

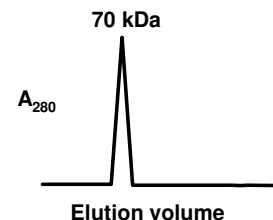
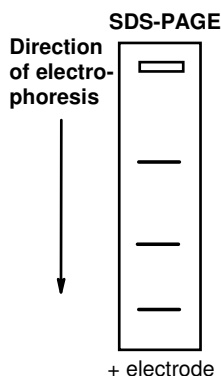
This six page exam contains 100 pts. Allot 1 min/2 pnts.

1. (5 pts) Please do **one** of the following three choices. Please indicate your choice.

Choice A: In very general terms, how does the structure, or arrangement, of atoms in an object (e.g. a protein in a crystal) affect the scattering of X-rays.

Choice B: Briefly describe the *final* step in the determination of a structure by X-ray diffraction.

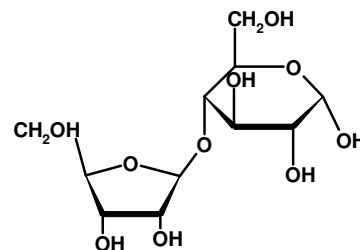
Choice C: A protein is denatured using sodium dodecyl sulfate (SDS). The protein is then run on an SDS-PAGE and the image of the gel is shown on the right. The protein is known to contain 5 kDa, 10 kDa, and 20 kDa subunits. The same protein, in its native state, is run on a Gel filtration column and the elution profile from that column is also shown on the right. Please answer the following two questions:



- Label the bands on the SDS gel with the correct molecular weights (there are no standards on this gel, just the protein)(1 pt).
- Give, *and justify*, the quaternary structure that is consistent with both experiments (4 pts).

2. (5 pts)

- Are both monosaccharides aldoses, both ketoses, or one of each (1 pt)?
- Which of the following choice is the correct name for the dissaccharide shown on the right. Justify your answer if you want partial credit for an incorrect answer (4 pts).
 - β -ribofuranosyl (1-4) β -glucopyranose
 - β -fructofuranosyl (2-4) α -glucopyranose
 - β -ribofuranosyl (1-4) α -glucopyranose
 - α -glucopyranosyl (4-1) β -ribofuranose
 - β -ribofuranosyl (1-4) α -glucopyranoside



3. (8 pts) Please do **one** of the following two choices:

Choice A: *Briefly* describe the chemical structure of bacterial cell walls.

Choice B: Compare and contrast the chemical structure of cellulose to glycogen (or starch). What is the normal biochemical role of cellulose and glycogen?

4. (5 pts) *Briefly* describe the chemical difference between a phospholipid and a triglyceride. A simple sketch is an acceptable answer.

5. (10 pts) Please do any **one** of the following three questions:

Choice A: Briefly describe the role of the hydrophobic effect on the formation of phospholipid bilayers and micelles. Your answer should also discuss why these two compounds form structures with different shapes.

Choice B: Briefly explain why the mainchain conformation of membrane proteins is either α -helix or β -barrel.

Choice C: Describe the main types of transport proteins in membranes, provide **one** example.

6. (6 pts) Please answer **one** of the following two choices:

Choice A: What physically happens to a phospholipid bilayer when it undergoes a gel-to-liquid crystalline phase transition? How does cholesterol affect this phase transition?

Choice B: How does the chemical structure of a phospholipid affect the temperature (T_M) of its phase transition? What molecular force or interaction is involved?

7. (12 pts) Pick any **one** of the three food groups: i) proteins (amino acids), ii) carbohydrates (glucose), iii) fats (fatty acids), and list (or provide an overview drawing) **ALL** of the pathways involved in the *complete* conversion of the compound to CO_2 and ATP. You should include key intermediates in your answer and the location of the pathway in the cell. You should not list all compounds in all pathways.

8. (12 pts) Please do **one** of the following two choices:

Choice A: Briefly discuss how ATP is synthesized in the mitochondria. Your answer should include a brief discussion of why the overall change in the Gibbs free energy during this process is favorable and a description of the mechanism of ATP synthase.

Choice B: A three step biological pathway: $A \rightarrow B \rightarrow C$ is found to be spontaneous, yet the difference in the standard energies between compounds A and B is large and positive. Briefly describe **both** of the possible types of coupling that can be used to make the step from A to B spontaneous. Provide **one** example.

9. (8 pts) Please do one of the following two choices. Please indicate your choice.

Choice A:

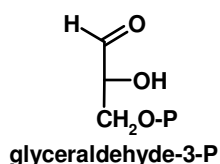
- i) What enzymatic reaction is catalyzed by a *protein* kinase (4 pts)?
- ii) What is the importance of reactions of this type in regulation of metabolism (4 pts)?

Choice B:

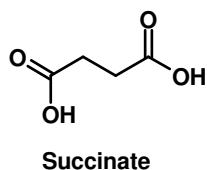
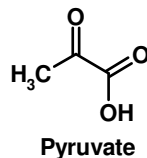
Compare and contrast a feedback inhibitor to a product inhibitor (6 pts). Provide an example of *either* and indicate the biological importance of the regulation in your example (2 pt)

10. (10 pts) Pick *any one* oxidation step in *any* biochemical pathway and answer all of the following questions. (*The structures on the right may be helpful.*)

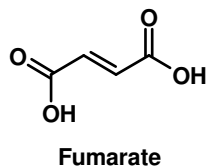
i) List the pathway(s) that your reaction is found (2 pt).



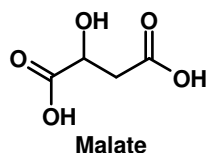
ii) Draw the structure of the reactant and product, if the reactant is shown on the right, just draw the product (2 pts).



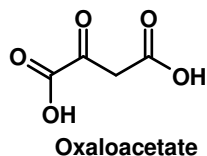
iii) Name the enzyme that catalyzes the reaction (1 pt).



iv) Indicate any cofactors or cosubstrates that would be required (1 pt).



v) Show, by balancing, that the reaction you have selected is indeed an oxidation (2 pts).



vi) In *very* general terms, what is the most important product from *any* oxidation (2 pts).

11. (5 pts) Please do one of the following two choices:

Choice A: Although glycolysis does not directly utilize O₂, it will quickly stop in the absence of oxygen unless anaerobic metabolism occurs. What is the purpose of anaerobic metabolism?

What product of commercial value can be produced by anaerobic metabolism in yeast?

Choice B: Why can't humans convert excess calories from ingested fat into glucose?

12. (14 pts) Pick *one* coordinately regulated step in glycogen or glucose metabolism and briefly describe (*use the back of the previous page if you need additional room*):

i) How it is regulated, including a *brief* description of either direct or indirect hormonal control (8pts).

ii) The biological importance of this regulation (6 pts).

1: _____/5

2: _____/5

3: _____/8

4: _____/5

5: _____/10

6: _____/6

7: _____/12

8: _____/12

9: _____/8

10: _____/10

11: _____/5

12: _____/14

TOT: _____/100