

Discussion Exercise 7: Qualitative Thermodynamics

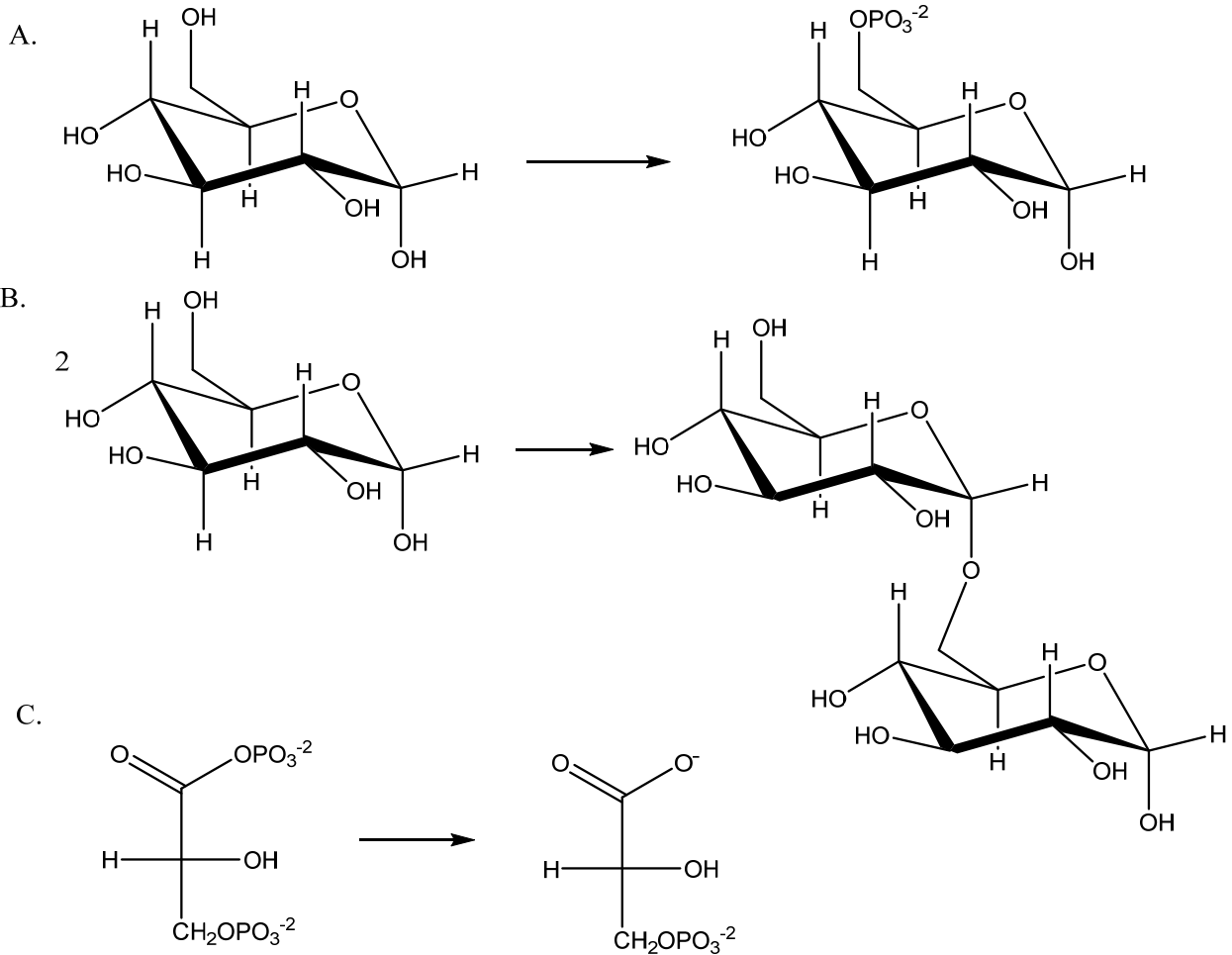
Key

Problem 1: Label each reaction as spontaneous or nonspontaneous.

- A. 2 glucose \rightarrow maltose (a disaccharide) **nonspontaneous**
- B. Ala-Gly \rightarrow Ala + Gly **spontaneous**
- C. glycerol + 3 fatty acids \rightarrow triacylglyceride **nonspontaneous**
- D. glucose-6-phosphate \rightarrow glucose + inorganic phosphate **spontaneous**

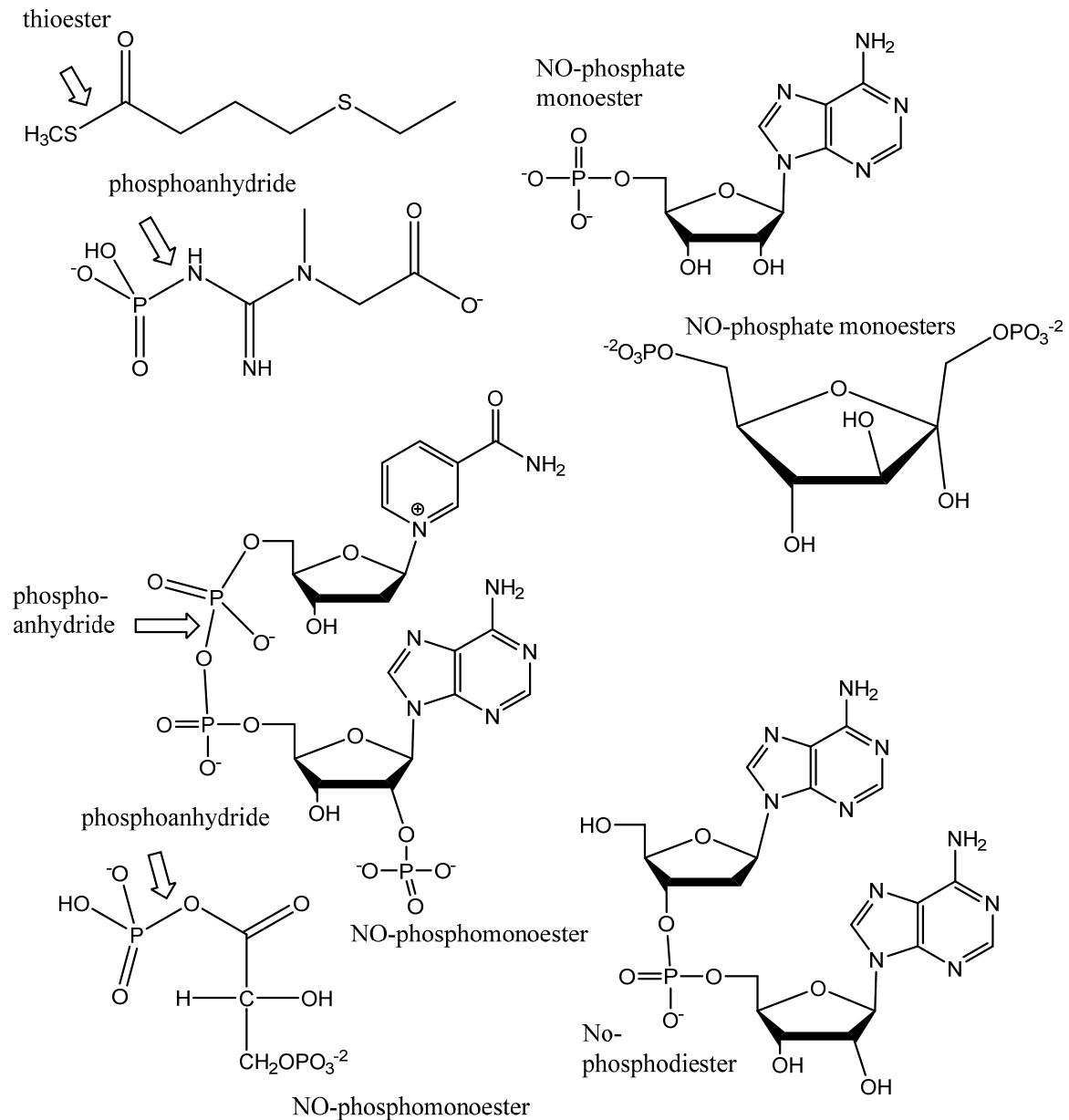
Problem 2: Which of the following reactions requires input of ATP?

A. requires ATP for phosphate transfer (condensation). B requires ATP (glycoside bond formation is condensation) C. does not require ATP (hydrolysis reaction)



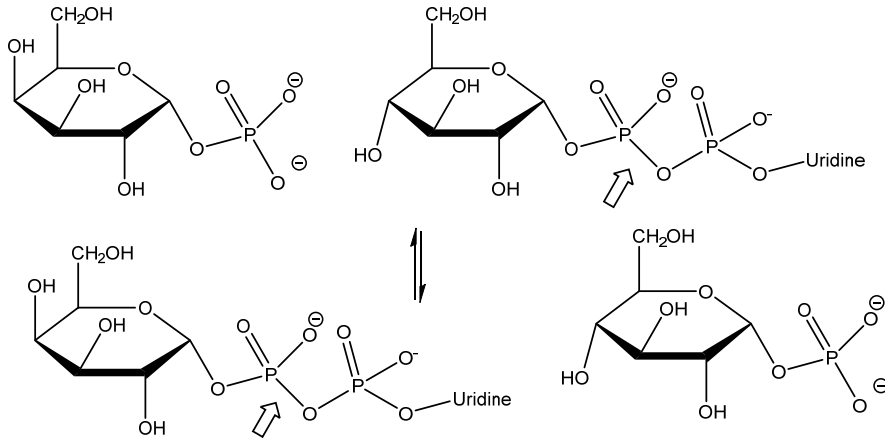
Problem 3: Explain why a ligase requires ATP, but a hydrolase does not. **A ligase catalyzes bond formation (condensation reactions, for example) and hydrolases catalyze hydrolysis reactions.**

Problem 4: Indicate the high energy bond(s) in each of these compounds, or say “no high energy bond.”

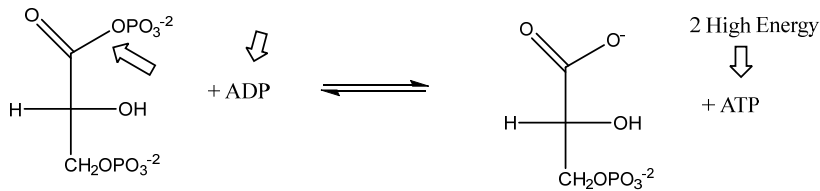


Problem 5: Indicate the number of high energy bonds in the reactants and products, and indicate the direction of equilibrium for the reaction.

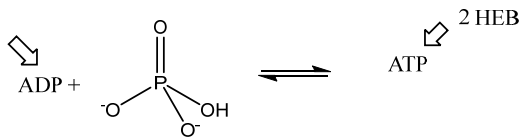
A. No net change--near equilibrium



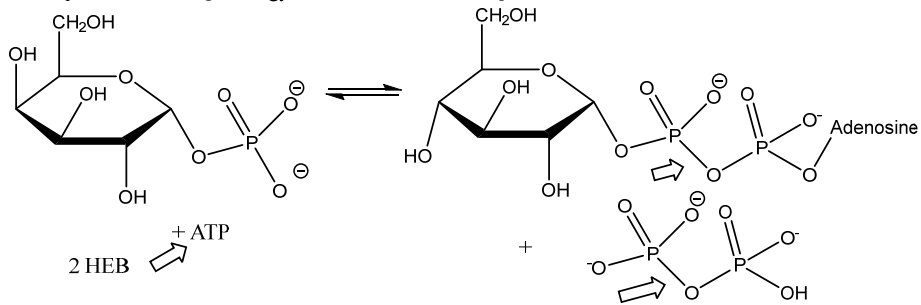
B. no net change--two high energy bonds in reactants and products



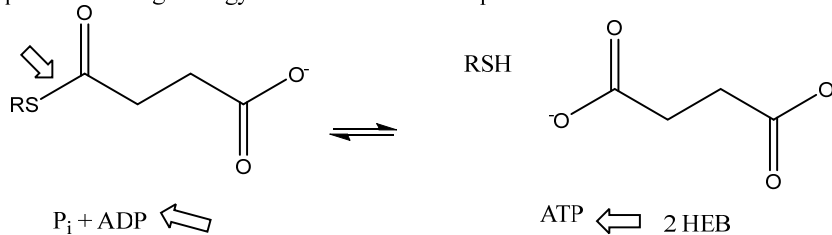
C. Increase in high energy bonds from one to two: nonspontaneous, lies to left



D. near equilibrium: 2 High energy bonds in reactants and products



E. near equilibrium: 2 high energy bonds in reactants and products



Problem 6: Draw the structures of the products of these kinase catalyzed reactions. The name of each product is given. Explain why the reaction is thermodynamically favorable in terms of bonds made and broken.

