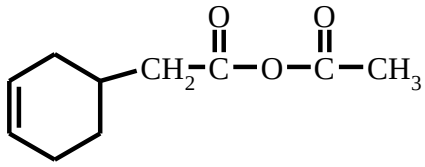
NAME_____

Physiological Chemistry II
Final
Dr. Melissa Kelley
April 27, 2004

Provide the one best answer for each, following the instructions given in each section of the exam. You have 2 hours to complete the exam.

Match the functional group listed below with the compounds shown below. Questions 1a-f.

Anhydride	Ketone	Aldehyde	Amide	Carboxylic acid
Ester	Alcohol	Ether	Amine	Lactone



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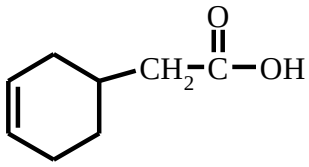

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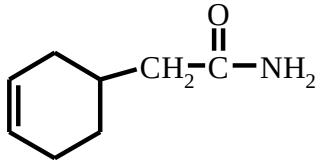

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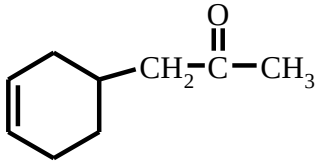

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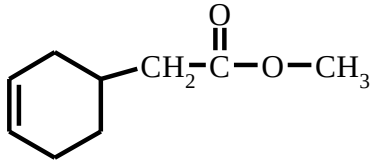

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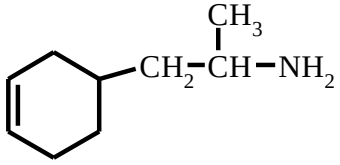


f._____

Multiple Choice: Select the one best answer to each question. Questions 2-39.

_____2. Which of the following amino acids would likely be located on the exterior of a protein?
A. Aspartate
B. Isoleucine
C. Phenylalanine
D. Tryptophan

_____3. Addition of water to an alkene will yield which of the following products?
A. Aldehyde
B. Ketone
C. Anhydride
D. Alcohol

_____4. Which of the following compounds is an intermediate in the TCA cycle?

A. Oxaloacetate
B. Aspartate
C. Ornithine
D. Citrulline

_____5. Which of the following pathways is used to produce ribose?

A. Glycolysis
B. Gluconeogenesis
C. Pentose phosphate pathway
D. β-oxidation

_____6. Which of the following amino acids would be involved in a salt bridge of a protein?

A. Serine
B. Cysteine
C. Methionine
D. Lysine

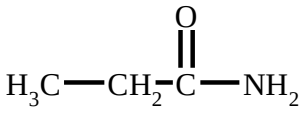
_____7. Oxidation of a secondary alcohol will yield which of the following products?

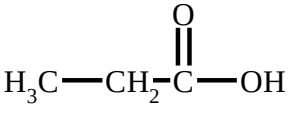
A. Amide
B. Ketone
C. Ester
D. Ether

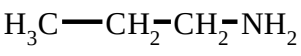
_____8. Which of the following lipids would not be found in animal cell membranes?

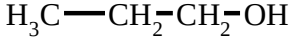
A. Phospholipids
B. Triacyglycerides
C. Sphingolipids
D. Cholesterol

_____9. Which of the following compound is a base?

A. 

B. 

C. 

D. 

_____10. Which of the following is the central dogma of molecular biology?

A. DNA? RNA? Protein? DNA
B. DNA? DNA? RNA? Protein
C. RNA? Protein? DNA? DNA
D. Protein? DNA? RNA? DNA

_____11. Which of the following statements about enzymes is **not correct**?

A. Enzymes do not alter the equilibrium of a reaction.
B. Enzymes are reused and regenerated.
C. Enzymes increase the energy barrier of a reaction.
D. Enzymes accelerate the rate of the reaction.

_____12. Which of the following compounds is **not** an intermediate of the urea cycle?

A. α-ketogluterate
B. Citrulline
C. Ornithine
D. Arginine

_____13. Which of the following is **not true** of electron transport and oxidative phosphorylation?

A. NAD and FAD from the TCA cycle are used to generate ATP in the electron transport chain.
B. Electrons are passed through protein complexes containing cytochromes.
C. Protons are pumped from the mitochondrial matrix to the intermembrane space of the mitochondria.
D. Oxidative phosphorylation involves formation of ATP.

_____14. Anhydrides react with amines to form which of the following products?

A. Carboxylic acid and an ester
B. Carboxylic acid and an amide
C. Alcohol and an amide
D. Alcohol and an ester

_____15. Ferritin is an iron storage protein, which has a bundle of α-helices that it uses to bind iron. Which of the following levels of protein structure best defines these α-helices?

A. Primary structure
B. Secondary structure
C. Tertiary structure
D. Quaternary structure

_____16. Which of the following is **not true** of glucose?

A. It is an aldohexose.
B. It is the end product of gluconeogenesis.
C. It is a reducing sugar.
D. It can be used to form ketone bodies.

_____17. Hydrolysis of an ester will yield which of the following products?

A. Carboxylic acid and an alcohol
B. Carboxylic acid and an ether
C. Amide and an ether
D. Anhydride and an amine

_____18. Which of the following best describes glycogen?

A. A polymer of ribose residues joined by *beta*-1,4-glycosidic bonds with 1,6 branches.
B. A polymer of ribose residues joined by *alpha*-1,4-glycosidic bonds with 1,6 branches.
C. A polymer of glucose residues joined by *beta*-1,4-glycosidic bonds with 1,6 branches.
D. A polymer of glucose residues joined by *alpha*-1,4-glycosidic bonds with 1,6 branches.

_____19. Which of the following statements is **not true**?

A. Acetyl-CoA is a thioester.
B. Ketone bodies are produced from Acetyl-CoA.
C. All carbons in cholesterol are from Acetyl-CoA.
D. The end product of lipogenesis is Acetyl-CoA.

_____20. Which of the following hormones stimulates lipogenesis?

A. Insulin
B. Glucagon
C. Prostaglandins
D. Vitamin A

_____21. The bond that connects the base to the sugar in DNA or RNA is:

A. A phosphate ester bond.
B. A phosphate anhydride bond.
C. A N-glycosidic bond.
D. A phosphate nitrogen bond.

_____22. Arachidonic acid serves as a precursor to which of the following compounds?

A. Cholesterol
B. Acetyl-CoA
C. Leukotrienes
D. Oxaloacetate

_____23. The carbons of the amino acid cysteine are metabolized to pyruvate. Which of the following best describes cysteine?

A. Cysteine is a ketogenic amino acid.
B. Cysteine is a glucogenic amino acid.
C. Cysteine is both a glucogenic and ketogenic acid.
D. Cysteine is neither a glucogenic or ketogenic amino acid.

_____24. Which of the following statements is **not correct**?

A. TAG mobilization from adipocytes occurs when insulin levels are high.
B. TAG storage in adipocytes requires glycerol-3-phosphate.
C. Fatty acids are esterified to glycerol-3-phosphate.
D. TAG mobilization results in many fatty acids released into the blood stream bound to serum albumin.

_____25. Which of the following amino acids serves as a carrier of amino groups into the urea cycle?

A. Aspartate
B. Citrulline
C. Glutamate
D. Ornithine

_____26. In the 1950's Watson and Crick proposed the DNA double helix as a model for DNA structure. Which of the following statements concerning the DNA double helix is **not correct**?

A. The bases are located on the outside of the helix.
B. The bases are capable of hydrogen bonding.
C. The two strands are antiparallel.
D. The DNA molecule consists of two polynucleotide strands.

_____27. In lipogenesis, Acetyl-CoA does not cross the mitochondrial membrane but condenses with oxaloacetate to form which of the following compounds that crosses the mitochondrial membrane?

A. Acetoacetate
B. Citrate
C. Aspartate
D. β-hydroxybuterate

_____28. In lipogenesis, the carbons required for a fatty acid to elongate come from which of the following sources?

A. Acetoacetate
B. Malate
C. Pyruvate
D. Malonyl-CoA

_____29. Which of the following lipids contain sphigosine as a backbone?

A. Phospholipids
B. TAG
C. Cholesterol
D. Glycolipids

_____30. Which of the following is **not true** of ketone body formation?

A. During starvation β-oxidation of fatty acids leads to decrease in Acetyl-CoA and decrease in ketone body formation.
B. Acetoacetate, β-hydroxybuterate and acetone are ketone bodies.
C. Ketone bodies are carboxylic acids.
D. Some amino acids can make ketone bodies.

_____31. Which of the following is **true** of DNA?

A. DNA contains the bases A, G, C, and T and ribose as the sugar.
B. DNA contains the bases A, G, C, and T and deoxyribose as the sugar.
C. DNA contains the bases A, G, C, and U and ribose as the sugar.
D. DNA contains the bases A, G, C, and U and deoxyribose as the sugar.

_____32. Which of the following compounds is the end product of β-oxidation?

A. Malonyl-CoA
B. Oxaloacetate
C. Acetyl-CoA
D. Glutamate

_____33. Which of the following serves as the five carbon unit that undergoes condensation reactions in cholesterol synthesis?

A. Isoprenes
B. Arachidonic acid
C. Leukotrienes
D. Malonyl-CoA

_____34. Biosynthesis of glutamate requires which of the following as a carbons source?

A. Oxaloacetate
B. α-ketogluterate
C. Pyruvate
D. Aspartate

_____35. Long chain unsaturated fatty acids can be converted to saturated fatty acids by which of the following reactions?

A. Transamination
B. Oxidative deamination
C. Hydrogenation
D. Claisen condensation

_____36. These sugars are usually found attached to proteins that are responsible for blood typing:

A. Monosaccharides
B. Disaccharides
C. Oligosaccharides
D. Polysaccharides

_____37. Which of the following statements about phospholipids is **incorrect**?

A. They contain a phosphoanhydride bond.
B. They contain glycerol as the backbone.
C. The contain two fatty acids
D. They contain a polar phosphate group.

_____38. Which of the following is **not tru**e of β-oxidation?

A. $FADH_2$ is produced.
B. NADH is produced.
C. β-oxidation is stimulated in response to glucagon.
D. β-oxidation is stimulated in response to insulin.

_____39. This compound is formed in the liver from Acetyl-CoA during starvation as a source of carbon units for brain metabolism.

A. Acetoacetate
B. Cholesterol
C. Malonyl-CoA
D. Glutamate

Associate the Following Pathways with the Reactions Presented. Questions 40-46.

_____40. Pentose Phosphate Pathway

_____41. Glycolysis

_____42. Urea cycle

_____43. Gluconeogenesis

_____44. β-oxidation

_____45. Lipogenesis

_____46. Glycogen synthesis

A. Palmitic acid ? 8 Acetyl-CoA + 7 NADH + 7 $FADH_2$

B. 2 Lactate + 6 ATP ? Glucose

C. Glycogen + Pi ? Glucose-1-phosphate

D. $NH_4^+ + CO_2$ + 2 ATP ? Carbamoyl phosphate

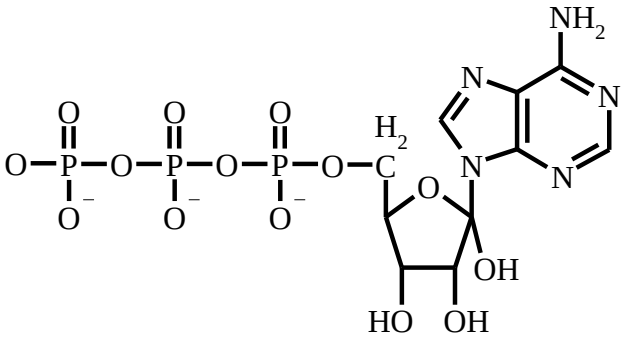
E. Glucose ? 2 Pyruvate + 2 ATP

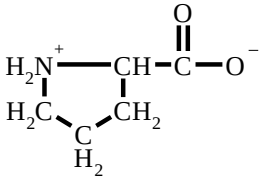
F. Glucose-6-P + 2 NADP ? Ribose-5-P + 2 NADPH

G. Glucose-1-P + UTP ? UDP-glucose + PPi

H. 7 Acetyl-CoA + 14 NADPH ? Myristic acid

Name or identify the compounds shown below. Questions 47-61.





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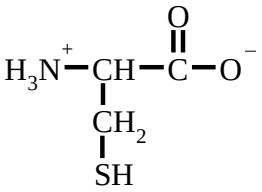

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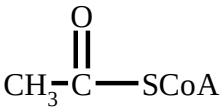

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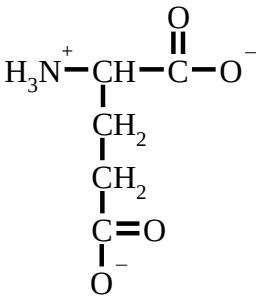

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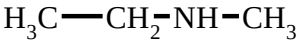

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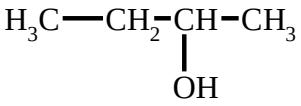

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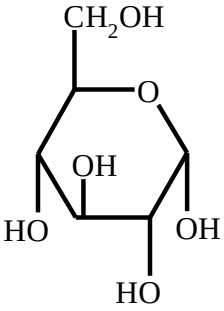

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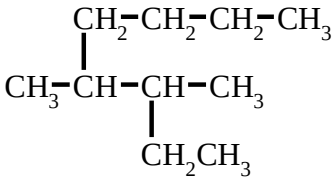

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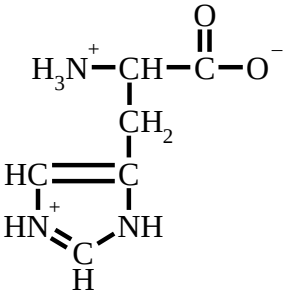

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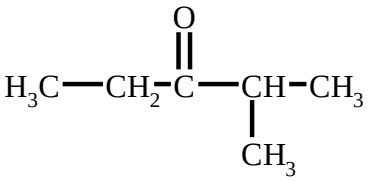

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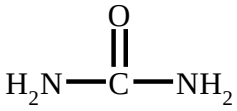

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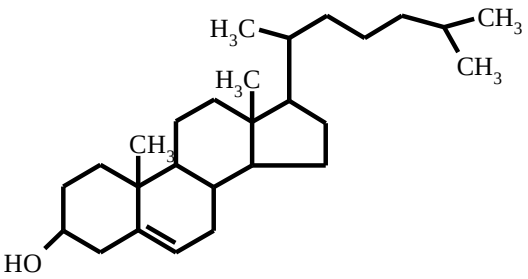

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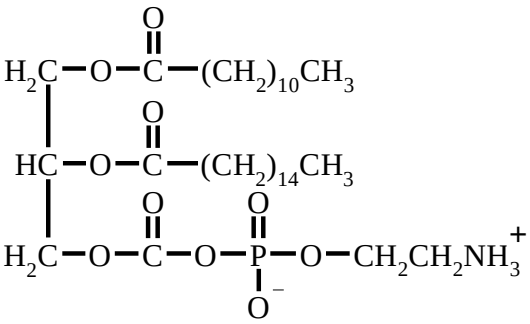

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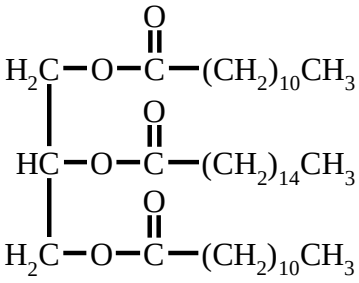


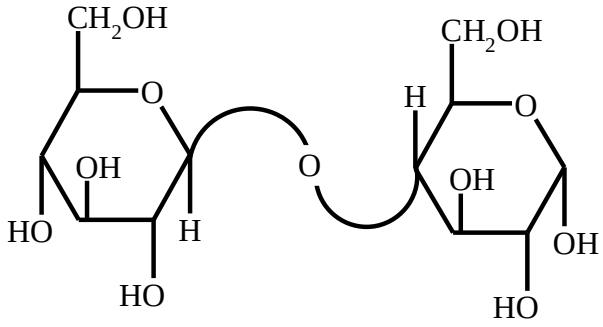
61._____

Short answer, fill in the blank (giving one or two word responses). If multiple answers are correct, any one answer is acceptable. Questions 62-75

62. Given the DNA sequence below, write the complementary sequence of the second strand of DNA.

5'-AGCTAGGTT-3'

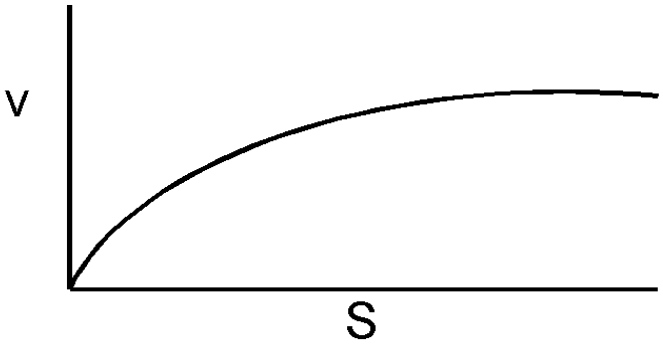
63. (3 points) Shown below is a disaccharide. Identify if this a reducing or non-reducing sugar. Circle the anomeric carbon. Place a square around all the atoms involved in the glycosidic linkage.



_____64. This vitamin serves as a precursor to the cofactors NAD, NADP, NADH, and NADPH. Name this vitamin.

65. In the space provided below, draw the structure of 3-propylcyclohexene.

66. In the chart below, the change in reaction rate (v) versus increasing substrate concentration for an uninhibited enzyme is shown. Draw the curve expected if a non-competitive inhibitor is added to the reaction.



_____67. This vitamin serves as a precursor to the cofactors FAD, FMN, and $FADH_2$. Name this vitamin.

68. In the space provided below draw the structure of β-D-glucose.

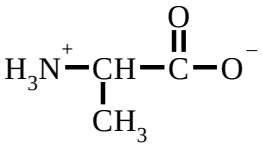
_____69. Nucleic acids are long polymers of nucleotides connected by what type of bond?

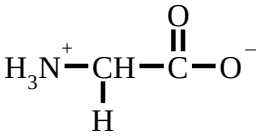
_____70.This vitamin is essential in vision and growth promoting activity. Name the vitamin.

71. In the space provided below draw the structure of 2-ethylheptanal.

72. In the space provided below draw the structure of α-D-ribose.

73. (4 points) Shown below are alanine and glycine. Draw the dipeptide that would form if glycine is the N-terminal amino acid and alanine is the C-terminal amino acid. Place a square around the atoms involved in the peptide bond.



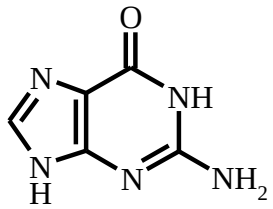


74. (5 points) In this class we talked about how Acetyl-CoA is made through metabolism. Name two compounds that acetyl-CoA serves as a precursor to:

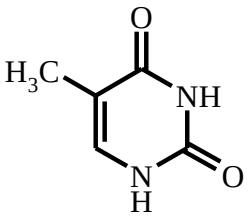
1.

2.

75. (4 points each) Shown below are the bases. Name the base, identify whether the base is a purine or pyrimidine, and whether the base is found in DNA, RNA or both.



a._____



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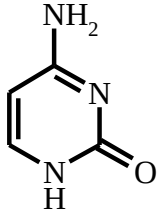

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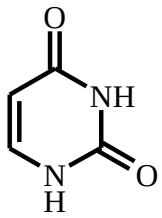

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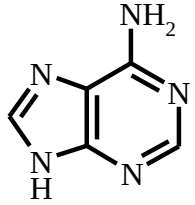
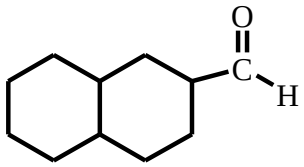


e._____

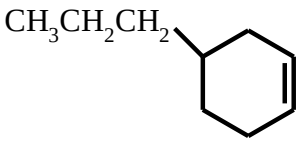
In the following questions, provide the product of the reaction given. If there is no reaction, specify no reaction (NR) in the answer. Questions 76-83.

76.



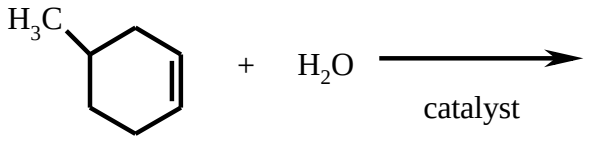
Mild oxidation →

77.

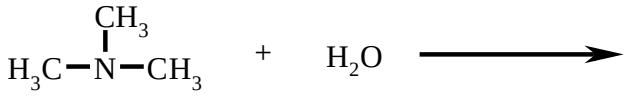


+ H_2 → (Pd, catalyst)

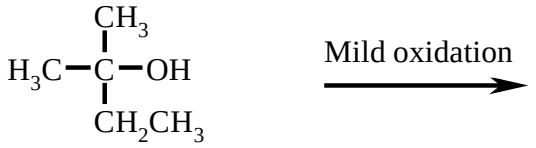
78.



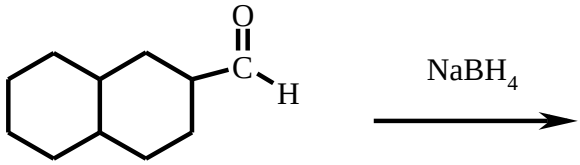
79.



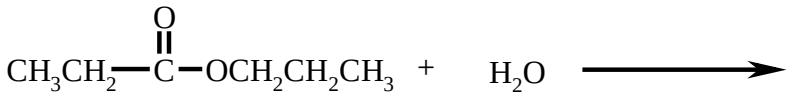
80.



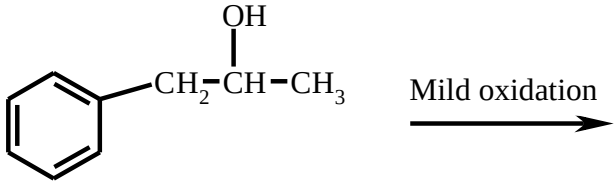
81.



82.



83.



HAVE A GREAT SUMMER!!!!