

# Postharvest Sample Questions

## Sample Questions - Respiration

What process captures all the energy that a plant (and ultimately animals) will use to survive?

What organic compounds primarily store the energy in plants?

What is respiration?

Why is compartmentation (e.g. organelles & membranes) important for biological organisms to live?

What is the function of adenosine triphosphate (ATP) in living cells?

What organelle within cells houses the Krebs Cycle and Electron Transport Cycle?

Indicate whether the following are substrate or product in the process of respiration.

	<b>Substrate</b>	<b>Product</b>
CO <sub>2</sub>		
O <sub>2</sub>		
H <sub>2</sub> O		
glucose		
organic acids		
ATP		
heat		

If broccoli is placed inside a well-insulated container without ice, the temperature inside will (decrease/not change/increase) over time. Why?

# Postharvest Sample Questions

## Sample Questions - Respiration

Answer the following questions with: 'climacteric', 'nonclimacteric', or 'both'.

- a) Ripening is triggered in mature specimens upon exposure to ethylene.
- b) Produces ethylene in response to wounding.
- c) Respiration rate elevated upon exposure to ethylene.
- d) Respiration rate returns to pre-exposure level when ethylene is removed.
- e) Chlorophyll is degraded upon exposure to ethylene.

Explain how the respiratory pattern of a commodity reflects its perishability.

What is the Respiratory Quotient (RQ) and what can it tell about the substrate being used for respiration?

Rank the following in order of their anticipated shelf life (1 = longest shelf life, 4 = shortest shelf life) based on their given respiration rates at 20C (68F).

Potatoes: 10 mg CO<sub>2</sub>/kg-hr

Broccoli: 290 mg CO<sub>2</sub>/kg-hr

Grapefruit: 20 mg CO<sub>2</sub>/kg-hr

Tomatoes: 30 mg CO<sub>2</sub>/kg-hr

Q<sub>10</sub> refers to the change in respiration rate for every \_\_\_\_\_ (°C or °F) increase in temperature.

What useful benefit is there in knowing the Q<sub>10</sub> of a commodity?

# Postharvest Sample Questions

## Sample Questions - Respiration

(T/F) The  $Q_{10}$  of a given commodity is the same through all temperatures.

Say a commodity has a  $Q_{10}$  of 2. If it is warmed 10C, the respiration rate would be (the same, half, doubled) its initial rate. (circle the correct answer)

If a given commodity has a shelf life of 10 days at 20C, a  $Q_{10}$  of 2 between 0 and 10C, and a  $Q_{10}$  of 2 between 10 and 20C, then what would be its expected shelf life if held at 0C instead of 20C?

What is the  $Q_{10}$  of a commodity between 20 & 30C that has a respiration rate of 60 mg  $\text{CO}_2/\text{kg-hr}$  at 30C and 20 mg  $\text{CO}_2/\text{kg-hr}$  at 20C?

GIVEN for many of the following questions:

mg  $\text{CO}_2/\text{kg hr}$  X 61 = kcal/MT/day

mg  $\text{CO}_2/\text{ml CO}_2$  = 2

RQ = 1

$Q_{10} = (R_2/R_1) \exp (10/T_2-T_1) = 2$

mg  $\text{CO}_2$  produced X 0.68 = mg sugar consumed

# Postharvest Sample Questions

## Sample Questions - Respiration

Freshly harvested green snap beans respire at a rate of 200 mg CO<sub>2</sub>/kg hr at 25°C.

- a. At what rate would heat need to be removed in order to maintain the beans at 25°C?
  
  
  
  
  
  
  
  
  
  
- b. When cooled to 5°C and placed in storage, what would be the beans' expected rate of respiration?
  
  
  
  
  
  
  
  
  
  
- c. What would you expect the relative postharvest life of the beans to be at 5°C compared to 25°C?

You are carrying out an experiment to determine the effect of temperature on respiration of artichokes. At 5°C their respiration rate is 20 mg CO<sub>2</sub> kg<sup>-1</sup> hr<sup>-1</sup>, and at 10°C it is 40 mg kg<sup>-1</sup> hr<sup>-1</sup>.

- a) What is the Q<sub>10</sub> for the respiration rate of this commodity in this temperature range?  
Show work.
  
  
  
  
  
  
  
  
  
  
- b) What would you predict the shelf life of these artichokes to be at 10°C if it is 10 days at 5°C?

# Postharvest Sample Questions

## Sample Questions - Respiration

Onions held at 30C respire at a rate of 32 mg CO<sub>2</sub> kg<sup>-1</sup> hr<sup>-1</sup>. Estimate the following.

a) Rate of heat production and dry weight loss at 30C.

b) Rate of O<sub>2</sub> consumption at 0C. Show assumptions.

Which would probably have a higher rate of respiration, a growing leaf or a mature fruit, and why?

Explain briefly how a plant tissue's requirement for energy to carry out metabolic processes controls the tissue's rate of respiration.

Discuss how internal factors of a commodity influence its respiration rate.

Discuss how environmental factors might influence the respiration rate of a commodity.

# Postharvest Sample Questions

## Sample Questions - Respiration

(T/F) Anaerobic respiration uses oxygen and aerobic respiration does not.

Describe why fruit CO<sub>2</sub> production rises so much under anaerobic conditions.

What are the some negative effects of anaerobic respiration?

Under anaerobic conditions, indicate which of the following are still able to function:

Krebs Cycle

Glycolysis

Electron Transport System

Describe how ethylene exposure affects climacteric fruits?

Describe how ethylene exposure affects non-climacteric commodities?

# Postharvest Sample Questions

## Sample Questions - Respiration

Match the 5 important classes of organic compounds on the left (e.g. draw a line to) with their corresponding biological role on the right.

Phenolics

Enzymes

Carbohydrates

Genetic Information of the cell (DNA, RNA)

Lipids

The primary form of energy storage (shorter term)

Nucleic Acids

Phytoalexins (defense) & lignin

Protein

Membranes