

Chem 331 Biochemistry Exam I OLD TEST QUESTION EXAMPLES

Name \_\_\_\_\_

**Part I** Multiple choice True/False (2 point each)

1) Which of the following amino acid functional groups can bind metals and become phosphorylated?

- a) The hydroxyl of serine
- b) The guanidine of histadine
- c) The OH of the carboxyl from aspartate
- d) The imidazole of histadine
- e) The imidazole of threonine

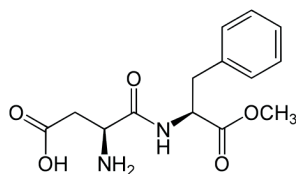
2) Glutamine is best described as \_\_\_\_\_

- a) An uncharged non-polar side chain with an amide
- b) A charged polar side chain with ammonia group
- c) An uncharged polar side chain with an amide bearing side chain
- d) A non-polar uncharged phenyl-containing side group
- e) None of the above

3) Chose the each correct statement about hydrogen bonds.

- a) Hydrogen bonds are an example of a weak polar covalent bond
- b) The OH of water is a weak acid acting as a donar group
- c) Hydrogen bonds are shorter than the calculated van der Walls distance
- d) Cannot form an attraction with -OH groups of amino acids
- e) A linear hydrogen bond (orientation between atoms involved in the bond) is stronger than when there is an angel or the bond is "bent".

4) It is reported that aspartame, a methylester of a dipeptide, was discovered when the organic chemist licked his finger to turn a page. Identify the two amino acids that make aspartame. Circle each that apply.



- a) S b) Tyr c) Phe d) D e) N f) A

6) A patient with emphysema (a disease which decreases air exchange) would expect to have an uncompensated \_\_\_\_\_ and would compensate by \_\_\_\_\_

- a) Respiratory acidosis with a significant decrease in  $p\text{CO}_2$  ----- and ----- metabolic mechanism
- b) Metabolic alkalosis with low  $\text{HCO}_3^-$  ----- and ----- reduce bicarbonate via the kidney

- c) Respiratory acidosis with an increase in  $p\text{CO}_2$  ---- and ---- metabolic means with decreased retention of bicarbonate in the kidney
- d) Respiratory acidosis with an increase in  $p\text{CO}_2$  ---- and ---- metabolic means with increased retention of bicarbonate in the kidney

7) The covalent bond of a compound containing a ketone to a lysine side chain amino group is called?

- a) Isoprenylation
- b) Acetylation
- c) Schiff-base formation
- d) Palmitoylation
- e) Methylation of a Cys S atom

8) The aromatic properties and resonance states of purines and pyrimidines facilitate the ability for migration of protons changing the hydrogen bond capacity of bases. This phenomena is called \_\_\_\_\_

- a) Isomerization
- b) Phosphorylation
- c) Keto-enol transformation
- d) Tautomerization
- e) Base pair pi bond stacking

9) Which of the following DNA forms are found near the start of transcribing genes, have a high alternating purine-pyrimidine sequences and are stabilized by cation binding to reduce electrostatic repulsion from the phosphate backbone?

- a) A DNA. b) B DNA c) Z DNA

10) The ribose of DNA can assume two conformations, that of C2' or C3' endopucker. Which of the two are accompanied with A form duplex and a the 3' and 5' phosphate groups being closer together?

- a) C2' endopucker
- b) C3' endopucker

### SHORT Answer

1) You have prepared a 25 mM, 500 ml solution of phosphate buffer at pH 7.2 to use for an enzymatic reaction. The reaction produces 0.005 mole/liter hydroxide ions.

a) What is the new pH after the reaction? Show ALL STEPS!

b) If in an identical buffer an enzyme produce instead,  $H^+$  causing the pH to shift below 6.21 what would you to ensure the solution was buffered?

3) You have prepared a 75 mM, 200 ml solution of phosphate buffer at pH 7.5 to use for an enzymatic reaction. The reaction produces 0.05 mole/liter hydroxide ions. Feel free to use the table of buffers at the end of this test if you need to do so.

a) What is the new pH after the reaction? Show ALL STEPS!

b) Was this a good buffer for this reaction? Support your answer.

2) A high school student studying for a science exam asks you about hydrophobic bonds. How do you, as an expert biochemist, explain detail what drives this interaction and how it is not a bond to set this young budding scientist on the right track.

2) a - Based on the pKa of the bicarbonate buffer system, does it make sense that bicarbonate is the prime agent responsible for blood buffering (use in terms of Henderson Hasselbalch as well as being descriptive)? Explain. b - How would you advise someone to correct for hyperventilation?

1) Describe the factors that impact a good PCR amplification and the choices one has to make to ensure a high yield and low side reaction amplification.

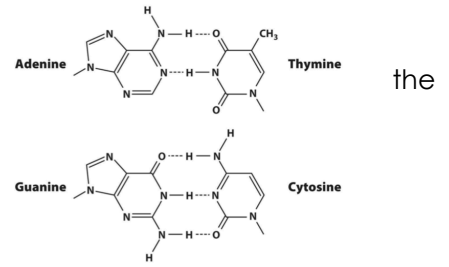
2) Explain the process of Gibson cloning.

2) What is the relationship between  $K_{eq}$  and  $\Delta G^\circ'$  that explain why a small change in free energy of a reaction – such as a hydrogen bond, brings about a significant shift in a reaction to proceed in either the forward or reverse direction.

3) Explain in mathematical and descriptive terms, how the concentrations of a reaction can shift a non-favorable reaction at standard state ( $+\Delta G^\circ'$ ) to a favorable reaction? How is this achieved in a cell?

1) Explain how DNA hybridization is entropically driven not by enthalpy but enthalpy not entropy maintain the structure of a DNA helix

2) In solution, adenine can form 2 to 3 H bonds with guanine and cytosine can form several hydrogen bonds with thymine. Yet as shown in accompanying figure, we only find adenine hybridizing with thymine and guanine hybridizing with cytosine in duplex DNA. Please explain why these are the typical Watson Crick pairings found in duplex DNA.



3) Z DNA is described as a zigzag left handed DNA that maintains Watson Crick base pairing. What are the structural features of Z DNA that allow this base pairing to take place? What is the result of a C'2 vs C'3 endopucker on the phosphate backbone and how is this stabilized in Z form DNA?