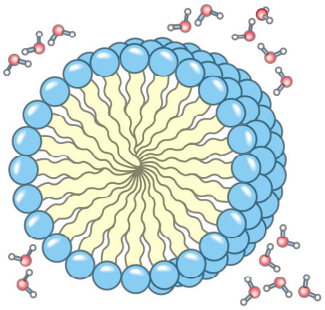
) For the following two ligands, what type of forces could be involved in their non-covalent binding to a protein's active site? (do not include van der Waals forces) (4) _____

leucine ionic or charge-charge or electrostatic, H-bonding, hydrophobic interaction

glucose H-bonding

) The image shown here is a(an) (2) _____

micelle



) 10 mmols of NaH_2PO_4 is dissolved in 423 ml of water. To bring the pH to 7.16, you could add (2) _____

20 mmols of Na_2HPO_4 .

$\Delta = 7.16 - 6.86 = 0.30$

$\Delta = \log R, \quad R = \text{antilog } 0.30 = 1.995 \approx 2.0$

$pH > pKa$, so $(\text{mmol } Na_2HPO_4) / (\text{mmol } NaH_2PO_4) = 2/1 = x/10$

$x = 20$ mmol

) How many mmol of lactic acid must be added to 50 ml of water to make the pH=4.4? (2) _____

$Ka = [H^+][A^-] / [HA] = [H^+]^2 / [HA]$, $\quad [HA] = [3.98 \times 10^{-5} M]^2 / 1.39 \times 10^{-4} M = 1.15 \times 10^{-4} M$

Total lactate $= [HA] + [A^-] = [HA] + [H^+] = 3.98 \times 10^{-5} M + 1.1 \times 10^{-5} M = 5.13 \times 10^{-5} M$

5.13×10^{-5} mmol/ml x 50 ml = 256.5×10^{-5} mmol = $\boxed{2.57 \times 10^{-3} \text{ mmol}}$

1 pt credit if answer assumes total lactate $\approx [HA] = 1.15 \times 10^{-4} M$

1.15×10^{-4} mmol/ml x 50 ml = $\boxed{5.8 \times 10^{-4} \text{ mmol}}$

Sorry about this question - more complicated than I intended - but a few students did get the 1 pt answer.

) 100 pmol of the following peptide is subjected to automated Edman degradation in a sequencer that produces an average yield of 85% at each cycle. LASVEGAS (2) _____

Step 4 should produce 52.2 or 61.4 pmol of the amino acid valine .

$0.85 \times 0.85 \times 0.85 \times 0.85 = (0.85)^4 = 0.522$, $\quad 0.522 \times 100$ pmol = ***52.2 pmol*** *(Aswad's answer)*

$0.85 \times 0.85 \times 0.85 = (0.85)^3 = 0.614$, $\quad 0.614 \times 100$ pmol = ***61.4 pmol*** *(Lehninger answer)*

) Complete the following for the peptide A-N-G-E-L-I-C-A (5) _____

a. molecular weight _____789_____ grams/mol

b. net charge at pH 9.7 _____-2.5_____

c. isoelectric point (pI) ___3.3 ± 0.1_____

d. Upon incubation with dithiothreitol (DTT), the molecular weight of this peptide will (circle one)

increase decrease remain unchanged

e. Upon incubation with iodoacetate, the molecular weight of this peptide will (circle one)

increase decrease remain unchanged

*(a) mol wt = (89 + 132 + 75 + 147 + 131 + 131 + 121 + 89) - 7(18) = 915 - 126 = **789***

amino acid Mr values water

(b,c)

Group	*pKa*	*charge forms acid / base*	*charge at pH 9.7*	*charge at pH = (2.34+4.25)/2 = **3.3***
Ala, C-term	*2.34*	*0 / -1*	*-1*	*-1*
Glu, side-chain	*4.25*	*0 / -1*	*-1*	*0*
Cys, side-chain	*8.18*	*0 / -1*	*-1*	*0*
Ala, N-term	*9.69*	*+1 / 0*	*+0.5*	*+1*
Net charge >>>>			***-2.5***	*0*

) The table below shows real data for the purification of an enzyme called PIMT. (4) _____

(a) Fill in the missing values for the **Specific Activity** and designate the proper units in the open brackets **( ).**

(b) Which purification step gives the greatest increase in purity? __3__

(c) What technique might be used to judge the final purity? SDS polyacrylamide gel electrophoresis or SDS-PAGE

Step - Procedure	**Total protein (mg)**	**Enzyme activity (units)**	**Specific activity (units/mg)**
1 Initial extract	531	210,000	395-396
2 Ammonium sulfate precipitation	349	144,000	412-413
3 Anion-exchange chromatography	6.3	87,000	13,800-13,810
4 Affinity chromatography	2.5	42,500	17,000

) Enzyme X enhances the reaction A → B by a factor of $2x10^6$. It takes 10 min for 10 µg of X to completely convert 700 mmol of A to B. How long would the same conversion take without enzyme? ___38__ yr (2) _____

Let T = time for no-enzyme reaction. $2x10^6$ = rxn time (-enzyme) / rxn time (+enzyme) = T/10 min

T = 10 min x $2x10^6$ = $20x10^6$ min x 1 h/60 min x 1 d/24 h x 1 yr/365 d = 38.05 yr

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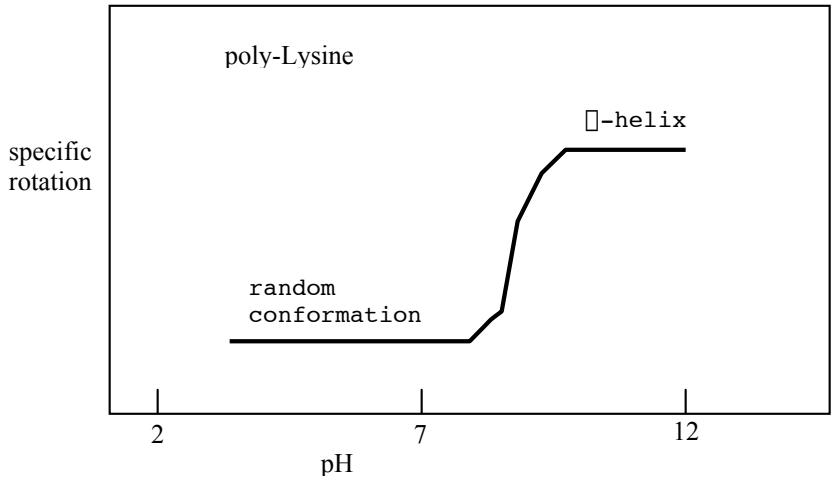
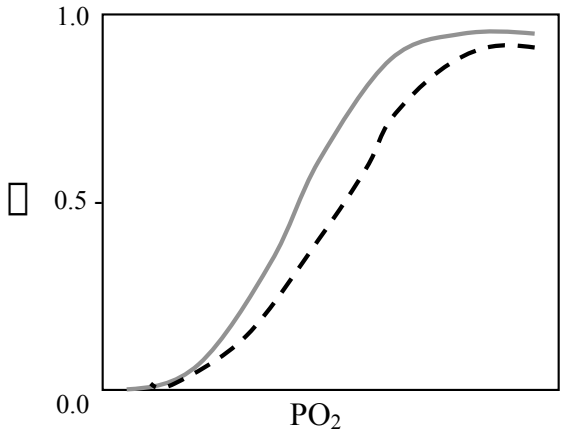
) Poly-lysine exists in two different structural forms, depending on the pH. Write the name of each form above the appropriate flat region of the plotted line. (2) _____



exactly same as assigned problem # 4 in chap 4

) The Hb O_2 binding curve below was obtained at pH 7.5. Draw another line to illustrate how the curve would look at pH 7.1. This pH dependence of O_2 binding by Hb is known as the _____Bohr_____ effect. (2) _____



) Without drawing any graph, estimate the K_m and V_{max} from this table of kinetic data. (2) _____

S	V
µM	µM/min
0	0
0.040	8.333
0.067	12.500
0.100	16.667
0.133	20.000
0.200	25.000
0.300	30.000
0.400	33.333
0.600	37.500
1.000	41.667
2.000	45.455
4.000	47.619

Vmax = ___47.6-50 µM/min_____

Km = ___0.13-0.20 µM _____

Include proper units for full credit!

) To 5.0 ml of a solution containing 2.0 mg/ml of pure enzyme Z, Joe added just enough $AgNO_3$ to inhibit all the activity of Z. A total of 0.516 µmol of $AgNO_3$ was required. Assuming Z contains two cysteines (each with a free -SH group), calculate the molecular weight of Z. __38,700 - 39,000__ gm/mol (2) _____

0.516 µmol AgNO3 x 1 Enz/2Ag = 0.258 µmol enzyme

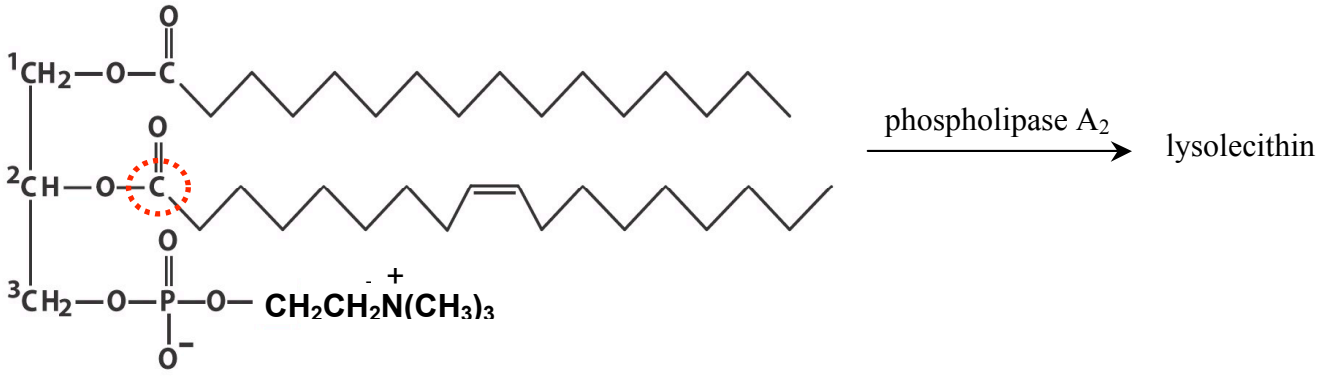
µg enzyme = 5.0 ml x 2.0 mg/ml = 10 mg = 10 x 10^3 µg

10 x 10^3 µg enzyme / 0.258 µmol enzyme = 38,760 µg/µmol = 38,760 gram/mol

) Blood may contain several different reducing sugars. The commonly used reagent for measuring the total amount of all reducing sugars is ____Fehling's_____ solution. The best reagent for measuring only D-glucose is the enzyme _____glucose oxidase_____ . (2) _____

see assigned problem 6 in chap 7

) Circle the carbon that undergoes nucleophilic attack in the reaction shown below. (2) _____



See assigned problem 6 in chap 10. Also tests general knowledge of ester hydrolysis mechanism.

) Define K_{eq} for the following reaction: $H_2SO_4 + 2\ NaHCO_3 \Leftrightarrow Na_2SO_4 + 2\ H_2CO_3$ (2) _____

$$K_{eq} = \frac{[Na_2SO_4\,]\,[\,H_2CO_3]^2}{[H_2SO_4]\,[NaHCO_3]^2}$$

2/1/06 Bio 98A Midterm Exam Name _____

For the following questions, just circle the one best answer.

) The term that bests describes the characteristics of detergents is ... (1) _____

hydrophilic hydrophobic amphipathic nucleophilic zwitterionic

) To concentrate an enzyme without denaturing it, you would likely use... (1) _____

urea ammonium sulfate a detergent HCl NaOH PITC

) A spectrophotometer set to a wavelength of 280 nm will most easily detect peptides that contain... (1) _____

Phe Tyr His Ala Lys Glu Cys

) The tertiary strucure of many proteins is stabilized by covalent bonds between the side chains of (1) _____

Asn Met Pro Cys Ser Trp

) The organic molecule that that holds the Fe^{2+} in place in hemoglobin... (1) _____

clathrate porphyrin ferroglobin oxytocin

) Enzymes accelerate reactions by _____ of the reaction. (1) _____

decreasing $\Delta G^{\ddagger}$ increasing $\Delta G^{\ddagger}$ decreasing $\Delta G°$ increasing $\Delta G°$ decreasing ΔG

) Chymotrypsinogen is activated *in vivo* by (1) _____

allosteric activation substrate binding cleavage of a peptide bond phosphorylation

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