Name_____ Class_____ Date_____

Conceptual Biology Minds-On Calculation
Heavy Breathing

Materials Needed: Pencil, Paper, Calculator

Purpose: To calculate the effect of breathing on our weight

Discussion:
The air we inhale has a different chemical composition from the air we exhale. Ignoring water vapor, here is the approximate composition of each given by volume:

Air we inhale	Air we exhale
78% Nitrogen, N_2	78% Nitrogen, N_2
21% Oxygen, O_2	15% Oxygen, O_2
1% Argon, Ar	1% Argon, Ar
0.04% Carbon dioxide, CO_2	6% Carbon dioxide, CO_2

Minds-On:
Assuming a volume of 5 liters of air. what is the mass of this air when inhaled and what is the mass of this air when exhaled? Note that one mole of air has a volume of about 22.4 liters. Use the following atomic masses, which you can get from the periodic table:

Nitrogen: 14 grams per mole

Oxygen: 16 grams per mole

Carbon: 12 grams per mole

Argon: 40 grams per mole

Your Calculations:

Step 1: Solve for the number of moles of air in 5 liters:

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Step 2: Multiply this total number of moles in 5 liters of air by the percentage of each component. This will give the number of moles of each component:

Step 3: Convert the number of moles of each component into grams. You're given the atomic masses, but for molecules, you'll need the molecular masses. For example, Nitrogen, N, is 14 grams per mole. But molecular nitrogen, N_2, is 28 grams per mole:

Step 4: Add up the grams of each component in the inhaled air. Do the same for the exhaled air. Then compare the total mass of each. Are they the same? Is one greater than the other? What effect does breathing have on your weight? After a good jog you'll be breathing harder. How does this impact your weight? Why can't you change your weight by breathing hard without exercising?

Step 5: All of the above ignores the role of water vapor. If you were to take into account the water vapor we inhale and the water vapor we exhale, how would this change the results?

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