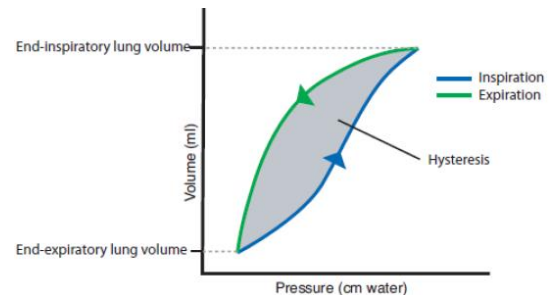


# Medical Equipment IV - 2013

## Extra Problem Assignment

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1. Consider the estimation of ultrafiltration rate in hemodialysis using 2 flowmeters before and after the dialyzer to measure the dialysate flow rate. If the flowmeters have an accuracy of 1%, compute the estimation accuracy for the ultrafiltration rate. Assume the dialysate flow rate as 1L/min and assume it is required to remove 1 Kg of water from the patient every hour during the treatment.
2. Consider the estimation of ultrafiltration rate in hemodialysis using 2 flowmeters before and after the dialyzer to measure the dialysate flow rate. If it is desired to reach estimation accuracy for ultrafiltration that is compliant with the AAMI standard, compute the required accuracy for the flowmeters to be used in the system to achieve this. Assume the dialysate flow rate as 1L/min and assume it is required to remove 0.8 Kg of water from the patient every hour during the treatment.
3. Prove that if the surface tension within an alveolus is proportional to the surface area of this alveolus then large alveoli tend to empty into smaller alveoli. What would that implicate for the whole lung?
4. If the pressure-volume relationship of the respiration cycle is given by the shown plot, how can you compute the work needed for each breath? Would that work be positive or negative? Explain the meaning of positive and negative work.



5. Explain the cause of the difference between the Peak Inspiratory Pressure and the Plateau Pressure in the ventilator waveform.
6. Explain why a running athlete may need to stop to catch his breath after a while. Would running at a higher altitude help make it easier for him to run longer?
7. Illustrate on the volume-pressure plot of CPAP how this treatment can be beneficial to the patient.
8. Determine the trigger, limit, cycle, and baseline variables of example practical ventilator modes including mandatory, triggered and assisted types.
9. Assuming spontaneous breathing happens at a rate of 15 breaths/min. Draw a diagram showing the pressure vs. time for the following cases:
  - a. Spontaneous breathing
  - b. Mandatory breathing at a rate of 30 breaths/min
  - c. Mandatory breathing at a rate of 10 breaths/min
  - d. CPAP treatment
  - e. Triggered breathing
  - f. Mandatory breathing at a rate of 10 breaths/min + Triggered breathing
  - g. Synchronized Mandatory breathing at a rate of 10 breaths/min + Triggered breathing