**Breathing III**  name and number of the circle ………….………….

**1. FRC - Plethysmography**

- derivation of FRC calculation from Boyle's law

|  |  |
| --- | --- |
| Tracheal Pressure Difference (mmHg)  |  |
| Box volume difference (ml)  |  |
| FRC (ml) |  |

**2. Climbing to high altitudes**

Dan celebrated graduating from college by going on a climbing expedition in the French Alps. Dan is in excellent physical condition: he runs 3-5 miles a day and has played football, volleyball and rugby throughout his studies. At the insistence of his parents, Dan underwent a complete medical examination before the climbing, which he passed with flying colors. He went to the Alps!

What is the partial pressure of oxygen (Po2) in humidified air on Mont Blanc?

What was Dan's alveolar Po2 (PA O2) at Mont Blanc?

Predict whether each of the following parameters would increase, decrease, or remain unchanged at Mont Blanc. Explain why each of the predicted changes would occur.

a. Respiratory rate

b. Percentage saturation of hemoglobin

c. Po2 at which hemoglobin is 50% saturated

d. Pulmonary artery pressure

If Dan's arterial Pco2 (Pa co2) were measured at Mont Blanc, would it be elevated, decreased, or unchanged from normal? Why? If you predicted a change in Pa co2, what effect would this change have on arterial pH? What acid-base disorder would it cause?

**3. CO poisoning**

Mr. Majer is a 65-year-old retired landscape architect. One cold January morning, he decided to warm up his car in the garage. Forty minutes later, Mr. Majer's wife found him collapsed in the front seat of the car, confused and breathing rapidly. He was taken to a nearby emergency room where he was diagnosed with acute carbon monoxide poisoning and given 100% O2 for breathing. The arterial blood sample had an unusual cherry red color.

Values obtained from the sample:

- Pa O2, (arterial Po2) 660 mmHg (normal, 100 mm Hg, room air)

- Pa co2, (arterial Pco2) 36 mm Hg (normal, 40 mmHg)

- % saturation 50% (normal, 95%-100%)

In healthy people, the percentage saturation of hemoglobin O2 in arterial blood is 95-100%. Why was Mr. Majer's 02 saturation reduced to 50%?

What percent of the heme groups on his hemoglobin had carbon monoxide (CO) attached?

Draw the normal hemoglobin dissociation curve for O2 and the dissociation curve that would be obtained for Mr. Majer in the emergency room. What effect did CO poisoning have on Hb's binding capacity for O2? What effect did CO poisoning have on the affinity of hemoglobin for O2?

In healthy people breathing standard air, the arterial PO2 (Pa O 2) is approximately 100 mmHg. Mr. Majer had a Pa O2 of 660 mmHg while breathing 100% O2. Is a value of 660 mmHg possible? [Help: There is a calculation to help you determine if this value makes sense. For this calculation, assume that Mr. Majer's respiratory quotient (CO2 production/O2 consumption) was 0.81.

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Teacher's signature