

Problem Set 8

1. Do problem 24-2 in McQuarrie and Simon.
2. Do problem 24-6 in McQuarrie and Simon.
3. Do problem 24-34 in McQuarrie and Simon.
4. Do problem 26-31 in McQuarrie and Simon.
5. Do problem 26-40 in McQuarrie and Simon.

6. Global warming

CO₂ in the earth's atmosphere prevents heat from escaping, and is responsible for roughly half of the 'greenhouse' effect, the putative origin of global warming. Would global warming cause a further increase in atmospheric CO₂ through vaporization from the oceans? Assume that the ocean is a two-component solution of water plus CO₂, and that CO₂ is much more volatile than water. Give an algebraic expression for the full temperature dependence of Henry's law constant k_H for the CO₂ in water; that is; derive an equation for $\partial k_H / \partial T$.

7. Extra credit: The mechanism of anesthetic drugs

Anesthetic drug action is thought to involve the solubility of the anesthetic in the hydrocarbon region of the lipid bilayer of biological membranes. According to the classical 'Meyer-Overton hypothesis,' anesthesia occurs whenever the concentration of drug is greater than 0.03 mol kg⁻¹ membrane, no matter what the anesthetic.

- a) For gaseous anesthetics like nitrous oxide or ether, how would you determine what gas pressure of anesthetic to use in the inhalation mix for a patient in order to achieve this membrane concentration?
- b) Lipid bilayers 'melt' from a solid-like state to a liquid-like state. Do you expect introduction of the anesthetic to increase, decrease or not change the melting temperature? If the melting temperature changes, how would you predict the change?