

Name: _____

Student ID: _____

CHEM 161 PAL Fall 2026

Worksheet #24: ATP Synthase

1. Draw a diagram of ATP synthase in the inner mitochondrial membrane. Show all the subunits in F_0 and F_1 . On your diagram circle and label the location of ATP synthesis and proton movement.
2. Draw a diagram of the c-ring of ATP synthase. In your diagram, include the following: N-side half channel, P-side half channel, c subunits (showing Glu), a subunit (showing His and Arg), inner membrane, p-side, n-side.

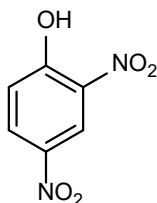
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3. Describe how the proton gradient causes rotation of the c-ring.

4. How does ATP synthase offset the energy required to synthesize ATP? Explain your answer by discussing the various conformation of the β subunits and how the c-ring rotation causes those changes.

5. Dinitrophenol (DNP) is a molecule that acts as an uncoupler because it shuttles protons across the inner mitochondrial membrane, dissipating the proton gradient.



Dinitrophenol (DNP)

a. What chemical features and/or functional groups allow DNP to act as a proton shuttle?

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- b. What effect does DNP have on the synthesis of ATP? Explain.

- c. What effect does DNP have on electron transfer between complexes I-IV? Explain.