

Page	Points
1	_____
2	_____
3	_____
4	_____
5	_____
Total	_____

(6) 1. Describe three major structural differences between DNA and RNA.

(6) 2. Which form of DNA (**A**, **B**, or **Z**) (Put answer in blank)

\_\_\_\_\_ has the greatest tilt angle of the base pairs?

\_\_\_\_\_ has deoxyguanosine in the **syn** conformation?

\_\_\_\_\_ is favored by high GC content?

\_\_\_\_\_ has a left-handed helix?

\_\_\_\_\_ is favored by low humidity?

\_\_\_\_\_ is formed by RNA double helices?

(8) 3. Draw the structure of the following, showing the bases in their proper tautomeric form.:

(a) cytosine

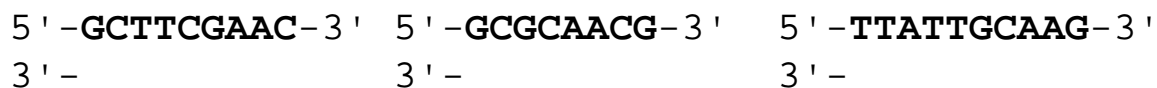
(b) adenine

(c) a **ribonucleoside** containing uracil

(d) a **deoxynucleotide** containing guanosine

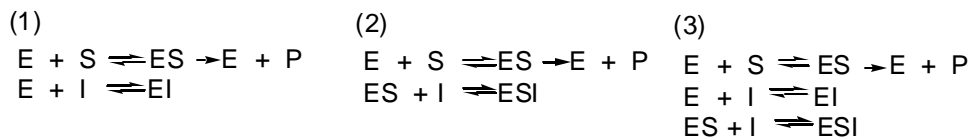
(5) 4. Explain why RNA is sensitive to base hydrolysis and DNA is not. What products are formed on base hydrolysis of RNA?

- (6) 5. From the following DNA sequences, write the complimentary sequence under it in the 3' to 5' direction), and **circle** the bases of the resulting double stranded DNA which are palindrome sequences at least four base pairs in length.



- (6) 6. What three types of RNA are involved in protein synthesis?
- (4) 7. Give the equation that describes the effect of temperature on reaction rate. What is it called?
- (4) 8. What is the difference between a **ligase** and a **lyase**?
- (4) 9. Explain the difference between coenzymes that are classified as **cosubstrates** and those classified as **prosthetic groups**.

(15) 10. Following are three models for reversible inhibition:



where  $K_I = \frac{[E][I]}{[EI]}$  and  $K'_I = \frac{[ES][I]}{[ESI]}$

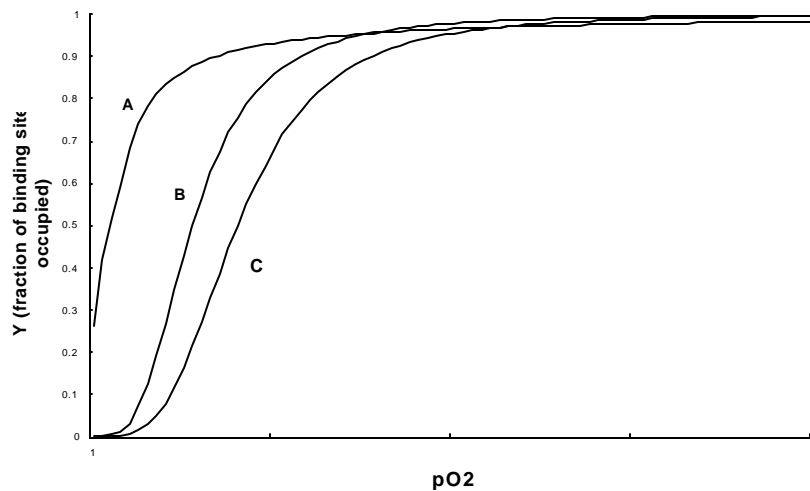
- (a) Identify each model by the **name** of the inhibition.
- (b) Give the kinetic equation in the reciprocal Lineweaver-Burk form that corresponds to each model.
- (c) Draw a Lineweaver Burk plot for each model, showing one line for the uninhibited reaction and a second line for a reaction containing inhibitor.

(8) 11. Which of the following are **not** assumptions made in the derivation of the Michaelis-Menten equation for a one-substrate, one-product reaction? (Put a check by the inappropriate assumptions.)

- |  |   |
|--|---|
| <p>_____ [S] &gt;&gt; [E<sub>total</sub>].</p> <p>_____ The rate of formation of ES equals its rate of breakdown.</p> <p>_____ The rate of breakdown of ES to E + P is much faster than the rate of breakdown of ES back to E + S.</p> <p>_____ <math>K_M = [E][S]/[ES]</math></p> | <p>_____ The concentration of ES is small relative to the concentration of E<sub>total</sub>.</p> <p>_____ [E<sub>total</sub>] &gt;&gt; [E<sub>free</sub>].</p> <p>_____ The rate of reaction is equal to <math>k_2[ES]</math>.</p> <p>_____ The velocity of the catalyzed reaction is equal to <math>k_1[E][S]</math>.</p> |
|--|---|

- (5) 12. The pH-rate profile for ribonuclease is bell shaped, with a pH maximum at 6.0 and inflection points of approximately 5.8 and 6.2 in the two sides of the curve.
- (a) What amino acid side chain(s) would be likely candidates for titration at these pK values?
- (b) Presumably the groups responsible for these pH effects would be involved in general-acid or general-base catalysis in the mechanism. Identify by pK (5.8 or 6.2) the
- \_\_\_\_\_ general-acid catalyst
- \_\_\_\_\_ general-base catalyst

- (10) 13. The following graph shows three idealized curves that could describe oxygen binding to a transport protein such as hemoglobin or myoglobin. Identify by letter the curve or curves that represent the situations described in the comparisons below.



- (a) Comparing \_\_\_\_\_ to \_\_\_\_\_ could represent the comparison of fetal hemoglobin to normal hemoglobin A.
- (b) Comparing \_\_\_\_\_ to \_\_\_\_\_ could represent the comparison of hemoglobin to myoglobin.
- (c) Comparing \_\_\_\_\_ to \_\_\_\_\_ could represent the shift in oxygen binding to hemoglobin when the pH is decreased from 7.4 to 7.2.
- (d) Comparing \_\_\_\_\_ to \_\_\_\_\_ could represent the change in oxygen binding to hemoglobin when hemoglobin is dissociated into its subunits.
- (e) Comparing \_\_\_\_\_ to \_\_\_\_\_ could represent the change in oxygen binding to hemoglobin if the concentration of bis-phosphoglycerate (BPG) is decreased.

- (6) 14. For each of the following enzymes, describe the change in geometry of the substrate as it achieves the transition state and the factor(s) stabilizing or assisting in the conversion to the transition state.

<b>Enzyme</b>	<b>Change in Geometry (Substrate @ Transition State)</b>	<b>Factor(s) Stabilizing Transition State</b>
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elastase

HIV-protease

lysozyme

- (7) 15. Fumarase catalyzes the conversion of fumarate to L-malate. It has a  $K_m$  of 2.0 mM for fumarate, and a  $V_m$  of  $2.6 \text{ mmol} \cdot \text{min}^{-1}$  per mg enzyme. What would be the rate of the reaction when the fumarate concentration is 1.2 mM and the amount of enzyme is 100 micrograms ?