Biochemistry 694:301   Name_____

First Exam Dr. Deis   Last 5 digits of ID _____

Wed. Feb. 20, 2002   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. _____

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 would be about the size of a

      A. a house   D. an apple
      B. a truck   E. a marble
      C. a large pillow

2.   Entropy is a measure of

      A. bond energies   D. disorder
      B. heat content   E. none of the above
      C. molecular weight

3.   In CPK models, the color of nitrogen is

      A. brown   D. white
      B. blue   E. black
      C. red

4.   Stanley Miller wrongly assumed what?

      A. amino acids formed in early Earth atmosphere
      B. lightning is simulated by a spark
      C. the Earth had a reducing atmosphere
      D. nucleotides are easily synthesized
      E. all of the above

5.   Ion pumps use chemical energy (ATP) to pump certain ions out of a cell. If the concentration of ions outside the cell becomes extremely high, what happens?

      A. ion flow simply stops   D. ions react with each other
      B. ions flow in making ATP   E. ions lose their charge
      C. ions diffuse in through membrane

6.   Secondary structures are generally stabilized by

      A. salt bridges   D. hydrophobic forces
      B. magnetism   E. peptide H bonds
      C. van der Waals forces

7.*   Examine the amino acids drawn below:

      A. #1 is L, #2 is L   C. #1 is D, #2 is L
      B. #1 is L, #2 is D   D. #1 is D, #2 is D

8.   The "beta sheet" would be located where on a standard Ramachandran plot?

      A. top left corner   D. lower right corner
      B. top right corner   E. near the center
      C. lower left corner

9.   Anfinsen denatured Ribonuclease by adding urea and beta-mercaptoethanol. When he was ready to allow it to fold back up, how would he have removed the denaturants?

                A. distillation   C. centrifugation
                B. dialysis   D. activated charcoal

10.   The most *accurate* value of a protein's molecular weight would come from

                A. SDS PAGE   D. ELISA
                B. Amino Acid Analysis   E. Gel Filtration
                C. MALDI-TOF

11.   Some proteins can fold up rapidly and spontaneously. Proteins which need chaperones (heat shock proteins, Gro-EL) are likely to be

                A. alpha helical   D. beta sheets
                B. large, hydrophobic   E. from yeast or fungus
                C. small, globular

12.   Specific cleavage at F, Y, and W residues is catalyzed by

                A. chymotrypsin   D. acetylcholinesterase
                B. trypsin   E. none of the above
                C. cyanogen bromide

13.   Home pregnancy tests detect low levels of hCG by means of

                A. Western Blotting   D. Edman Degradation
                B. Equilibrium sedimentation   E. ELISA
                C. Amino Acid Analysis

14.   Now that several genomes have been sequenced, plans are in the works to collect massive amounts of data about 3-D protein structures. Which technique shown below would yield this information?

                A. ion-exchange   D. rate sedimentation
                B. affinity chromatography   E. Edman degradation
                C. X-ray crystallography

15.   Who confirmed Crick's speculation and showed that DNA replication is semiconservative?

                A. Melanie Griffith   D. Watson and Holmes
                B. Meselson and Stahl   E. Kenneth Lay
                C. James Watson

16.   When you heat a solution of double-stranded DNA you can tell when the strands separate into single stranded DNA because

                A. solution turns blue   D. vial gets cold
                B. UV absorption increases   E. DNA precipitates out
                C. UV absorption decreases

17.   Reverse Transcriptase makes
              A. RNA from DNA template C. DNA from DNA template
              B. RNA from RNA template D. DNA from RNA template

18.   If one strand of a short stretch of DNA reads AGGTTC, the other strand will read
              A. AGGTTC   D. AGCTGC
              B. TCCAAG   E. CTTGGA
              C. GAACCT

19.   Which of the following would have the *lowest* (most negative) score on the
        BLOSUM62 Matrix as a replacement for "D"?
              A. E   D. Q
              B. W   E. S
              C. N

20.   Proteins with greater than 25% sequence identity are considered definitely
        homologous, but proteins with less than 15% identity are not. If protein B is
        clearly homologous to A and C, but a comparison of A and C only shows 10%
        identity, what can we deduce? All identities are spread throughout the sequences
        evenly.
              A. the low score shows no homology between A and C
              B. the apparent homology of B with A and C is an illusion
              C. A and C must be homologous despite the low identity score
              D. The alignment is probably wrong between A and C
              E. no conclusions can be drawn

21.   What protein was shown to be homologous with HSP-70 and Hexokinase?
              A. Actin   D. Myoglobin
              B. Myosin   E. Angiogenin
              C. Ribonuclease

22.   Is it possible for a reaction with a positive Gibbs Standard Free Energy change to
        go forward?
              A. yes, they always go forward   C. sometimes forward
              B. no, they can never go forward   D. none of above

23.   One difference between Competitive and Non-competitive Inhibitors is that
        Competitive Inhibitors
              A. bind at a distance from the active site   D. always change the Vmax
              B. trap S in the active site   E. none of the above
              C. prevent S from binding at the active site

24.   If a given substrate has a high Km with an enzyme we usually assume
              A. weak binding   C. reaction is very fast
              B. strong binding   D. "substrate" is an inhibitor

25.   Pick one topic you'd like to *never* hear anything about again
              A. Enron   D. Al Qaida
              B. Speed skating   E. Pairs figure skating gold medal
              C. Francis Lawrence   F. Biochemistry

PART II   Answer these questions here on the question pages.

1.   a.   Explain briefly why scientists think that all life on Earth comes from a
                 common ancestor.

(3)

        b.   Archaea are one of the three domains of life. Briefly characterize the
                 Archaea – do they have a nucleus? How do they differ from Bacteria and
                 Eukarya? Where would you find them living?

(3)

        c.   What three characteristics are required for evolution to occur?
(3)
                 _____

                 _____

                 _____

        d.   How old is most banded iron?

(1)

2.   a.   The pentapeptide Asp-Ala-AsN-Gly-Leu-Glu would have what sequence
      when expressed in one-letter amino acid code?

(2)

_____

      b. Draw the dipeptide Lys-Trp (KW) as it would appear at pH 7 in water.

(3)

      c.   If the pKa values for Aspartate are 2, 4, and 10, calculate the isoelectric
      point (pI) for Aspartate. Show work and circle answer.

(2)

      d.   To 1 mole of Aspartate in its isoelectric form is added 0.2 moles of NaOH.
      What is the pH of the resulting solution? Show work, circle answer.

(3)

3.   a.   Draw the Edman Reagent and show how it reacts with a peptide chain (in basic solution – first step only).

(3)

    b.   What do the letters "SDS PAGE" stand for? Describe briefly how the method works to separate proteins.

(4)

    c.   Matching – Amino Acid Analysis

(3)
    _____ column to separate AA   A. Glutamine
                                       B. Tyrosine
    _____ destroyed by this method   C. cation exchanger
                                       D. gel filtration
    _____ AA visualized by   E. Sanger's reagent
                                       F. Ninhydrin

4.   a.   Draw an AT base pair – include all details, such as double bonds, hydrogen bonds, and show where sugars attach.

(3)

       b.   What are the "start" and "stop" signals for Transcription, and where do they appear?

(3)

       c.   Paralogs arise from gene duplication, and orthologs come from speciation. (definitions corrected from original study guide) When we compare chimpanzee ribonuclease to human ribonuclease, are we looking at orthologs or paralogs? Explain your answer briefly.

(2)

       d.   Is it ever possible to recover useful DNA from fossils? Will we be able to grow dinosaurs, as in Jurassic Park? Why or why not?

(2)

5.   a.   An enzyme is found to have a V_{max}, at a certain concentration, of 100 mM per second. The enzyme has a K_m with its substrate of 6 mM. Calculate the initial rate when substrate is present at 4 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)

_____

c. Given that R = 1.987 cal/° mol and T = 300°K, calculate the equilibrium constant for a reaction with $\Delta G°' = -7.3$ kcal/mol.

(3)