5 B I O C H E M I S T R Y E X A M

November 6, 2007

NAME_____

1. The glycerol phosphate shuttle is an _____ process which functions to move _____ from one cellular compartment to another.

A) aerobic -- phosphate energy B) aerobic -- reducing power C) aerobic -- glycerol phosphate
D) anaerobic -- NADH E) anaerobic -- dihydroxyacetone-P

2. Which of the following cellular types is most likely to support the malate shuttle?

A) central nervous system neurons B) skeletal muscle cells C) red blood cells D) adipocytes
E) hepatocytes

3. Under anaerobic conditions, cytoplasmic NADH is oxidized by pyruvate, but under aerobic conditions, the NADH is oxidized by _____, depending on the cellular type.

A) glycerol-P or malate B) dihydroxyacetone-P or malate C) dihydroxyacetone-P or oxaloacetate
D) glycerol-P or oxaloacetate E) malate or pyruvate

4. The Cori cycle describes the movement of carbon atoms, in the form of glucose or lactate, between _____.

A) hepatocytes and skeletal muscle cells B) adipocytes and hepatocytes
C) skeletal muscle cells and red blood cells D) intestinal lumen and hepatocytes
E) hepatocytes and neurons of the central nervous system

5. If the reaction: ATP + creatine → Cr-P + ADP; has a ΔG° = -9.6 kJ, then the reaction: Creatine-P → P_i + Creatinine; would have a ΔG° equal to _____.

A) +21.4 kJ B) -21.4 kJ C) +40.6 kJ D) +9.6 kJ E) -40.6 kJ

6. Given the following enzyme kinetic data: glucokinase (K_m = 10 mM); hexokinase (K_m = 0.1 mM); G-6-phosphatase (K_m = 3 mM); the conversion of G-6-P into glucose occurs to a significant extent when _____.

A) [glucose] = 0.1 mM B) [glucose] = 5 mM C) [glucose] = 3 mM D) [G-6-P] = 3 mM
E) [G-6-P] = 0.1 mM

7. Digested lipids are absorbed from the intestinal mucosal cells in the form of _____.

A) ionized fatty acids B) individual fatty acids C) sphingolipids D) monoacylglycerols
E) chylomicrons

8. The 'activation' of a fatty acid, in preparation for its catabolism, requires the expenditure of _____ and leaves the fatty acid as a _____.

A) CoASH -- phosphate ester B) GTP -- conjugate base C) CoASH -- conjugate base
D) ATP -- coenzyme A ester E) carnitine -- phosphate ester

9. The effect of the agent carnitine on the catabolism of a fatty acid can best be described as _____.

A) reduction B) oxidation C) hydration D) transport E) thiolytic cleavage

10. The process called β-oxidation accomplishes the conversion of the carbons in a fatty acid to the metabolite _____.

A) CO_2 B) pyruvate C) acetyl CoA D) fatty acyl CoA E) acetoacetate(a ketone body)

11. Approximately what percentage of the ATP produced from the catabolism of a C-16 saturated fatty acid requires the combined effects of the TCA Cycle AND the electron transport system?

A) 67% B) 100% C) 25% D) 75% E) 50%

12. If an unsaturated fatty acid designated, 18:2 Δ11 Δ14, undergoes four β-oxidation sequences, the fatty acid will now be designated _____.

A) 18:2 Δ3 Δ6 B) 12:2 Δ3 Δ9 C) 10:2 Δ3 Δ6 D) 10:2 Δ2 Δ5 E) 8:2 Δ3 Δ6

13. The heat of combustion for a C-16 saturated fatty acid is 9800 kJ/mol, or about 612 kJ/carbon, while the heat of combustion for a C-6 carbohydrate is 2880 kJ/mol, or about 480 kJ/carbon. This difference in energy content exists because _____.

A) carbohydrates are water soluble B) fatty acids are more reduced
C) fatty acids are water insoluble D) fatty acid oxidation is more efficient
E) there are more carbons in fatty acids

14. Ketogenesis is normally associated with _____.

A) blood plasma B) skeletal muscle cells C) hepatocytes D) adipocytes
E) neurons of the central nervous system

15. Ketone body catabolism is regarded as _____ and takes place in _____.

A) aerobic -- red blood cells B) aerobic -- skeletal muscle cells C) anaerobic -- adipocytes
D) aerobic -- hepatocytes E) anaerobic -- hepatocytes

16. Protein digestion is _____, with the digestion products being absorbed from the intestinal lumen via the _____.

A) hydrolytic -- hepatic portal vein B) hydrolytic -- lymphatic system
C) reductive -- hepatic portal vein D) oxidative -- hepatic portal vein
E) oxidative -- lymphatic system

17. Complete the reaction for the oxidative deamination of the amino acid glutamate (glu): glu + _____ → α-ketoglutarate + NH_3 + _____.

A) alanine -- pyruvate B) NAD^+ -- NADH C) $FADH_2$ -- FAD D) H^+ -- CO_2 E) ATP -- ADP

18. A transamination reaction using a six carbon amino acid and pyruvate as reactants will yield alanine and _____ as products.

A) oxaloacetate B) ammonia C) glutamate D) aspartate E) a six carbon α-keto acid

19. If the catabolic pathway for an amino acid goes through several steps, including a decarboxylation reaction, with the remaining carbon atoms forming acetoacetate only, the amino acid is regarded as _____.

A) ketogenic B) essential C) both glycogenic and ketogenic D) glycogenic E) aromatic

20. Which of the following glycolytic steps is not reversed during hepatic gluconeogenesis?

A) phosphoenolpyruvate → pyruvate B) 3-phosphoglycerate → 2-phosphoglycerate
C) pyruvate → lactate D) dihydroxyacetone-P → glyceraldehyde-3-P E) G-6-P → F-6-P

21. Which of the following is a viable glucose precursor?

A) acetoacetate B) succinate C) palmitate D) acetyl CoA E) unsaturated fatty acids

22. In most cellular environments gluconeogenesis stops at G-6-P, but in _____, the pathway forms glucose.

A) red blood cells B) hepatocytes C) skeletal muscle cells D) neurons of the C.N.S.
E) adipocytes

23. The hormone glucagon can best be described as being formed in the _____ in response to _____.

A) pancreas -- falling blood sugar B) adrenal medulla -- falling blood sugar
C) adrenal cortex -- increasing blood sugar D) pancreas -- increasing blood sugar
E) adrenal medulla -- increasing blood sugar

24. cAMP activity in hepatocytes ceases when _____.

A) cAMP is hydrolyzed to AMP B) intracellular [ATP] increases
C) adenyl cyclase is no longer stimulated by glucagon D) cAMP leaves the hepatocyte
E) Both 'A' and 'C' are correct

25. Gluconeogenesis is the major source of glucose in the blood plasma after about _____ hours since a meal.

A) 2 B) 4 C) 20 D) 8 E) 10

M A T C H I N G

THE ITEMS 26-30 REFER TO THE LIST AT THE RIGHT. THERE IS ONLY ONE CORRECT ANSWER FOR EACH ITEM 26-30, BUT A GIVEN RESPONSE FROM THE LIST AT THE RIGHT MAY BE USED MORE THAN ONCE.

26. Ketogenesis starts with this metabolite.

27. This pathway moves reducing power reversibly between the cytoplasm and the mitochondrion.

28. The condition called PKU comes about because of a problem in the catabolism of this amino acid.

29. The carbon atoms in a fatty acid are converted to carbon dioxide by this pathway.

30. Lipid digestion takes place under the influence of this enzyme.

A) Transamination
B) Malate shuttle
C) Gycerol phosphate shuttle
D) Steapsin
E) Phsnylpyruvate
AB) Acetyl CoA
AC) Pyruvate
AD) TCA Cycle
AE) Ketogenesis
BC) β-ketothiolase
BD) β-oxidation
BE) β-oxoacid coenzyme A transferase
CD) Lactate
CE) Tyrosine
DE) Phenylalanine

T R U E - - - F A L S E
(A) (B)

31. Extracellular glucagon encourages the production of intracellular cAMP in hepatocytes.

32. The more skeletal muscle activity a person performs, the more creatinine he/she will excrete.

33. The effect of the hepatic enzyme G-6-phosphatase is to guarantee that glucose does not move from the liver to the blood plasma.

34. The more double bonds in a fatty acid, the fewer ATP's per carbon will be produced when the fatty acid is oxidized.

35. Transmination reactions routinely produce large amounts of ammonia.

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1-B 2-E 3-C 4-A 5-E 6-D 7-E 8-D 9-D 10-C 11-D 12-C 13-B 14-C 15-B 16-A 17-B 18-E 19-A 20-A
24-E 25-C 26-AB 27-B 28-DE 29-AD 30-D 31-A 32-A 33-B 34-A 35-B