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.

<table>
<thead>
<tr>
<th></th>
<th>Substrate</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O₂</td>
<td></td>
<td></td>
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<tr>
<td>H₂O</td>
<td></td>
<td></td>
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<tr>
<td>glucose</td>
<td></td>
<td></td>
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<tr>
<td>organic acids</td>
<td></td>
<td></td>
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<tr>
<td>ATP</td>
<td></td>
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<tr>
<td>heat</td>
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</table>

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 20°C (68°F).

Potatoes: 10 mg CO₂/kg-hr
Broccoli: 290 mg CO₂/kg-hr
Grapefruit: 20 mg CO₂/kg-hr
Tomatoes: 30 mg CO₂/kg-hr

Q₁₀ refers to the change in respiration rate for every _____ (°C or °F) increase in temperature.

What useful benefit is there in knowing the Q₁₀ 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 CO_2/kg-hr at 30C and 20 mg CO_2/kg-hr at 20C?

GIVEN for many of the following questions:
mg CO_2/kg hr X 61 = kcal/MT/day
mg CO_2/ml CO_2 = 2
RQ = 1
Q_{10} = (R_2/R_1) \exp \left( \frac{10}{T_2-T_1} \right) = 2
mg 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\textsubscript{2}/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\textsubscript{2} kg\textsuperscript{-1} hr\textsuperscript{-1}, and at 10°C it is 40 mg kg\textsuperscript{-1} hr\textsuperscript{-1}.

a) What is the Q\textsubscript{10} 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?
Onions held at 30°C respire at a rate of 32 mg CO₂ kg⁻¹ hr⁻¹. Estimate the following.

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

b) Rate of O₂ consumption at 0°C. 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.
(T/F) Anaerobic respiration uses oxygen and aerobic respiration does not.

Describe why fruit CO₂ 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.

<table>
<thead>
<tr>
<th>Phenolics</th>
<th>Enzymes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>Genetic Information of the cell (DNA, RNA)</td>
</tr>
<tr>
<td>Lipids</td>
<td>The primary form of energy storage (shorter term)</td>
</tr>
<tr>
<td>Nucleic Acids</td>
<td>Phytoalexins (defense) &amp; lignin</td>
</tr>
<tr>
<td>Protein</td>
<td>Membranes</td>
</tr>
</tbody>
</table>