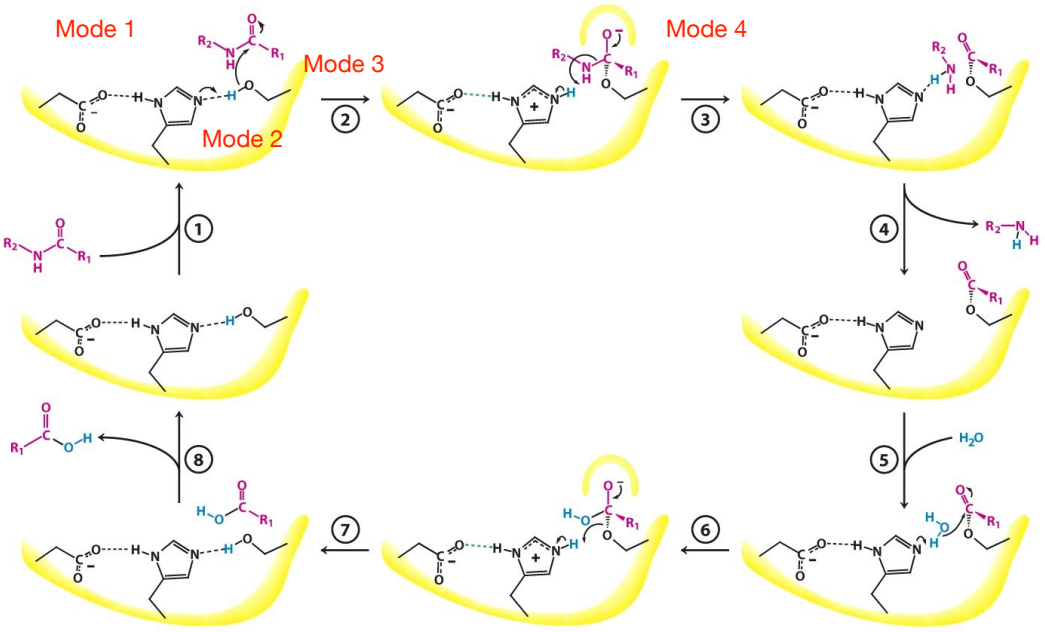
Name Key

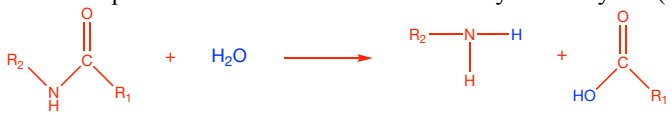
Chem 352 - Spring 2018
Quiz 3

10/10

1. Below is a figure illustrating the catalytic cycle for bacterial protease *subtilisin* .



a. Write a balanced chemical equation for the reaction carried out by this enzyme. (Hint: In → Out)

2 

b. What enzyme class does this enzyme belong to? 1 Hydrolase

c. What type of substrate ordering is observed in this catalytic cycle, random, ping-pong, or sequential? 1 Ping-pong

d. This enzyme catalyzed reaction illustrates a number of the catalytic and binding modes of catalysis that we discussed in class. Describe four of these below and in the figure above label one example of each mode. (Label figure with *Mode1*, *Mode 2*, *etc*.)

i. Mode 1 **Proximity Effect**: On binding to the enzyme, the carbonyl group is placed immediately next to the catalytic serine residue from the enzyme.

6

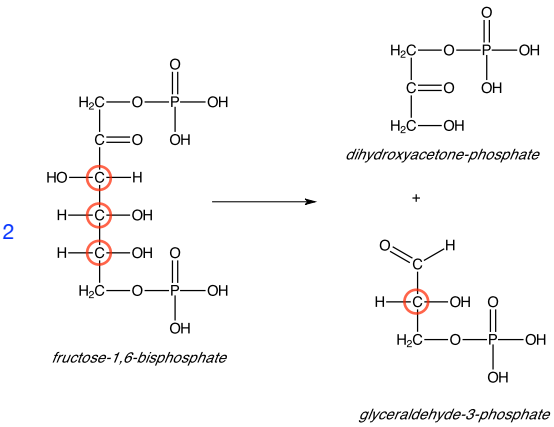
ii. Mode 2 **Acid/Base catalysis**: The active site histidine, as a base, accepts a proton from the active site serine, converting it to an alkoxide ion, which is a powerful nucleophile.

iii. Mode 3 **Covalent bond catalysis**: Upon being converted to an alkoxide, the serine side chain undergoes a nucleophilic attach on the cabonyl carbon of the substrate, forming a covalent bond to the polypeptide substrate..

iv. Mode 4 **Transition state stabilization**: In going from the initial state to the transition state the carbon that was attacked by the serine side chain has gone from a trigonal planar geometry to a tetrahedral geometry, also, the oxygen has become negatively charge. The shape and chemical environment of the active site favors both of these aspects of the transition state.

15/15

2. The following reaction is from the glycolytic pathway?



2

a. What class of enzyme catalyzes this reaction? 2 Lyase

b. All three of the molecules involved in this reaction are derivatives of monosaccharides. Based on their number of carbons and carbonyl-containing functional groups, what group of monosaccharide does each belong to, *e.g.*, are they derivatives of an *aldohexose,* a *ketotetrose*, *etc.*?

i. fructose 1,6-bisphosphate 2 ketohexose

ii. glyceraldehyde 3-phosphate 2 aldotriose

iii. dihydroxyacetone phosphate 2 ketotriose

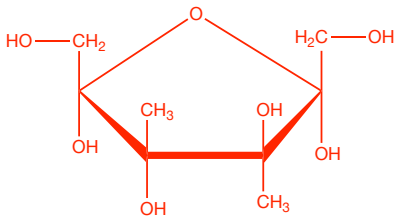
c. What type of sugar derivative do these molecules represent? 1 sugar phosphates

d. On the Fischer projections shown above, circle all of the chiral carbons for each molecule.

e. How many stereoisomers does *fructose 1,6-bisphosphate* have? 2 2^3 - 1 (for itself) = 8-1 = 7

f. Draw the Haworth projection for the *a-anomer* of the furganose ring form of *fructose 1,6-bisphosphate*.

2



25/25