

Biochemistry 694:301
Third Exam
Wed., Apr. 5, 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. _____ |
| 9. _____ | | |

GRADE:

Part I Total _____

Part II:

II-1 _____

II-2 _____

II-3 _____

II-4 _____

II-5 _____

Part II Total _____

Total, I & II _____

1. The Cori Cycle is responsible for the presence of two compounds in the blood – glucose and
 - A. Lactose
 - B. Galactose
 - C. Malate
 - D. Lactate
 - E. Sucrose

2. Which enzyme is found universally, in all living organisms on Earth?
 - A. Hexokinase
 - B. Phosphoglycerate Mutase
 - C. Aldolase
 - D. Isocitrate Lyase
 - E. none of the above

3. Which compound is an activator for Pyruvate Carboxylase?
 - A. Pyruvate
 - B. ADP
 - C. Acetyl CoA
 - D. F-2,6-BP
 - E. Alanine

4. The complete process of gluconeogenesis resulting in production of Glucose occurs mainly where in the human body?
 - A. brain
 - B. adipose
 - C. salivary gland
 - D. heart
 - E. liver

5. Which statement is *incorrect*? Succinate Dehydrogenase...
 - A. has iron-sulfur clusters
 - B. contains FAD
 - C. contains integral membrane proteins
 - D. catalyzes an oxidative decarboxylation
 - E. all of the above

6. Which cofactor is responsible for the decarboxylation of Pyruvate by the Pyr DH Complex?
 - A. NAD⁺
 - B. TPP
 - C. Biotin
 - D. B-12
 - E. Lipoamide

7. Symptoms of Thiamine deficiency (beriberi) resemble symptoms of what?
 - A. eating an uncoupler
 - B. hemolytic anemia
 - C. diabetes
 - D. heavy metal poisoning
 - E. cyanide poisoning

8. Anaplerotic reactions are reactions which resupply which intermediate to the CAC?
 - A. Malate
 - B. Oxaloacetate
 - C. Citrate
 - D. alpha-Ketoglutarate
 - E. Glyoxylate

9. Pyruvate DH Complex is inhibited by what compound?
A. NADP+ C. ADP
B. ATP D. Glucose
10. Compared to cytochromes, Iron Sulfur Clusters are
A. older and higher in energy C. older and lower energy
B. newer and higher in energy D. newer and lower energy
11. Which conformation of α and β in F_1 attracts binding of ADP and P_i ?
A. open C. tight
B. loose D. secretory
12. Which rotating subunit of the Racker's Knob corresponds to the "camshaft" which makes the conformations change resulting in ATP formation?
A. alpha D. delta
B. beta E. gamma
C. "c"
13. When electrons from FADH₂ are transported to oxygen via the mitochondrial electron transport chain, how many ATP are formed?
A. 1 D. 2.5
B. 1.5 E. 3
C. 2. F. 6
14. In the Glycerol Phosphate Shuttle, what is reduced by NADH giving Glycerol 3P?
A. DHAP D. Glycerol 3P
B. Glyceraldehyde-3P E. none of the above
C. 1,3 BPG
15. The mechanism of Transaldolase depends on covalent attachment of substrate to
A. serine D. cysteine
B. phosphate E. TPP
C. lysine
16. The Wernicke Korsakoff Syndrome is a genetic disease caused by a mutation in
A. G6Pase D. Glutathione
B. Transketolase E. G6PDH
C. Transaldolase
17. Both parts of the Pentose Phosphate Pathway (Oxidative and Non-oxidative) can be run together as a cycle. When this is done, what is the result?
A. Much Ribose-5-P is produced but no NADPH
B. Much NADPH is produced but no Ribose-5-P
C. Roughly equal amounts of NADPH and Ribose-5-P are produced
D. NADPH is used up rapidly and turned into NADP+
E. none of the above

18. The Pentose Phosphate Pathway is most active in which tissue?
A. brain
B. liver
C. skeletal muscle
D. heart
E. adipose
19. Glycogen is found in the
A. cytoplasm
B. mitochondrial matrix
C. lumen of ER
D. nucleus
E. all of the above
20. During glycogen synthesis, the "Branching" enzyme moves how many glucose residues from the main chain to form a branch?
A. 1
B. 3
C. 7
D. 11
E. 25
21. If your supply of liver glycogen is depleted, you can replenish it by eating as little as
A. 300 potatoes
B. 3 large meals
C. one piece of cake
D. half a slice of white bread
E. a grape
22. Which result implies a deficiency of Branching Enzyme (Type IV Andersen's disease?) if in vitro hydrolysis of assayed liver glycogen yields:
A. 95% G1P, 5% Glucose
B. 90% G1P, 10% Glucose
C. 80% G1P, 20% Glucose
D. 10% G1P, 90% Glucose
23. Which of the following would NOT be a substrate for Protein Phosphatase I?
A. Phosphorylase A
B. Protein Kinase A
C. Phosphorylase Kinase
D. Glycogen Synthase
E. None of the above
24. The reason you have liver glycogen is
A. to survive a week's fast
B. just to keep liver cells alive
C. buffer for blood glucose
D. storage of fatty acids
E. none of the above
25. When Marathon runners exhaust their glycogen supply, it is called hitting the
A. Bottle
B. Deck
C. Bottom
D. Wall
E. Hypoteneuse

PART II Answer these questions here on the question pages.

1. a. Show the beginning of Gluconeogenesis, starting with Pyruvate and ending with 2-Phospho-glycerate. You do not need to show "transport" steps involving L-Malate. Draw all reactants and products, name all enzymes, indicate all cofactors.

(5)

- b. Diagram the Cori Cycle

(3)

- c. Fructose-2,6-BP is an important regulator of Gluconeogenesis. What enzyme does it affect? How does it affect it?

(2)

2. a. Show the Citric Acid Cycle starting with Oxaloacetate and ending with Succinyl CoA. Go "forward" around the cycle. Draw all reactants and products, name all enzymes, and indicate all cofactors. You don't have to show mechanisms. About 1/2 point per fact.

(7)

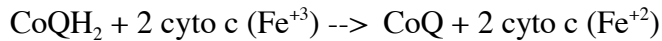
- b. Show the transfer of carbon from HE-TPP to Lipoamide in the Pyruvate DH complex. Draw substrates and "five membered rings" of cofactors.

(3)

3. a. Label the picture below. What is the "olive" at the top? The circles have a consistent meaning, including the "hole" in the "olive" – what does each represent? Label as many features as you can, and name the complex represented here.

(4)

- b. Calculate the standard potential difference and the standard free energy change when two electrons are transferred from Ubiquinol (CoQH_2) to 2 cytochrome c, using the half reaction reduction potentials given below. $F = 23.06$ kcal/V mol, $R = 1.987$ cal/mol K and $T = 300$ K. Show work, state equation(s), circle answers.



(4)	Reduction Half-reaction	n	E_o'
	$\text{CoQ} \rightarrow \text{CoQH}_2$	$2e^-$	+0.12 V
	$\text{cyto c Fe}^{+3} \rightarrow \text{cyto c Fe}^{+2}$	$1e^-$	+0.22 V

- c. Give the linear structure of the mitochondrial electron transport chain from CoQH_2 to Oxygen.

(2)

4. a. Show how G6P is converted into Ribulose-5-P by the Oxidative Branch of the Pentose Phosphate Pathway – draw reactants and products, name enzymes, and indicate cofactors.

(5)

- b. Show how Sedoheptulose-7-P and Glyceraldehyde-3-P would react with the enzyme Transketolase. Draw reactants and products, indicate any cofactors.

(3)

- c. Briefly explain the biochemical origin of Pamaquine Induced Hemolytic Anemia. What enzyme is lacking? What causes the problem?

(2)

5. a. Diagram the Glycogen Breakdown Cascade, starting with Epinephrine and ending with Glucose-1-P. Remember to add required cofactors.

(6)

- b. Name the enzyme and label the diagram (where you see arrows).

(4)