

CHEM 4420 Biochemistry II Spring 2016 Sugar Metabolism

Glycolysis Reactions are in alphabetical order: for each reactant and product draw the structure, for each enzyme write reversible or not reversible. If the enzyme is regulated, put how it is regulated. Cut out the squares and put them in order for glycolysis. You should have 10 reactions: reactants → products. (It is not set up to do as a continuous pathway, do each reaction separately.)

Enzymes	Reactants	Products
aldolase	1,3-bisphosphoglycerate	1,3-bisphosphoglycerate + NADH <sup>+</sup>
enolase	2-phosphoglycerate	2-phosphoglycerate
glyceraldehyde-3-phosphate dehydrogenase	3- phosphoglycerate	3-phosphoglycerate + ATP
hexosephosphate isomerase	dihydroxyacetone phosphate	fructose-1,6-bisphosphate + ADP
hexokinase II	fructose-1,6-bisphosphate	fructose-6-phosphate

phosphofructokinase	fructose-6-phosphate + ATP	glucose-6-phosphate + ADP
phosphoglycerate kinase	glucose + ATP	glyceraldehyde-3-phosphate
phosphoglycerate mutase	glucose-6-phosphate	glyceraldehyde-3-phosphate + dihydroxyacetone phosphate
pyruvate kinase	glyceraldehyde-3-phosphate + Pi + NAD <sup>+</sup>	phosphoenol pyruvate
triose phosphate isomerase	phosphoenol pyruvate + ADP	pyruvate + ATP

2. Xyulose-5-phosphate is made when \_\_\_\_\_ is metabolized by the \_\_\_\_\_ pathway. It allosterically activates \_\_\_\_\_. This enzyme removes a \_\_\_\_\_ from \_\_\_\_\_ and this makes the \_\_\_\_\_ activity increase and the \_\_\_\_\_ activity decrease. The net result is a \_\_\_\_\_ in the concentration of \_\_\_\_\_ and this increases the activity of \_\_\_\_\_ and decreases the activity of \_\_\_\_\_. Thus, Xyulose-5-phosphate stimulates \_\_\_\_\_

Not all of the words are used. Some could be used more than once:

decrease  
FBPase-1  
FBPase-2  
fructose-2-6-bisphosphate  
gluconeogenesis  
glucose  
glycolysis  
increase  
pentose phosphate  
PFK-1  
PFK-2  
PFK-2/FBPase-2  
phosphate  
phosphoprotein phosphatase 2A (PP2A)

3. What effect does glucagon have on glycolysis? (Hint: PKA phosphorylates PFK-2/FBPase-2)

#### 4. The Fate of Pyruvate:

For each reaction, give the enzyme and how it is regulated and indicate when this reaction proceeds. Only one of these reactions is reversible, which one? When does it favor the formation of products? When does it favor the formation of products?

Pyruvate---> Lactate

Pyruvate -----> acetyl CoA

Pyruvate----> oxaloacetate

5. How does a high carbohydrate diet increase fat storage? What key reactions are involved? How are these reactions stimulated by carbohydrates?

6. How is the liver isozyme for hexokinase regulated?

7. Give two examples of how insulin increases the transcription of enzymes that promote glycolysis and fatty acid synthesis in the liver.