1. a. Fatty acid
   b. Myristic acid, 14:0
   c. B, C, D, F, G, H
   d. True
   e. False; at physiologic pH (~7.2-7.4), nearly all will be deprotonated, in the carboxylate form
   f. Yes. Pyruvate's pKa would be lower because of the inductive effect. Myristic acid's hydrocarbon tail is electron donating, which strengthens the carboxylic O-H bond, whereas pyruvate's carbonyl oxygen is electron withdrawing, weakening the O-H bond.

2. d. *explanation:*
   a. False; linoleic is 18:2*n*-6 and oleic is 18:1*n*-9; more double bonds corresponds to a *lower* melting point.
   b. False; peripheral membrane proteins are very similar in structure and hydrophobicity to soluble (non-membrane) proteins
   c. False; a membrane's fluidity increases with *decreasing* saturation of its lipids (or increasing *unsaturation*)

3. Hot temperatures increase the fluidity of the membrane, so thermophiles would have to counteract excess fluidity by producing membranes with longer, more saturated fatty acids (having higher melting points). So that means the order, from most abundant to least, would be:
   e. 20:0
   a. stearic acid (18:0)
   b. lauric acid (12:0)
   c. oleic acid (18:1*n*-9)
   f. 16:1 (Δ^9)
   d. 18:3, ω-3

4. a. Ganglioside (less specific: glycosphingolipid; glycolipid, sphingolipid, membrane lipid)
   a. A. D-galactose (or D-galactopyranose)
      B. D-glucose (or D-glucopyranose)
      C. Sphingosine
      D. Stearic acid (or stearate)
   c. 1. β(2→4) *O*-glycosidic
      2. α(1→4) *O*-glycosidic
      3. β(1→O) glycosidic
      4. amide
   d. Membrane component; recognition
   e. Lipid rafts of the outer leaflet of the plasma membrane
   f. True
   g. Tropics. This lipid lacks *cis* double bonds, allowing close packing of hydrophobic tails and promoting membrane stiffness. This stiffness can counteract excess membrane fluidity caused by hot temperatures of the tropics.

5. d; *explanation:*
   a. False; transbilayer diffusion is slow because the polar head groups must pass through the hydrophobic interior of the membrane.
   b. False; carbohydrates are a *minor* component of *some* biological membranes.
   c. False; peripheral membrane proteins only contact the surface of the membrane.
   e. False; in the plasma membrane, glycolipids are always in the outer leaflet.

6. F; because of their roughly cylindrical shape, glycerophospholipids will not form micelles

7. a. A, B, C, E
   b. E
   c. C
   d. D
   e. B
   f. B
   g. E

8. False; while saturated fatty acids are individually more flexible (have more conformations, more bonds about which to rotate than unsaturated), as a group they pack together more tightly, yielding *less* flexibility that unsaturated fatty acids in a membrane bilayer.

9. True

10. True

11. a. 2 and 5
    b. 1 and 4
    c. 3