Chem 352 - Quiz 3 Study Guide

Use constants: Ideal gas law constant, R = 0.08206 (l•atm)/(mol•K) = 8.314 (J/(mol•K); Faraday's constant, $\mathcal{F}$ = 9.659 x 10^4 J/(V•mol); Planck's constant, h = 6.626 x 10^{-34} J•s.

1. Describe the metabolic purpose for each of the following pathways:
   a. Gluconeogenesis:

   b. The alcohol fermentation pathway:

   c. Glycolysis:

2. Lactic acid fermentation comprises a single reaction.
   a. Using structural formulas, write the *reaction equation* this reaction and name the the reactants and produc

   b. The enzyme that catalyzes the reaction is *lactate dehydrogenase*. What enzyme class does this enzyme belong to?
   _____

   c. In is the purpose for lactic acid fermentation in mammalian muscle tissue?

   d. Using the appropriate reduction potentials provided in the table below, calculate the standard free energy for this reaction.
   $\Delta G°' =$ _____

Table 10.5 Standard reduction potentials of some important biological half-reactions

Reduction half-reaction	$E°'$ (V)
Acetyl CoA + CO_2 + H^+ + $2e^-$ → Pyruvate + CoA	−0.48
Ferredoxin (spinach). Fe^{3+} + e^- → Fe^{2+}	−0.43
2 H^+ + $2e^-$ → H_2 (at pH 7.0)	−0.42
α-Ketoglutarate + CO_2 + 2 H^+ + $2e^-$ → Isocitrate	−0.38
Lipoyl dehydrogenase (FAD) + 2 H^+ + $2e^-$ → Lipoyl dehydrogenase ($FADH_2$)	−0.34
$NADP^+$ + H^+ + $2e^-$ → NADPH	−0.32
NAD^+ + H^+ + $2e^-$ → NADH	−0.32
Lipoic acid + 2 H^+ + $2e^-$ → Dihydrolipoic acid	−0.29
Thioredoxin (oxidized) + $2H^+$ + $2e$ → Thioredoxin (reduced)	−0.28
Glutathione (oxidized) + 2 H^+ + $2e^-$ → 2 Glutathione (reduced)	−0.23
FAD + 2 H^+ + $2e^-$ → $FADH_2$	−0.22
FMN + 2 H^+ + $2e^-$ → $FMNH_2$	−0.22
Acetaldehyde + 2 H^+ + $2e^-$ → Ethanol	−0.20
Pyruvate + 2 H^+ + $2e^-$ → Lactate	−0.18
Oxaloacetate + 2 H^+ + $2e^-$ → Malate	−0.17
Cytochrome b_5 (microsomal). Fe^{3+} + e^- → Fe^{2+}	0.02

   e. Is this reaction favorable under standard state conditions? (Y/N) _____
   Explain:

f. If you drew the correct reaction equation in part a., it should show an NADH + H^+ being reoxidizes to NAD^+. Using structural formulas, draw the *balanced reaction equation* for the one reaction in glycolysis that reduced the NAD^+ to NADH + H^+ and label the reactants and products

3. There are three reactions in glycolysis that are regulated allosterically. Name two of these using their enzyme names and indicate at least one metabolite that regulates each allosterically. Also indicate the cellular condition that the regulation is responding to.

Enzyme Name	Allosteric Regulator	Is it an Activator or Inhibitor	Cellular Condition