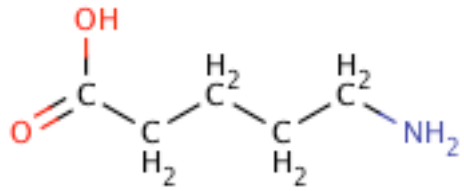
Biochemistry Quiz 1 Review Questions

These questions are representative of material that may appear on the Quiz, but are not exhaustive. You are responsible for all material covered in class and in the textbook.
A general note: Short answer questions are just that, short. Writing a paragraph filled with every term you can remember from class won't improve your answer— just answer clearly, succinctly, and in your own words.

Useful information: R = 8.315 J/mol*K T = 298 K

Circle and identify the functional groups in the following molecules:

1.



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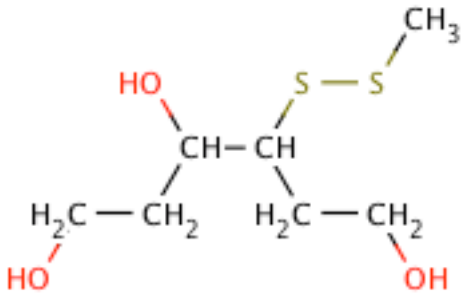

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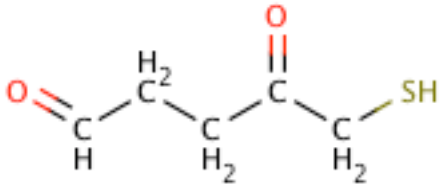
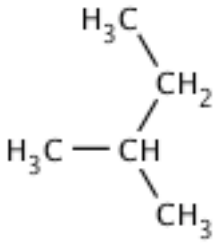
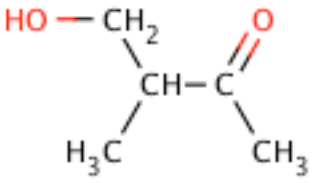


4. In your own words, explain the difference between steady state and equilibrium conditions.

5. Which of the following molecules would you expect to be more soluble in water? Explain why.





6. In your own words, why is life an unfavorable process in terms of entropy?

7. What is the pH of a 1.0×10^{-4} M solution of HBr?

8. What is the [OH-] concentration in a solution with a pH of 4.51?

9. Calculate the pH of a solution that contains a molar ratio of sodium acetate to acetic acid (pKa 4.76) of 3:1.

10. Buffer preparation: Calculate the concentrations of potassium acetate and acetic acid (pKa 4.76) necessary to prepare a 0.5 M buffer solution at a pH of 5.2.

11. Buffer Adjustment: Given 200 mL of a 0.5 M solution of acetic acid at pH 5.50, how much 1 M HCl must be added to change the pH to 5.0?

12. In your own words, explain the difference between ΔG °' and ΔG.

13. The reaction A + B → C has a $\Delta G'^\circ$ of +13 kJ/mol. What is the K_{eq}' for this reaction, and does it favor products or reactants? Show your work.

14. The standard free-energy changes for the reactions below are given.

Glucose 1-phosphate → glucose 6-phosphate $\Delta G'^\circ = -7.1$ kJ/mol

Glucose 6-phosphate → fructose 6-phosphate $\Delta G'^\circ = +1.7$ kJ/mol

What is the $\Delta G'^\circ$ for the overall reaction?

15. Draw an example structure that is a good electrophile, and put a star beside the electrophilic atom. Draw an example structure that is a good nucleophile, and put a # beside the nucleophilic atom.

16. What is a buffer? Why are buffers important for life?

17. Explain, in terms of bonding, why water has a higher boiling point than methane.

18. The reaction A → B has a Keq of 200. Which is more favorable, A or B? Estimate the $\Delta G'^{\circ}$ for the reaction.

19. The standard reduction potentials (E'°) for the following half reactions are given.

Fumarate + $2H^+$ + $2e^-$ → succinate E'° = +0.031 V

FAD + $2H^+$ + $2e^-$ → FADH2 E'° = –0.219 V

(The Faraday constant, F, is 96.48 kJ/V·mol.)

What is the $\Delta G'^{\circ}$ for the overall reaction? Show your work.

20. What is hydrophobic exclusion? What force(s) drive this process?

21. How does life on Earth thrive despite the 2nd law of thermodynamics?

22. Give a working definition of Enthalpy useful for biochemistry.