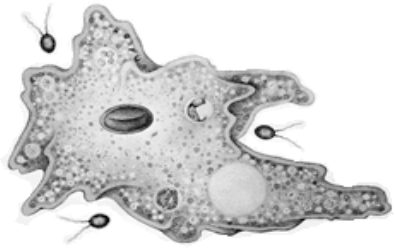
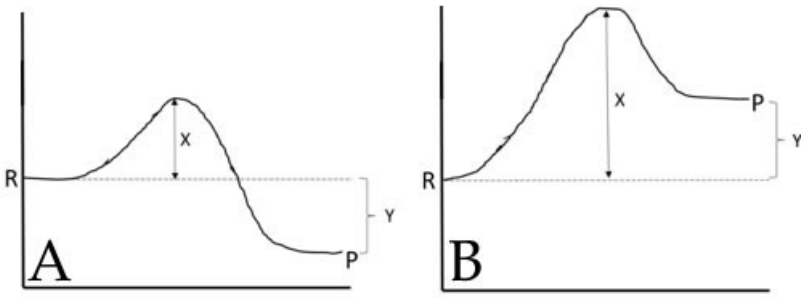
**MCDB 1150-003 Biofundamentals NAME**_____
**Midterm 2 - Fall 2015**



**Directions:** There are 20 questions, each worth 5 points. Remember, you can check "no idea" and you will receive 1 point (no reasoning is required).

As before, in some cases you are asked to select the wrong answer, otherwise pick the correct answer. **READ CAREFULLY** to determine what the question wants you to do next**!**

**Q1: Consider two chemical reactions, described by the reaction coordinate graphs A and B.**




These reactions involve reactants (R) and products (P). Which reaction is thermodynamically favorable?

□ A □ B □ C - impossible to tell □ no idea

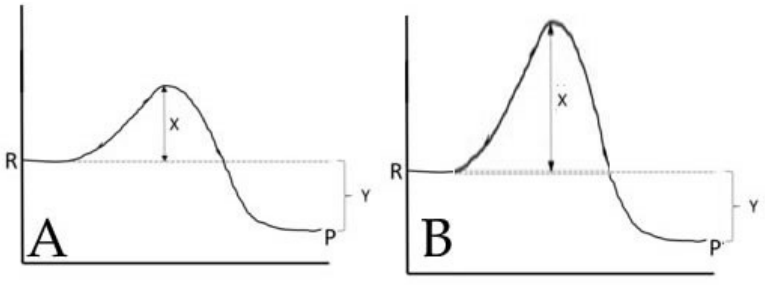
**Explain the logic behind your answer:**

**Q2: Now consider these two chemical reactions.** Given the same physical conditions (e.g. temperature) which reaction is more likely to proceed faster toward equilibrium?

□ A □ B

□ C - not possible to tell □ no idea

**Explain the logic behind your answer AND predict what will happen to the values of X and Y if a catalyst is added to the reactions.**



**Q3: If the electronegativities of H and O were equal to one another, what would happen to the boiling point of water?**

□ A. it would increase □ B. it would decrease

□ C. it would remain unchanged □ no idea

**Explain the logic behind your answer:**

**Q4: Two neutral molecules of similar size will begin to repel each other when …**

□ A. They are dissolved in a polar solvent, like water

□ B. They are closer that the sum of the van der Waals radii

□ C. They are close enough to make H-bonds with one another □ no idea

**Explain the logic behind your answer:**

**Q5: Bonds between atoms with significantly different electronegativities are polar because:**

□ A. The electrons associated with the bond are shared equally

□ B. The electrons associated with the bond spend more time in the vicinity of the more electronegative atom.

□ C. The electrons associated with the bond spend more time in the vicinity of the less electronegative atom

□ D. The distribution of electrons is not involved in bond polarity □ no idea

**Explain, what makes all of the wrong answers wrong.**

**Q6: Consider the following set of reactions.** A+B ⇆ C+D is thermodynamically unfavorable, while C+E ⇆ F is highly thermodynamically favorable.

Both reactions rapidly reach equilibrium. We compare two reaction systems.
At the start of the experiment flask 1 contains [A] = 1M , [B] = 1M, and [C] = 0.5 M,
while flask 2 contains [A] = 1M, [B] = 1M, and E = [0.5 M]
After the two reaction systems reach equilibrium which is the expected result.

□ A. There is more D in flask 2 □ B. There is more D in flask 1

□ C. There is the same amount of D in the two flasks □ no idea

**Explain the logic behind your answer.**

**Q7: PICK THE <u>WRONG</u> ANSWER: Compared to H-bonding interactions, van der Waals interactions …**

□ A. are non-directional □ no idea

□ B. occur only when molecules contain atoms with different electronegativities

□ C. occur between all molecules, regardless of their atomic composition

**Explain why the incorrect answer is wrong.**

**Q8: A cell generates ATP using a plasma membrane-associated H+ gradient. ATP hydrolysis is coupled to the movement of Na+ out of the cell and K+ into the cell. Other channels permit Na+ and K+ to leak slowly through the membrane. What will happen to intracellular [Na+] and [K+] when a drug is added that allows H+ to pass freely through the plasma membrane?**

□ A. Nothing, the process depends on ATP, Na+ and K+

□ B. cytoplasmic [Na+] will increase while cytoplasmic [K+] will decrease

□ C. cytoplasmic [Na+] changes while cytoplasmic [K+] remains constant

□ D. impossible to predict □ no idea

**Explain the logic of your choice.**

**Q9: A channel in a membrane is like a catalyst in that it …**

□ A. decreases the free energy needed to pass through the membrane □ no idea

□ B. changes the structure of the molecule passing through the membrane

□ C. increases the speed at which molecules collide with the membrane

□ D. increases the size of the gradient between inside and outside of the cell

**Explain the logic behind your answer:**

**Q10: PICK THE <u>WRONG</u> ANSWER: The plasma membrane of a cell …**

□ A. Provides a barrier between the cytoplasm of the cell and its environment □ no idea

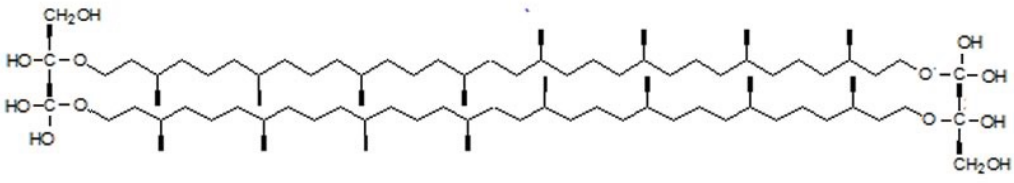
□ B. Helps cells maintain a non-equilibrium state

□ C. Is likely to be homologous to the membrane present in the first living organism on earth.

□ D. Likely evolved multiple times independently

**Explain, what makes the WRONG answer wrong.**

**Q11: Here is a type of lipid, somewhat different from the typical lipid.**



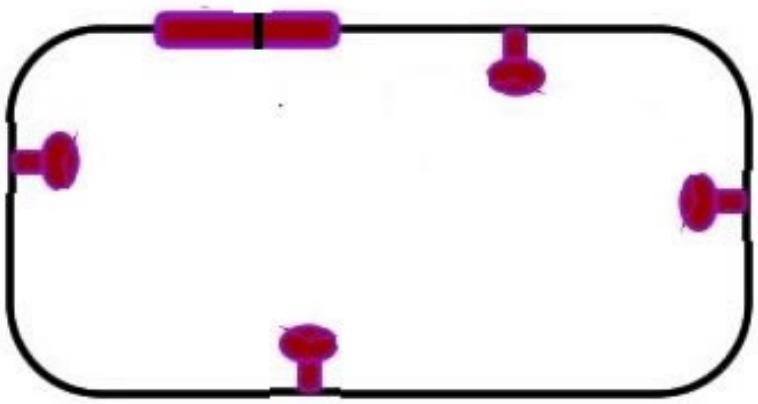

**Part A (2 POINTS)** Explain why it could reasonably classified as a lipid. □ no idea

**Part B (3 points):** You disperse these molecules in water; draw a stable structure they might form and explain the logic behind your prediction. Use a simple schematic to represent the molecule.

**Q12: Here is a diagram of the photosynthetic prokaryote *Halobium;***

1) indicate the direction in which H+ ions move in response to light
2) indicate the direction in which H+ ions move when ATP is synthesized
3) indicate where ATP synthesis occurs

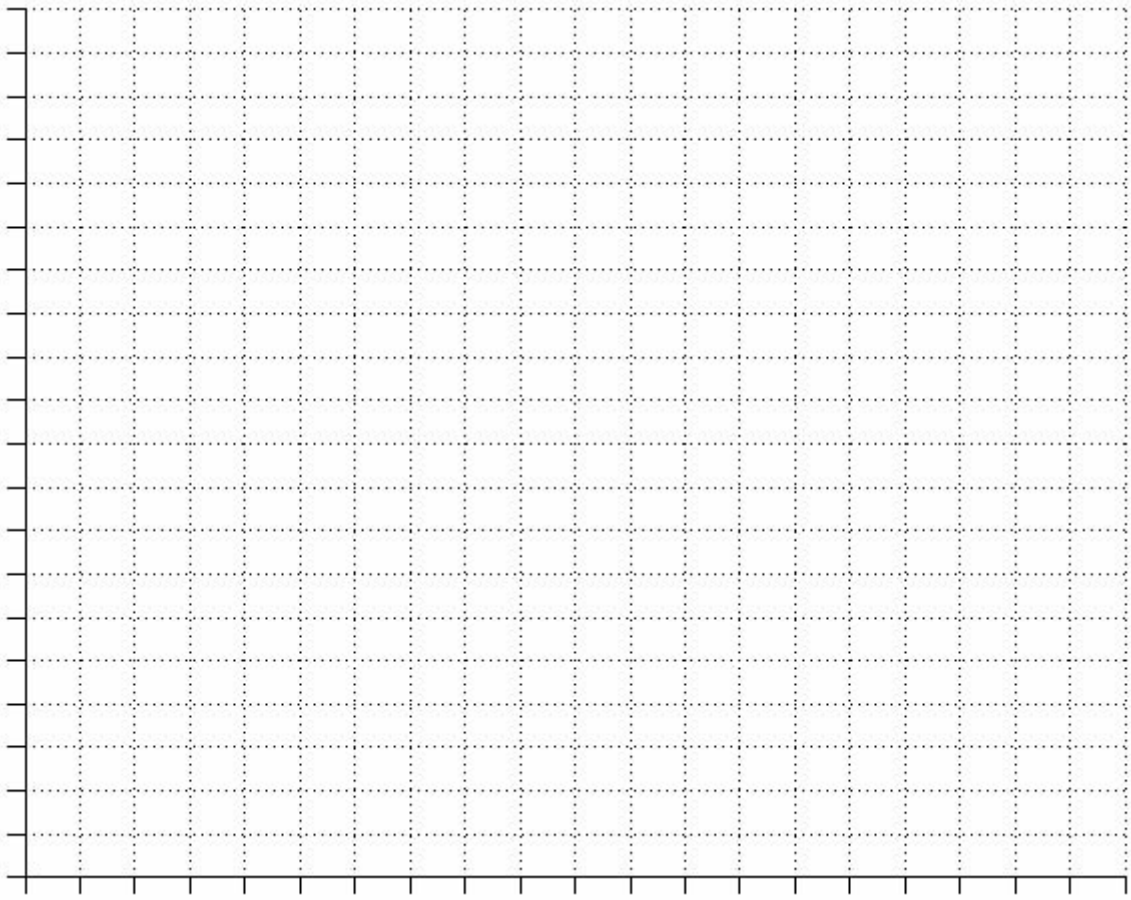
□ no idea



**Q13: You measure the rate of ATP synthesis in Halobium:** you start taking measurements beginning at midnight and continue through an entire day (until midnight of the next day).

Draw the graph of the **rate of ATP synthesis** as a function of time.

□ no idea




**Explain how your graph will change if, at noon, you add a drug that makes the membrane of the cells freely permeable to H+.**