Module C

1. What is the normal P_{BARO} at sea level?

   760 mm Hg $760mmHg \times \frac{1.36cmH_2O}{mmHg} = 1034cmH_2O$

2. List the fractional concentrations of the four major gases that comprise the atmosphere.

	Gas	Fractional Concentration
A.	**Nitrogen (N_2)**	**78.08% or 0.78**
B.	**Oxygen (O_2)**	**20.95% or 0.21**
C.	**Argon (Ar)**	**0.93% or 0.009**
D.	**Carbon Dioxide**	**0.03% or 0.0003**

3. Calculate the Partial Pressure of each gas in the atmosphere at a PB of 760 mm Hg.

   A. P_{N_2} = $PN_2 = P_{BARO} \times FN_2 = 760\ mmHg \times .78 = 592.8 = 593\,mmHg$

   B. P_{O_2} = $PO_2 = P_{BARO} \times FO_2 = 760\ mmHg \times .21 = 159.6 = 160\,mmHg$

   C. P_{Ar} = $PAr = P_{BARO} \times FAr = 760\ mmHg \times .009 = 6.8 = 7\,mmHg$

   D. P_{CO_2} = $PCO_2 = P_{BARO} \times FCO_2 = 760\ mmHg \times .0003 = 0.23 = 0.2\,mmHg$

4. As we inspire air into the lung, the air becomes fully saturated by the time the gas reaches the carina. This means that the air now contains all the water it can hold. We can say that:

   a. The air is **100** % saturated.
   b. The air hold **43.9** mg/L of water.
   c. The water vapor pressure (P_{H_2O}) is **47** mm Hg.

5. Calculate the partial pressure of the inspired gas at normal PB of 760 mm Hg.

a. PiN_2 =

$$PN_2 = (P_{BARO} - 47\text{ mmHg}) \times FN_2 = (760\text{ mmHg} - 47\text{ mmHg}) \times .78 = 713 \times .78 = 548.3 =$$

b. PiO_2 =

$$PO_2 = (P_{BARO} - 47\text{ mmHg}) \times FO_2 = (760\text{ mmHg} - 47\text{ mmHg}) \times .21 = 713 \times .21 = 149.7 = 150\text{ mmHg}$$

c. PiAr =

$$PAr = (P_{BARO} - 47\text{ mmHg}) \times FAr = (760\text{ mmHg} - 47\text{ mmHg}) \times .009 = 713 \times .009 = 6.42 = 6\text{ mmHg}$$

d. $PiCO_2$ = ________________________________

$$PCO_2 = (P_{BARO} - 47\text{ mmHg}) \times FCO_2 = (760\text{ mmHg} - 47\text{ mmHg}) \times .0003 = 713 \times .0003 = 0.21 = 0.2\text{ mm}$$

6. Dalton's Law states that the total pressure of a gas mixture is equal to the sum of the individual partial pressures of the gases. Calculate the pressure of gas B.

Total Pressure 500 mm Hg
Gas A 40 mm Hg
Gas C 50 mm Hg
Gas D 200 mm Hg
Gas E 10 mm Hg

Pressure of Gas B would be: **500-40-50-200-10=200 mm Hg**.

7. Calculate the pressure of gas C.

Total Pressure 640 mm Hg
Gas A 38 mm Hg
Gas B 69 mm Hg
Gas D 150 mm Hg
Gas E 300 mm Hg

Pressure of Gas C would be:**640-38-69-150-300-83 mm Hg**.

8. Calculate the Alveolar Air Equation (P_AO_2)

a. Given a P_B of 760 mm Hg, $PaCO_2$ 40 mm Hg, FIO2 50%

$$PAO_2 = [(P_{BARO} - PH_2O) \times FIO_2] - (PaCO_2 \times 1.25)$$

$$PAO_2 = [(760\text{ mm Hg} - 47\text{ mm Hg}) \times .50] - (40\text{ mm Hg} \times 1.25)$$

$$PAO_2 = (713\text{ mm Hg} \times .50) - 50\text{ mm Hg}$$

$$PAO_2 = 356.5\text{ mm Hg} - 50\text{ mm Hg} = 306.5 = 307\text{ mm Hg}$$

b. Given a P_B of 740 mm Hg, $PaCO_2$ 50 mm Hg, FIO2 40%

$$PAO_2 = [(P_{BARO} - PH_2O) \times FIO_2] - (PaCO_2 \times 1.25)$$

$$PAO_2 = [(740\ mm\ Hg - 47\ mm\ Hg) \times .40] - (50\ mm\ Hg \times 1.25)$$

$$PAO_2 = (693\ mm\ Hg \times .40) - 62.5\ mm\ Hg$$

$$PAO_2 = 277.2\ mm\ Hg - 62.5\ mm\ Hg = 214.7 = 215\ mm\ Hg$$

Given a P_B of 700 mm Hg, $PaCO_2$ 30, FIO2 60%

$$PAO_2 = [(P_{BARO} - PH_2O) \times FIO_2] - (PaCO_2 \times 1.25)$$

$$PAO_2 = [(700\ mm\ Hg - 47\ mm\ Hg) \times .60] - (30\ mm\ Hg \times 1.25)$$

$$PAO_2 = (653\ mm\ Hg \times .60) - 37.5\ mm\ Hg$$

$$PAO_2 = 391.8\ mm\ Hg - 37.5\ mm\ Hg = 354.3 = 354\ mm\ Hg$$

9. As you rise above sea level the barometric pressure will
   a. increase
   b. decrease
   c. stay the same

10. As you rise above sea level, the fractional concentration of the individual gases will
   a. increase
   b. decrease
   c. stay the same

11. Fractional concentrations of gases are expressed as
   a. pressure
   b. volume
   c. % **(Technically as a decimal)**

12. By the time gas reaches the level of the carina at (37° C) the
   a. relative humidity (%) = **100%**
   b. absolute humidity = **43.9 mg/L**
   c. partial pressure = **47 mm Hg**

13. 1 atmosphere of pressure is equal to **760** mm Hg or **1034** cm H_2O.

14. At a barometric pressure of 750 mm Hg and PH_20 of 25.2 mm Hg, calculate the following:
   a. $PO_2 = (P_{BARO} - P_{H_2O}) \times FO_2 = (750\ mm\ Hg - 25.2\ mm\ Hg) \times .21 = 724.8\ mm\ Hg \times .21 = 15$
   b. $PN_2 = (P_{BARO} - P_{H_2O}) \times FN_2 = (750\ mm\ Hg - 25.2\ mm\ Hg) \times .78 = 724.8\ mm\ Hg \times .78 = 565.3 = 565\ mm\ Hg$

15. At a barometric pressure of 680 mm Hg and a PH_20 of 35.7 mm Hg, calculate the following:

a. $\mathbf{PO_2 = (P_{BARO} - P_{H_2O}) \times FO_2 = (680\text{ mm Hg - }35.7\text{ mm Hg}) \times .21 = 644.3\text{ mm Hg} \times .21 = 135.3 = 135\text{ mm Hg}}$

b. $\mathbf{PCO_2 = (P_{BARO} - P_{H_2O}) \times FCO_2 = (680\text{ mm Hg - }35.7\text{ mm Hg}) \times .0003 = 644.3\text{ mm Hg} \times .0003 = 0.19 = 0.2\text{ mm}}$

16. At a barometric pressure of 730 mm Hg (dry gas), calculate the

a. $PO_2 = (P_{BARO} - P_{H_2O}) \times FO_2 = (730\text{ mm Hg - }0\text{ mm Hg}) \times .21 = 730\text{ mm Hg} \times .21 = 153.3 = 153\text{ mm Hg}$

b. $PAr = (P_{BARO} - P_{H_2O}) \times FAr = (730\text{ mm Hg - }0\text{ mm Hg}) \times .009 = 730\text{ mm Hg} \times .009 = 6.57 = 7\text{ mm Hg}$

17. In the hospital, how much oxygen can be administered to a patient?
UP TO 100%.

18. Who's law states that in a gas mixture, each gas will exert its own individual partial pressure? **DALTON'S**