

1. Many biosynthetic reactions involve the input of energy from ATP and the reducing agent NADPH. For the lipid (fatty acid and sterol) biosynthesis reactions we have studied, identify (by giving reactants and products—structure or name) the steps in which:
- (12) (a) ATP is utilized in sterol biosynthesis (3 steps).

Page	Points
1	_____
2	_____
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- (8) (b) NADPH is utilized in fatty acid biosynthesis (2 steps)

- (6) 2. Citrate plays two distinct roles in fatty acid biosynthesis. Describe them.

- (10) 3. HMG-CoA is an intermediate in both ketone body formation and in sterol synthesis. Identify the next step in its metabolism in **each** pathway by giving:
- The structure of the reactants and products of the step (abbreviation of nucleotides is okay).
 - The name of the enzyme catalyzing the step.
 - The cellular location of the enzyme.
- (10) 4. Two enzymes involved in lipoprotein metabolism are **lipoprotein lipase** and **LCAT**. Explain:
- The reaction catalyzed by each enzyme. (Give reactants and products, name or structure).
 - The apoprotein cofactor required by each enzyme.
 - The lipoprotein(s) with which each enzyme reacts.
- (4) 59. Apolipoprotein **B-48** is a truncated version of apolipoprotein **B-100**. Contrast these two apoproteins with respect to (a) site of synthesis, and (b) lipoprotein(s) containing each.

- (6) 61. Give the structure of the enzyme bound intermediate of the enzyme **alanine aminotransferase** (also known as **GPT**) in which the **prosthetic group** is covalently attached to **alanine**. What does **GPT** stand for?
- (18) 7. **Butyric acid** is a four-carbon fatty acid with an unpleasant, rancid odor that is found in butter. It can be used as an energy source by most tissues. Assuming it is oxidized in the same manner as longer chain fatty acids, give the overall pathway for its complete oxidation to CO_2 , showing structures of intermediates, and indicating the steps where ATP, GTP, NADH and CoQH_2 are used or produced. Give the **overall stoichiometry** of the reaction, and calculate the total yield of ATP from the complete oxidation assuming one NADH yields 2.5 ATP and one CoQH_2 yields 1.5 ATP during oxidative phosphorylation. (Note: butyric acid can bypass the cytosolic activation step and the carnitine transport system, diffusing directly into mitochondria).

- (6) 8. **Phosphatidyl ethanolamine** can be formed in two different enzymatic reactions, one a salvage pathway and another by conversion from another phospholipid. Give the **reactants** and **products** of each of these reactions (structures or names okay).
- (12) 9. Compare and contrast the structural organization of the **fatty acid synthase** from **yeast** and from **animals**. Identify the catalytic domains that participate in the overall reaction (name or abbreviation), and explain in each case how the domains are organized to provide an active enzyme. How do the **products** of the reaction differ for the two enzymes?.
- (8) 10. A major reaction by which ammonia is assimilated into organic form is catalyzed by the enzyme **glutamine synthetase**.
- (a) Give the reaction catalyzed by this enzyme, including the **structure** of the reactants and products and the **structure** of the enzyme bound intermediate. (ATP and ADP may be abbreviated).
- (b) The bacterial form of this enzyme is regulated by covalent modification. Describe the functional group added in the modification and indicate whether the modification **activates** or **inactivates** the enzyme.