Understandings:

1. Explain cell respiration.

- This is the most fundamental process in all living organisms. It is an umbrella term for a process where organic compounds are broken down to release energy. More specifically, it releases ATP that can in turn be used as a source of energy.

One obvious example is our breakdown of glucose.

ATPs cannot be transferred, thus all cells must be able to respire to survive.

2. Explain what ATP is.

- ATP is the battery of life. When we use this adenosine triphosphate, it becomes adenosine diphosphate + phosphate (makes sense). Cell respiration does the reverse process of making the ADP+P into ATP again by using glucose.

So, what is it used for?

1. Synthesis of macromolecules. These include DNA, RNA and proteins.

2. Active transport.

3. All movements in the cell, such as muscle contraction, endocytosis, exocytosis, etc.

Once we use the ATP, we lose all energy through heat, so that is why we need a continuous intake of energy through food.

3. Explain what anaerobic respiration is.

- This is a type of cell respiration, but a process without oxygen. The total yield of ATP is small, but they are provided very quickly.

Thus the cases we use them are:

1. When a sudden boost of ATP is needed (sprint).

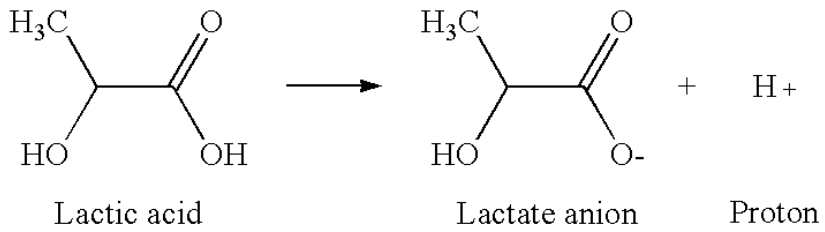
2. Not enough oxygen in environment or in cell.

Animals produce lactate while plants and yeasts produce ethanol + carbon dioxide.

Extra notes

- It is important to distinguish between lactate and lactic acid (no, not really). Lactate is the molecule that first gets produced after anaerobic respiration. This is a charged molecule with -1 charge. Now, what happens when it is in water, or more correctly, blood? It will take one proton ion, and thus produce lactic acid. So lactate is the conjugate base of lactic acid.

Lactate/Lactic Acid



Lactic acid Lactate anion Proton

4. Explain what aerobic respiration is.

- It is a type of cellular respiration that uses oxygen and gives higher yield of ATP. Anaerobic respiration gives about 2 ATP/glucose while aerobic respiration gives more than 30 ATP/glucose.

This process produce carbon dioxide and water as we already know. Indeed, some animals, like desert rats, do not need to drink because the aerobic respiration provides all their water supply. Interesting!

Applications and skills:

1. Explain how bakers use anaerobic respiration of yeasts.

- The products of anaerobic respiration of yeast are ethanol and carbon dioxide. Here are two uses of each of these products.

We use yeasts when we bake. When we knead it into our dough and keep it relatively warm so enzymes can work efficiently (37 Celsius just like us), we force it to respire. When it has used up all the oxygen, it will respire anaerobically and produce carbon dioxide and ethanol. That carbon dioxide gets trapped in bubbles and therefore makes the dough rise. Ethanol is evaporated in the oven.

We use yeast when we want some fuel. When we have supply of sugar, usually corn and sugar cane, we can make the yeast respire anaerobically in fermenters (machine). We can combust that bioethanol for vehicles and drive!

2. Explain when humans use anaerobic respiration.

- As mentioned, anaerobic respiration occurs when there is a sudden need of contraction in muscles or other need of energy. In the past, we might have used it for hunting or escaping, but nowadays, it is mainly during workouts.

One could wonder where the lactic acid goes after we have been working out. Simply, it gets transferred to our liver and there, lactic acid becomes glucose again together with oxygen. That is why we breathe so hard after sprinting and it is called oxygen debt. We need oxygen to convert lactic acid into glucose!

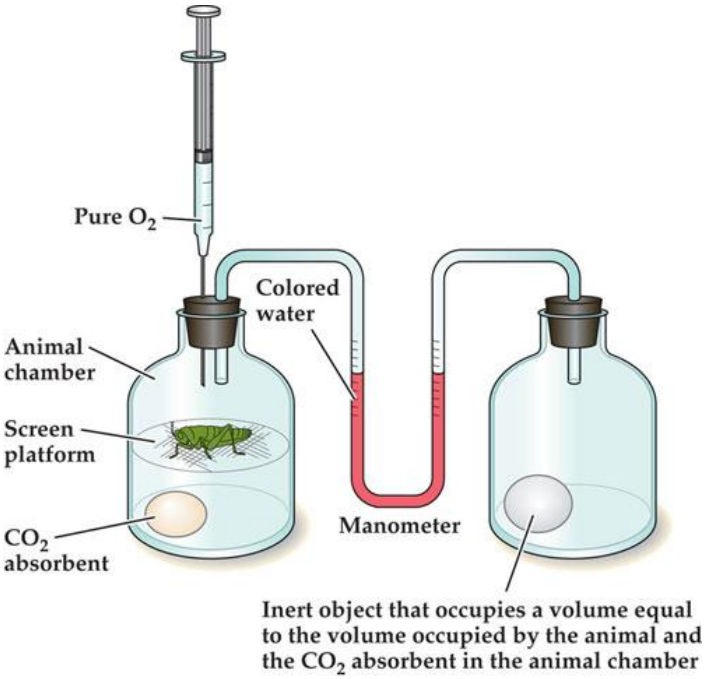
3. Explain what a respirometer is and be able to use it.

-

Just as its name tells us, it is a meter for measuring respiration rate.

The fundamental idea is to see the change in pressure, hence the volume of the manometer.

Now, let's take this step by step.



1. We set up two systems where pressure is equal. This will adjust the manometer into equilibrium.

2. We have one system of respiring organism and the other non-respiring.

3. The respiring side will be provided with oxygen to initiate aerobic respiration.

4. The respiring organism will use up the oxygen and produce CO2 and water. The CO2 will be absorbed by an alkali and make it a solid so that it minimizes change of pressure.

5. Since water and CO2 sinks, the pressure in respiring system will decrease, thus liquid will move up on its side.

The readings can be measured with time.