THE CELLULAR RESPIRATION DIAGNOSTIC QUESTION CLUSTER
DQC Group, Michigan State University

Questions are categorized according to the practices demanded by the stem. Correct answers are indicated in green. Some questions have alternative stems that can be used with the same foils. Where the multiple choice stems would not work for essay format, alternative stems are suggested.

Tracing matter and identifying scale and location

1. **Animals loosing weight**

Jared, the Subway man, lost a lot of weight eating a low calorie diet. Where did all the fat/ mass go?

2. **Animals loosing weight**

You have a friend who lost 15 pounds of fat on a diet. Where did the mass go?

3. **Animals loosing weight**

The emperor penguins of Antarctica live on a diet of fish and crustaceans obtained from the cold Antarctic seawaters. During their annual breeding cycle, however, they migrate across the frozen continent to their breeding grounds 50 miles away from the sea (and 50 miles away from their source of food). For over 2 months the male emperor penguins care for and incubate the eggs while the females return to the sea to feed. During this time the male penguin can lose up to 50% of its biomass (by dry weight). Where did this biomass go?

A. The mass was released as CO_2 and H_2O.
B. The mass was converted to energy and used up.
C. The mass was converted to ATP molecules.
D. The mass was broken down to amino acids and eliminated from the body.
E. The mass was converted to urine and feces and eliminated from the body.

4. Plants loosing weight

A potted geranium plant sits in a windowsill, absorbing sunlight. After I put this plant in a dark closet for a few days (but keep it watered as needed), will it weigh more or less (discounting the weight of the water) than before I put it in the closet?

A. It will weigh less because it is still respiring.
B. It will weigh less because no photosynthesis is occurring.
C. It will weigh more because the Calvin cycle reactions continue.
D. It will weigh the same since no biomass is produced.
E. It will weigh more because it still has access to water and soil nutrients.

[Essay format - After I put this plant in a dark closet for a few days (but keep it watered as needed), will it weigh more or less (discounting the weight of the water) than before I put it in the closet? Explain your answer.]

5. Growth and respiration

An agar plate was left uncovered for two weeks. Three different kinds of mold grew on it. Assuming that the plate did not dry out, which of the following is a reasonable prediction of the weight of the plate and mold?

A. The mass has increased, because the mold has grown.
B. The mass remains the same as the mold converts agar into biomass.
C. The mass remains the same as the growing mold converts agar into energy.
D. The mass decreases as the mold converts agar into biomass and gases.

[Essay format- Assuming that the plate did not dry out, will the mass of the plate and mold increase, decrease, or remain the same. Explain your answer.]

6. Breathing and the role of oxygen

A runner breathes harder taking in oxygen as she sprints to the finish. What is the role of oxygen in the runner's cells?

A. The oxygen is converted to energy.
B. The oxygen is converted to ATP.
C. The oxygen is the final electron acceptor.
D. The oxygen is required for glycolysis.
E The oxygen is required for blood flow.

7. Sources of ATP

When you contract muscles during exercise, your muscle cells use ATP. What percentages(s) of ATP come from the following sources?

When your cells transport a protein, they use ATP. What percentages(s) of ATP come from the following sources?

A. Blood:50, Mitochondria:40, Nucleus:5, Cytoplasm: 5
B. Blood:50, Mitochondria: 25, Nucleus:0, Cytoplasm:25
C. Blood:0, Mitochondria:50, Nucleus:0, Cytoplasm:50
D. Blood:0, Mitochondria:95, Nucleus:0, Cytoplasm:5
E. Blood:0, Mitochondria:100, Nucleus:0, Cytoplasm:0

[Essay format – What is/are the source(s) of ATP? List the source(s) and the approximate percentage(s) of ATP that come from each.]

Tracing matter

8. A novel organelle

A research group has discovered an organism with cells that contain a previously undescribed organelle. They isolate a large quantity of these organelles and test to see if they are involved in any major metabolic reactions. They incubate the organelles for a period of time and determine changes in the amount of various substances in the

suspending solution. (Note: you can assume that various starting substrate materials for the pathways are provided in sufficient quantity by the researchers.) The results are:

Glucose	No change
CO_2	Increase
O_2	No change
ATP	Increase
NADH	Increase

Alternative stem: A newly discovered cell organelle is found to produce or use up the following molecules under experimental conditions:

Produce	**Use Up**	**No Change**
CO_2		O_2
ATP	ADP + Pi	glucose
NADH	NAD^+	

Based on these data, what process is taking place in the organelle?

A. Glycolysis
B. Krebs Cycle
C. Electron Transport Chain / Oxidative Phosphorylation
D. Light Reactions of Photosynthesis
E. Calvin Cycle

Tracing energy

9. Cellular fuel

You eat a grape high in glucose content. How could a glucose molecule from the grape provide energy to move your little finger?

A. The glucose is digested into simpler molecules having more energy.
B. The glucose reacts to become ATP.
C. The glucose is converted into energy.
D. The energy of the glucose is transferred to other molecules.
E. The energy of the glucose is transferred to CO_2.and H_2O.

10. Energy management molecules

Which of the products of the Krebs cycle has most of the chemical potential energy originally found in the glucose?

A. CO_2
B. H_2O
C. ATP
D. $FADH_2$ & NADH