Chem/Bio 332 Biochemistry II **Practice** **Exam I**

Name_____

Just a reminder - I want chemical details where appropriate (mechanism, structure, kinetics and so on). Support your answer with details. A series of declaratory or general statements without supporting evidence will not earn top points. No outline or bullet points will be graded. Simple answers will earn simple points.

Extra Credit: Draw the set of reactions of phosphorylation/dephosphorylation and describe why this impacts protein structure and function. (2 points)

Multiple Choice 2 points each

1)Insulin stimulated protein-kinase will
a. Phosphorylate glycogen to allow for the complete activation of phosphoprotein phosphatase-1
b. Activate the phosphodiesterase to remove the phosphate from PKA
c. Phosphorylate the GM subunit of regulatory subunit of phosphoprotein phosphatase-1
d. Lead to the same regulation of phosphoprotein phosphatase-1 in liver and muscle

2) The step that utilizes a "UDP high energy handle" is
a. Glycogen synthase
b. Glycogen transferase
c. Glycogen phosphorylase
d. Phosphorylase kinase

3) Which enzyme acts as a glucosyltransferase with two separate activities?
a. Phosphorylase kinase
b. Glycogen debranching enzyme
c. Phosphoglucomutase
d. Pyruvate dehydrogenase

4) Phosphorylation of Ser 14 of glycogen phosphorylase…
a. Opens the regulatory loop that covers the active site of phosphorylase
b. Is catalyzed by AMP Kinase
c. Causes the phosphorylation of Arg 569 inactivating phosphorylase
d. Promotes the T (inactive) over the R (active) form

5) ATP and Glucose shift the equilibria of glycogen phosphorylase____
a. To the T inactive form
b. To bind tighter to phosphorylase kinase leading to glycogen phosphorylase activation
c. As they both compete for AMP binding at the active site
d. Not this choice – don't pick this one… please don't

6) PPi (pyrophosphate) hydrolysis is used to drive reactions because.
a) there is very little of it in the cell
b) the Gibbs free energy change is very positive for the hydrolysis
a) it creates free inorganic phosphate
d) the enzyme inorganic pyrophosphatase makes the overall reaction exergonic

19) If a 14C label were introduced into the aceate of acetyl CoA where would the label appear after one round of the Krebs cycle?
a) Oxaloacetate b) CO_2
c) Malate Dehydrogenase
d) NADH e) none of the above

20) Which of the following reactions are responsible for substrate level phosphorylation?
a) citrate synthase
b) isocitrate dehydrogenase
c) aconitase
d) a ketopglutarate dehydrogenase
e) succinate thiokinase

23) In E2 of the PDH enzyme complex, lipoic acid acts as:
a) The reducing compound for NAD+
b) The electron sink for decarboxylation
c) A swinging arm transfer compund
d) An FAD prostetic group
e) None of the above

14) All but one of the citric acid cycle enzymes are found in what cellular location?
a) matrix of the mitochondria
b) cytosol
c) inner mitochondrial membrane

d) in the space between the inner and outer mitochondria membrane
e) in the mind of Morpheus and Trinity!

15) Which of the following enzymes is responsible for an aldol condensation?
a) Citrate Synthase
b) Pyruvate dehydrogenase
c) Succinate Thiokinase
d) Aconitase
e) Malate dehydrogenase

16) Substrate level phosphorylation takes place when:
a) NADH enters into the TCA
b) NADH or $FADH_2$ is reduced from NAD^+ or FADH
c) When ATP is formed from ADP and P_i
d) When a protein kinase transfers a phosphoryl from ATP to a protein

18) The association of separate enzymes in large complexes in the matrix of the mitochondria are known as a:
a) Protein complexes
b) Metabolic complexes
c) Protein aggregation
d) Metabolons

4) Cytochrome C is responsible for?
a) accepting one electron at a time
b) moving between site III and IV in the space between membranes in the mitochondria
c) can cause apoptosis when a mitochondria becomes old and leaky.
d) is highly conserved throughought most organisms with an ETS
e) all of the above

5) The immediate acceptor of electrons from NADH is
a) FMN Flavin mononucleiotide
b) iron sulfur centers
c) FADH2
d) cytochrome C
e) none of the above

6) The two cycle reaction that involves a stable semiquinone is
a) FMN Flavin mononucleiotide
b) the Q cycle
c) the riske center of site I
d) involved only with complex one and Co-enzyme Q.
e) none of the above

7) The Riske Center is found in which of the following ETS complexes?
a) I b) II c) Q cycle d) III e) IV

21 What is the chemical effect of oligomycin on aerobic metabolism?
A) The flow of electrons from NADH to CoQ is blocked.
B) The flow of electrons from Cyt a-a_3 to oxygen is blocked.
C) Oligomycin blocks the proton transfer through Fo of ATP synthase and therefore blocks the phosphorylation of ADP to form ATP.
D) The transport of ATP out of and ADP into the mitochondria is blocked.
E) Oxidative phosphorylation is uncoupled from electron transport and all the energy is lost as heat.

22 The subunit of the ATPase embedded in the inner mitochondrial membrane is the ____
A) Anchor subunit
B) Membrane-c ring subunit
C) F0 subunit
D) F1 subunit
E) Fm subunit

24 How does the rotation of the c ring lead to ATP synthesis?
A) The c ring is linked tightly to the gamma and epsilon subunits in the stalk of F1
B) The c ring interacts with the beta subunit
C) The gamma subunit rotates with proton gradient formation inducing the binding-change mechanism
D) All of the above
E) None of the above

25 A diet pill which acts to increase oxygen consumption and high amount of electron transport without ATP production is likely what kind of compound?
A) 2,4 dinitrophenol
B) ATP synthase activator
C) Site I inhibitor
D) Site II activator
E) cyanide

1) Which of the following poisons would block the donation of electrons from NADH into the ETS?
a) CO, b) H_2S, c) rotenone, d) antimycin A

2) How many ATPs are potentially made when the glycerol phosphate shuttle is involved in NADH transport into the mitochondria?
a) 1 b) 2 c) 3 d) 4

3) ATP is formed when the F1 complex moves into the _____ conformation?
a) Tight
b) Lose
c) Open
d) Phosphorylated

26 In the malate-aspartate shuttle, electrons from NADH are

A) oxaloacetate
B) aspartate
C) acetate
D) glutamate
E) none of the above

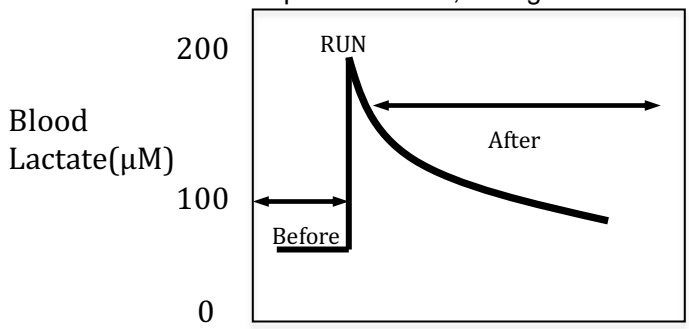
ESSAY Examples

1) AMP Kinase is activated in low energy states. Explain how this kinase is activated and how this statement is true.

2) The EF Hand of calmodulin regulates what step in glycogen metabolism? How does this calcium binding protein function?

3) Phosphorylysis vs hydrolysis… why do we care when concerning glycogenolysis? What are the key steps of phosphorylysis of glycogen?

4) The concentration of lactate in blood plasma before, during and after a 400 m sprint are shown in the graph



I. What causes the rapid rise in lactate concentration?
II. What causes the decline in lactate concentration after completion of the sprint? Why does the decline occur more slowly than the increase?
III. Why is the concentration of lactate not zero during the resting state?

5) Glucose has several metabolic fates depending on tissue, cell type, nutritional status and oxygen availability. Explain, using stoichiometry and limiting reagents how metabolism is limited to a few moles (~4) ATP or many (~30-32) moles of ATP produced per mole of metabolized glucose.

6) Phosphoenolpyruvate kinase (PEPCK) is an important enzyme in the production of glucose. This enzyme has a very short half-life in a cell and it's expression is tightly controlled. Describe the most likely method of regulation for this enzyme.

7) Glucose 6 phosphate builds up in liver with Von Gierkie's Disease. What is the cause of this and how might you suggest avoiding the G6P buildup?

8) Predict the major consequence of each of the following mutation on the action of the enzyme **AND** the effect on blood sugar concentration **WITH** a brief explanation of why this happens.
- Loss of the AMP-binding site in muscle phosphorylase
- Mutation of Ser14 to Ala14 in liver phosphorylase
- Over expression of phophorylase kinase in the liver
- Loss of the gene that codes for glycogenin in liver
- Loss of GTPase activity of the G protein alpha subunit
- Loss of the cAMP-binding site on the regulatory subunit of protein kinase A

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