BCH 4054 **PRE-TEST 1** **GROUP NAME _____**
Auguat 26, 1998

This test is take-home and open book, and it is intended that all members of the group contribute to completing it. Only one copy is to be submitted by the group, and all members who participated should sign their names below. **Test is due at the end of class on Friday, September 4.**

Please use dark pencil or ink and write legibly.

_____ _____

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Page	Points
1	_____
2	_____
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Points

(12) 1. Plants, but not animals, can convert acetyl-CoA to glucose. To accomplish this, it is necessary that the acetyl-CoA be converted to phosphoenolpyruvate (PEP) in a net manner, and plants have two enzymes that animals do not which enable this conversion.

(a) Show a pathway, including structures of all intermediates, by which the following metabolic conversion can be achieved. **Circle the steps of the pathway that are peculiar to plants.**

2 Acetyl-CoA $\rightarrow$ PEP + CO_2 + 2 CoASH

(b) Complete the overall stoichiometric balance of the above reaction, showing the total consumption or production of ATP, GTP, NADH, $CoQH_2$,and P_i. (Show on your pathway where these coenzymes are being used or produced).

(16) 2. Name the enzymes involved in oxidation of glucose to CO_2 via the glycolytic and TCA pathways that have the following properties. For **one** enzyme in each category, show the **structure** of the reactants and products, and identify coenzymes that are either cosubstrates or prosthetic groups, indicating which class they fall into. (Coenzymes may be identified by name.)

(a) Catalyzes interconversion of an aldose and a ketose.

(b) Produces CO_2.

(c) Produces or utilizes CoASH as a product or substrate.

(d) Produces ATP or GTP directly as a product.

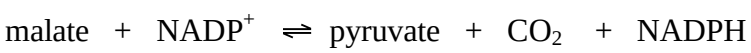
(20) 3. Upon starvation, your body begins to break down muscle protein to provide energy and to produce glucose needed by the brain for fuel. As an example, glutamate is oxidized by an enzyme called **glutamate dehydrogenase**, producing *α*-ketoglutarate by the following reaction:

glutamate + NAD^+ → *α*-ketoglutarate + NH_4^+ + NADH

Starting with glutamate, give a pathway by which glutamate can be converted to glucose, showing all intermediates in the pathway. Identify steps in which substrate coenzymes (**NADH, ATP, GTP, $CoQH_2$**) are either used or produced, and write an equation giving the **overall stoichiometry** of the net reaction.

(16) 4. As an exercise in tracing radioactive labels, use the enzymes of the pentose phosphate pathway, as well as any enzymes you may need from the glycolytic pathway, to show how radioactivity from [2-^{14}C]-glucose (i.e., glucose labeled with carbon-14 in position 2) can be converted to $^{14}CO_2$. Show the structures of the intermediates of your pathway, circling or starring the radioactive atoms in each structure, and give the name of the enzyme catalyzing each step.

(15) 5. **Malic enzyme** can be an **anaplerotic reaction** and it can also provide a source of NADPH. It catalyzes the following reaction:



malate + $NADP^+$ ⇌ pyruvate + CO_2 + NADPH

(a) Give the **name of the enzyme** and the **reaction catalyzed** for three other enzymes you have studied that can produce NADPH.

(b) Give the **name of the enzyme** and the **reaction catalyzed** for two other anaplerotic reactions you have studied.

(10) 6. You have studied two enzymes with covalently bound prosthetic groups which act as carriers for intermediates in the enzymatic reaction. Identify by name these prosthetic groups, and give the structures which each cycles through during the course of the reaction.

(11) 7. 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:	_____	_____