

BIOSCI 1820
FINAL EXAM
APR 2001

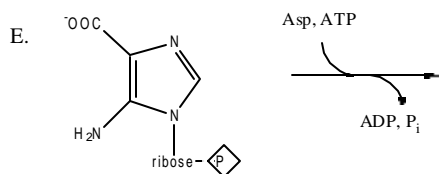
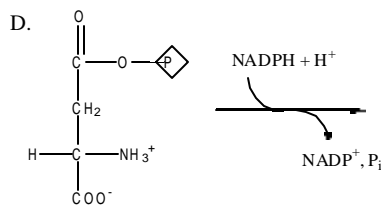
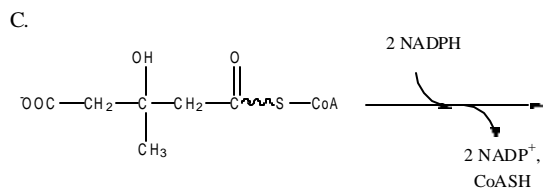
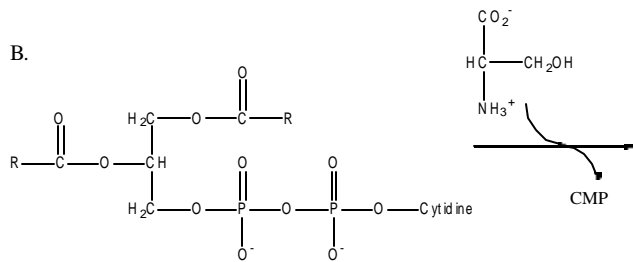
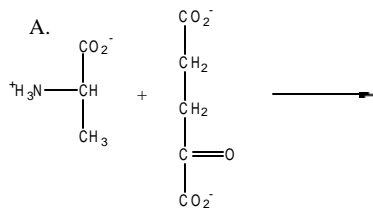
I. Recitation Section:

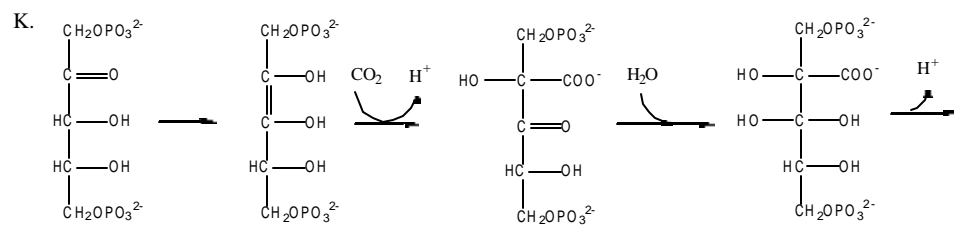
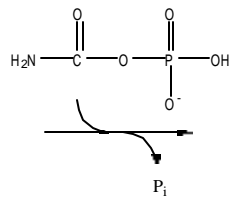
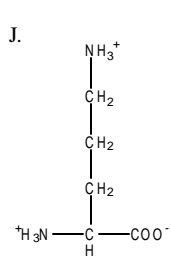
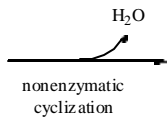
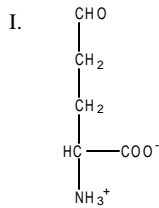
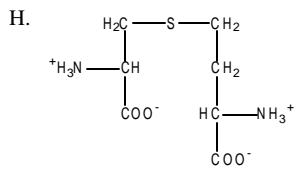
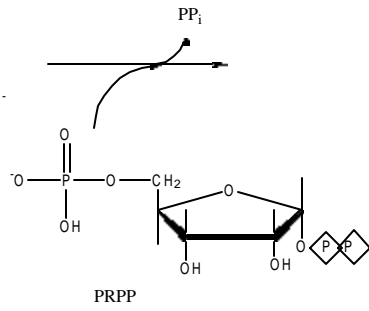
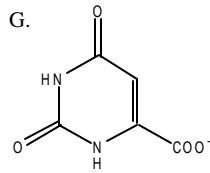
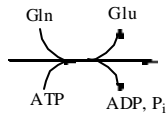
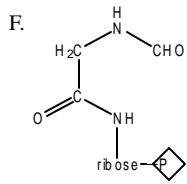
A. Describe one of the two ways that urea cycle disorders can be treated:

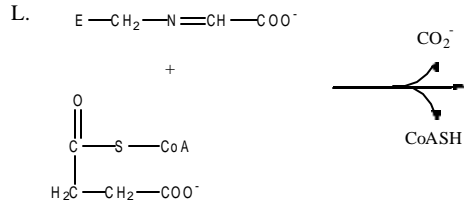
B. Describe one of the many molecular defects that can give rise to familial hypercholesterolemia:

C. In the classic experiment by Jagendorf and Uribe in which it was shown that a proton gradient drives the formation of ATP, how was the proton gradient established across the membranes of isolated chloroplasts?

II. Draw the structures of the products of the following reactions:







III. Multiple Choice

Which of the following statements about photosynthesis is false?

- A. Protons are pumped into the thylakoid lumen
- B. Photosystem II is located in the stromal lamellae
- C. Species such as sorghum and sugar cane are known as C-4 plants
- D. Pheophytin is essentially the same as chlorophyll except that two H⁺s are bound in place of Mg²⁺
- E. Rubisco is activated by increases in the Mg²⁺ concentration and pH

Which of the following metabolites is not utilized by the heart?

- A. fatty acids
- B. glucose
- C. lactate
- D. ketone bodies
- E. All of the above are utilized by the heart

Lactose is a disaccharide composed of:

- A. galactose-glucose
- B. sucrose-glucose
- C. glucose-mannose
- D. fucose-galactose
- E. glucose-glucose

Glucagon performs each of the following in liver except:

- A. decreases glycogen synthesis
- B. increases glucose release from liver cells
- C. increases the activity of adenylate cyclase
- D. decreases triacylglycerol hydrolysis
- E. All of the above statements are true

Each of the following are intermediates in or products of ketone body metabolism except:

- A. acetone
- B. β-hydroxybutyrate
- C. HMG-CoA
- D. cholesterol
- E. acetyl-CoA

On a carbon-per-carbon basis, which of the following is the best energy source?

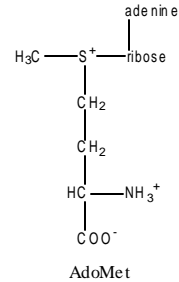
- A. amino acids
- B. glucose
- C. saturated fatty acid
- D. unsaturated fatty acid
- E. glycogen

Tyrosine can be converted into each of the following except:

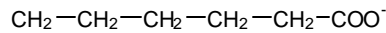
- A. thyroid hormone
- B. epinephrine
- C. DOPA
- D. Dopamine
- E. Serotonin

The depicted molecule is used to catalyze which of the following processes:

- A. Sulfur addition
- B. Methyl group additions
- C. Nitrogen donor
- D. Carboxylate addition
- E. None of the above



How many ATPs can be produced by the complete oxidation of the following molecule in the cell (assume that each FADH and NADH give rise to 2 and 3 ATPs respectively)?



- A. 46
- B. 44
- C. 29
- D. 27
- E. 51

The precursor for creatine is which amino acid?

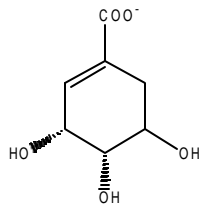
- A. tryptophan
- B. asparagine
- C. arginine
- D. tyrosine
- E. histidine

Which of the following statements about the *de novo* synthesis or degradation of pyrimidines is incorrect?

- A. ATP activates their synthesis
- B. CTP inhibits their synthesis
- C. Carbamoyl phosphate is an intermediate in the pathway
- D. The pyrimidine is assembled from the start directly onto a ribose-phosphate
- E. The breakdown products of pyrimidines are generally not toxic since they are quite soluble

The depicted molecule is a precursor of which of the following?

- A. cinnamom
- B. lignin
- C. tryptophan
- D. cayenne
- E. All of the above



IV. Regulation

A. It was recently reported that -- besides activating adenylate cyclase -- the GTP-bound form of an α subunit of a G protein could bind to phosphodiesterase and inhibit its activity. Why does this make sense?

B. A mutant form of cAMP-dependent protein kinase ("protein kinase A") that is always **active** is expressed in muscle cells. What would be the effect on lipid and glycogen metabolism in the muscle cell? Why?

C. Another target of G α -GTP is phospholipase C. What are the two products of this enzyme and what are their respective effects in the cell? [worth two credits]

V. The real world...

The following is an abstract that appeared in the March 30th issue of Science. Read the abstract and answer the following questions:

Malonyl-coenzyme A (malonyl-CoA), generated by acetyl-CoA carboxylases ACC1 and ACC2, is a key metabolite in the regulation of energy homeostasis. Here, we show that *Acc2*^{-/-} mutant mice have a normal life span, a higher fatty acid oxidation rate, and lower amounts of fat. In comparison to wild type, *Acc2*-deficient mice had 10- and 30-fold lower levels of malonyl-CoA in heart and muscle, respectively. The fatty acid oxidation rate in the soleus muscle of the *Acc2*^{-/-} mice was 30% higher than that of wild-type mice and was not affected by addition of insulin; however, addition of insulin to the wild-type muscle reduced fatty acid oxidation by 45%. The mutant mice accumulated 50% less fat in their adipose tissue than did wild-type mice. These results raise the possibility that pharmacological manipulation of ACC2 may lead to loss of body fat in the context of normal caloric intake.

A. In mice, there are two forms of acetyl-CoA carboxylase (*ACC1* and *ACC2*). Write the reaction (structures of the reactants and product) catalyzed by this enzyme: [2 credits]

B. Deletion of one of the forms of the enzyme gives rise to thin mice. Does this make sense? Why or why not?

