

Scoring Guidelines for Free-Response Question 1

10 points maximum; 1 point for each specific prediction. A maximum of 3 points can be earned in any one section.
(Part a) 1 point for each reasonable resulting change to a cellular process. Effects may include: <ul style="list-style-type: none">• Less ATP produced.• Less NADPH produced.• Inability to fix carbon via Calvin cycle without products of electron transport chain.• Decrease in O₂ production.
(Part b) 1 point for each reasonable expected change to an individual plant, with explanation. Explanations may include: <ul style="list-style-type: none">• Plant cannot produce glucose due to decrease in photosynthetic product (G3P).• Stunted growth due to lack of energy for building molecules.• Plant becomes weakened and may die due to lack of ability to capture energy.• Plant uses up pre-infection energy stores.• Cannot perform growth/repair/reproduction due to lack of usable energy.
(Part c) 1 point for each reasonable predicted short-term change to the plant population or the prairie community, with justification. Predictions may include: <ul style="list-style-type: none">• Reduction in population size of affected prairie grass due to death of infected members.• Decrease in consumer population size as less energy available for the higher trophic levels.• Smaller herbivore population size due to increased competition for limited resources.• Unaffected plant species gain resources due to loss of infected plants.• Uninfected plants have increased offspring due to more available resources.
(Part d) 1 point for each reasonable predicted long-term change to the plant population or the prairie community, with justification. Predictions may include: <ul style="list-style-type: none">• Plant species becomes locally extinct.• Reduction in genetic variability due to loss of infected plants.• Change in allele frequencies for the affected species.• Loss of consumer species dependent on affected prairie grass species.• Members of the affected species with a genotype conferring resistance become more common, leading to no long-term effects to the population or community.• Grass is replaced by other species — community is stabilized, or some changes in members of the food chain.• Increased erosion due to lack of grass leading to degradation of abiotic environment, further limiting the ability of the environment to support the community.

Scoring Guidelines for Free-Response Question 2

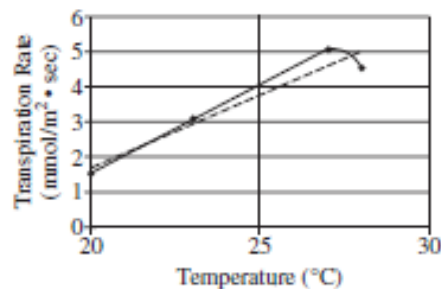
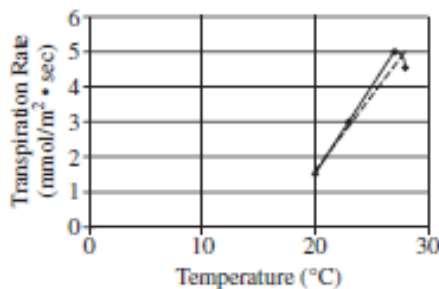
10 points maximum; students must earn points in each part of the question to receive all 10 points.

(Part a) Up to 3 points for a properly drawn graph.

One point for each of the following:

- Axes properly labeled and scaled
- Points properly plotted
- Correctly drawing either the curve with connected points or the best-fit line

NOTE: The student may use full scale (0–30), limited scale (20–30), or other legitimate scaling of the x-axis. Two examples are shown. The solid lines indicate the curve with connected points, and the dashed lines indicate the best-fit line.



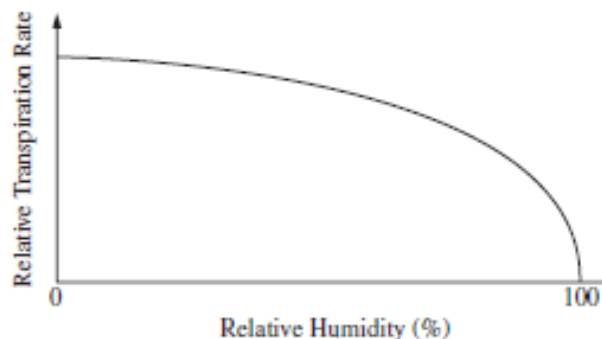
1 point for an appropriate description of the shape of the curve:

- Drawn curve shows increasing rate of transpiration from 20 to 27 degrees and reduction in transpiration rate from 27 to 28 degrees; or
- Best-fit curve shows steady increase in transpiration correlated to increase in temperature.

1 point for appropriate explanation of the change:

- Rate of water evaporation increases with increasing temperature.
- As temperature increases there are more open stomata.
- At the higher temperature stomata begin to close.
- Plants open and close stomata in response to environmental conditions.

(Part b) 1 point for a properly drawn curve, as shown, with correct axes and labels. The curve must have some indication of humidity measure, e.g., 0–100.



1 point for a correct explanation:

- Increasing humidity leads to reduced evaporation rates due to decreased difference in water vapor pressure (water potential) between leaf and atmosphere.

(Part c) 1 point for a correct explanation of the increase in transpiration rate from 0 to 60 percent of open stomata:

- From 0 to 60 percent open stomata, there is an increase in gas exchange with more stomata open.
- There is higher rate of diffusion between the leaf interior and the environment with more stomata open.

1 point for a correct explanation of the flattening of the curve when more than 60 percent of stomata are open:

- When more than 60 percent of the stomata are open, another factor becomes limiting.
- Rate of water movement is now limiting.
- Transpiration is now limited by humidity.

(Part d) Up to 3 points for a reasonable description of each environment, with an appropriate justification.

Descriptions may include:

- Anacharis is adapted to an environment where transpiration does not occur, such as underwater or in 100 percent humidity. There is no need for water vapor *or* it cannot occur via transpiration.
- Water lilies are adapted to an environment where only the upper side of the leaf is exposed to air; thus, only one surface can exchange water vapor with the environment. The large number of stomata is not a disadvantage because the plant has easy access to water.
- Black walnut is adapted to an environment where the upper surface is exposed to strong sunlight and higher temperatures and/or where water is more limited compared to a watery environment. Stomata located on lower epidermis of leaves are shaded from exposure to direct sunlight and higher temperatures, mitigating excessive water loss.