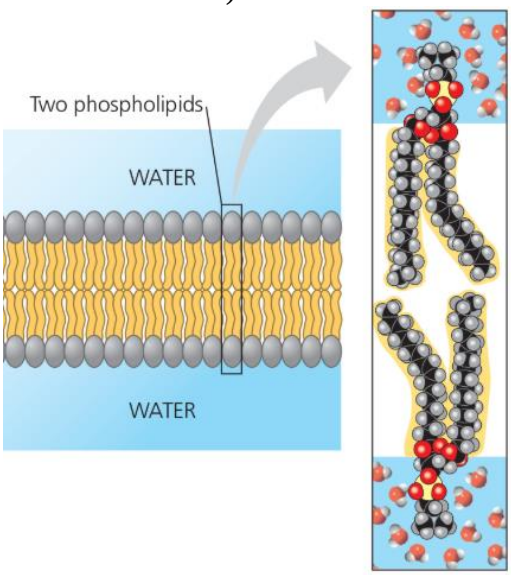
Membrane Structure and Function Review
Chapter 7

1. Provide reasoning to explain why the cell membrane is described as a fluid mosaic. (The membrane consists of many smaller components, like a mosaic. Many of the components of the membrane are not static. Rather, they move freely throughout the membrane. Hence, it is called a fluid.)



2. Draw a circle around and label the hydrophilic and hydrophobic portions of the enlarged phospholipids on the right of the diagram above. Identify what each portion contacts when the phospholipids are in the plasma membrane.

3. a) Describe how the membrane lipid composition of a native grass found in warm soil in a southern habitat would be expected to differ from that of a native grass found in cool soil in a northern environment. (The grasses living in the cooler region would be expected to have more unsaturated fatty acids in their membranes because those fatty acids remain fluid at lower temperatures. The grasses living in the warmer region hot springs would be expected to have more saturated fatty acids, which would allow the fatty acids to "stack" more closely, making the membranes less fluid and therefore helping them to stay intact at higher temperatures.)
   b) Winter wheat is a plant that can withstand cold temperatures late into the growing season. Describe how membrane fluidity of winter wheat is maintained as summer changes to autumn. (As summer changes to autumn, the cooler temperatures would cause the wheat to increase the amount of unsaturated fatty acids in the plasma membrane. This change would allow the membrane to remain fluid at lower temperature.)
4. Describe some common functions of membrane proteins. (Transporting solutes across the membrane, enzymes can be attached to or embedded in membranes, receptors for molecules, attaching cells together, etc.)
5. Explain how membrane carbohydrates function in cell-cell recognition. (A carbohydrate on the membrane of a cell can be recognized (by shape) by a protein on the membrane of another cell.)
6. Explain how molecules such as O_2 and CO_2 are able to cross a plasma membrane without the aid of membrane proteins. (O_2 and CO_2 are both nonpolar molecules that can easily pass through the hydrophobic interior of a membrane.)

7. Propose a reason aquaporins are needed in cell membranes. (Water is a polar molecule, so it cannot pass very rapidly through the hydrophobic region in the middle of a phospholipid bilayer.)
8. Aquaporins exclude passage of hydronium ions (H_3O^+), but some allow passage of glycerol, a three-carbon alcohol, as well as water. H_3O^+ is closer in size to water than glycerol is yet cannot pass through. Propose an explanation for this selectivity. (The hydronium ion is charged, while glycerol is not. Charge is probably more significant than size as a basis for exclusion by the aquaporin channel.)
9. Explain how diffusion provides a steady supply of oxygen and eliminates carbon dioxide for a cell undergoing cellular respiration. (As long as [O2] outside the cell remains higher than inside and [CO2] inside the cell remains higher than outside, the gases will continue to diffuse.)
10. Define the terms hypotonic, hypertonic and isotonic. Describe what would happen to both a plant cell and an animal cell if each were placed in each of these solutions. (Hypotonic: the solution contains a lower [solute] than the cell. An animal cell would swell and possibly lyse. A plant cell would swell but the cell wall would prevent lysing; hypertonic: the solution contains a higher [solute] than the cell. An animal cell would shrivel. The membrane of a plant cell would pull away from the cell wall; isotonic: the solution contains the same [solute] as the cell. Both animal and plant cells would remain unchanged.)
11. Explain how facilitated diffusion increases the efficiency of transport. (Facilitated diffusion uses specialized protein channels embedded in a membrane to increase the speed of transport. It is faster because solutes do not have to cross the phospholipid bilayer through the tails.)
12. Describe a scenario in which a cell would need to use active transport. (Active transport is necessary whenever a cell needs to move a solute from an area of lower concentration to an area of higher concentration.)