This is from last year. I'll add questions about papers also, and points are different

Biochemistry E3100: Exam 22nd Oct. 2018

You need to choose questions to obtain 65 or 50 points. (The questions presented add up to 75 points, it means you have to leave out questions for 10 or 25 points.)
Last-names of students that need only 50 points are: I

- **Have a look at all questions**
- **Select which ones to answer** (only whole questions Q1-Q10 selectable, not sub-questions!)
- **Answer only the selected questions.**

The questions I am going to answer are: _____
Write your name on all papers. No material, no devices allowed.

Q1: Topic B Thermodynamics (5P)

$$ATP + H_2O \rightarrow ADP + P_i \quad (\Delta G^{\circ\prime} = -30.5 \text{ kJ mol}^{-1})$$

A) Is reaction exergonic or endergonic under standard conditions? 1P
B) What does ° stand for within $\Delta G^{\circ\prime}$? 1P
C) What does ′ stand for within $\Delta G^{\circ\prime}$? 1P
D) Explain why a cell usually requires about 50 kJ mol^{-1} to produce 1 ATP from ADP and P_i. 2P

Q2: Topic B Thermodynamics (10P)

$$\text{Ethanol} + NAD^+ \rightarrow \text{Acetaldehyde} + NADH + H^+$$

A) What is oxidized and what is reduced? 1P
B) Is the reaction endergonic or exergonic under standard conditions? 2P
C) What is the electromotive force $\Delta E^{\circ\prime}$ for the reaction? 2P
D) What is standard Gibbs energy change $\Delta G^{\circ\prime}$ for the reaction? 2P
E) What is $\Delta G'$ at room temperature (25 °C) if [ethanol]/[acetaldehyde] ratio is 1000 and [NAD^+]/[NADH] concentration ratio is 100? 2P
F) Does the reaction occur spontaneously under the above mentioned conditions? 1P

TABLE 14-4 Standard Reduction Potentials of Some Biochemically Important Half-Reactions

Half-Reaction	$\mathscr{E}^{\circ\prime}$ (V)
$Pyruvate^- + 2\,H^+ + 2\,e^- \rightleftharpoons lactate^-$	−0.185
$Acetaldehyde + 2\,H^+ + 2\,e^- \rightleftharpoons ethanol$	−0.197
$FAD + 2\,H^+ + 2\,e^- \rightleftharpoons FADH_2$ (*free coenzyme*)	−0.219
$S + 2\,H^+ + 2\,e^- \rightleftharpoons H_2S$	−0.23
$Lipoic\ acid + 2\,H^+ + 2\,e^- \rightleftharpoons dihydrolipoic\ acid$	−0.29
$NAD^+ + H^+ + 2\,e^- \rightleftharpoons NADH$	−0.315
$NADP^+ + H^+ + 2\,e^- \rightleftharpoons NADPH$	−0.320
$Cysteine\ disulfide + 2\,H^+ + 2\,e^- \rightleftharpoons 2\ cysteine$	−0.340
$Acetoacetate^- + 2\,H^+ + 2\,e^- \rightleftharpoons \beta\text{-hydroxybutyrate}^-$	−0.346
$H^+ + e^- \rightleftharpoons \frac{1}{2}\,H_2$	−0.421
$SO_4^{2-} + 2\,H^+ + 2\,e^- \rightleftharpoons SO_3^{2-} + H_2O$	−0.515
$Acetate^- + 3\,H^+ + 2\,e^- \rightleftharpoons acetaldehyde + H_2O$	−0.581

Source: Mostly from Loach, P.A., *in* Fasman, G.D. (Ed.), *Handbook of Biochemistry and Molecular Biology* (3rd ed.), Physical and Chemical Data, Vol. I, pp. 123–130, CRC Press (1976).

Hints:
Faraday constant (F):
F ≈ 100 kJ mol^{-1} V^{-1}

R * 298 K * ln(10) = 5.7 kJ mol^{-1}

1,2,3,4,5 * 5.7
= 5.7, 11.4, 17.1, 22.8, 28.5

Q3: Topic C Glycolysis (10P)
Describe all the steps of glycolysis, including intermediates and enzymes (structures or names of intermediates, no abbreviations). 5P
What is the fate of glucose under anaerobic conditions? 2.5P
What is the biological role of glycogen? What is glycogen made up from? 2.5P

Q4: Topic D TCA cycle (10P)
a) Write the overall reaction of the TCA cycle. 2P
b) Draw a figure of the TCA cycle where all the intermediates, enzymes and substrates are indicated. 8P

Q5: Topic D TCA cycle (5P)
a) Where is the TCA cycle happening? 1P
b) What is the principle of the TCA cycle? 2P
c) Give one example each of an anaplerotic and cataplerotic reactions in the TCA cycle. 2P

Q6: Topic E Mitochondrial ATP synthesis (10P)
A) Where does electron-transport process take place? 2P
B) Describe the overall structural organization, the main events and the role of electron transport chain + oxidative phosphorylation in cell metabolism? 8P

Q7: Topic F Photosynthesis (10P)
A) Explain how absorbed light energy is used to form a proton gradient in the light reaction of photosynthesis (drawing). 8P
B) What happens to the resulting proton gradient thereafter? 2P

Q8: Topic G Lipids (5P)
A) What are lipoproteins? What is their role? 2P
B) Explain fatty acid oxidation briefly. Where does it happen? What are the steps? 3P

Q9: Topic G Lipids (5P)
A) What are ketone bodies and why do we need those? 1P
B) In which organ and under what kind of conditions are ketone bodies produced? 2P
C) From what are ketone bodies derived from? 1P
D) Draw an example of a ketone body and name it. 1P

Q10: Topic I Regulation (5P)
A) When is insulin secreted? 1P
B) What are the effects of insulin? 1P
C) How does it regulate metabolism in different organs? 3P