



Backyard STEM

Where's all the O₂???

An experiment about Biochemical Oxygen Demand

Goals:

- ⇒ Be able to describe biochemical oxygen demand.
- ⇒ Be able to link organic matter pollution with oxygen depletion.
- ⇒ Be able to compare a demonstration to a real world scenario.
- ⇒ Be able to create a mathematical relationship.

Words to Explore:

- ⇒ Biochemical oxygen demand
- ⇒ Oxygen uptake
- ⇒ Organic matter

Add Tech:

The air we breathe is made of approximately 78% nitrogen, 21% oxygen and small amounts of other gases like argon and carbon dioxide. There is plenty of oxygen in the air we breathe to provide our bodies with an amount that supports our bodies through activities. We are not in short supply.



But, in the water is a different case. Dissolved oxygen in water is vital for fish and aquatic invertebrates. These organisms are bound within the water, so when oxygen is pulled from the water, there may not be enough to support biodiversity in the aquatic environment. But what pulls oxygen out of water?

Just as we pull oxygen out of the air when as we live (whether is just sitting and reading a book or being active), microbes use oxygen when they are active, which is usually when they are breaking down organic materials. In the water, the amount of oxygen that is utilized during the decomposition and utilization of organic matter is called biochemical oxygen demand, or BOD. BOD is typically measured in mass per volume, or commonly milligrams per liter (mg/L). This is a common measurement of water to describe the amount of organic matter in water. Organic matter can be a pollutant in water if there is too much of it. Organic matter and other substances that reduce oxygen from the water due to BOD can come from many sources. Common sources include land uses of agriculture, urban development, golf courses and roadways.

We are going to explore oxygen demand by using our own body as a demonstration. The oxygen uptake rate of our bodies can be measured by our oxygen consumption, or VO₂ rate. Just as microbes doing work to break down organic matter utilize oxygen from the water, we utilize oxygen from the atmosphere when we exercise. As our work or exercise increases, our VO₂ rate increases.



Activity: Exploring Oxygen Demand

Complete the O₂ demand activity. Calculate your oxygen consumption rate, or VO₂.

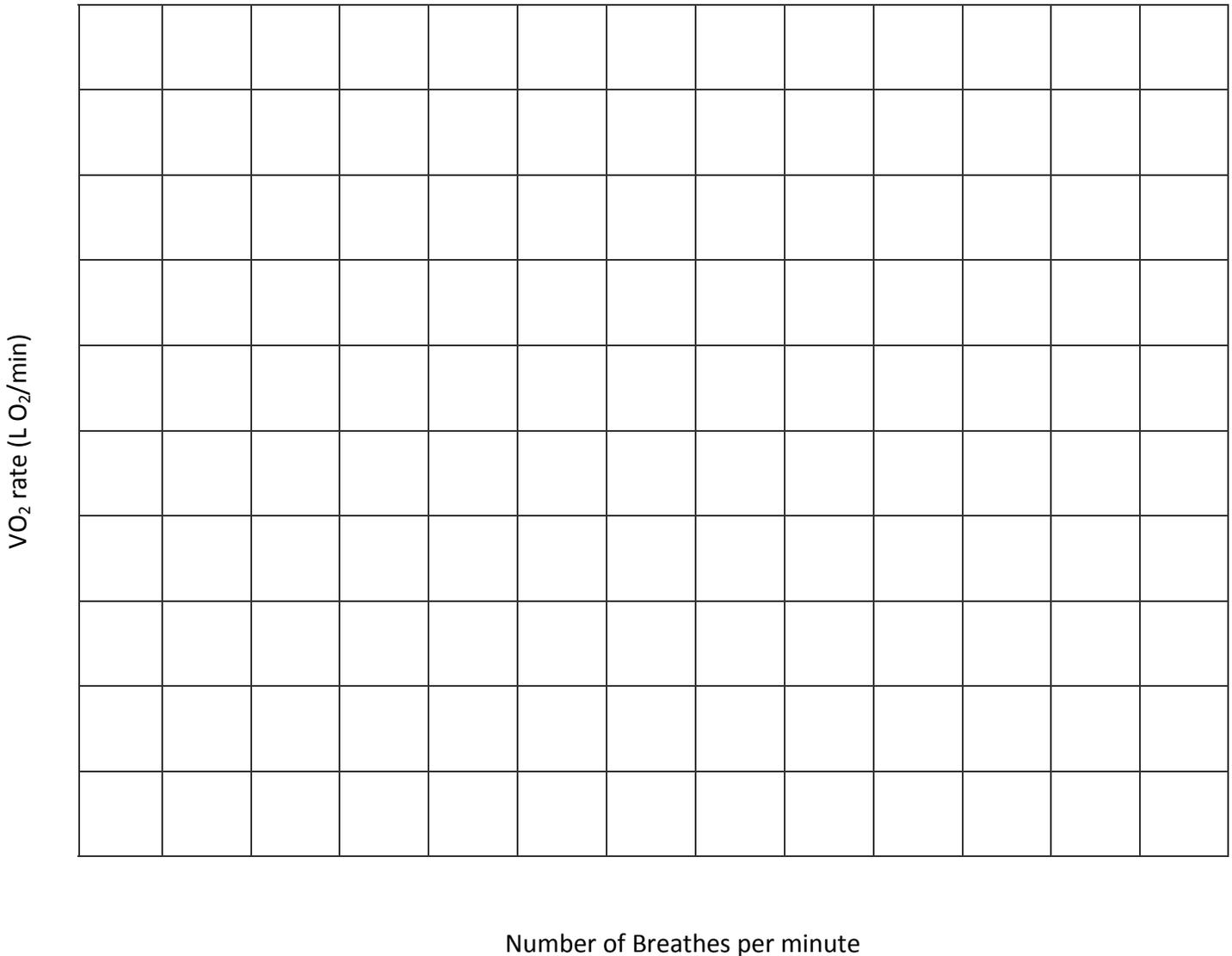
VO₂ factors:

1 breath = 0.5 L air

1 breath = 20% oxygen inhaled, 15% exhaled

Average Adult (resting) = 7 L air/min

Plot your data below where the x-axis is the number of breathes taken and the y-axis is the rate of oxygen consumption. Plot your classmates data. What shape do you expect the relationship to look like?



Reflect.

How did your oxygen consumption rate change between resting and exercising? How did your data compare to your classmates? What was the highest and lowest oxygen consumption rate?