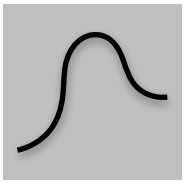
Problem Set 14: An Introduction to Energy in Chemical Reactions

1. Use the energy diagram below to answer a-c.



   a. Is the reaction endergonic or exergonic?
   b. Label the activation energy barrier (E_a).
   c. How would you expect the energy diagram to change when a catalyst is used?
   d. Is the reverse of this reaction endergonic or exergonic?

2. Draw a generic energy diagram for an exergonic reaction that occurs slowly with a large free energy change.

3. Explain why an increase in temperature increases the rate of a reaction.

4. What is the difference between an exergonic reaction and an exothermic reaction?

5. Photosynthesis occurs with a free energy change of +686 kcal/mol. During photosynthesis, carbon dioxide and water combine to form glucose ($C_6H_{12}O_6$) and oxygen.

   a. Write a balanced equation for photosynthesis.

   b. Draw an energy diagram for photosynthesis, and label the following: activation energy, reactants, products, and the +686 kcal/mol energy change.