

1) (6 points) In the biochemistry standard state,

temperature = _____

pH = _____

pressure = _____

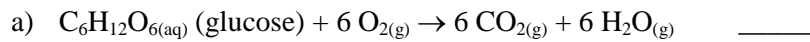
concentration of each reactant = _____

concentration of each product = _____

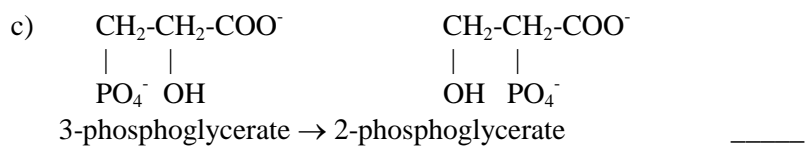
activity of water is defined as _____

2) (7 points) Summarize the major stages of CHEMICAL (prebiotic) evolution.

3) (6 points) Does entropy increase (\uparrow) or decrease (\downarrow) or remain the same (--) in the following processes?



b) Ice melting at 0°C _____



- 4) (8 points) List four types of noncovalent interactions among biomolecules and the strength of each one.

<u>Type of Interaction</u>	<u>Strength (kJ/mol)</u>
1.	
2.	
3.	
4.	

- 5) (8 points) Explain, in terms of entropy and noncovalent interactions, why polar substances dissolve in water, while nonpolar substances do not.

- 6) (8 points) In the following molecule, circle the hydrogen bond donors and put a square around the hydrogen bond acceptors.

- 7) (3 points) Where would the following substances partition in water containing palmitic acid micelles? The structure of palmitic acid is $\text{CH}_3(\text{CH}_2)_{14}\text{COO}^-$. (For each substance, circle either "water" or "micelle.")

a) $^+\text{H}_3\text{N}-\text{CH}_2-\text{COO}^-$	Water	Micelle
b) $^+\text{H}_3\text{N}-(\text{CH}_2)_{11}-\text{COO}^-$	Water	Micelle
c) $\text{H}_3\text{C}-(\text{CH}_2)_{11}-\text{COO}^-$	Water	Micelle

8) (5 points) Calculate the pH of a 1L solution containing 10 mL of 5 M NaOH.

The information in the following table may be useful for answering questions 9 and 10.

Acid	pK _a (s)
Acetic acid	4.76
Phosphoric acid	2.15, 6.82, 12.38
Tris-HCl	8.08

9) (5 points) If you wanted to make a buffer at a pH of 7.2, which acid/ base pair would be the best choice? (Circle only one.)

- a) $\text{H}_3\text{PO}_4/\text{H}_2\text{PO}_4^-$
- b) $\text{H}_2\text{PO}_4^-/\text{HPO}_4^{2-}$
- c) $\text{HPO}_4^{2-}/\text{PO}_4^{3-}$
- d) Acetic acid/sodium acetate
- e) Tris-HCl/Tris base

10) (10 points) Calculate the pH of a 1L solution containing 10 mL of 2 M acetic acid and 5 g of sodium acetate (MW 82 g/mol).

11) (5 points) Explain how the Fischer convention describes the absolute configuration of a chiral molecule.

Use the following table to answer questions 12 through 14.

Amino Acid	pK _{COO⁻}	pK _{NH₃⁺}	pK _R
alanine	2.35	9.87	
arginine	1.82	8.99	12.48
asparagine	2.14	8.72	
aspartic acid	1.99	9.90	3.90
cysteine	1.92	10.70	
glutamic acid	2.10	9.47	4.07
glutamine	2.17	9.13	
glycine	2.35	9.78	
histidine	1.80	9.33	6.04
isoleucine	2.32	9.76	
leucine	2.33	9.74	
lysine	2.16	9.06	10.54
methionine	2.13	9.28	
phenylalanine	2.20	9.31	
proline	1.95	10.64	
serine	2.19	9.21	
threonine	2.09	9.10	
tryptophan	2.46	9.41	
tyrosine	2.20	9.21	10.46
valine	2.29	9.74	

12) Calculate the pI of each of the following amino acids. Show your work.

a) ala
pI = _____
(2 points)

b) glu
pI = _____
(3 points)

c) his
pI = _____
(3 points)

13) (18 points) Using only L-amino acids, draw the peptide FTLDPK as it would exist at pH 7.0.

14) (3 points) Calculate the approximate pI of the peptide you drew in #17.