

1) (2 points) Name two structures that are present in all eukaryotic cells but not in prokaryotic cells.

2) (4 points) Explain how entropy drives the formation of micelles.

3) (8 points) List the four types of weak interactions among biomolecules and the strength of each one.

<u>Type of Interaction</u>	<u>Strength (kJ/mol)</u>
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1.

2.

3.

4.

4) (2 points) What is the approximate strength of a covalent bond? _____ kJ/mol

5) (3 points) How does K_w differ from K_a for water?

6) (1 point) Which has a higher pK_a ?

- a) A strong acid
- b) A weak acid

7) (2 points) How is pK_a related to the pH scale?

8) (12 points) Phosphoric acid has three pK_a s: 2.12, 7.21, and 12.32.

You have available four reagents:

Liquid H_3PO_4 (18.1 M)

NaH_2PO_4 (MW 138.01 g/mol)

Na_2HPO_4 (MW 141.98 g/mol)

Na_3PO_4 (MW 141.98 g/mol)

To make 2.00 L of 0.100 M phosphate buffer, pH 7.40:

- a) Circle the reagent you would use as the weak acid (HA).
- b) Put a box around the reagent you would use as the conjugate base.
- c) Calculate how much acid and its conjugate base you would measure out. (Give your answer in grams or milliliters.)

- 9) (4 points) Draw a titration curve for an acid with a pK_a of 9.0.
(1 point) Circle the buffering region.

- 10) (1 point) Which amino acid has a pK_a nearest physiological pH?

- 11) (12 points) Fill in this table:

Amino acid	Charge at pH 1.5	Charge at pH 7.0
Glycine		
Arginine		
Aspartic Acid		

- 12) (15 points) Show the chemical reaction for the formation of the dipeptide val-thr from L-valine and L-threonine. (Draw all structures.)

13) (1 point) What general type of reaction forms a peptide bond?

14) The pKas of valine are 2.29 and 9.72. The pKas of threonine are 2.09 and 9.10.

a) (3 points) What is the pI of the dipeptide val-thr? (You MUST show your work for credit.)

b) (3 points) Would the dipeptide val-thr make a good buffer at pH 7.0? Why or why not?

15) (2 point) How many peptide bonds are in a tripeptide? _____

16) (3 points) Which of the following tripeptides would be retained the longest on a cation exchange column at pH 7.0?

a) ser-gly-thr

b) asp-glu-ser

c) gly-thr-lys

d) glu-thr-lys

17) (5 points) You attempt to separate five proteins from each other using a size exclusion (gel filtration) column, with a resin that has a molecular weight cut-off of 25kD. The proteins have the following molecular weights (in kD): 3, 12, 22, 40, and 100. List the order of elution of these proteins from this column, starting with the proteins that elute first.

18) (5 points) Describe the similarities and differences between denaturing gel electrophoresis and size exclusion column chromatography.

19) (3 points) How does information about the sequence of a protein contribute to an understanding of a protein's function?

20) (8 points) What is the sequence of the peptide that, when cleaved with the following proteases, results in these fragments:

Pepsin

- a) FQRLV
- b) YCA
- c) WMEKG
- d) NDEQ

Trypsin

- a) NDEQFQR
- b) LVWMEK
- c) GYCA