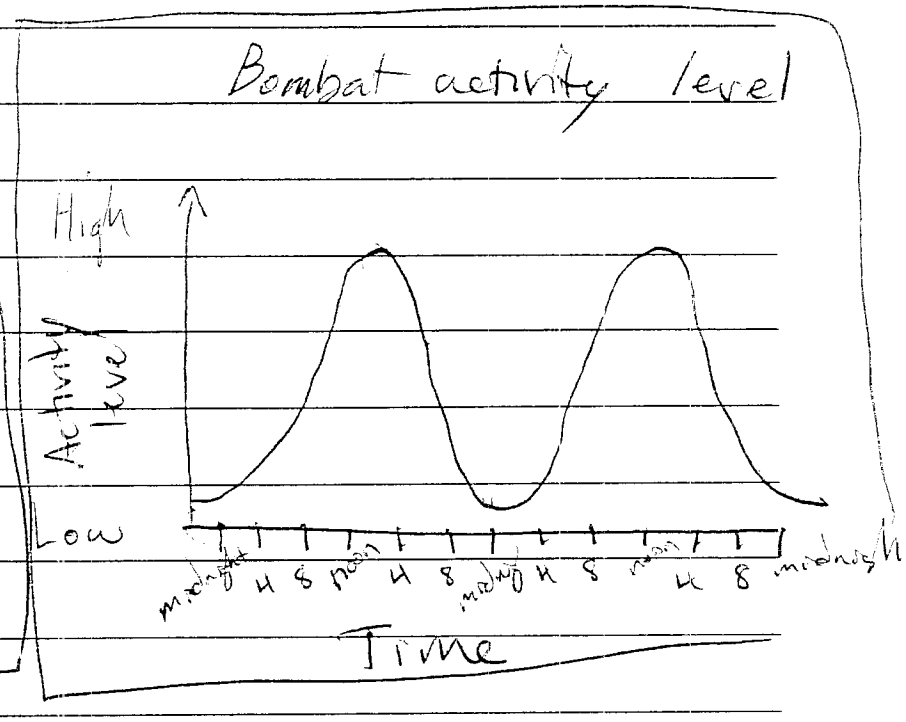
ADDITIONAL PAGE FOR ANSWERING QUESTION 2

Expected Graphs

72°F Constant



Natural Fluctuations



As expected the bombats that were ~~~~ kept at a constant temperature had a more constant level of activity than did those who were left in a habitat where the temperature changed as it does naturally.