

Chem 464 Biochemistry

Multiple choice (4 points apiece):

1. Sphingosine is not a component of:
A) **cardiolipin.**
B) ceramide.
C) cerebrosides.
D) gangliosides.
E) sphingomyelin.
2. Which of the following is true of sphingolipids?
A) **Cerebrosides and gangliosides are sphingolipids.**
B) Phosphatidylcholine is a typical sphingolipid.
C) They always contain glycerol and fatty acids.
D) They contain two esterified fatty acids.
E) They may be charged, but are never amphipathic.
3. Circle the fatty acid in each pair that has the higher melting temperature.
(a) **18:1 Δ 9** 18:2 Δ 9,12
(b) 18:0 18:1 Δ 9
(c) 18:0 16:0
4. Which of these statements about the composition of membranes is true?
A) All biological membranes contain cholesterol.
B) Free fatty acids are major components of all membranes.
C) **The inner and outer membranes of mitochondria have different protein compositions.**
D) The lipid composition of all membranes of eukaryotic cells is essentially the same.
E) The lipid:protein ratio varies from about 1:4 to 4:1
5. Which of these is a general feature of the lipid bilayer in all biological membranes?
A) **Individual lipid molecules are free to diffuse laterally in the surface of the bilayer.**
B) Individual lipid molecules in one face (monolayer) of the bilayer readily diffuse (flip-flop) to the other monolayer.
C) Polar, but uncharged, compounds readily diffuse across the bilayer.
D) The bilayer is stabilized by covalent bonds between neighboring phospholipid molecules.
E) The polar head groups face inward toward the inside of the bilayer.
6. The type of membrane transport that uses ion gradients as the energy source is:
A) facilitated diffusion
B) passive transport.
C) primary active transport.
D) **secondary active transport.**
E) simple diffusion.

7. When a mixture of glucose 6-phosphate and fructose 6-phosphate is incubated with the enzyme phosphohexose isomerase (which catalyzes the interconversion of these two compounds) until equilibrium is reached, the final mixture contains twice as much glucose 6-phosphate as fructose 6-phosphate. Which one of the following statements is best applied to this reaction outlined below?

($R = 8.315 \text{ J/mol}\cdot\text{K}$; $T = 298 \text{ K}$)

Glucose 6-phosphate \rightarrow fructose 6-phosphate

- A) ΔG° is incalculably large and negative.
- B) ΔG° is -1.72 kJ/mol .
- C) ΔG° is zero.
- D) ΔG° is $+1.72 \text{ kJ/mol}$.
- E) ΔG° is incalculably large and positive.

8. Define or identify the following terms: (2 points each)

lipase

An enzyme that hydrolyses the Fatty Acid - glycerol bond in a triacylglycerol. Note that the enzymes that hydrolyze the bonds in phospholipids are phospholipases

neutral glycolipid

Another name for globosides and cerebroside - glycosphingolipids with uncharged sugars attached

liposome

A hollow sphere bounded by a lipid bilayer that forms spontaneously when lipids of the right compositions are mixed with water.

Peripheral Membrane Protein

Proteins loosely associated with a membrane through hydrogen bond or electrostatic interactions.

F-type ATPase

While classed as an ATPase because it degrades ATP to ADP and P_i when isolated in a test tube, this class of enzymes are actually ATP synthases in biological systems using a proton gradient to put ADP and P_i together to form ATP.

9. (10 points) I have just analyzed lipid samples from an extra-terrestrial organism found on the planet Fluorine. Biochemically these organisms are similar to earthly organisms, except that hydrogens are often replaced with fluorines. Below are three compounds found in the cellular membrane of organisms found in different locations of the planet.

- A. $\text{CF}_3\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-COOF}$
- B. $\text{CF}_3\text{-CF}_2\text{-CF}_2\text{-CF=CF-CF}_2\text{-CF=CF-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-COOF}$
- C. $\text{CF}_3\text{-C}\equiv\text{C-CF}_2\text{-C}\equiv\text{C-CF}_2\text{-C}\equiv\text{C-CF}_2\text{-C}\equiv\text{C-CF}_2\text{-COOF}$

One organism was found in a volcanic vent, another on the planet's surface at the equator, and the third was on a mountain top near the north pole. Unfortunately my lab assistant, Jared L. forgot to label which sample was which. Which compound do you think came for which location and why?

To keep the membrane fluid, you want the most solid lipid with the highest melting point in the volcano, and the most fluid lipid with the lowest melting point in cold polar mountain top. The usual logic is that the more double bonds you have the more fluid the lipid so you would put A in the vent, B at the equator and C at the polar mountain. However the good organic chemist recognizes that the $\text{C}\equiv\text{C}$ in #C is linear so this be a long rigid molecule and would have the highest melting point of all, so the real order is: C - volcanic vent, A- equator, B-polar mountain

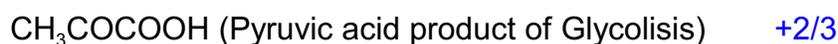
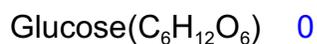
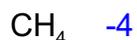
10. Eicosanoids are signal lipids derived from arachidonic acid. What are the three major classes of eicosanoids and how do their structures differ from each other? (You don't need to get the structures exactly right, just show the key structural features that differentiate one class from another)

11. What does the term lipid corral refer to?

12. Ions can be transported across membranes using with transporter proteins or ion-channels. How can these transport mechanisms be distinguished kinetically?

13. In class we discussed how the model of how Voltage-gated Sodium channel sense voltage changes, and then discussed some new information of voltage gated potassium channels that gave used a different model. What are the differences between the voltage gated Sodium channel discussed in the book and the new model for the voltage gated potassium channel.

14. Below are several compounds. Calculate the oxidation state for C in each compound and rank the compounds from highest energy potential to lowest energy potential. If the compound contains more than 1 C, find an 'average' oxidation number.



15. Can be substituted for any questions 8-14

During the preparation of Bearnaise sauce, egg yolks are incorporated into melted butter to stabilize the sauce and avoid separation of the butter from the sauce. The stabilizing agent in the egg yolks is lecithin (phosphatidylcholine). Suggest why this works.

Lecithin is an amphiphatic detergent that will act like an emulsifier. The water insoluble lipid in the butter will associate with the lipid part of the detergent, while the polar part of the detergent will keep the lipid soluble by forming micelles or vesicles with the lecithin.

1. Ans: A
2. Ans: A
3. Ans: (a) 18:1Δ9 (b) 18:0 (c) 18:0
4. Ans: C
5. Ans: A
6. Ans: D
7. Ans: D