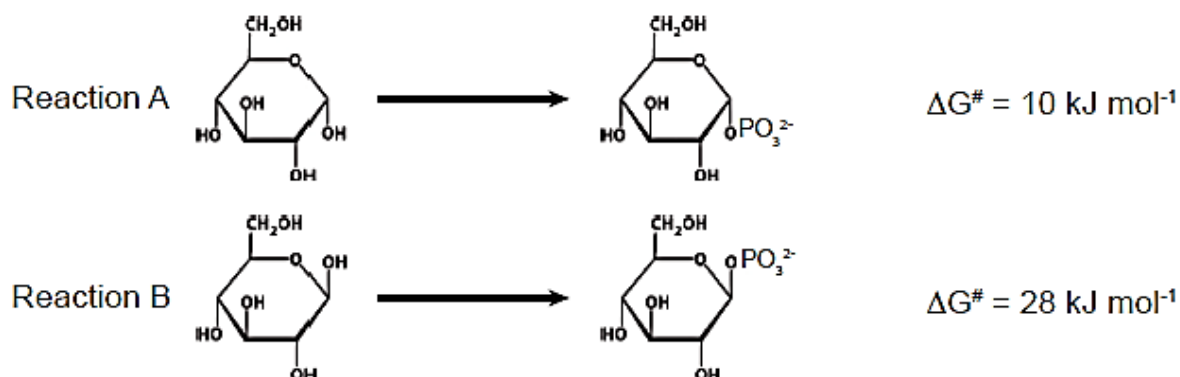


01. Consider the two enzyme-catalyzed reactions below:



Can you predict which of these reactions will have a higher rate? Explain your answer.

02. Consider the two reactions shown below:



Which will occur spontaneously? Which will occur at a higher rate in human cells? Most likely, will the enzyme that catalyzes reaction A also catalyze reaction B? Give reasons for each answer!

03. Mark each statement below TRUE or FALSE and explain your choice. Credit given only if your reasoning is correct.

- The molecule $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ can participate in hydrophobic interactions.
- Strong bonds are important in biochemistry because enzymes cannot break strong bonds
- ATP hydrolysis can be coupled with non-spontaneous reactions to make them spontaneous
- Changing the concentration of a substrate can make a non-spontaneous reaction spontaneous in human cells.

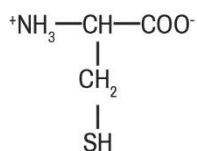
04. What is the net charge of the following peptides at pH 1? Towards which pole will they travel in a linear electric field at that pH? Explain your reasoning.

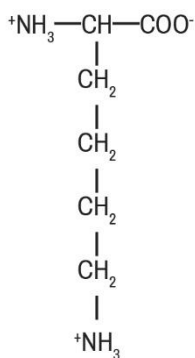
Ala-Pro-Val-Ile-Leu-Leu-Ile

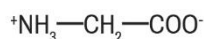
Ala-Pro-Glu-Val-Asp-Lys-Leu

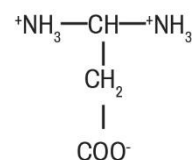
PRACTICE MID-TERM 1

05. If the K_{eq} for a reaction in the cell is 0.46, is the reaction spontaneous in the cell? Explain your answer.
06. What is the pI of the following peptide? TDRLYAK
07. Write in the amino acid depicted for each molecule in the box below it. If the molecule shown is not a standard amino acid, write in "NS."

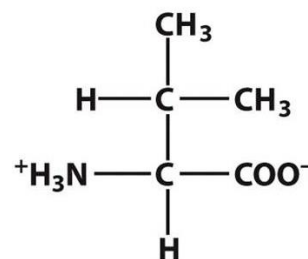




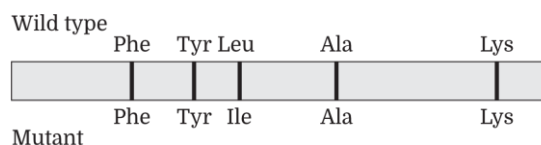




08. Consider the molecule below. If $pK_1 = 2.4$ and $pK_2 = 11.3$, what is its net charge at pH 12?



09. The figure depicts the primary structure of an enzyme. The amino acids that make up the active site are marked for the wild type enzyme (top amino acids) and a mutant enzyme (bottom amino acids). Based on this, what is your **BEST** prediction about the mutant enzyme?

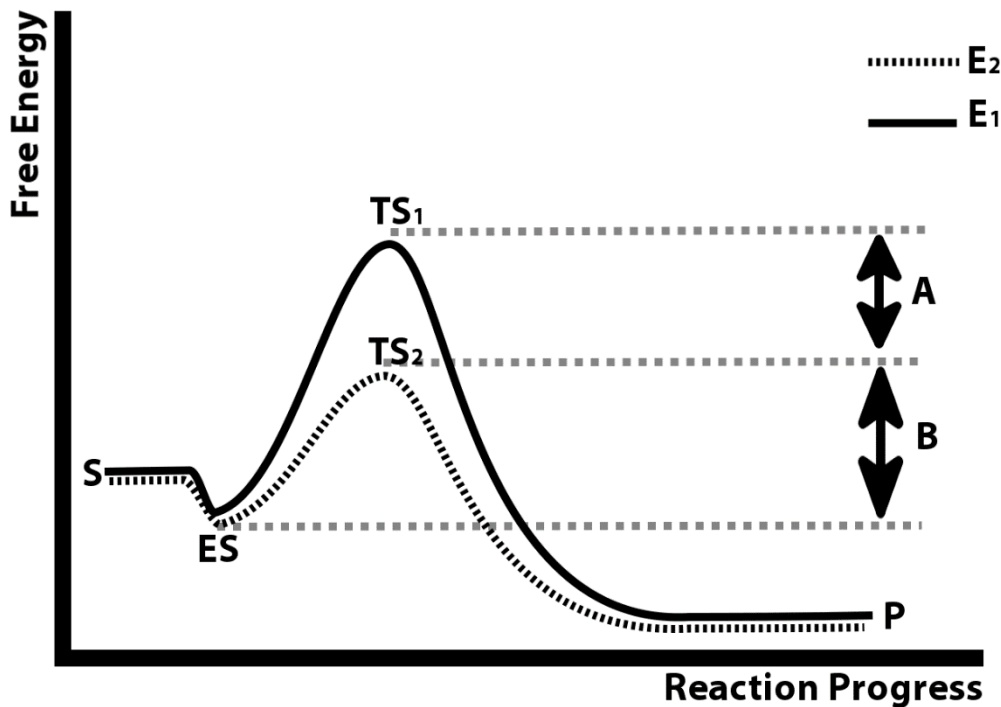


- ☐ T ☐ F ☐ ? Mutant enzyme will have lower activity; Ile will not bind substrate as well as Leu, and will not stabilize the transition state.
- ☐ T ☐ F ☐ ? Mutant enzyme will have lower activity; mutation will cause protein to unfold.
- ☐ T ☐ F ☐ ? Mutant enzyme will have the same activity as wild type; Leu and Ile have similar R-groups with similar weak bonds.

10. Which amino acid is **more** soluble in water? Explain why!
- Val
 - Tyr
 - Ala
 - Leu
 - Phe
11. Mark each statement below TRUE or FALSE and explain your choice. Credit given only if your reasoning is correct.
- Secondary structures are primarily stabilized by ionic interactions
 - Regions of a protein that lack a regular secondary structure are considered denatured
 - A single protein can have multiple α -helices
 - Bends and loops are not important in forming secondary structure
12. A protein is mutated and converts one Asp \rightarrow Ala. What effects might this mutation have on the protein structure? Your answer should also explain the impact on each level of protein structure.
13. You want to test the role of a particular Cys residue in an enzyme by mutating it to another amino acid and seeing its effect on function. For the mutation, you want to pick an amino acid that is most similar in size and shape. Which amino acid would you pick and why? Give the full name, the 3 letter code, AND the 1 letter code.
14. What types of amino acids would you most expect to see on the inside of a folded globular protein? Explain.
15. Consider a reaction that occurs in human cells with a $\Delta G = 5 \text{ kJ mol}^{-1}$. What mechanisms could make the reaction spontaneous? Explain.

PRACTICE MID-TERM 1

16. The graph below shows the same reaction catalyzed by 2 enzymes E_1 and E_2 . **If $A = B$** , and the free energy of $ES_1 = ES_2 = ES$, which of these reactions will occur at a higher rate? Explain your answer.



17. A mutation from $G \rightarrow A$ causes a protein to lose its activity. Which level of protein structure is most likely affected and how? Explain your answer.
18. You are simulating the first reaction of glycolysis in a test tube: $\text{Glucose} + \text{ATP} \rightarrow \text{Glucose-6-PO}_4 + \text{ADP}$. You mix all the components (Glucose, ATP, ADP and Glucose-6- PO_4), making sure to match $[\text{Glc-6-PO}_4][\text{ADP}]/[\text{Glc}][\text{ATP}] = K_{eq}$ for the reaction. You then add the hexokinase. What will happen? Will more $\text{ADP} + \text{Glc-6-PO}_4$ be made? Will more $\text{Glucose} + \text{ATP}$ be made? Will nothing happen? Explain your answer.
19. A substrate binds tightly to the “X” domain of a protein. Would you expect the same substrate to bind to another protein that also has an “X” domain? Explain your answer.
20. Which of the following statements are TRUE about isomers/isomerization? (Mark all that apply)
- ☐ They have different molecular masses
 - ☐ Isomerization can result in different functional groups
 - ☐ Isomers can have different physical properties
 - ☐ Enzymes cannot differentiate between isomers
 - ☐ Only carbohydrates can form isomers
 - ☐ A molecule that has no chiral carbons cannot show isomerization