

## 2019 AP® BIOLOGY FREE-RESPONSE QUESTIONS

**TABLE 1. CHANGES IN MORNING GLORY PETAL CELLS DURING FLOWER OPENING**

BUD		OPEN FLOWER	
Vacuole pH	6.6		7.7
Flower Color	Red		Blue
Cell Volume	Small		Large

8. The petal color of the Mexican morning glory (*Ipomoea tricolor*) changes from red to blue, and the petal cells swell during flower opening. The pigment heavenly blue anthocyanin is found in the vacuole of petal cells. Petal color is determined by the pH of the vacuole. A model of a morning glory petal cell before and after flower opening is shown in Table 1.
- (a) Identify the cellular component in the model that is responsible for the increase in the pH of the vacuole during flower opening AND describe the component's role in changing the pH of the vacuole.
- (b) A researcher claims that the activation of the  $K^+/H^+$  transport protein causes the vacuole to swell with water. Provide reasoning to support the researcher's claim.

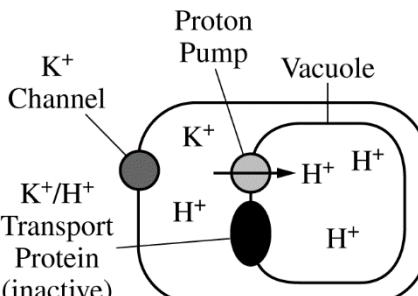
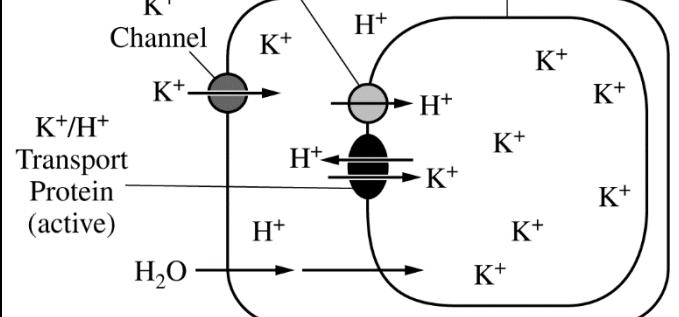
**STOP**

**END OF EXAM**

**AP® BIOLOGY**  
**2019 SCORING GUIDELINES**

**Question 8**

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BUD		OPEN FLOWER	
			
Vacuole pH	6.6		7.7
Flower Color	Red		Blue
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The petal color of the Mexican morning glory (*Ipomoea tricolor*) changes from red to blue, and the petal cells swell during flower opening. The pigment heavenly blue anthocyanin is found in the vacuole of petal cells. Petal color is determined by the pH of the vacuole. A model of a morning glory petal cell before and after flower opening is shown in Table 1.

- (a) Identify the cellular component in the model that is responsible for the increase in the pH of the vacuole during flower opening AND describe the component's role in changing the pH of the vacuole.

**Identification (1 point)**

- $(K^+ / H^+)$  transport protein

**Description (1 point)**

- It moves  $H^+$  out of the vacuole.

- (b) A researcher claims that the activation of the  $K^+ / H^+$  transport protein causes the vacuole to swell with water. Provide reasoning to support the researcher's claim.

**Reasoning (1 point)**

- The concentration of solute ( $K^+$ ) is increasing inside the vacuole.
- The solute ( $K^+$ ) is moving into the vacuole, making it hypertonic/hyperosmotic/lowering water potential.