3.

(a) Decrease.

(b) Increase.

(c) Decrease.

(d) Increase.

7. From the experimental results, we know that the properties to bind to oxygen of alpha-subunit of hemoglobin is resemble to myoglobin which just contains single peptide. Thus, we can figure out that single alpha subunits of hemoglobin lose its capacity of cooperativity. So, these phenomena indicate that the source of cooperativity of hemoglobin is from interactions between for subunits.

8.

(a) HbF has a higher affinity for oxygen. Fetal gets oxygen from mater through placenta rather than directly from atmosphere. This means that fetal erythrocytes must get oxygen from lower partial pressure surrounding. So, it has higher affinity for oxygen to get oxygen regularly.

(b) Higher affinity of fetal HbF is important for fetus to compete oxygen with maternal blood in placenta so that fetus can get oxygen from mater.

(c)

BPG can make hemoglobin affinity for oxygen be lower.

After removing of BPG, HbA gets higher affinity for oxygen than HbF and became lower when BPG is reintroduced. This phenomenon indicates that the differ between HbF and HbA is caused by the different ability to bind BPG. HbA is easier to bind BPG than HbF. So, when BPG exists, HbA will bind more BPG than HbF so that the HbA affinity for oxygen is lower than HbF.

9.

(a) Hb Memphis. Because this substitution changes neither the charge or the hydrophily of the protein and the size of two amino acids are similar

(b) HbS, Hb Milwaukee, Hb Providence. These substitutions change the charge of protein.

(c) Hb Providence. BPG contains negative charges so it can interact with positive charges between beta subunits. The substitution decrease the positive charges around BPG binding site, so it will influence the interaction between BPG and Hb.

10.

I think that the variants are likely to bind oxygen more tightly. BPG bind to the central pocket between two beta-subunit which have positive charge to stabilized the T-state. Dimer has just one beta-subunit, so BPG can’t bind to it and T-state will be less stable than tetramer.

Also, dimer structure limits the cooperativity, so the binding curve of oxygen will be more hyperbolic. So, the variants are likely to bind oxygen more tightly.

11.

(a)

(b)

(c)

(d)