(6)   1.   Give two experimental features that would distinguish between
            passive diffusion and facilitated diffusion in the transport of a
            substance across a cell membrane.

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

(10)   2.   Classify each of the following transport systems according to the terms in the list at the
            right by putting the appropriate letter or letters in the blank next to the transport system.
            More than one term may apply.

_____ glucose transporter of erythrocytes

_____ anion transporter of erythrocytes

_____ Na^+/K^+ ATPase of plasma membrane

_____ Ca^{2+} ATPase of sarcoplasmic reticulum

_____ amino acid uptake driven by a Na^+ gradient

a. primary active transport
b. secondary active transport
c. symport
d. antiport
e. uniport
f. facilitated diffusion

(8)   3.   You have prepared DNA from two organisms isolated from the swamps of south Georgia,
            designated **culture A** and **culture B**. DNA from **culture A** contains 28% G, while DNA
            from **culture B** contains 23% G. Complete the following table for the expected composition
   of the other purine and pyrimidine bases.

	%G	%A	%T	%C	Total
Culture A	28	____	____	____	100%
Culture B	23	____	____	____	100%

DNA from which organism will have the higher melting temperature?

(12)   4.   Which form of DNA helix (**A**, **B**, or **Z**): (put answer in blank)
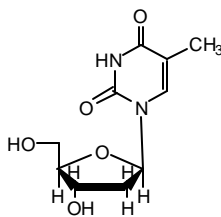
____ has the greatest tilt angle of   ____ has a left-handed helix?
     the base pairs?
____ has deoxyguanosine in the   ____ is favored by low humidity?
     syn conformation?
____ is favored by high GC   ____ is formed by RNA-DNA
     content?   hybrids?

(12)   5.   Name the following structures, and indicate whether they can be found in DNA, RNA, or both.

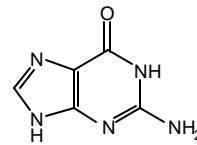_____   _____   _____

_____   _____   _____
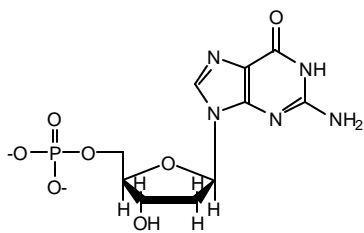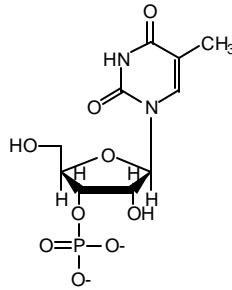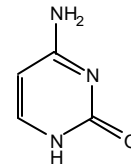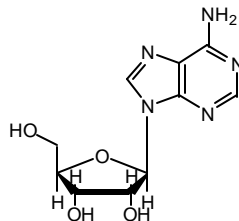
(12)   6.   Name the six classes of enzymes according to the International Commission on Enzymes classification scheme.

(8)   7.   Which of the following are assumptions made in the **original** derivation of the Michaelis-Menten equation for a one-substrate, one-product reaction? (Not the Briggs-Haldane modification. Put a check by the appropriate assumptions.)

_____ $[S] \gg [E_{total}]$.

_____ $[E_{total}] \gg [E_{free}]$.

_____ $K_M = [E][S]/[ES]$

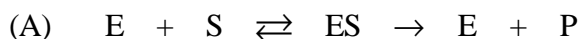_____   The rate of formation of ES equals its rate of breakdown.

_____   The velocity of the catalyzed reaction is equal to $k_1[E][S]$.

_____   The rate of breakdown of ES to E + P is much faster than the rate of breakdown of ES back to E + S.

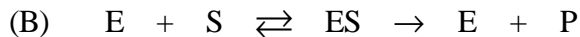_____   The concentration of ES is small relative to the concentration of E_{total}.

_____   The rate of reaction is equal to $k_2[ES]$.

(17)   8.   Following are three models for reversible inhibition of a simple one-substrate enzyme
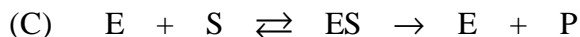reaction:

(A)   E + S $\rightleftarrows$ ES $\rightarrow$ E + P   *where*

E + I $\rightleftarrows$ EI $K_I = \dfrac{[E][I]}{[EI]}$

(B)   E + S $\rightleftarrows$ ES $\rightarrow$ E + P   *and*

ES + I $\rightleftarrows$ ESI $K'_I = \dfrac{[ES][I]}{[ESI]}$

(C)   E + S $\rightleftarrows$ ES $\rightarrow$ E + P

E + I $\rightleftarrows$ EI

ES + I $\rightleftarrows$ ESI
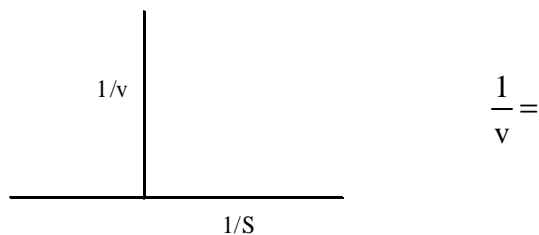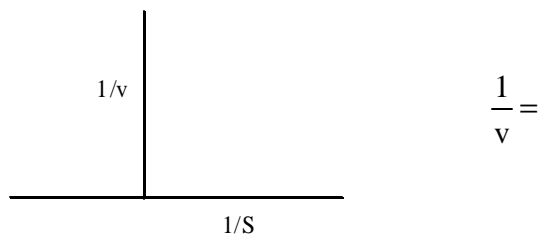
(a)   For each of the above models, complete the reciprocal form of the rate equation given
below, and draw two lines on each of the Lineweaver Burke plots for each rate equation,
one line showing no inhibitor, one line showing the presence of inhibitor (indicate which
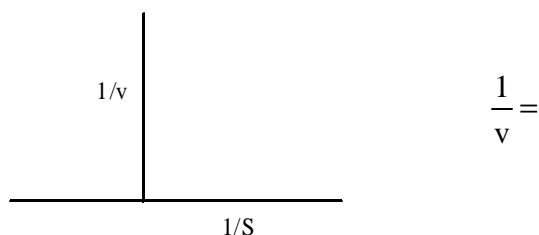line is which):

A.

$\dfrac{1}{v} =$

1/v

1/S

B.

$\dfrac{1}{v} =$

1/v

1/S

C.

$\dfrac{1}{v} =$

1/v

1/S

(b)   Which of the above models (**A, B, or C**) correspond to

competitive inhibition _____   pure noncompetitive inhibition _____

uncompetitive inhibition _____   mixed noncompetitive inhibition _____

not competitive _____

(5)   9. 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)   10. 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.
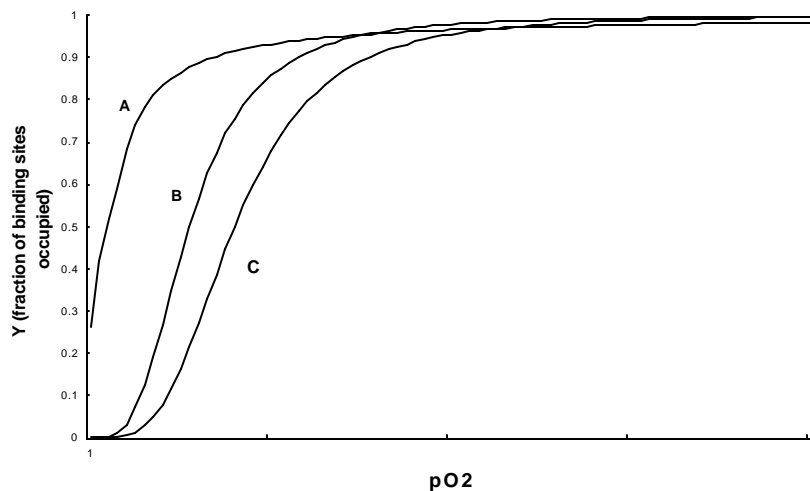
(a)   Comparing fetal hemoglobin (_____) to normal hemoglobin A (_____).

(b)   Comparing hemoglobin (_____) to myoglobin (_____).

(c)   Comparing hemoglobin at pH 7.4 (_____) to hemoglobin at pH 7.2 (_____).

(d)   Comparing hemoglobin (_____) to hemoglobin dissociated into subunits (_____).

(e)   Comparing hemoglobin with normal bis-phosphoglycerate (BPG) (_____) to hemoglobin with a lower concentration of bis-phosphoglycerate (BPG) (_____)