

CH353 – Physical Chemistry I
Spring 2015, Unique 51170

Quiz 2, 3 February 2015

The lungs of a healthy adult are approximately 4-6 L in volume, although at rest, only ~1 L of air is exchanged in each breath. As air is inhaled, it is warmed from ambient temperature to body temperature of 37°C. For each of the following questions, state any assumptions you are making clearly.

a) Are your lungs an open, closed, or isolated system?

open - both energy + matter (i.e. air) are exchanged w/ the surroundings

b) Is breathing a constant pressure or constant volume transformation? Justify your answer.

constant pressure = pressure of atmosphere

c) On the inhale, what is the sign of work, heat, and change in internal energy? Justify your answer.

Assuming $\Delta T > 0$: $\Delta V > 0 \Rightarrow w < 0$. $\Delta T > 0 \Rightarrow \Delta U > 0$. $\Rightarrow w + q = \Delta U$

d) On the exhale, what is the sign of work, heat, and change in internal energy? Justify your answer.

We now don't know what happens to T. It probably goes down, but it is outside our system at that point (i.e. the lungs don't spend any energy cooling the air). So I am going to assume $\Delta T \approx 0$

$$\Rightarrow \Delta U \approx 0, \Delta H \approx 0$$

$$\Delta V < 0 \Rightarrow w > 0$$

$$q + w \Rightarrow q < 0$$