

1. Discuss and compare the structural differences between DNA and RNA molecules (10 points).
2. One of the greatest discoveries in the 20th century is the polymerase chain reaction. Please describe the principle of this technique (10 points).
3. Describe the first, secondary, tertiary, and quaternary structures of a protein (10 points).
4. Fatty acid degradation is mediated through the so-called β -oxidation. One cycle of β -oxidation generates one acetyl-CoA and one of each electron-carrying molecules, NADH and FADH₂. Acetyl-CoA, NADH, and FADH₂ will be further metabolized to produce ATP. Please list how many moles of acetyl-CoA, NADH, and FADH₂ will be generate if one mole of palmitic acid, a 16-carbon saturated fatty acid, is completely oxidized. Also calculate how many moles of ATP can be produced by oxidation of one mole of palmitic acid (10 points).
5. Write a major function for the followings (2 points each):
 - a. Chaperonins
 - b. DNA-dependent RNA polymerase II
 - c. Protin kinase
 - d. Phosphorylase
 - e. Proliferating cell nuclear antigen
 - f. Ribonuclease P
 - g. Glucagon
 - h. Human chorionic gonadotropin
 - i. Oncogenes
 - j. Reporter genes

6. Identify the place, listed in column B, where the reactions listed in column A occur. Note: The places listed in column B may not be used, may be used once or more than once (2 points/each).

Column A: Reactions	Column B: Places
a. synthesis of pregnenolone	mitochondria
b. synthesis of progesterone	endoplasmic reticulum
c. Citric acid cycle	ribosome
d. Translation	cytosol
e. Phosphoinositol 4, 5 bisphosphate breakdown	nucleus
f. Formation of Okazaki fragment	lysosome
g. Binding of estrogen to its receptor	peroxisome
h. Conversion of glucose-6-phosphate to fructose-6-phosphate	plasma membrane
i. Conversion of arachidonic acid to prostaglandin H ₂	nuclear membrane
j. Light reaction	Golgi apparatus
	chloroplast
	cellular wall
	extracellular matrix

7. Briefly describe the following concepts or techniques (4 points/each):
 - a. The Watson-Crick model for DNA
 - b. Semiconservative theory of DNA replication
 - c. DNA fingerprinting
 - d. Gel diffusion precipitin test
 - e. Western blotting