

Biochemistry 694:301
First Exam Dr. Deis
Wed. Feb. 15, 2006

Name _____

Row Letter ____ Seat Number _____

This exam consists of two parts. Part I is multiple choice. Each of these 25 questions is worth two points. Answer the Part I questions on this sheet, below. Answer the Part II questions on the question pages.

Please use BLOCK CAPITAL letters like this --- A, B, C, D, E. Not lowercase!

- | | | |
|----------|-----------|-----------------------------|
| 1. _____ | 10. _____ | 18. _____ |
| 2. _____ | 11. _____ | 19. _____ |
| 3. _____ | 12. _____ | 20. _____ |
| 4. _____ | 13. _____ | 21. _____ |
| 5. _____ | 14. _____ | 22. _____ |
| 6. _____ | 15. _____ | 23. _____ |
| 7. _____ | 16. _____ | 24. _____ |
| 8. _____ | 17. _____ | 25. _____ NCBI search score |
| 9. _____ | | |

GRADE:

Part I Total _____

Part II:

II-1 _____

II-2 _____

II-3 _____

II-4 _____

II-5 _____

Part II Total _____

Total, I & II _____

1. On the scale of the CPK models used in class, i.e. magnification of 10^8 , an average amino acid (say, Alanine) would be about the size of a
 - A. a house
 - B. a truck
 - C. a pillow
 - D. an apple
 - E. a marble

2. You go to the Old Faithful Geyser in Yellowstone Park and collect a yellow scum from the edge of a pond of nearly boiling water. Chances are the organisms are
 - A. Bacteria
 - B. Mold
 - C. Eukaryotes
 - D. Dead
 - E. Archaea

3. The most important force stabilizing protein primary structure is
 - A. ionic attraction
 - B. hydrophobic
 - C. van der Waals forces
 - D. hydrogen bonds
 - E. covalent peptide bonds

4. Banded Iron formations are evidence that what happened?
 - A. Great Flood
 - B. Dinosaurs lived
 - C. Oxygen increased
 - D. Magnetic field switched
 - E. Moon came from collision

5. Evolution will occur when you find three things. Which choice isn't one of those?
 - A. Reproduction
 - B. Adaptation
 - C. Variation
 - D. Selective pressure

6. Examine the amino acids at right:
 - A. #1 is L, #2 is L
 - B. #1 is L, #2 is D
 - C. #1 is D, #2 is L
 - D. #1 is D, #2 is D

7. On the Ramachandran plot at right, the dot represents
 - A. the right handed alpha helix
 - B. the left handed alpha helix
 - C. the beta pleated sheet
 - D. the collagen triple helix

8. The protein structure shown at right is
 - A. a sandwich
 - B. a barrel
 - C. a saddle
 - D. a helix bundle

9. The commonly used pregnancy test looks for hCG using what method?
 - A. rate sedimentation
 - B. amino acid analysis
 - C. ELISA
 - D. Southern Blot
 - E. SDS PAGE

10. Chaperones for protein folding like HSP-70 and Gro-EL are usually unnecessary if the protein is:
- A. small
 - B. globular
 - C. hydrophobic
 - D. large
 - E. an enzyme
11. If one strand of a short stretch of DNA reads GAACCT, the other strand will read
- A. AGGTTC
 - B. TCCAAG
 - C. GAACCT
 - D. TCCAAG
 - E. AGCTGC
12. Who showed that DNA replication is semi-conservative?
- A. Fred Griffith
 - B. Fred Sanger
 - C. Fred Flintstone
 - D. Oswald Avery
 - E. Hershey and Barr
 - F. Meselson and Stahl
13. A "start signal" for translation in prokaryotes (bacteria) would be
- A. -35, -10, etc.
 - B. hairpin poly-U
 - C. AUG start codon and AGGAG
 - D. promoter sequence
 - E. UAA stop codon
14. Eukaryotic DNA genes contain (what) which must be removed during transcription.
- A. Exons
 - B. Introns
 - C. Prions
 - D. Photons
15. Sometimes genes are duplicated and produce two related proteins that are used for different purposes in the cell. These are called
- A. monologues
 - B. dialogues
 - C. paralogs
 - D. orthologs
 - E. metalogs
16. BLAST is used to search for nucleotide sequences. For proteins you need to use
- A. PLAST
 - B. BLASTP
 - C. PROBLAST
 - D. KAPOW
17. Which sort of DNA might be recoverable in the laboratory?
- A. from stromatolites 1 billion years old
 - B. from brachiopods 250 million years old
 - C. from dinosaurs 64 million years old
 - D. from Neanderthals 40,000 years old
18. Trypsin and Subtilisin both have a "charge network" with Ser, His and Asp at the active site, but very different overall folds. The similarity is caused by
- A. Intelligent design
 - B. convergent evolution
 - C. bifurcated adaptation
 - D. telepathy
 - E. homology only at that site

PART II Answer these questions here on the question pages.

1. a. The peptide Trp-Arg-Ile-Thr-His-Glu would have what sequence when expressed in one-letter amino acid code?

(2)

- b. Draw the dipeptide Phe-Val (FV) as it would appear at pH 7 in water.

(3)

- c. Lysine's pKa values are 1.8 (alpha carboxyl), 9.0 (alpha amino), and 11.5 (R group). Calculate the isoelectric point for Arginine (the pI) – show work and circle answer.

(2)

- d. To 1 mole of Lysine at its isoelectric point is added 0.2 moles of HCl. What is the pH after the addition? State equation, show work, circle answer.

(3)

2. a. Draw the structures of Ninhydrin and Edman's Reagent

(2)

b. What are the differences between Rate Sedimentation and Equilibrium Sedimentation? What do you learn from each process? Which is quicker and easier?

(4)

c. Describe Amino Acid Analysis. Does it tell you the sequence of a peptide?

(4)

3. a. Draw an AT base pair, and show where sugars attach.

(4)

b. Briefly state what Reverse Transcriptase does – what sort of organisms depend on Reverse Transcriptase?

(2)

c. Describe the start and stop signals for prokaryotic transcription. Be reasonably complete, this is a 4 point question. Include whatever details you can recall.

(4)

4. a. On the BLOSUM 62 diagram there are only 3 amino acid residues which have NO positive scoring replacements. They are P, G, and C. In each case the highest scores include A and S at zero or minus one. Draw P, G, and C and for each briefly explain why they would be unique and irreplaceable in proteins.

(6)

- b. Berg says that even though Actin and Hsp-70 share only 15% sequence identity, visual inspection of the 3-D structures proves that the two proteins are paralogs. Suppose that there is another protein "X" which has a 15% identity with Hsp-70, and only a 2% identity with Actin, but is judged to be homologous with Hsp-70 by visual inspection. Must protein "X" be homologous with Actin as well? Explain your answer, and tell what percentage of identity normally is taken to "prove" homology between two proteins.

(4)

5. a. An enzyme is found to have a V_{\max} , at a certain concentration, of 60 mM per second. The enzyme has a K_m with its substrate of 4 mM. Calculate the initial rate when substrate is present at 6 mM concentration. Show work and circle answer.

(4)

- b. On axes provided, sketch the curves or lines which would be observed for an enzyme in the presence and absence of a noncompetitive inhibitor. The axes are for a double reciprocal ("Lineweaver Burk") plot.

(3)

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- c. Given that $R = 1.987 \text{ cal/}^\circ \text{ mol}$ and $T = 300^\circ \text{K}$, calculate the equilibrium constant for a reaction with $\Delta G^\circ = -3 \text{ kcal/mol}$.

(3)