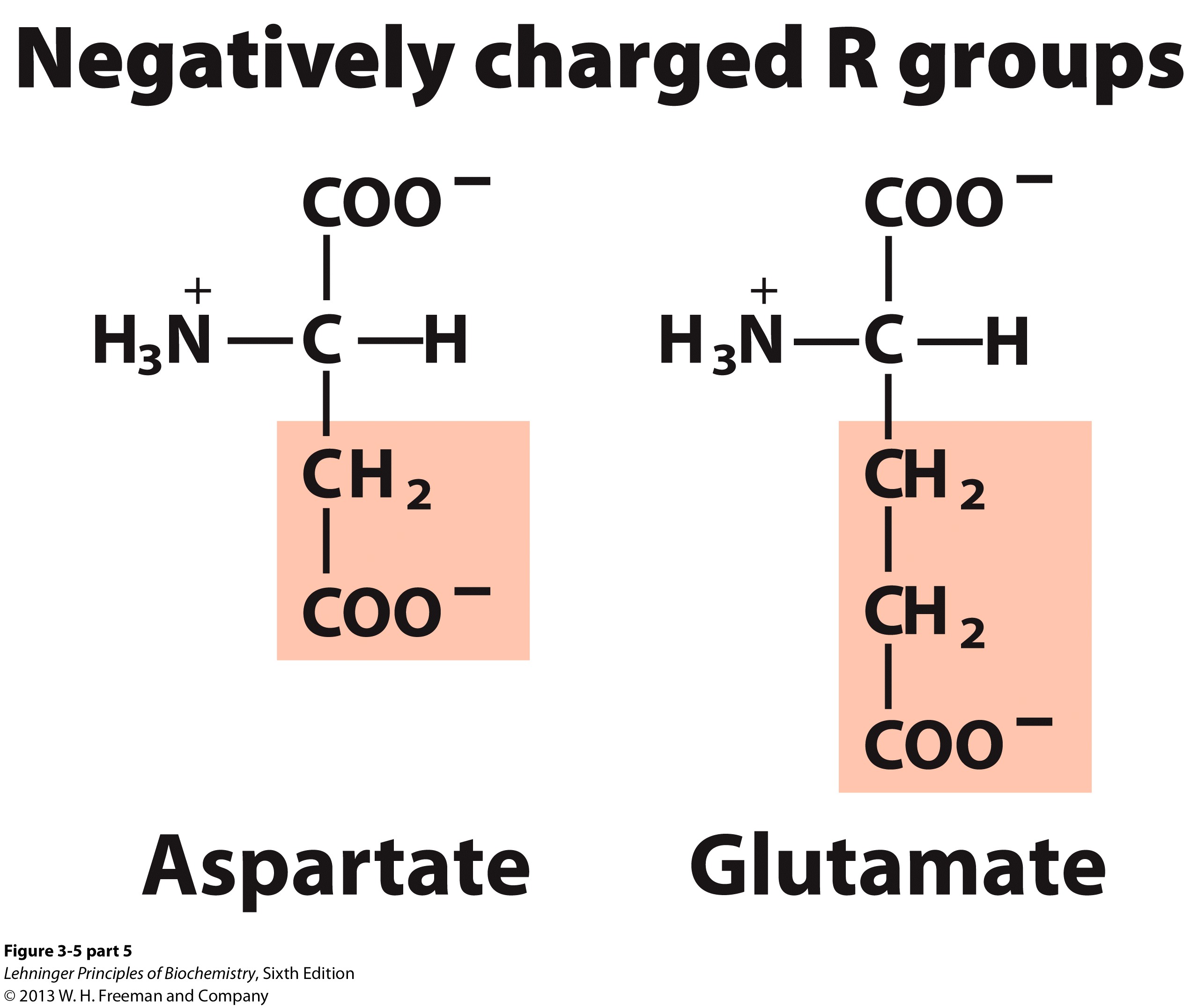
BIOCHEMISTRY W3300 Fall 2016  
Problem Set 3 (16 pts)

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Uni: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

For the following questions, answer them fully and show all work (if applicable). Use the blank space given appropriately.

**Question 1:** For this question, please do not assume general protonation/deprotonation rules of amino acids. (7 point total)

1. Draw the structure of the amino acid glutamate at physiological pH. (2 pts)



1. Calculate the precise overall charge of glutamate at pH 3.5. (5 pts)

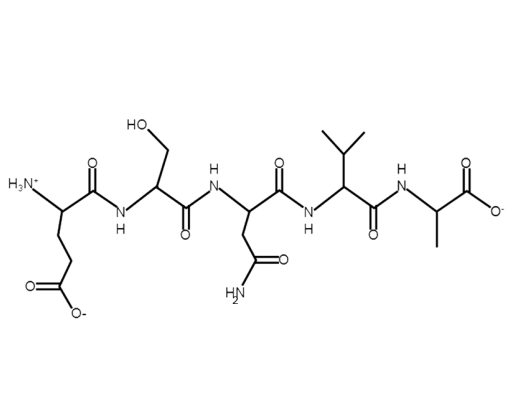
Charge on the α-carboxyl: Charge on the R group:

The α-amino group is fully protonated at pH 3.5.

Precise charge at pH 3.5 = (-.95) + (-.15) + 1 = -0.1

**Question 2:** For this question, answer using the follow pentapeptide, shown at physiological pH: (9 points total)



1. Give the 1-letter code of each amino acid in the sequence: (3 pts)

E S N V A

1. Calculate the precise overall charge of the peptide at pH 3.34. (6 pts)

At this pH, we are only concerned with R group of aspartate and the C-terminus. All other ionizable groups are fully protonated.

Charge of Asp R group: Charge of C-terminus:

Total precise charge: +1 + (-.110) + (-.910) = -.020