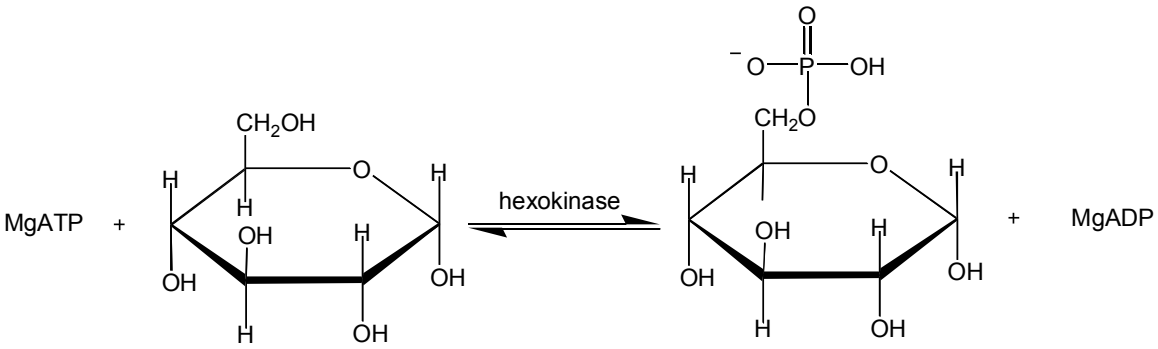
BMB 401 EXAM 4
May 8, 2003

Please write your name on your exam sheet and turn it in with your Scantron sheet!

Do not forget to include your student ID on the Scan Tron Sheet. It is not necessary to include a section number.

People whose last names begin with A–C should report to room 107 Ag Sci.

1. The reaction catalyzed by hexokinase is shown below.



How is it that hexokinase can discriminate between glucose and water as the acceptor of the phosphate group of ATP?

a. The active site of hexokinase is absolutely complementary to glucose as in a lock and key model of enzyme catalysis.

b. Water is excluded from the active site because the active site is completely nonpolar.

c. Glucose acts as a positive homotropic effector of hexokinase, whereas water does not.

d. Glucose binding to hexokinase induces a large conformational change that prepares the active site for catalysis.

e. The binding site for ATP in the hexokinase reaction is created only after glucose binds in this ordered sequential reaction.

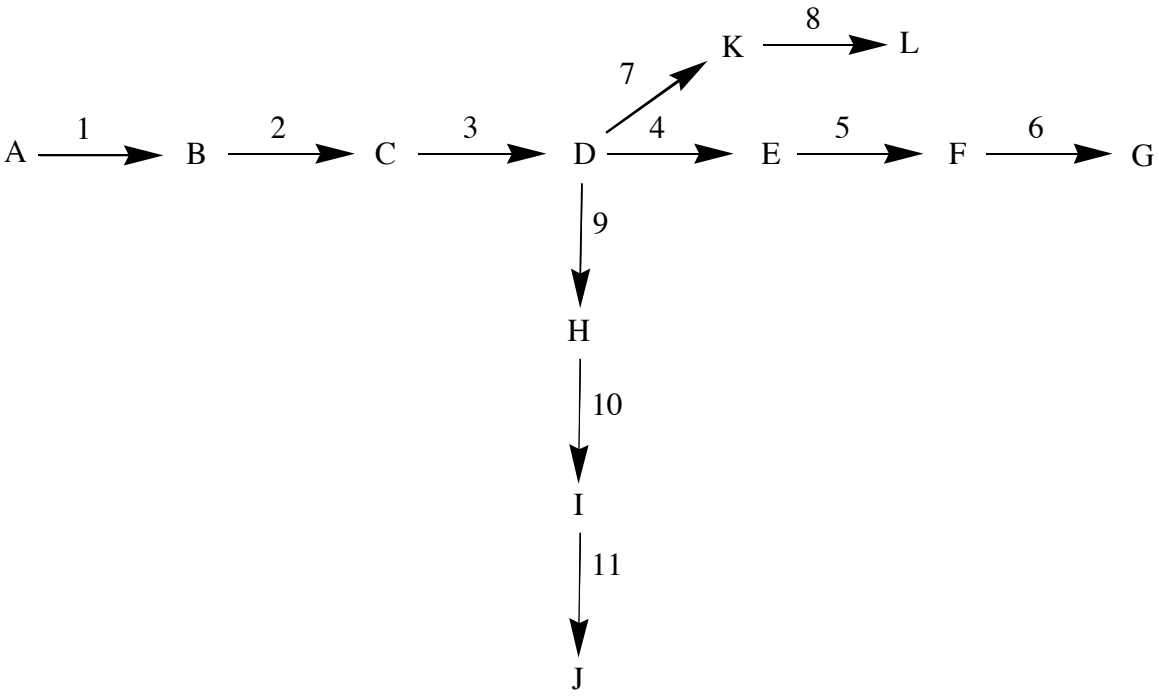
2. As a means of regulation via kinetic processes, the concentration of the substrate for a specific enzyme in the cell is very often found to be which of the following?
   a. Approximately equal to the K_m value
   b. Much less than the K_m value
   c. Much greater than the K_m vale
   d. Equal to or greater than kcat/K_m
   e. Equal to the concentration of enzyme

3. Which of the following is NOT a common regulatory post-translational modification?
   a. Ethylation
   b. Phosphorylation
   c. ADP-ribosylation
   d. Methylation
   e. Uridylylation

4. The primary control in the clotting of blood is which of the following?
   a. Kinetic control via *in vivo* substrate concentration
   b. Post-translational modification
   c. Enzyme activation by proteolytic cleavage
   d. Subunit association to form different isozymes
   e. Allostery

5. Enzymes that are synthesized in an inactive state and which must be proteolytically processed before becoming active are called which of the following?
   a. Isozymes
   b. Zymogens
   c. Diastereomers
   d. Homotropozymes
   e. Hemiacetals

Assume that the flow diagram shown below represents an amino acid biosynthetic pathway where letters represent metabolites in the biosynthesis of amino acids (L, G, and J represent the final amino acids), and numbers represent the individual enzymes that catalyze each transformation.



6. Enzyme 1 in the pathway would be feedback inhibited by which of the following metabolites?
   a. G
   b. D
   c. L
   d. J
   e. None of the above

7. What enzyme(s) would L regulate by feedback inhibition?
   a. 3
   b. 7
   c. 1
   d. both 7 and 3
   e. enzymes 7, 3, and 1

8. The complete oxidation of which organic fuel produces the greatest energy in metabolic reactions per gram in the cell?
   a. protein
   b. triacylglycerols
   c. carbohydrates
   d. DNA
   e. RNA

9. Membrane lipids in a lipid bilayer are held together primarily by which of the following forces?
   a. Hydrophobic forces
   b. Electrostatic forces
   c. Hydrogen bonds
   d. Covalent bonds
   e. Dipole interactions

10. Indicate the number of possible stereoisomers for a linear aldopentose.
   a. 2
   b. 4
   c. 6
   d. 8
   e. 10

11. Which carbon on glucose determines whether it is the D- or L-stereoisomer?
   a. 2
   b. 3
   c. 4
   d. 5
   e. 6

12. Which of the following is not a property of D-glucose?
   a. In aqueous solution, it can spontaneously form pyranose ring structures.
   b. It is an epimer of L-galactose
   c. It is the repeating unit of glycogen
   d. It is a reducing sugar
   e. Its mirror image is called L-glucose

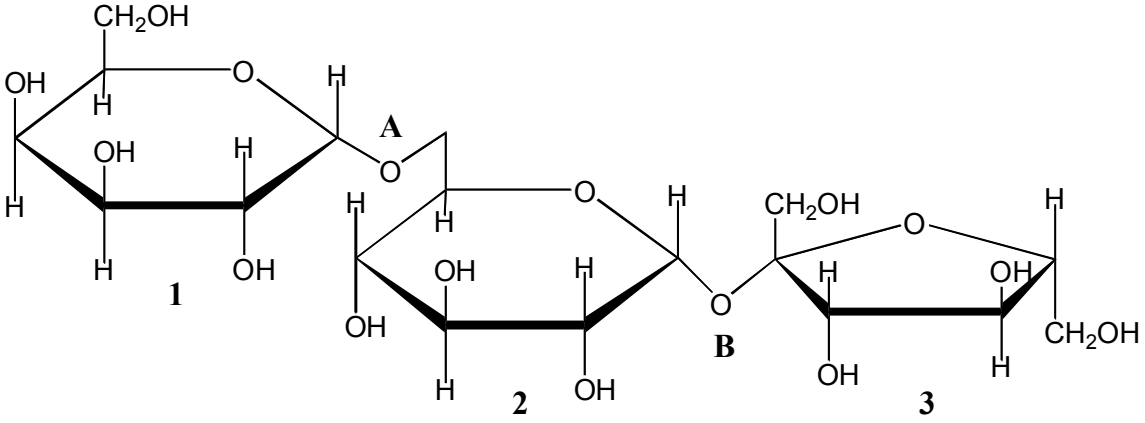
13. Which of the following sugars is classified as a ketose?
   a. Galactose
   b. Mannose
   c. Fructose
   d. Lactose
   e. Maltose

14. Which of the following molecules cannot undergo mutarotation?
    a. α-D-glucose
    b. β-D-glucose
    c. Lactose
    d. Maltose
    e. Sucrose

15. Which of the following pairs of sugars consists of epimers?
    a. D-glyceraldehyde and dihydroxyacetone
    b. D-glucose and D-mannose
    c. D- glucose and D-fructose
    d. α-D-glucose and β-D-glucose
    e. both b and c

16. Which of the following pairs of sugars consists of anomers?
    a. D-glyceraldehyde and dihydroxyacetone
    b. D-glucose and D-mannose
    c. D- glucose and D-fructose
    d. α-D-glucose and β-D-glucose
    e. both b and c

The structure of raffinose, a trisaccharide, is shown below.

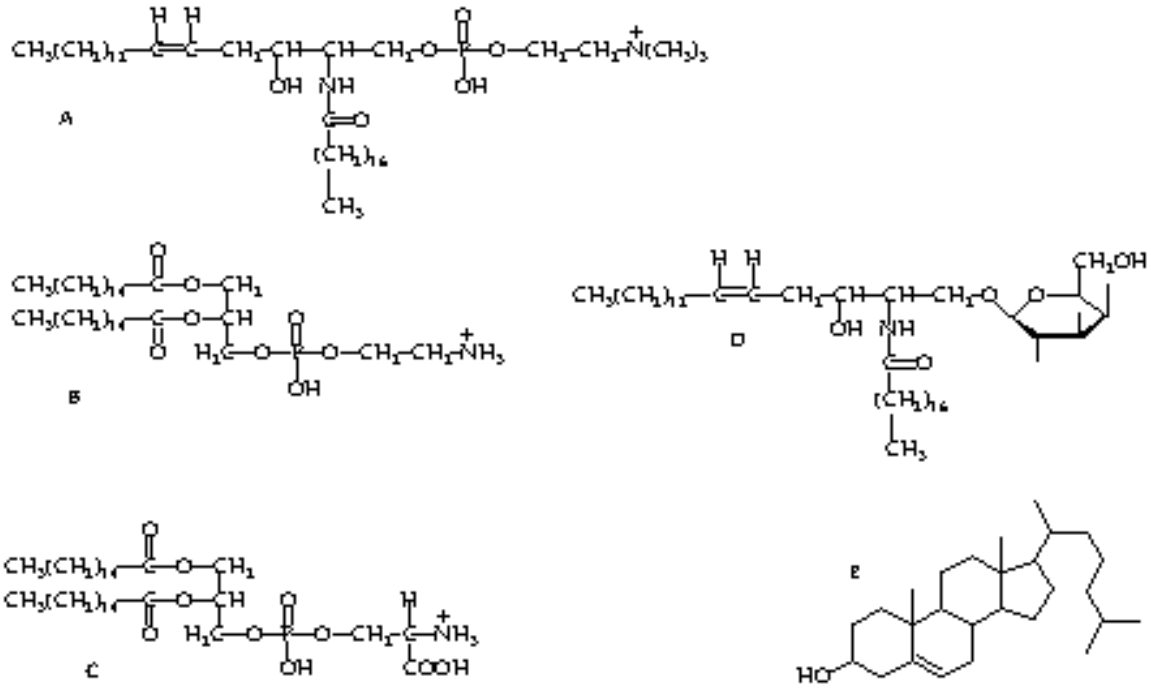


17. What are the three sugars (1, 2, 3 from left to right) that compose raffinose?
    a. Glucose, galactose, arabinose
    b. Galactose, glucose, arabinose
    c. Galactose, glucose, fructose
    d. Glucose, galactose, fructose
    e. Mannose, glucose, fructose

18. What is the linkage between sugars 1 and 2?
    a. □1□ 1
    b. □1□ 1
    c. □1□ 6
    d. □1□ 6
    e. □1□ 5

19. Which of the following is true about raffinose?
    a. Only one of its constituent sugars is a ketose
    b. All of its constituent sugars are aldoses
    c. Raffinose is not a reducing sugar
    d. Both b and c are true
    e. Both a and c are true

Answer the following questions (20 – 22) about the lipid molecules drawn below.



20. Which of the above structures has an ethanolamine head group?
    a. A
    b. B
    c. C
    d. D
    e. E

21. Which of the above structures is classified as a sterol?
    a. A
    b. C
    c. D
    d. E
    e. Both D and E

22. Which of the above compounds would be expected to lie completely within the membrane?
    a. A
    b. B
    c. C
    d. D
    e. E

23. Which of the following is not a fat-soluble vitamin?
    a. A
    b. K
    c. C
    d. D
    e. E

24. Fatty acids that contain no double bonds between two consecutive carbon atoms of the alkyl chain are referred to as which of the following?
    a. saturated
    b. monounsaturated
    c. polyunsaturated
    d. rancid
    e. hydrated

25. Hydrogenation of fatty acids has which of the following effects on them?
    a. It lowers the melting temperature of the fatty acids.
    b. It creates saturated fatty acids from unsaturated fatty acids.
    c. It creates unsaturated fatty acids from saturated fatty acids.
    d. Both a and b
    e. Both a and c

26. Which of the following is false concerning fatty acids that are found in nature?
    a. Almost all double bonds that are found in fatty acids are in the cis configuration.
    b. Almost all double bonds that are found in fatty acids are in the trans conformation
    c. Almost all fatty acids have an odd number of carbons
    d. Both a and c
    e. Both b and c

27. Waxes are formed upon condensation of which of the two following?
    a. 2 fatty alcohols
    b. 2 fatty acids
    c. A fatty alcohol and a fatty acid
    d. A fatty alcohol and a fatty amide
    e. A fatty acid and an ether

28. Which of the following would be expected to contain a fatty acid linked to a backbone structure by an amide linkage?
    a. Triacylglycerols
    b. Glycerophospholipids
    c. Sphingolipids
    d. Waxes
    e. Sterols

29. Which of the following concerning membranes is true?
    a. Only phospholipids are present in membranes.
    b. Lateral movement of molecules in membranes is incredibly slow.
    c. Phospholipids can flip easily from one leaflet of a membrane to the other without facilitation by an enzyme.
    d. Proteins can only associate with membranes via fatty acid anchors.
    e. Both a and d

30. If the pKa associated with loss of the phosphate proton of a glycerophospholipid is 2.15, estimate the isoelectric point of a generic phosphatidylserine.
    a. 4.35
    b. 5.7
    c. 9.2
    d. 2.2
    e. 5