

Biochemistry 694:301
Third Exam
Wed., Apr. 10, 2002

Name _____
last 5 digits SSN _____
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 enzyme glucose-6-phosphatase is found in the
 - A. brain
 - B. cytoplasm
 - C. mitochondrial matrix
 - D. lumen of endopl. reticulum
 - E. citric acid cycle

2. The activity of fructose-bisphosphatase is stimulated by
 - A. F-2,6-BP
 - B. citrate
 - C. AMP
 - D. CO₂
 - E. none of the above

3. According to the text, the evolutionarily oldest part of Glycolysis is
 - A. the kinase steps
 - B. aldolase
 - C. the triose steps
 - D. the hexose steps
 - E. none of the above

4. The enzyme G6PDH reacts covalently with its substrate via a residue of
 - A. glucose
 - B. serine
 - C. histidine
 - D. aspartate
 - E. cysteine

5. Which of the following are *not* intermediates in the entry of galactose into glycolysis? Choose all appropriate answers.
 - A. gal-6-P
 - B. gal-1-P
 - C. UDP-gal
 - D. gal-triphosphate
 - E. none of the above

6. Under anaerobic conditions, yeast converts glucose into carbon dioxide and
 - A. water
 - B. acetate
 - C. ethanol
 - D. galactose
 - E. ribose

7. Fructose 2,6 Bisphosphate was described as a signal meaning:
 - A. "too much calcium"
 - B. "not enough glucose"
 - C. "lots of glucose"
 - D. "falling proton gradient"
 - E. "I'm scared"

8. Which enzyme of the Citric Acid Cycle is stimulated by ADP?
 - A. -KGDH
 - B. Fumarase
 - C. Aconitase
 - D. ICDH
 - E. all of them

9. Acetyl CoA inhibits ____ but is a required activator for ____
 - A. Aconitase, Fumarase
 - B. Malate DH, G6Pase
 - C. Pyr DH Complex, Pyr Carboxylase
 - D. Citrate Synthase, Hexokinase
 - E. Citrate Synthase, PEPCK

10. The Citric Acid Cycle occurs where in eucaryotic cells?
A. the cytoplasm D. the mitochondrial matrix
B. the lumen of the E.R. E. the mito. intermembrane space
C. the nucleus
11. Unlike other organisms, organisms that have the Glyoxylate Cycle can
A. make glucose from fatty acids D. run gluconeogenesis
B. make fatty acids from glucose E. run the Citric Acid Cycle
backward
C. make acetyl CoA from fatty acids
12. In organisms that have the Glyoxylate Cycle, Glyoxylate is formed by
A. Glyoxylate Synthase D. Isocitrate Lyase
B. Glyoxylate Synthetase E. Malate DH
C. Citrate Lyase
13. During the Q cycle, outward-facing QH_2 gives its first electron directly to
A. b_H D. Rieske FeS
B. b_L E. cyto c
C. cyto c_1
14. The ATP yield, after oxidative phosphorylation, for oxidation of pyruvate from to CO_2 in respiring mitochondria is
A. 2 D. 12.5
B. 5 E. 30
C. 10
15. Compared with cytochromes, iron sulfur clusters are
A. higher in energy, evolutionarily older
B. higher in energy, evolutionarily younger
C. lower in energy, evolutionarily older
D. lower in energy, evolutionarily younger
E. none of the above
16. A "Racker's Knob" consists of the F_1 "knob" and the transmembrane F_o . The movement of protons inward through the Racker's Knobs causes rotation of
A. F_1 only D. neither
B. F_o only E. alpha and beta subunits of F_1
C. F_1 and F_o
17. The "cubical" Iron-Sulfur Cluster contains how many iron atoms?
A. 1 C. 3 E. 5
B. 2 D. 4 F. none
18. Transketolase requires
A. Mg^{+2} D. A, B, and C
B. NADPH E. B and C
C. TPP

19. Like the Pentose Phosphate Pathway, the Calvin Cycle
- A. oxidizes glucose and generates NADPH
 - B. uses the enzyme Transketolase
 - C. requires ATP to run
 - D. takes place in the cytoplasm
20. The Pentose Phosphate Pathway is of great importance for the maintenance of red blood cells because
- A. NADPH produced is needed for fatty acid synthesis
 - B. Sedoheptulose-7-P produced is needed
 - C. NADPH produced is needed to maintain reduced Glutathione
 - D. Pentose Phosphate Sugars are formed
21. What enzyme is the rate-limiting step for the Calvin Cycle?
- A. Ribulose-5-P Kinase
 - B. Transaldolase
 - C. G6PDH
 - D. Rubisco
 - E. none of the above
22. If we put 6 moles of ribose-5-P through the non-oxidative branch of the Pentose Phosphate Pathway, the immediate products would be
- A. 4 moles Fru-6-P, 2 moles Gly-3-P
 - B. 6 moles Rul-5-P, 6 moles CO₂, 12 moles NADPH
 - C. 3 moles Sed-7-P, 3 moles Gly-3-P
 - D. 6 moles Fru-6-P
23. Ribulose-5-phosphate is converted by an epimerase into
- A. ribose-5-P
 - B. sedoheptulose-7-P
 - C. xylulose-5-P
 - D. erythrose-4-P
 - E. none of the above
24. Which step of the PPP below is described in the text as functionally irreversible?
- A. lactonase
 - B. epimerase
 - C. G6PDH
 - D. transaldolase
 - E. none of the above
25. Is it, or isn't it?
- A. it definitely is
 - B. it might be
 - C. possibly?
 - D. I don't think so
 - E. hardly a chance
 - F. definitely not!

PART II Answer these questions here on the question pages.

1. a. Show how Glycolysis would convert Fructose-1,6-BP into PEP. Draw all reactants and products, name all enzymes, and indicate all cofactors. You do not need to show mechanisms. One half point per fact. If you need to use the back, be sure to say "see back!"

(8)

b. On the axes below, show how the activity of PFK-I varies when ATP concentration is varied, in the absence and presence of Fru-2,6-BP. Draw two curves and label "-" for absence and "+" for presence.

(2)

ATP ->

2. a. Show the reactions that convert Pyruvate into PEP at the beginning of Gluconeogenesis. Draw reactants and products, name enzymes, indicate cofactors. You do not need to include "transport" steps.

(4)

- b. Briefly explain how Insulin affects the GLUT-4 receptor, and why this system is necessary. In other words, GLUT-4 receptors could conceivably just stay in the same place all the time. What would be the problem if they did?

(3)

- c. G6Pase was described as a "dangerous" enzyme. Explain clearly how it is controlled, and why it would be dangerous if not carefully controlled.

(3)

3. a. Show the Citric Acid Cycle starting with Citrate and ending with Succinate. Draw all reactants and products, name all enzymes, and indicate all cofactors. Go "forward" through the cycle and do not "back up" through irreversible reactions. 1/2 point per fact.

(8)

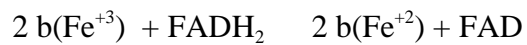
b. Draw the structure of HE-TPP, an intermediate from the Pyruvate DH Complex, and show how Lipoamide reacts with it.

(2)

4. a. Show the "linear" sequence of the mitochondrial electron transport chain starting with Q and ending with oxygen. Show all components, and indicate complex groupings.

(4)

- c. For the following reaction, calculate the E° and the G_o' . The value of a Faraday is 23.06 kcal/volt/mol. State equations, show work, and circle answers.



Reduction Potentials:

FAD	FADH ₂	2	-0.22 v
b(Fe ⁺³)	b(Fe ⁺²)	1	+0.07 v

(4)

- d. What does Atractyloside inhibit? What effect would Atractyloside have on the energy charge and on electron transport in coupled mitochondria?

(2)

5. a. Show the oxidative branch of the Pentose Phosphate Pathway, starting with Glucose-6-P and ending with Ribose-5-P.

(6)

- b. Show the reactants and products of the Transaldolase reaction (as found in the non-oxidative branch of the PPP), and indicate any cofactors.

(4)