

LOGARITHMS THAT MIGHT BE USEFUL

log 0.01 = -2	log 7 = 0.84
log 0.1 = -1	log 8 = 0.90
log 1 = 0	log 9 = 0.95
log 2 = 0.30	log 10 = 1.0
log 3 = 0.48	log 100 = 2.0
log 4 = 0.60	
log 5 = 0.70	
log 6 = 0.78	

ANTILOGS THAT MAY BE USEFUL

anti log 1 = 10
anti log 2 = 100
anti log 3 = 1000
anti log -1 = 1/10
anti log -2 = 1/100
anti log -3 = 1/1000

Amino Acid 1- and 3-letter Codes

A	Ala	Alanine	M	Met	Methionine
C	Cys	Cysteine	N	Asn	Asparagine
D	Asp	Aspartate	P	Pro	Proline
E	Glu	Glutamate	Q	Gln	Glutamine
F	Phe	Phenylalanine	R	Arg	Arginine
G	Gly	Glycine	S	Ser	Serine
H	His	Histidine	T	Thr	Threonine
I	Ile	Isoleucine	V	Val	Valine
K	Lys	Lysine	W	Trp	Tryptophan
L	Leu	Leucine	Y	Tyr	Tyrosine

pKas of Amino Acid Functional Groups

Ionizable Group	pKa
α -COOH of any aa	3
β -COOH of Asp	4
γ -COOH of Glu	4
imidazole of His	6
SH of Cys	8
α -NH ₂ of any aa	8
phenolic OH of Tyr	10
ϵ -NH ₂ of Lys	10
guanidino of Arg	12

Unit Conversion

nM = 10^{-9} molar, μ M = 10^{-6} molar, mM = 10^{-3} molar

TABLE 4.4 The genetic code

First position (5' end)	Second Position				Third position (3' end)
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	Stop	Stop	A
	Leu	Ser	Stop	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

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- Please identify the function of the proximal histidine in hemoglobin function:
 - This amino acid provides steric hindrance for the entry of CO into the heme oxygen-binding pocket.
 - This amino acid makes a hydrogen bond to O₂ that is bound to iron, which is in the heme ring.
 - This amino acid is a coordination site for the iron, which is in the heme ring.
 - Only a, and b are true
 - Only a, b, and c are true.
- Please choose the **true** statement:
 - The R-group of serine causes it to be a non-polar amino acid.
 - Glycine is a hydrophobic amino acid.
 - The histidine R-group can act like a base under physiologic conditions.
 - The asparagine R-group can act as an acid under physiologic conditions.
- If a reaction $A+B \rightleftharpoons C+D$ has a ΔG° of +34.30 Joules per mole, which of the following is **true**?
 - This reaction is thermodynamically favorable in the forward direction.
 - The ΔG° of $C+D \rightleftharpoons A+B = -34.30$ Joules per mole.
 - The reaction $A+B \rightleftharpoons C+D$ is not at equilibrium.
 - The reaction $A+B \rightleftharpoons C+D$ is exergonic.
 - All the above are true.
 - Only b and c are true.
 - Only b and d are true.
- Given a reaction, $A+B \rightleftharpoons C+D$, if the concentrations of C & D increased relative to the concentrations of A & B, what will be the most likely effect on the thermodynamics of the reaction $A+B \rightleftharpoons C+D$?
 - There would be no effect on the thermodynamics.
 - ΔG would decrease.
 - ΔG would increase.
 - The concentrations of products or reactants have no relevance to thermodynamics.
- Given the reaction $A+B \rightleftharpoons C+D$ above with a ΔG° of +34.30 Joules per mole, if this reaction were coupled with another reaction, $E+F \rightleftharpoons C+D$ with a ΔG° of +40.50 Joules per mole, which of the following is **true**?
 - The reaction $A+B \rightleftharpoons E+F$ has a ΔG° of +74.80 Joules per mole.
 - The reaction $A+B \rightleftharpoons E+F$ is unfavorable in the forward direction.
 - The reaction $A+B \rightleftharpoons E+F$ has a ΔG° of -6.20 Joules per mole.
 - The reaction $A+B \rightleftharpoons E+F$ is favorable in the forward direction.
 - Only a and b are true.
 - Only c and d are true.
- Which of the following is **true**?
 - In a polar solution like water, hydrophobic amino acids will be more likely to be found buried in the interior of the protein rather than at the surface of the protein, facing the solvent.
 - In a non-polar environment, like a membrane, hydrophobic amino acids will be more likely to be found buried in the protein rather than on the surface, facing the non-polar environment.
 - Both a and b are true.
 - Neither a nor b are true.
- The energy of attraction or repulsion of an ion pair is inversely proportional to the product of the charges of the ions. **True False**
- In regard to alpha helices, hydrogen bonds that stabilize this structure are parallel to the axis of the helix and are formed between amino acids that are 3 to 4 residues apart. **True False**
- The small molecule 2,3,BPG binds to histidine residues in hemoglobin, and binds more tightly to adult hemoglobin than fetal hemoglobin. **True False**

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10. Which of the following sets of amino acids, read 1, 2, 3 **from left to right** contains amino acids that are classified as: 1) basic; 2) aromatic; and 3) aliphatic, branched?
- Arginine; Lysine; Aspartic acid
 - Lysine; Tryptophan; Asparagine
 - Asparagine; Phenylalanine; Leucine
 - Lysine; Phenylalanine; Isoleucine
 - Leucine; Tryptophan; Valine
11. Which of the following is **true**?
- The highest order of structure seen in myoglobin is secondary structure.
 - The highest order of structure of hemoglobin is tertiary structure.
 - The myoglobin protein is made of four homologous monomers.
 - The primary and tertiary structures of beta-globin and myoglobin show high degrees of homology.
 - All of the above are true.
 - Only c and d are true
12. Which of the following is **true**? *Please note that RNase A and actin are homologous proteins.*
- Chimp RNase A and Human RNase A are paralogs, not orthologs.
 - Chimp RNase A and Human RNase A are both paralogs, and orthologs.
 - Chimp RNase A and chimp actin are paralogs, and not orthologs.
 - Chimp RNase A and chimp actin are both orthologs, and paralogs.
13. Select the **true** statement:
- Buffers are weak acids that buffer most effectively at the pKa of the acid, but can buffer within one pH unit above and below the acid's pKa.
 - The phosphate buffer system is the primary blood buffer in our bodies.
 - At the pKa of an acid, the acid and its conjugate base are at equimolar concentrations.
 - Free amino acids can function as buffers.
 - All the above are true.
 - Only a, c, and d are true.
14. Select the **true** statement:
- Secondary structures are primarily formed by hydrophobic interactions among main chain atoms.
 - Amino acid R-groups fill the interior of alpha helices.
 - Nucleic acid molecules are comprised of nucleotides that are linked together by phosphodiester bonds to form a polymer.
 - Prolines are amino acids that are common and stabilizing in alpha helices.
15. Select the **true** statement:
- Peptide bonds have a resonance structure that is comprised of a single and double bond.
 - Peptide bonds have partial double bond characteristics.
 - The nature of the peptide bond is such that free rotation about the bond is negligible.
 - All the above are true.
 - Only b and c are true
16. Select the **FALSE** statement:
- Motifs are recognized by the presence of secondary structural elements that follow one another directly in a specific pattern
 - Motifs such as helix-turn-helix can be used to characterize the function and classification of proteins.
 - Coils and loops are secondary structural elements.
 - The primary structure of a protein is the amino acid content of that protein.
17. Lipids are macromolecules that act as a fuel source, provide structure & act as signaling molecules. **True False**