BCH 4054 **HOUR TEST 2** **NAME**_____
February 23, 2001

Page	Points
1	____
2	____
3	____
4	____
Total	_____

1. Pyruvate kinase has a very large negative $\Delta G^{o'}$, and so the reaction operates with a large negative ΔG and is essentially irreversible.

(8) (a) How do animal cells carry out the conversion of pyruvate to phosphoenol pyruvate? Give the reactants, products, (names or structures) and the name(s) of the enzyme(s) involved.

(4) (b) How do C-4 plant cells carry out this conversion? Give the reactants, products, (names or structures) and the name(s) of the enzyme(s) involved.

(10) 2. **Rubisco** is the most abundant protein in the biosphere. What is the full name of this enzyme?

It reacts with both CO_2 and with O_2. Identify both reactions by giving the **structure** of the **reactants** and **products**.

(22) 3. Hormonal regulation of glycogen metabolism and glycolysis in liver and muscle is similar in some respects, and different in others. Compare and contrast the two tissues by filling in the blanks of the following table with the requested information.

	Liver	**Muscle**
Hormone stimulating glycogen breakdown:	_____	_____
Phosphorylated form of the following proteins is **active** or **inactive?**		
phosphorylase:	_____	_____
phosphorylase b kinase:	_____	_____
glycogen synthase:	_____	_____
phosphofructokinase-2:	_____	_____
fructose-2,6-bisphosphatase:	_____	_____
phosphoprotein phosphatase inhibitor:	_____	_____
Allosteric activator of the **inactive form** of the following enzyme:		
phosphorylase:	_____	_____
glycogen synthase:	_____	_____
Hormonal stimulation leads to **activation** or **inactivation** of the following:		
phosphofructokinase-1:	_____	_____
fructose-1-6-bisphosphatase:	_____	_____

(6) 4. The hormonally stimulated phosphorylation of the enzymes mentioned in question 3 is mediated by formation of a small molecule known as a "second messenger". Give the structure of this messenger, identify the protein it directly activates, and describe how it interacts with that protein.

(10) 5. Give the **name** and **structure** of the **products** formed when sedoheptulose-7-phosphate reacts with glyceraldehyde-3-phosphate in the presence of:

(a) transaldolase

(b) transketolase

(8) 6. One function of the pentose phosphate pathway is to produce NADPH for biosynthetic reactions. There are only two reactions of the pathway with NADPH as a product. Identify these reactions by giving the **structure** of reactants and products (NADP and NADPH can be abbreviated) and the **name** of the enzymes.

(6) 8. Describe the **Cori Cycle**

(8) 9. Give the structure of the three **ketone bodies**. Explain why these compounds accumulate in the blood of diabetics when insulin is deficient.

(18) 10. Under some conditions the liver oxidizes fatty acids to acetoacetate, which is secreted into the blood and then oxidized in peripheral tissues (such as heart muscle) to produce energy.

(a) Give the overall pathway for oxidation of palmitic acid ($C_{16:0}$) to acetoacetate in the liver, beginning with the free acid as it enters the liver and including the mechanism by which it gets into the mitochondria. Indicate by name or structure all intermediates, though steps which are repeated need only be shown once.

(b) Identify the steps at which ATP, NADH, and $CoQH_2$ are utilized or produced.

(c) Assuming reoxidation of NADH and $CoQH_2$ by the electron transport chain, calculate the net yield of ATP in liver for oxidation of one mole of palmitate when 2.5 ATP are made from each NADH and 1.5 ATP from each $CoQH_2$.