

CH353 – Physical Chemistry I
Spring 2013, Unique 52575

Quiz 1, Friday 18 January 2013

A healthy adult exchanges approximately 1.0 L of air with each breath during moderate activity such as walking or swimming, and breaths approximately 20 times every minute. (Total lung capacity is of course much larger than this, but is only used when activity become strenuous.) You want to scuba dive at a depth of approximately 30 ft, where the water pressure is 2.0 atm, and remain underwater for 2 hrs. If you are carrying a standard sized scuba tank of 11 L, to what pressure must the tank be filled with compressed air in order to ensure you have at least 10% of your tank left at the end of your dive? (Ignore the extra time taken to get to 30 ft and resurface.)

$$\left(\frac{1\text{L}}{\text{breath}}\right) \left(\frac{20\text{ breaths}}{\text{min}}\right) \left(\frac{60\text{min}}{\text{hr}}\right) (2\text{hr}) = 2400\text{ L used}$$

$$\text{Want 10\% left} \Rightarrow \text{need } (2400\text{L})(1.1) = 2640\text{L needed}$$

$$P_1 V_1 = P_2 V_2$$

$$P_1 = 2.0\text{atm}$$

$$V_1 = 2640\text{L needed}$$

$$V_2 = 11\text{L}$$

$$P_2 = ?$$

$$P_2 = \frac{P_1 V_1}{V_2} = \frac{(2.0\text{atm})(2640\text{L})}{(11\text{L})}$$

$$P_2 = 480\text{atm}$$