

Physical Chemistry Cumulative Exam

December 7th, 2017

Dr. Nan Jiang

- (30pts) Concept Questions. Try to be concise, and correct!
 - What is a Vibrational Relaxation?
 - What is an Internal Conversion?
 - What is an Intersystem Crossing?
- (40pts) The average human with a body weight of 70 kg has a blood volume of 5.00 L. The Henry's law constant for the solubility of N₂ in water is 9.04×10^4 bar at 298 K. Assume that this is also the value of the Henry's law constant for blood and that the density of blood is 1.00 kg L⁻¹.
 - Calculate the number of moles of N₂ absorbed in this amount of blood in air of composition of 80% N₂ at sea level, where the pressure is 1 bar, and at a pressure of 50 bar.
 - Assume that a diver was breathing compressed air at a pressure of 50 bar and then was suddenly brought to the sea level. What volume of N₂ gas was released as bubbles in the diver's bloodstream?
- (30pts) On the surface of Mars, a mean atmospheric is 600 Pa, and the air mostly consists of carbon dioxide. The mole fraction of CO₂ in Martian air is 0.9532, whereas the mole fraction of O₂ is only 0.0013. If a Martian sea were to exist, what would be the molalities of CO₂ and O₂ solutions in Martian water at 298 K?