

Respiratory II

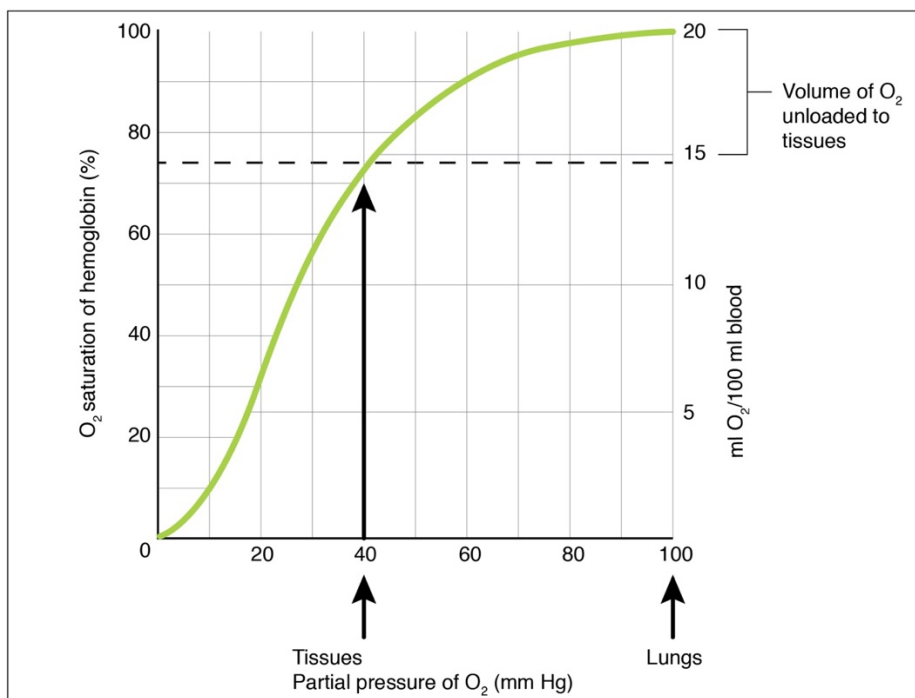
1. **Draw your answers:** Why do your body's cells need oxygen? What would cause them to use more than normal? What happens if they don't receive enough?
2. **Draw your answers:** How do your body's cells produce carbon dioxide? What would cause them to produce more?
3. Both of these gases (oxygen and carbon dioxide) are transported in the blood, but they don't just float there. MOST (98%) of all of the oxygen in your blood is transported on Hemoglobin, a protein inside red blood cells. Only 2% of oxygen travels in the plasma.

Is it a stretch to call Hemoglobin the superhero of the respiratory system? I think not.

The graph below shows these superhero-type behaviors that Hemoglobin has:

- 1) When oxygen is plentiful, Hemoglobin fills up
- 2) When oxygen is scarce, Hemoglobin generously give it up to the cells

Draw a version of this graph on your whiteboard. We are going to use an analogy of boats in a river. The *boats* are hemoglobin molecules, and the *river* is plasma. Note that the x axis is PO_2 . Specifically, it's PO_2 of the plasma (the amount of oxygen that's floating around in the "river"). The y-axis is really "how full are the hemoglobin boats?". Each hemoglobin molecule has four "seats". If $\frac{3}{4}$ seats are taken, it's 75% full.



(a) Partial pressure of oxygen and hemoglobin saturation

4. **Using your whiteboard-drawn graph**, indicate that a PO_2 of 100 mm Hg should be what you see at the lungs. A PO_2 of 40 mm Hg should be what you see as the blood is leaving the tissues. Why is it lower here?
5. At a PO_2 of 100, how full are the boats? _____
At a PO_2 of 40, how full are the boats? _____
6. A) At a PO_2 of 95, how full are the boats? _____ How about at 90% _____.
Overall, when PO_2 is high (between 85-100 mm Hg), how well does hemoglobin fill up?
Does it change much?
- B) At a PO_2 of 35, how full are the boats? _____ How about 30% _____.
Overall, when PO_2 is low (40 mm Hg or less) and getting lower, how would you describe hemoglobin's saturation (or "fullness")?
- C) In part A of this question, dropping the PO_2 from 100 to 90 caused what type of change to hemoglobin saturation? _____. Compare that to dropping it from 40 to 30 (both are changes of 10 mm Hg).
7. Look again and see if you can make sense of these claims:
The superhero-type behaviors that Hemoglobin has:
1) When oxygen is plentiful, Hemoglobin fills up
2) When oxygen is scarce, Hemoglobin generously give it up to the cells
8. Draw a prediction of what exercise would do to the PO_2 level in blood returning from working muscle. Would anything change at the lungs?
9. In a trained athlete, the limiting factor affecting performance is oxygen delivery to the tissues. How could blood doping boost performance? (blood doping = injecting extra red blood cells into your system right before an event).