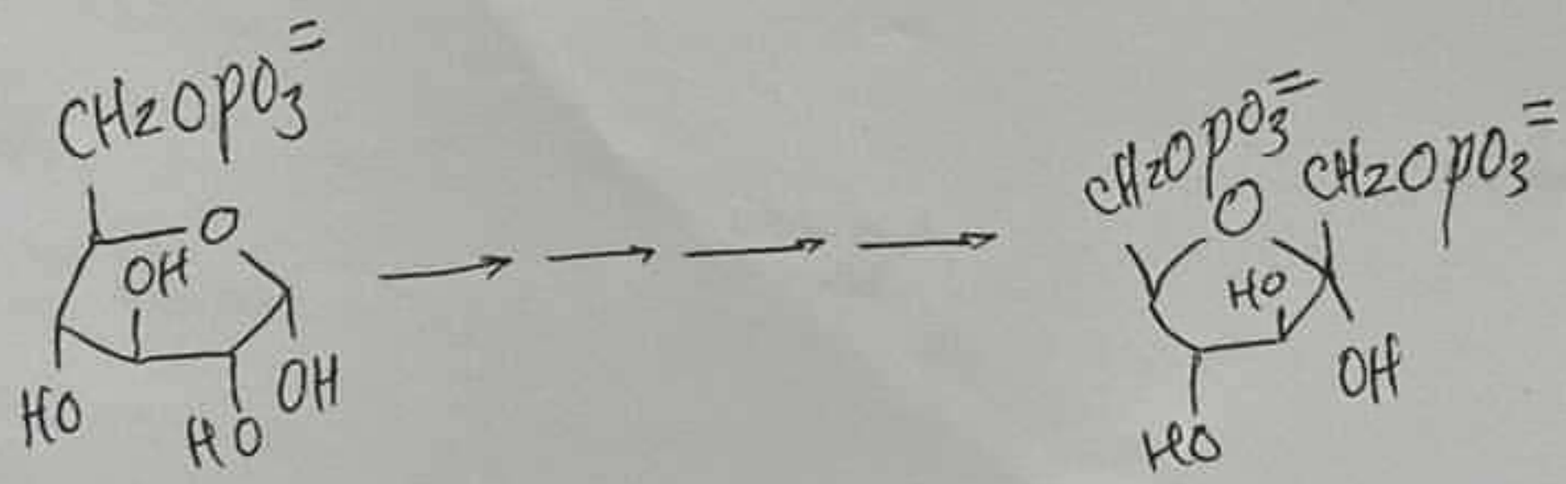
Final Exam, Introduction to Biochemistry January 12, 2021

1. Explain the following terminology and describe their significance in biochemistry: (10 points)

   a. Cori cycle
   b. Palindrome DNA
   c. Z scheme of photosynthesis
   d. Recombinant DNA
   e. Anomers

2. In glycolysis, please write down the molecular mechanism of the following conversion from glucose 6-phosphate to fructose-1, 6-bisphosphate. (10 points)



Glucose 6-phosphate Fructose-1,6-bisphosphate

3. Please draw the 3D structure of ATP synthesase including F_0 and F_1 subunit? (10 points)

4. Figure (on next page) shows the citric acid cycle. If carbon-14 was labeled on the C-2 position of glucose, please label carbon-14 position in the first run of citric acid cycle? (10 points)

5. Draw a picture of chloroplast. Label where are the thylakoid membrane, stroma, and thylakoid space in the figure? (10 points)

6. In the photosynthesis, what is light reaction? and dark reaction? If you walk into a park where has lots of green plants around it, which air quality is better in the daytime or at night, why? (10 points)

7. Briefly describe Calvin cycle. (10 points)

8. The net reaction of Calvin cycle for C_3 plant is

$6CO_2 + 18\ ATP + 12\ NADPH + 12\ H_2O \rightarrow$

$C_6H_{12}O_6 + 18\ ADP + 18Pi + 12\ NADP^+ + 6H^+$

While the net reaction of Calvin cycle for C_4 plant is

$6CO_2 + 30\ ATP + 12\ NADPH + 24\ H_2O \rightarrow$

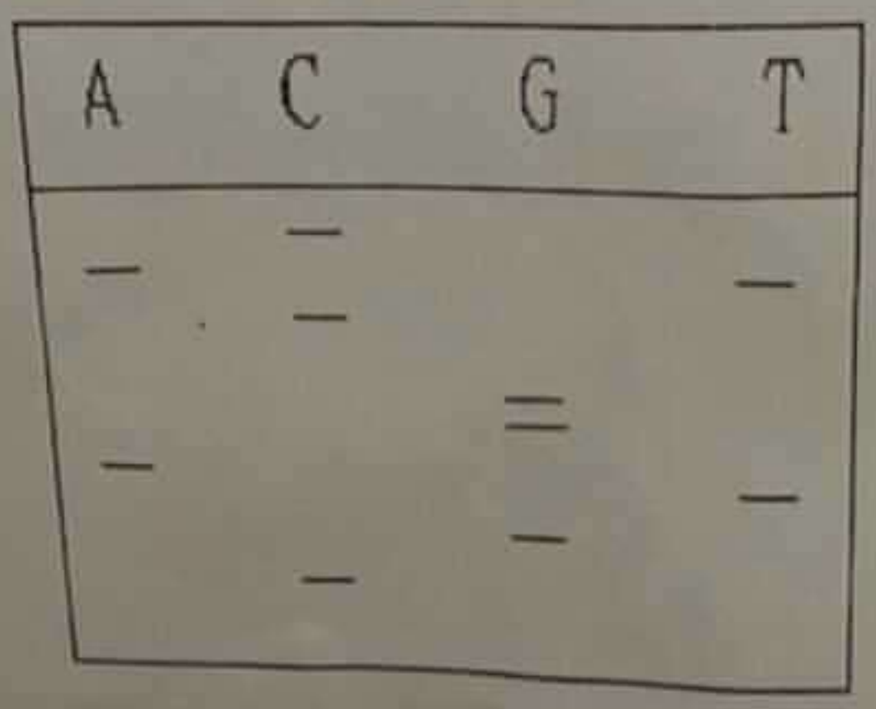
$C_6H_{12}O_6 + 30\ ADP + 30Pi + 12\ NADP^+ + 18H^+$

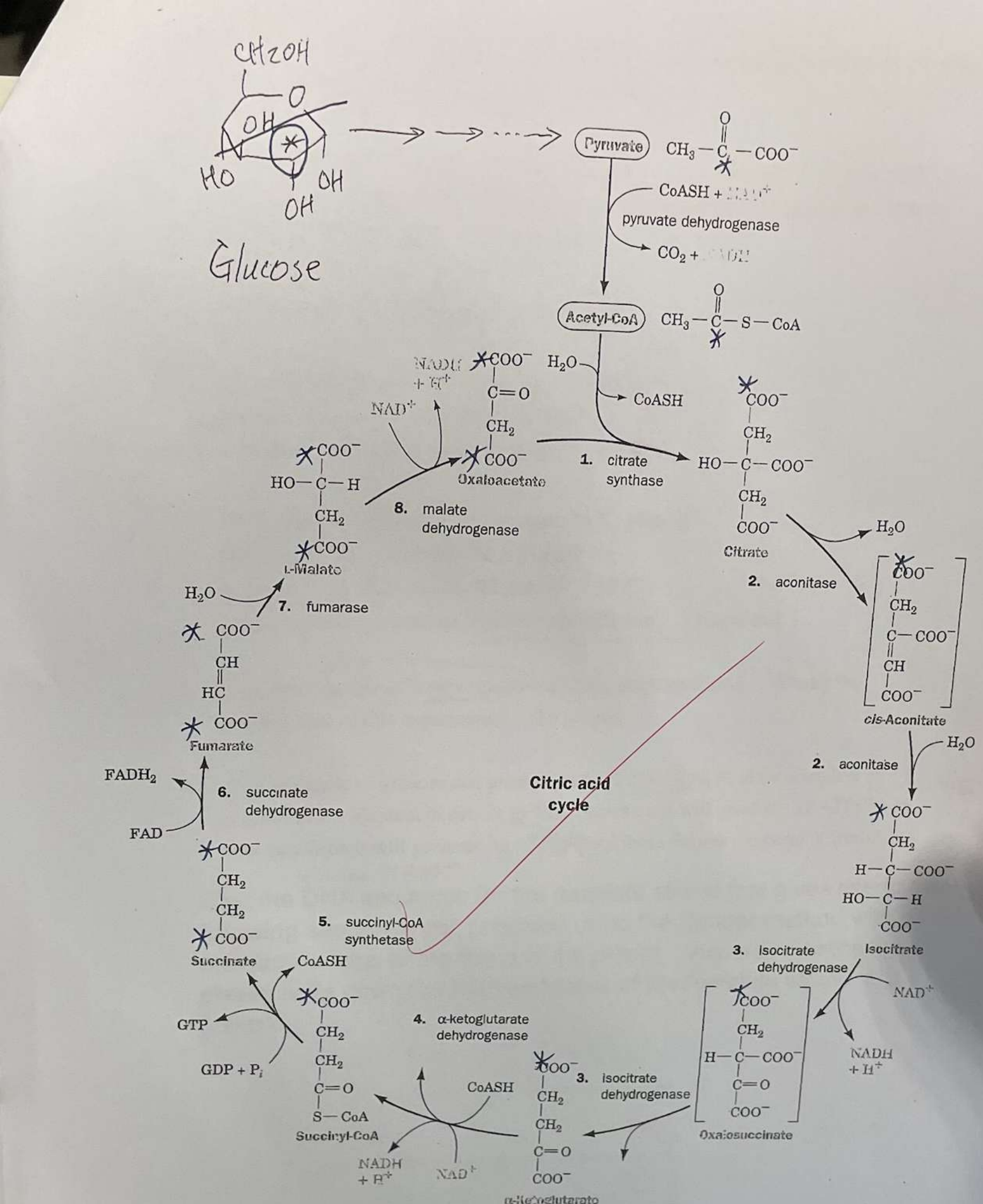
Please explain the reasons why they are different? (10 points)

9. Describe Jagendrorf's experiment regarding photosynthesis. What's the significance of this experiment? (10 points)

10. One molecule of glucose can produce either 32 or 30 ATPs after complete metabolized. Explain in details in what condition it will generate 32 ATPs? In what condition it will generate 30 ATPs? How these figures are coming from?

11. Give the DNA sequence for the template strand that gives rise to the following sequence gel, prepared using the Sanger method with a radioactive label at the 5'end of the primer. According to the figure, please write down the DNA sequence of the template strand. (10 points)




Glucose
Pyruvate
CoASH + NAD+
pyruvate dehydrogenase
CO2 + NADH
Acetyl-CoA
CoASH
H2O
NADH + H+
NAD+
Oxaloacetate
1. citrate synthase
Citrate
2. aconitase
H2O
cis-Aconitate
2. aconitase
H2O
Isocitrate
3. isocitrate dehydrogenase
NAD+
NADH + H+
Oxalosuccinate
3. isocitrate dehydrogenase
α-Ketoglutarate
4. α-ketoglutarate dehydrogenase
CoASH
NADH + H+
NAD+
Succinyl-CoA
GTP
GDP + Pi
CoASH
Succinate
5. succinyl-CoA synthetase
FADH2
FAD
6. succinate dehydrogenase
Fumarate
H2O
7. fumarase
L-Malate
8. malate dehydrogenase
Citric acid cycle