

Name _____

Physics 132
Spring 2017

Prof. Redish
20.II.17

Quiz #4
(10 points)

1. (3 points) A chemical reaction has a negative value for ΔS and negative value for ΔH . The entropy of the products is less than the entropy of the reactants and the enthalpy of the products is less than the enthalpy of the reactants. Assume that pressure is constant, and that ΔS and ΔH do not change with temperature. This reaction:

- A. Will be spontaneous at all temperatures
- B. Cannot be spontaneous at any temperature
- C. Can be spontaneous at high temperatures but not low temperatures
- D. Can be spontaneous at low temperatures but not high temperatures
- E. None of the above

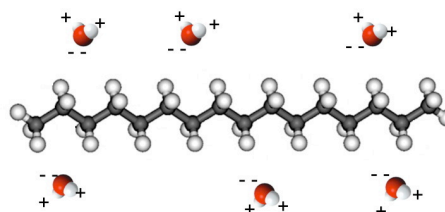
2. (3 points) The probability that a DoF will gain an energy ΔE from its interaction with a thermal bath at temperature T is

$$P(\Delta E, T) = P_0(T) e^{-\frac{\Delta E}{k_B T}}$$

where $P_0(T)$ is a (temperature dependent) normalization factor. Which statements are true?

- A. Low energy gains are more probable at high T .
- B. Low energy gains are more probable at low T .
- C. High energy gains are more probable at high T .
- D. High energy gains are more probable at low T .

3. (4 points) Lipid molecules are basically a backbone of carbon chains surrounded by hydrogen atoms. Lipids are non-polar molecules there is not much localized charge. Water molecules on the other hand have more + charge on one side and more - charge on the other so they are polar.



3.1 If you put a single lipid molecule in water, **as a result of electric forces alone**, would you expect the water molecules to be attracted to the lipid molecule or repelled? (2 pts.)

- A. Attract. When one charged side of a polar water molecule approaches a lipid molecule, it would polarize the lipid and would therefore be attracted to it.
- B. Repel. The hydrogens on the water molecules repel those on the lipid molecules.
- C. Neither. Both molecules are neutral so they shouldn't interact much.
- D. Some other answer. (Write it below.)

3.2 If you put two lipid molecules near each other with axes parallel, **as a result of electric forces alone** would you expect them to attract or repel? (2 pts.)

- A. Attract strongly. You know oil clumps together when water mixes with oil.
- B. Attract weakly. Fluctuations in one molecule will polarize the other near the fluctuation and produce an attraction. But because these are temporary fluctuations, the attraction will be weak.
- C. Repel. The hydrogen atoms would be closer so they will repel.
- D. Neither. The two molecules are neutral so they shouldn't interact much.
- E. Some other answer. (Write it below.)