1. a. 4 – since BPG is a negative effector, the curve will show lower affinity for O2
   b. 3 – although there is more hemoglobin, it has the same O2 affinity
   c. 1 – a single affinity gives rise to a hyperbolic curve
   d. 5 – bound CO prevents O2 binding, but also reduces the ability of Hb to release O2 at low partial pressures (by keeping it in the R-state)

2. x-axis: pO_2 (values 0-200+ torr); y-axis: θ (values 0-1.0)
   'F' curve is hyperbolic, starting at (0,0), passing through (20 torr, 0.5), and asymptotically approaching $\theta = 1.0$
   'G' curve is sigmoidal, starting at (0,0), passing through (80 torr, 0.3) and (200 torr, 0.9), and asymptotically approaching $\theta = 1.0$

3. a. True
   b. True
   c. True
   d. False – using different mechanisms is what varies the rate. It is the favorability, or equilibrium state, that is unchanged.

4. a. A, F, G, J, M, R, (and O may be possible, because binding is *reversible*)
   b. B, E, G, I, K, L, N, O, R, S

5. a. True. The hemoglobin itself is unchanged, so it binds O_2 with the same affinity.
   b. False. More red blood cells = more hemoglobin = more O_2
   c. False
   d. A – *this change substitutes a positively charged amino acid (which could form a salt-bridge with BPG) with a hydrophobic amino acid (with which BPG will not want to interact)*
   e. At the low pO_2 in the placenta, F hemoglobin will have a higher affinity for O_2 than the mother's hemoglobin, because 2,3-BPG is not binding and stabilizing the T-state (of F Hb). So more F hemoglobin will be in the R-state, binding more O_2, which can be distributed to fetal tissues.

6. Heme iron, distal histidine

7. c. Although different enzymes can function at different pH's, solute concentrations, and temperatures, in general proteins are functional under a smaller range of conditions than other chemical catalysts.