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. Avidin, a 70-kd protein in egg white, has a very high affinity for biotin. In fact it is a highly specific inhibitor of biotin enzymes. Which of the following conversions would be blocked by the addition of avidin to a cell homogenate?
   A. Glucose → Pyruvate   D. Glucose → Ribose-5-phosphate
   B. Pyruvate → Glucose   E. none of the above
   C. Oxaloacetate → Glucose

2. Glucose-6-phosphatase is located in the:
   A. cytoplasm of liver cells
   B. mitochondrial matrix of muscle cells
   C. endoplasmic reticulum lumen, liver cells
   D. cytoplasm of muscle cells
   E. mitochondrial intermembrane space of kidney cells

3. The Cori Cycle carries Glucose from liver to muscle, and what from muscle to liver?
   A. Fructose   D. Pyruvate
   B. Ketone Bodies   E. Lactate
   C. Lactose

4. Glycogen Phosphorylase b can be allosterically activated by
   A. cAMP   D. ATP
   B. G6P   E. F 2,6 BP
   C. AMP

5. Glycogen Synthase lengthens the chain of glycogen by reacting with
   A. Glucose-1-P   D. UDP-Glucose
   B. Glucose-2-P   E. UDP-Galactose
   C. Glucose-6-P

6. You can exhaust your supply of muscle glycogen by
   A. smoking a cigar   D. taking a final exam
   B. walking to class   E. running a marathon
   C. weight training one hour

7. In the laboratory, Ribose-5-P and Fructose-6-P can be reacted with the enzyme Transaldolase and the appropriate cofactor. The products observed are:
   A. Sedoheptulose-7-P and Erythrose-4-P
   B. Sedoheptulose-7-P and Ribose-5-P
   C. Octulose-8-P and Glyoxylate-2-P
   D. Octulose-8-P and Glyceraldehyde-3-P
   E. none of the above
8. The genetic disease Wernicke-Korsakoff Syndrome was described in a handout and in class. It can cause brain damage, and results from weak binding between
   A. Transketolase and TPP
   B. Transaldolase and TPP
   C. G6PDH and NADP+
   D. Glycogen and Phosphorylase a
   E. none of the above

9. If we run five molecules of hexose (Fru-6-P or Glu-6-P) through the oxidative branch of the Pentose Phosphate Pathway, we will get
   A. 5 Rib-5-P and 5 NADPH
   B. 5 Rib-5-P and 10 NADPH
   C. 6 Rib-5-P
   D. 6 Rib-5-P and 5 NADH
   E. 6 Rib-5-P, 5 NADPH, 5 NADH

10. Which amino acid is "essential" in humans?
    A. Tyrosine
    B. Glutamate
    C. Glutamine
    D. Glycine
    E. Methionine

11. Ammonium enters organic linkage via three major reactions that are found in all cells. Which enzyme doesn't belong among these three?
    A. Glutamate DH
    B. Glutamine synthetase
    C. Carbamoyl Phosphate Synthetase II
    D. Carbamoyl Phos Synth I
    E. none/all of the above

12. Glutamine Synthetase is cumulatively inhibited by several compounds including all of the following except which one?
    A. AMP
    B. Alanine
    C. Histidine
    D. Pyruvate
    E. Carbamoyl Phosphate

13. If a doctor asks for an "SGOT" test, which shows transamination of Aspartate by enzymes in the serum, he probably suspects
    A. PKU
    B. glycogen storage disease
    C. heart or liver damage
    D. gout
    E. sickle cell anemia

14.* The compound shown below represents
    A. N5 Formyl THF
    B. N10 Formyl THF
    C. N5 N10 Methylene THF
    D. N5 N10 Methenyl THF
    E. N5 Methyl THF

15. Phenylalanine can't be made by human cells but is easily made by certain other species. The starting materials for Phe synthesis are
    A. R5P and S7P
    B. E4P and PEP
    C. Alanine and Benzene
    D. OAA and Pyruvate
    E. Glu and PLP
16. Lack of Phenylalanine Mono-oxygenase ("Phe Hydroxylase") can cause
   A. Gout
   B. Leukemia
   C. Phenylketonuria
   D. Lesch-Nyhan Syndrome
   E. none of the above

17. Serine is synthesized by oxidation and transamination of
   A. Pyruvate
   B. 3PG
   C. G3P
   D. 1,3 BPG
   E. Glycine

18. Cystathionine has one sulfur, two nitrogens, and how many carbons?
   A. 5
   B. 6
   C. 7
   D. 8
   E. 11

19. Drugs like Methotrexate prevent synthesis of DNA by binding to
   A. DNA Pol I
   B. DNA Pol III
   C. Dihydrofolate Reductase
   D. Thymidylate Synthase
   E. Reverse Transcriptase

20. Synthesis of Phosphoribosylamine, UTP->CTP, and XMP->GMP would all be blocked by
   A. azaserine
   B. methotrexate
   C. high NADPH levels
   D. low Aspartate
   E. low Carbamoyl Phosphate

21. Ribonucleotide Reductase only accepts what substrate?
   A. 2'dNDP
   B. NTP
   C. NDP
   D. NMP

22. The extracyclic NH2 on "top" of the Adenine ring is introduced how?
   A. Glutamine donation
   B. Aspartate attachment
   C. direct Ammonia connection
   D. Asparagine donation
   E. Carbamoyl Phosphate transfer

23. During Pyrimidine biosynthesis, first the ring is built and then it undergoes a "salvage" reaction with PRPP. Which intermediate reacts with PRPP?
   A. Uridine
   B. Dihydroorotate
   C. Orotate
   D. Thymine
   E. Guanine

24. If [ATP]= 10 mM, [ADP]= 6 mM, and [AMP] = 10 mM, what is the energy charge in the cell?
   A. 26
   B. 1.0
   C. 0.88
   D. 0.80
   E. 0.66
   F. 0.50

25. What place would you most prefer to be on a Sunday afternoon in May?
   A. right here taking this test
   B. beer and BBQ in park
   C. watching/playing golf
   D. in Church
   E. out birding
   F. none of the above
Part II – answer these questions here on the question pages.

1. a. Explain briefly why having Glucose-6-Phosphatase as an active cytoplasmic enzyme would have harmful consequences in the cell.

(3)

b. Show the reaction catalyzed by PEPCK. Draw reactants and products and indicate cofactors.

(2)

c. Diagram the Glycogen Breakdown cascade, starting with Epinephrine and ending with active Phosphorylase. Include cofactors where appropriate.

(5)
2. a. Show the Oxidative Branch of the Pentose Phosphate Pathway, starting with Glucose-6-P and ending with Ribose-5-P. Draw intermediates, name enzymes, and indicate cofactors. Roughly 1/2 point per fact.

(5)

b. Show how Proline would be converted into alpha-KG by its catabolic pathway. Draw all structures, but enzymes and cofactors are not required.

(5)
3. a. Questions about Malcolm Gladwell's "Pima Paradox":
1- describe the Atkins diet briefly.

(1)

2- what does leptin "tell the brain" in lab animals?

(1)

3.- when leptin levels are tested in obese people, are they high or low?

(1)

b. Show the cyclic portion of the Urea Cycle. Draw all reactants and products, indicate all cofactors, and name all enzymes. You don't have to show compartment change. Roughly 1/2 point per fact.

(7)
4. a. Show Purine de novo synthesis starting with PRPP and ending with PRAI or 5-Aminoimidazole Ribonucleotide. Draw reactants and products (sticks are OK for sugars) and indicate all cofactors. Enzyme names are not required. About 1/2 point per fact.

(6)

b. Starting with Inosinate (IMP), show the pathway to GMP. Draw reactants and products, indicate cofactors and controls, no enzyme names.

(4)
5.  
a. Show the pathway from OMP (Orotidylate) to CTP. You only have to draw the initial and final structures, but do show all the steps with "OMP" type abbreviations. Name "important" enzymes (i.e. all but the first enzyme) and show all cofactors. Roughly 1/2 point per fact.

(6)  

b. Explain how Ribonucleotide Reductase is re-reduced after it has been used to produce a 2’ deoxynucleotide. Mention all cofactors involved. Sketch the shape of the enzyme as depicted in the text (it's a dimer).

(4)