BCH 4054	
November 19	, 1999

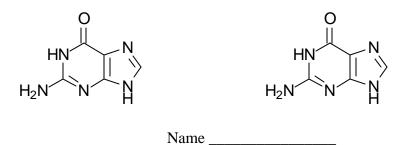
HOUR TEST 4

NAME

			Page	Points
(6)	1.	Using partial structures to designate the tetrahydrofolic acid (i.e.,		
		showing just the N_5 and N_{10} positions of the molecule), give the	1	
		structure of the following C_1 -derivatives of THF:	2	
		(a) The product formed from serine.	3	
		(b) The precursor of the 2 position of purines.	4	
		(c) The C_1 donor in thymidylate biosynthesis.		
			Total	
		(a) (b) (c)		

Following are two structures, of a purine. 2.

- (a) Give the **name** of the purine.
- (b) In the first structure circle each nitrogen atom that is derived from glutamine, and put an X through each **nitrogen atom** that is derived from **aspartate**.
- (c) In the second structure circle each carbon atom that is derived from CO_2 , and put an X through each carbon atom that is derived from N_{10} -formyl THFA.



(4)	3.	What enzyme is inhibited by the drugs aminopterin and amethopterin, and why are these
		drugs effective in blocking the growth of cancer cells?

(6) 4. What enzyme is deficient in Lesh-Nyhan syndrome, what product accumulates, and how does deficiency of this enzyme cause the accumulation of this product?

(6)

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(5) 5. Ribose is first activated before incorporation into either purine or pyrimidine nucleotides. Draw the structure of this activated form of ribose.

(6) 6. Complete the following table by naming the nucleoside containing the indicated base and sugar. An example is given in the first row.

Base	Sugar	Nucleoside
adenine	deoxyribose	deoxyadenosine
guanine	ribose	
cytosine	deoxyribose	
thymine	ribose	

(8) 7. The urea cycle extracts a nitrogen atom from aspartate for the production of urea, the other nitrogen coming from ammonia liberated from glutamate. An alternative way of utilizing the nitrogen of aspartate to form ammonia makes use of two steps of purine biosynthesis (the steps in which IMP is converted to AMP) coupled to the enzyme AMP deaminase, which converts AMP to IMP and ammonia. These steps form a cycle that is referred to as the **purine cycle**. Write out these three reaction steps, giving the reactants and products of each step (names or structures okay), and give the overall reaction catalyzed by the purine cycle.

(4) 8. Some of the eukaryotic enzymes of the purine biosynthetic pathway are covalently linked as part of the same polypeptide chain. What advantage does this organization provide to the organism?

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(6)	9.	Aspartate transcarbamoylase (ATCase) describe the sigmoid kinetic behavior of enzyme involved in, and what compoun Pathway	allosteric er	tzymes . What pathway is this y inhibit and activate it?
(10)	10.	List the mammalian tissue characterized b	by each of the	following:
		contains a high Km form hexokinase called glucokinase		uses only glucose as a fuel arce except after a period of starvation.
		lacks glucose-6-phospha	tase	lacks glycerokinase
		stores energy as creatine phosphate	glu	uses lactate and alanine for coneogenesis
		produces insulin	glu	contains a receptor for cagon
		unable to activate acetoa	cetate	increase in cyclic AMP
		in order to oxidize it.	inc	reases rate of glycolysis.
(12)	11.	One hormonal signaling pathway we hav	e studied in sc	me detail in class involves

(PI2) The other hormonial signaling pairway we have statiled in some detail in easist involves production of adenylcyclase as a second messenger and leads to activation of a cyclic AMP dependent kinase that phosphorylates various cellular proteins. A second signaling pathway involving second messengers has been found to utilize phosphatidylinositol bisphosphate (PIP2) as a key intermediate. Describe this **phosphoinositide system**, including the sequence of steps by which a hormonal signal affects the metabolism of PIP₂, the second messengers produced by the system, and how these second messengers lead to stimulation of a different protein kinase called **protein kinase C**.

(7) 12. You have prepared DNA from two organisms isolated from the swamps of south Georgia, designated culture A and culture B. DNA from culture A contains 24% G, while DNA from culture B contains 30% G. Complete the following table for the expected composition of the other purine and pyrimidine bases.

-	%G	%A	%T	%C	Total
Culture A	24				100%
Culture B	30				100%

DNA from which organism will have the higher melting temperature?

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- Name_
- (6) 13. Complete the following table by identifying the DNA structures described:

Helix Direction:	Right	Right	Left
Base Pairs/Turn	11	10.4	12
Base Tilt	19 ^o	1.2°	9°
Diameter (Å)	2.55	2.37	1.84
Name of Structure			

Which helical structure does double stranded RNA form?

(6) 14. Suppose that negatively supercoiled DNA with L=23, T=25, and W=-2 is acted upon by topoisomerase I. After one catalytic cycle, what would be the values of L, T, and W?

Suppose that negatively supercoiled DNA with L=23, T=25, and W=-2 is acted upon by DNA gyrase (a type II topoisomerase) and ATP. After one catalytic cycle, what would be the values of L, T, and W?

(8) 15 DNA Polymerase I from bacteria has three enzymatic activities.

(a) Explain what each does during DNA replication:

5'-3' polymerase

3'-5' exonuclease

5'-3' exonuclease

(b) Explain how Polymerase I participates in the normal DNA replication process in bacteria.