BMB 514 --- Exam II --- October 9, 2006 **1A**

Name: _____ **College: CHM COM**
(please print) (please circle)

Please complete the following information on your Answer Sheet:

(a) your name and signature
(b) your student number (PID)
(c) your college (in the area under **SECTION**): mark **001** for **CHM** student
mark **002** for **COM** student
(d) your version of the exam is **1A** --- mark this in the area under **FORM**

- There are 32 questions on this exam. For each question, mark the letter corresponding to what you consider is the BEST answer on the Answer Sheet provided.

- When you leave the exam room, please turn in your Answer Sheet AND your exam to the proctors standing by the doors INSIDE the auditorium. Once you exit the auditorium, please leave the building. Hallway conversations disturb those still taking the exam.

- There will be answer keys to this exam posted on the course website after the exam is completed. You may wish to copy your responses from your Answer Sheet onto the answer grid on the LAST page of this exam so that you can check your results. You can tear off the last page and take it with you.

- You have 60 minutes to complete this exam. We will close the exam promptly at 8:30 a.m. Once we withdraw the boxes for the Answer Sheets from the doors, no additional Answer Sheets will be accepted.

- Do well and good luck.

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1. A person has consumed a large bag of candy corn and his blood glucose is very high (two times normal). Which of the following best describes the activity of hexokinase and glucokinase in the liver under these conditions?

	Hexokinase	**Glucokinase**
A)	At Vmax	At Vmax
B)	Below Vmax	Below Vmax
C)	At Vmax	Below Vmax
D)	Below Vmax	At Vmax

2. A cell within your body requires high levels of NADPH and energy. Which of the following pentose phosphate pathway enzymes are necessary to produce these two things in the cell?

   A) glucose 6-phosphate dehydrogenase
   B) transketolase
   C) transaldolase
   D) All of the above
   E) B and C only

3. The conversion of mitochondrial oxaloacetate to cytosolic phosphoenolpyruvate involves all of the following EXCEPT:

   A) Malate transporter
   B) Malate dehydrogenase
   C) GTP
   D) Fumarase
   E) Phosphoenolpyruvate carboxykinase

4. Which of the following is **FALSE** with regard to carbohydrate digestion and absorption?

   A) The digestive process begins in the mouth by salivary amylases
   B) Stomach amylases convert dextrins to disaccharides
   C) Disaccharide hydrolysis occurs at the surface of mucosal cells
   D) Absorption of fructose occurs because of a concentration gradient
   E) The absorption of glucose requires a Na^+/K^+ ATPase

5. The reciprocal regulation between glycogen synthase and glycogen phosphorylase directly involves all of the following EXCEPT?

   A) Biological amplification
   B) cAMP
   C) Protein phosphorylation
   D) Adenylate cyclase
   E) Glucose 6-phosphate

6. A patient comes to your office with symptoms of hemolytic anemia. This bout of anemia was brought on following treatment with antimalarial medications he began taking during a trip to Africa. He had a similar instance following a meal that included fava beans. Analysis of his red blood cells found that he had very low levels of reduced glutathione. Which enzyme would most likely be defective in this patient?

   A) Glucose 6-phosphate dehydrogenase
   B) Fumarase
   C) Isocitrate dehydrogenase
   D) Pyruvate dehydrogenase
   E) Aconitase

7. The link between glyceraldehyde 3-phosphate dehydrogenase and lactate dehydrogenase is physiologically important because of its role in anaerobic metabolism, exercising muscles and the Warburg effect. Which of the following is involved in the link between these two enzymes?

   A) The conversion of pyruvate to lactate
   B) The conversion of glyceraldehyde 3-phosphate to 1,3 bisphosphoglycerate
   C) The generation of NADH by lactate dehydrogenase while producing lactate
   D) All of the above
   E) A and B

8. Fructose 2,6-bisphosphate (F-2,6-bP) plays an essential regulatory role in gluconeogenesis and glycolysis. Which of the following **INCORRECTLY** describes F-2,6-bP?

   A) Is produced from fructose 6-phosphate by the action of phoshofructokinase 2
   B) Is a positive regulator of phosphofructokinase 1
   C) Is removed from the cell by the action of fructose 2,6-bisphosphatase
   D) In the presence of glucagon, its concentration increases
   E) Is a negative regulator of fructose 1,6-bisphosphatase

9. There are several gluconeogenic enzymes that are critical to overcome essentially irreversible steps in glycolysis. Which of the following gluconeogenic enzymes is **NOT** matched with the glycolytic enzyme that it overcomes?

	Gluconeogenic	**Glycolytic**
A)	pyruvate carboxylase	pyruvate kinase
B)	fructose 1,6-bisphosphatase	phosphofructokinase 1
C)	phosphoenolpyruvate carboxykinase	pyruvate kinase
D)	glucose 6-phosphatase	hexokinase
E)	pyruvate carboxylase	phosphoglycerate kinase

10. The mitochondrial malate dehydrogenase has a high positive $\Delta G^{o'}$. Which of the following explains why this enzymatic process proceeds forward as written?

$$\text{Malate} + NAD^+ \rightarrow \text{Oxaloacetate} + NADH$$

A) The mitochondria maintains very low concentration of oxaloacetate
B) Citrate synthase has a high negative $\Delta G^{o'}$
C) NADH is quickly removed from the system by the electron transport chain
D) All of the above
E) A and B

11. A patient is brought into the emergency room on the verge of death. He was exposed to a mitochondrial poison but you do not know which one. You know that he is not making enough ATP and his mitochondrial oxygen consumption is very low. Using virtual technology you are able to deduce that the addition of 2,4-dinitrophenol to his mitochondria does not rescue oxygen consumption. Finally, these purified mitochondria have an excess of QH2 (ubiquinol) without any measurable reduced cytochrome C. Which of the following poisons was the patient exposed?

A) Amytal
B) Rotenone
C) Oligomycin
D) Cyanide
E) Antimycin

12. If you wanted to insure **maximum** activity from the pyruvate dehydrogenase complex which of the following would you want to have at very **LOW** levels inside your mitochondria?

A) ADP
B) Pyruvate
C) Coenzyme A
D) NAD^+
E) NADH

13. The transport of reducing equivalents from cytosolic NADH into the mitochondria involves all of the following EXCEPT?

A) Malate dehydrogenase
B) Alpha-ketoglutarate
C) Glutamate
D) Asparate
E) Isocitrate

14. Which of the following correctly describes the electron transport chain?

A) Coenzyme Q accepts electrons from Complex III.
B) Cytochrome C is a water soluble protein that donates electrons to Complex IV.
C) NADH donates electron directly to complex II.
D) Protons are pumped by Complexes I, II, III and IV.
E) Cytochromes are carriers of electrons and protons.

15. A patient is brought into the hospital with symptoms of fatigue, loss of muscle control and other neurological abnormalities. Having taken biochemistry 514 you quickly hypothesize that the patient has the early signs on Wernicke-Korsakoff syndrome and lab tests verify a genetic defect in the patient's transketolase gene. Which of the following vitamins would you prescribe to the patient to help alleviate the symptoms caused by this defect?

A) Ascorbate
B) Niacin
C) Cobalamin
D) Pyridoxal
E) Thiamine

16. A patient is brought into the office suffering from complications in Cori's disease (Type III, glycogen storage disease, amylo-1,6-glucosidase (debranching) deficiency). Which of the following would you expect to find in terms of amount and structure of the patient's glycogen stores?

	Amount	**Structure**
A)	Increased	normal structure
B)	Increased	short outer branching
C)	Normal	minimal outer branching
D)	Normal	very long branching
E)	Increased	very long branching

17. The patient with Von Gierke's disease (Type I glycogen storage disease, glucose 6-phosphatase deficiency) would have a build up of glucose 6-phosphate (G 6-P) inside his/her cells. Which of the following enzymes will most likely be **DIRECTLY** influenced by this increased G 6-P concentration?

A) citrate synthase and phosphoglucose isomerase
B) glucose 6-phosphate dehydrogenase and phosphoglucose isomerase
C) glucose 6-phosphate dehydrogenase and phosphoglycerate kinase
D) phosphoglucomutase and phosphoglycerate kinase
E) citrate synthase and phosphoglucomutase

18. Following the complete depletion of your glycogen stores, all of the following are necessary to replenish your glycogen **EXCEPT**?

A) glycogenin
B) uridine tri-phosphate (UTP)
C) α 1,6-glucosidase
D) Branching enzyme
E) Glycogen synthase

19. The transketolase and transaldolase reactions of the pentose phosphate pathway are all that is necessary to convert xylulose 5-phosphate and ribose 5-phosphate to which of the following?

A) glyceraldehyde 3-phosphate and fructose 6-phosphate
B) glucose 1-phosphate and glyceraldehyde 3-phosphate
C) glucose 1-phosphate and fructose 6-phosphate
D) erythrose 4-phosphate and dihydroxyacetone phosphate
E) dihydroxyacetone phosphate and fructose 6-phosphate

20. Given the following reactions and hypothetical standard oxidation/reduction potentials:

$\frac{1}{2}O_2 + 2H^+ + 2\ e^- \Leftrightarrow H_2O$ $\quad\quad$ $\Delta E'o = 1.25$

$NAD^+ + 2H^+ + 2e^- \Leftrightarrow NADH + H^+$ $\quad\quad$ $\Delta E'o = -0.25$

What would the Standard State Free energy be of the following reaction?

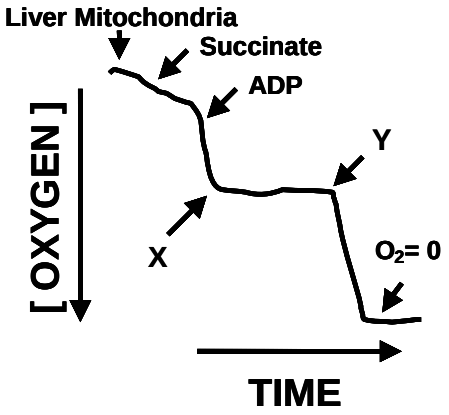
$NADH + \frac{1}{2}O_2 + H^+ \Leftrightarrow NAD^+ + H_2O$

(Given: $\Delta G_o' = -n\mathbf{F}\ \Delta E'_o$ and $\mathbf{F}$ = 23 kcal/volt mole e^-)

A) +69 kcal/mole
B) -46 kcal/mole
C) +46 kcal/mol
D) -34.5 kcal/mole
E) -69 kcal/mol

21. You are performing some experiments on mitochondrial poisons in the lab and have accidentally washed off the labels of two of your test samples. Given your extensive knowledge from BMB 514 you decide to go ahead with the experiment. You place your purified mitochondria, succinate and ADP into a test tube and you observe the expected decrease in oxygen within the tube (see figure below). Upon addition of poison X you see the oxygen consumption stops and further analysis of the sample shows a lack of ATP production in the presence of sample X. Upon the addition of sample Y (you now have X and Y in the tube) the oxygen consumption begins, however, you still have no ATP production. What is the most likely identity of poison X and Y?

	X	Y
A)	2,4 dinitrophenol	oligomycin
B)	oligomycin	2,4-dinitrophenol
C)	antimycin	2,4-dinitrophenol
D)	rotenone	oligomycin
E)	oligomycin	rotenone



22. Isocitrate dehydrogenase carries out the conversion of isocitrate to α-ketoglutarate. Which of the following CORRECTLY describes this reaction?

A) ATP is a positive regulator.
B) The reactant, isocitrate can be directly converted to various amino acids.
C) Produces the first mole of NADH in the tricarboxylic acid (TCA) cycle.
D) It is one of the fastest reaction in the TCA cycle.
E) It performs the committed step of the TCA cycle.

23. What is the correct sequence of enzyme types for the four repeated steps of beta-oxidation of fatty acids?

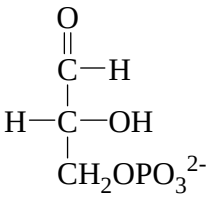
A) condensing enzyme, reductase, dehydratase, reductase
B) reductase, hydratase, reductase, beta-ketothiolase
C) dehydrogenase, dehydratase, dehydrogenase, beta-ketothiolase
D) dehydrogenase, hydratase, dehydrogenase, beta-ketothiolase
E) condensing enzyme, dehydrogenase, hydratase, dehydrogenase

24. What are the products of beta-oxidation of a C_{18} fatty acid?

A) 1 propionyl CoA, 8 acetyl CoA, 8 $FADH_2$, and 8 ($NADH + H^+$)
B) 9 acetyl CoA, 8 $FADH_2$, 8 ($NADH + H^+$)
C) 8 acetyl CoA, 8 $FADH_2$, 8 ($NADH + H^+$)
D) 8 acetyl CoA, 7 $FADH_2$, 7 ($NADH + H^+$)
E) 9 acetyl CoA, 9 $FADH_2$, 9 ($NADH + H^+$)

25. Which of the following conditions would most likely result in the production of ketone bodies?

A) A high carbohydrate diet
B) High levels of insulin
C) Activation of the pyruvate dehydrogenase complex in the liver
D) High concentrations of malonyl CoA
E) Activation of pyruvate carboxylase in the liver



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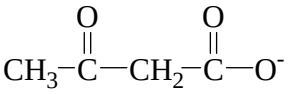

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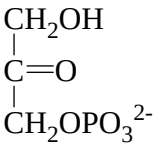

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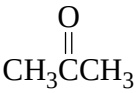

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26. Which of the above molecules becomes a circulating fuel source when glucose concentrations are low?

A) Molecule 1
B) Molecule 2
C) Molecule 4
D) Molecules 1 and 3
E) Molecules 2 and 4

27. Which of the following statements regarding acetyl CoA carboxylase is INCORRECT?

A) It is part of the fatty acid synthase complex.
B) It is activated by insulin and citrate.
C) It requires biotin as a cofactor.
D) It has a similar reaction mechanism to pyruvate carboxylase.
E) It catalyzes the committed step of fatty acid synthesis.

28. Which of the following statements regarding regulation of beta-oxidation and fatty acid synthesis is CORRECT?

A) Beta-oxidation and fatty acid synthesis are “on” simultaneously in a cell.
B) An increased concentration of palmitoyl CoA activates fatty acid synthesis.
C) Increased levels of malonyl CoA and glucagon activate beta-oxidation.
D) An increase in the concentration of leptin activates fatty acid synthesis.
E) Increased concentrations of palmitoyl CoA and glucagon activate beta-oxidation.

29. Which of the following statements is CORRECT?

A) Triacylglycerols (TAG) and glycolipids are synthesized by branches of the same pathway.
B) GTP is used for activation in the salvage pathway of phospholipid synthesis.
C) Dihydroxyacetone phosphate (DHAP) is a source used to create the backbone of phospholipids and triacylglycerols (TAG).
D) Breakdown of phospholipids yields molecules such as inositol triphosphate (IP_3), which are first messengers in signaling pathways.
E) Insulin inhibits triacylglycerol (TAG) synthesis.

30. Which of the following statements about cholesterol synthesis is INCORRECT?

A) HMG-CoA is an intermediate in both cholesterol and ketone body synthesis.
B) HMG-CoA synthase catalyzes the committed step of cholesterol synthesis.
C) Beta-ketothiolase, an enzyme in cholesterol synthesis, is also an enzyme in ketone body synthesis and beta-oxidation of fatty acids pathways.
D) Statins act as competitive inhibitors because they resemble HMG-CoA.
E) Cholesterol can be used to synthesize vitamin D.

31. The regulation of cholesterol synthesis involves all of the following EXCEPT:

A) glucagon inactivates HMG-CoA reductase
B) cholesterol inhibits the synthesis of HMG-CoA reductase
C) cholesterol inhibits the synthesis of the LDL receptor
D) cholesterol inhibits the activity of HMG-CoA reductase
E) cholesterol inhibits the degradation of HMG-CoA reductase

32. A skeletal muscle cell is dividing. The process is almost complete, but it has not yet separated to form the two daughter cells. Which of the following processes would most likely be highly active?

A) Triacylglycerol synthesis
B) Ketone body synthesis
C) Sphingolipid synthesis
D) Phospholipid synthesis
E) Answers C and D

BMB 514 – Exam II – October 9, 2006

Tear off and keep this for your record of your answers.

ANSWER GRID

Version of the Exam: **1A**

1.		**5.**		**9.**		**13.**		**17.**		**21.**		**25.**		**29.**	
2.		**6.**		**10.**		**14.**		**18.**		**22.**		**26.**		**30.**	
3.		**7.**		**11.**		**15.**		**19.**		**23.**		**27.**		**31.**	
4.		**8.**		**12.**		**16.**		**20.**		**24.**		**28.**		**32.**	