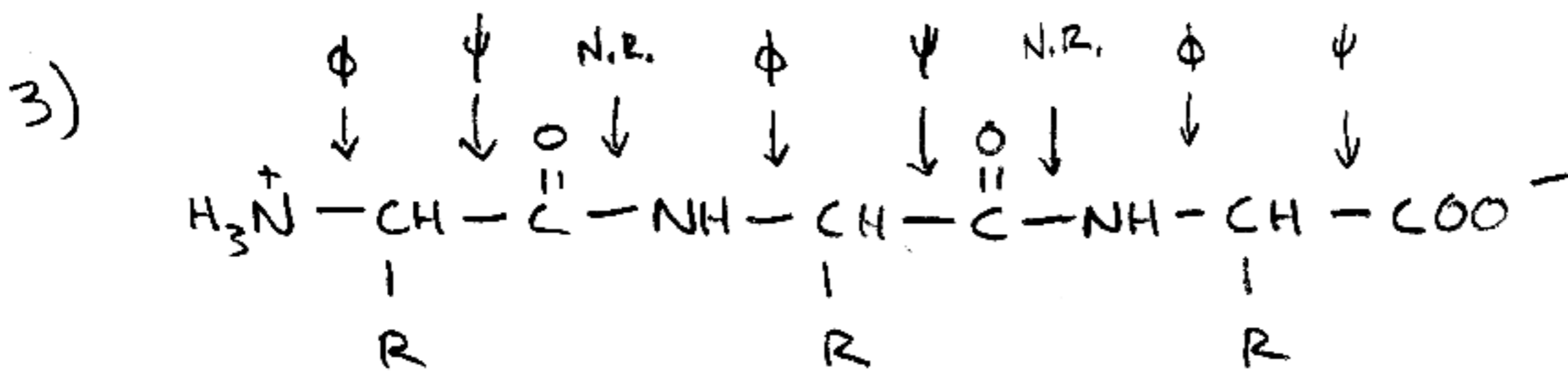


PROTEINS PRACTICE PROBLEMS KEY:

①

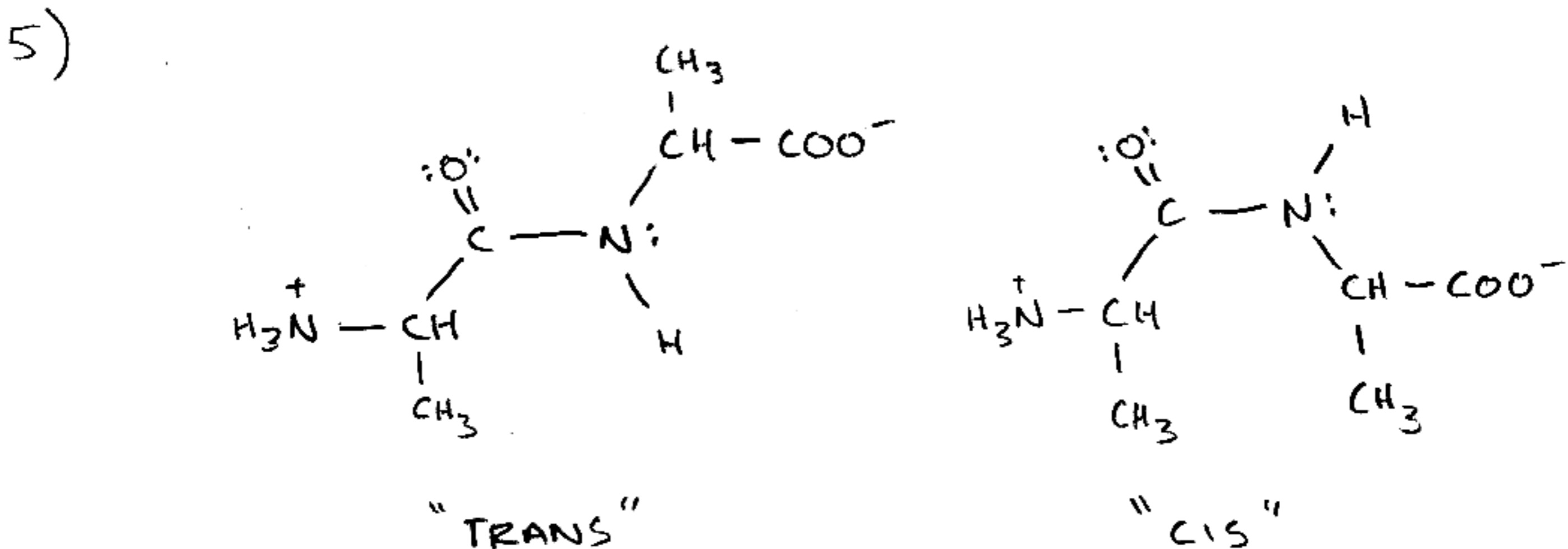
1) THE ISOELECTRIC POINT IS THE pH AT WHICH AN AMINO ACID OR A PEPTIDE HAS NO NET CHARGE. BELOW THE ISOELECTRIC POINT (LOWER pH VALUES), THE MOLECULE ACQUIRES A POSITIVE CHARGE, AND ABOVE IT THE MOLECULE IS NEGATIVE.

2) THE AMIDE NITROGEN - ALPHA CARBON BOND $\rightarrow \phi$
THE ALPHA CARBON - AMIDE CARBON BOND $\rightarrow \psi$



4) DRAW THE SAME AS #3 ABOVE BUT R GROUPS ARE:

LEU, ALA, LYS, ILE, ASN, GLY, SER



6) $2d \sin \theta = n \lambda$ "BRAGG EQUATION"

↑
LOOKING FOR d

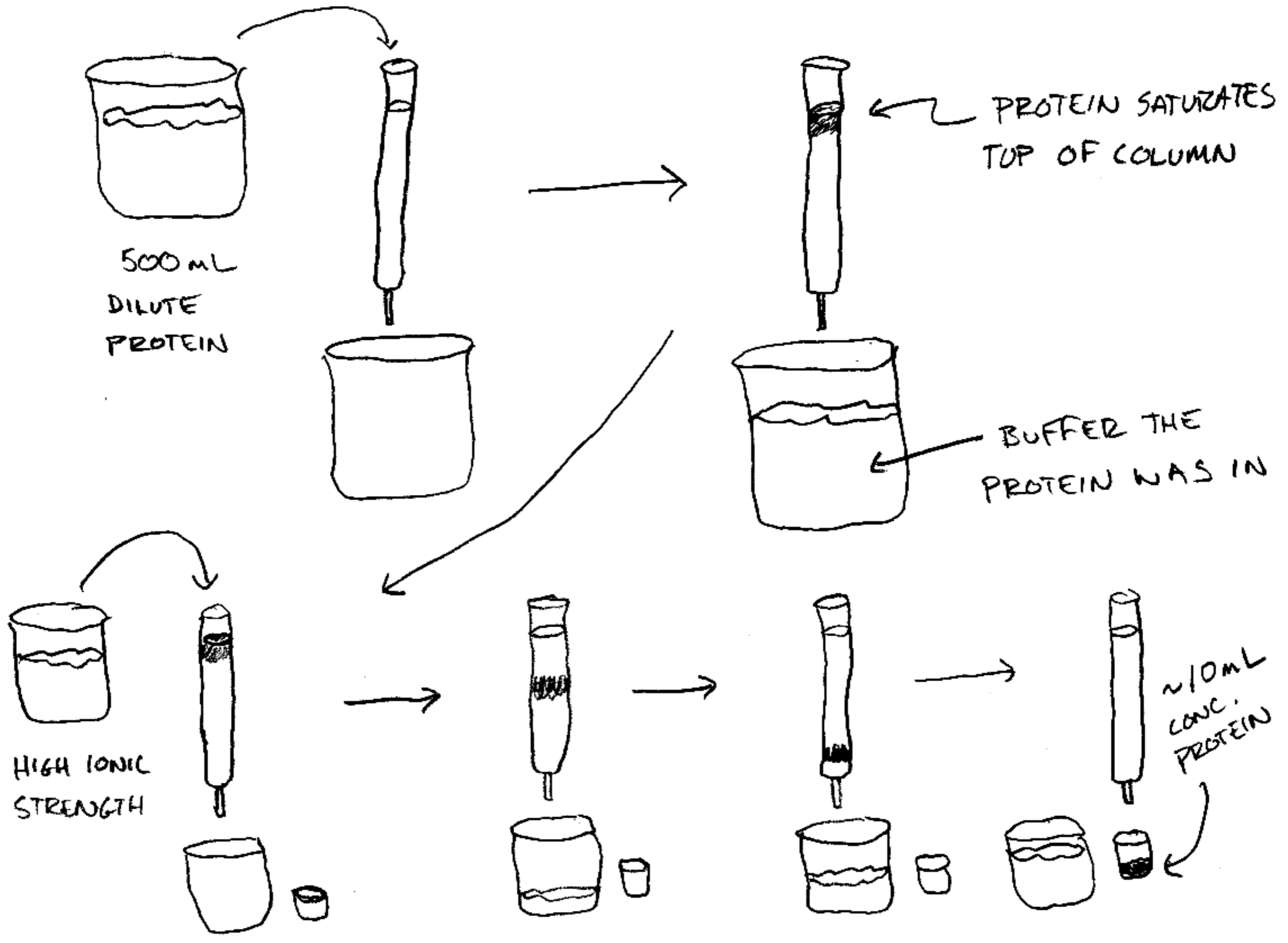
$d = \frac{n \lambda}{2 \sin \theta} = \frac{(1)(1.54 \text{ \AA})}{2 \sin(39.2^\circ)}$

"SMALLEST POSSIBLE"

$d = 1.22 \text{ \AA}$

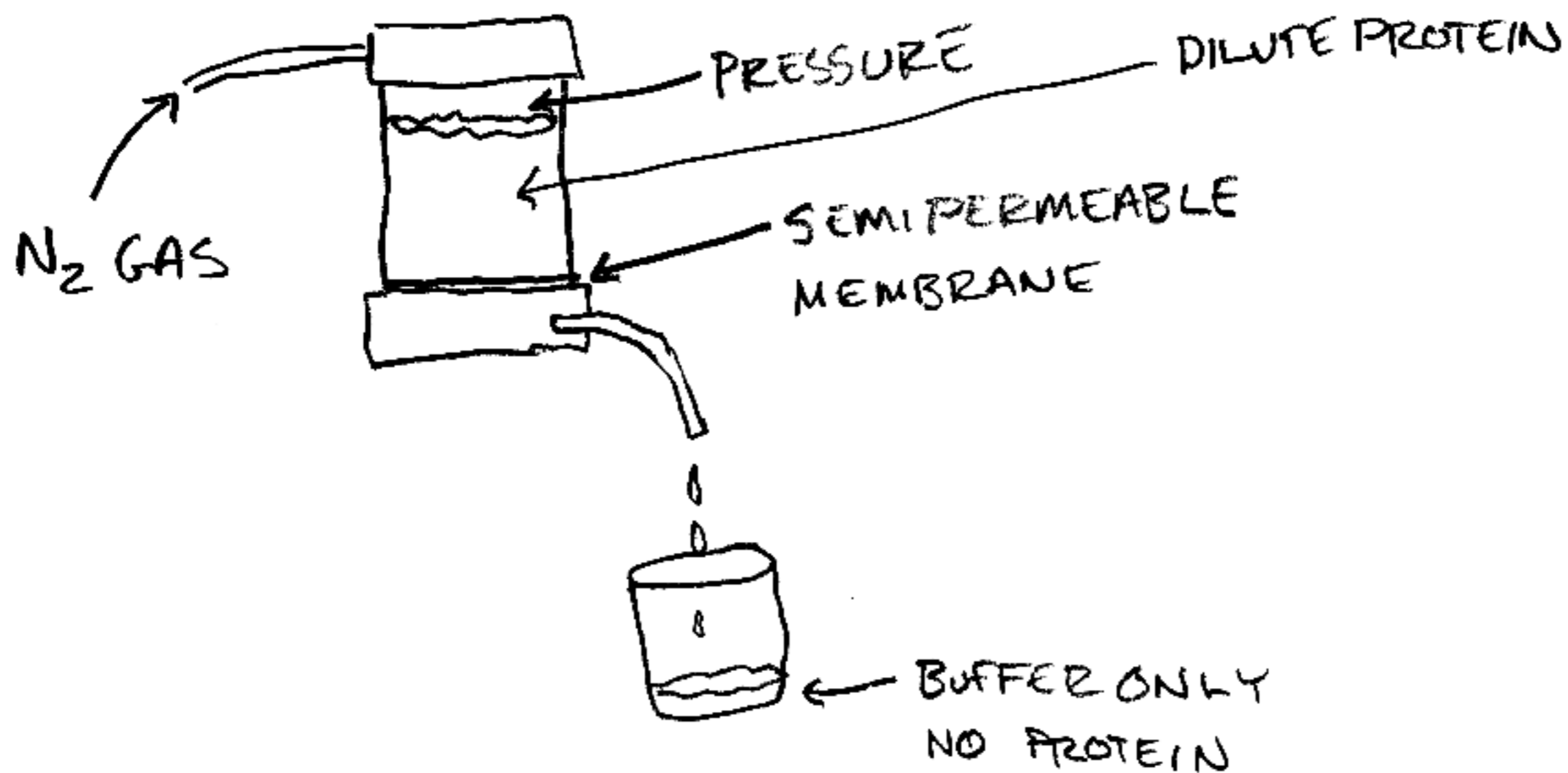
7) THERE ARE MANY OPTIONS DEPENDING ON YOUR NEEDS, BUT HERE ARE A COUPLE GENTLE METHODS:

ION EXCHANGE COLUMN:

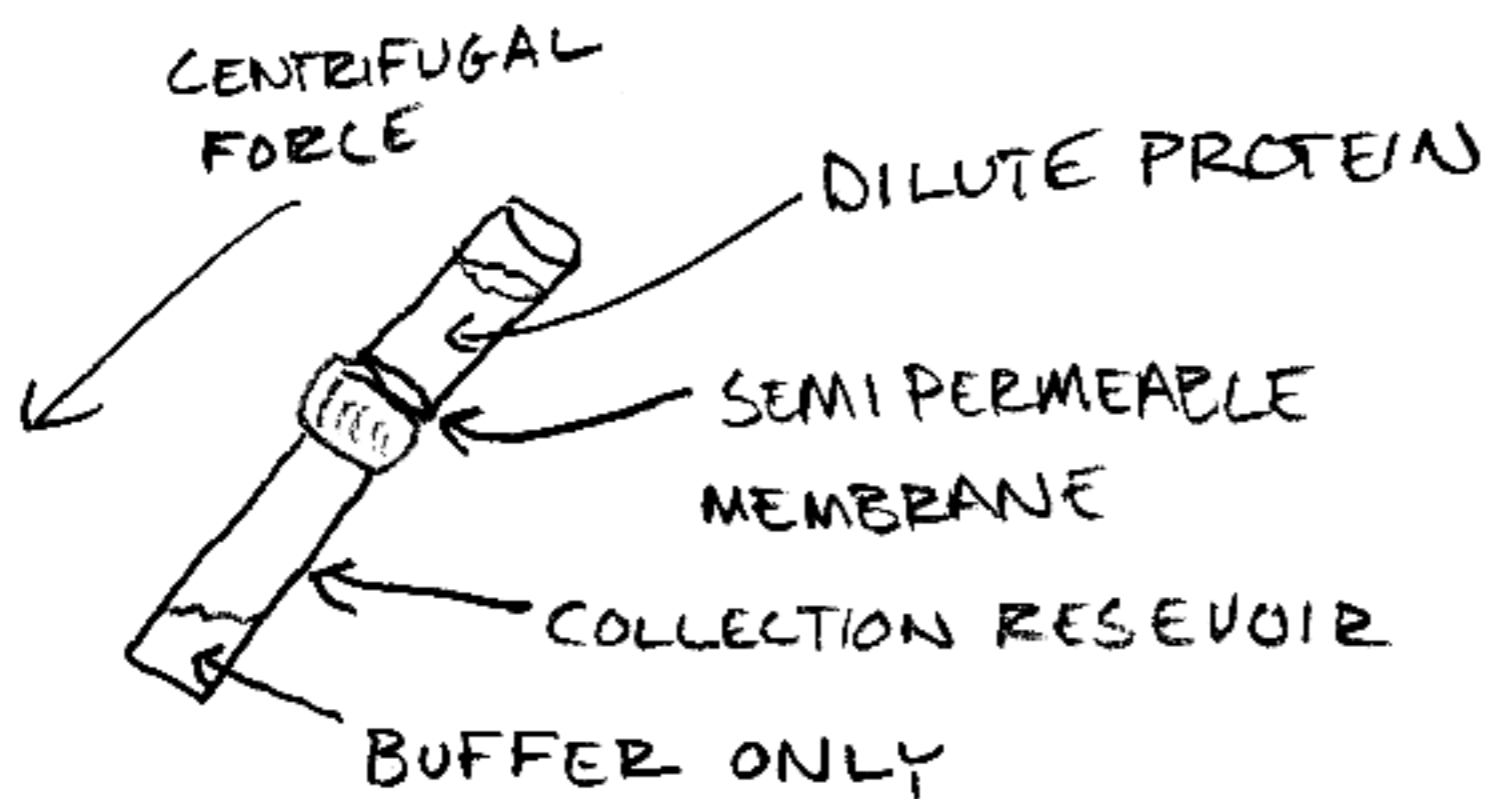


REVERSE OSMOSIS: (ULTRAFILTRATION)

a) INERT GAS PRESSURE

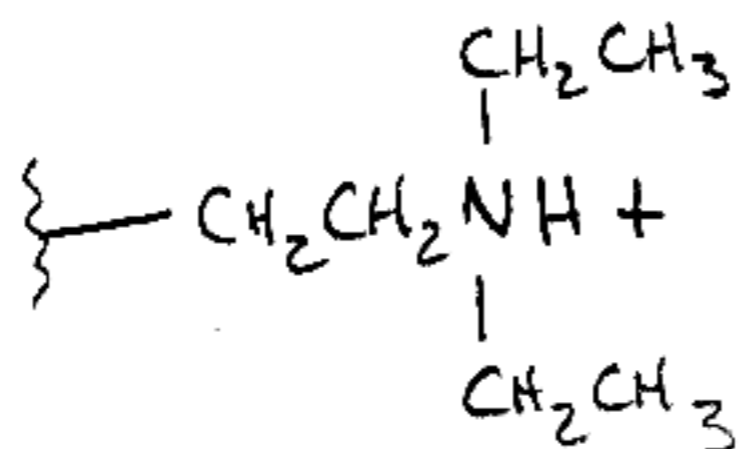


b) CENTRIFUGE



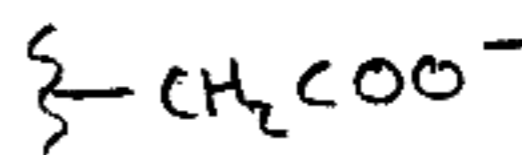
THIS APPARATUS FITS INTO A CENTRIFUGE AND CENTRIFUGAL FORCE PUSHES BUFFER THROUGH MEMBRANE.

8) DEAE:



"ANION EXCHANGER"

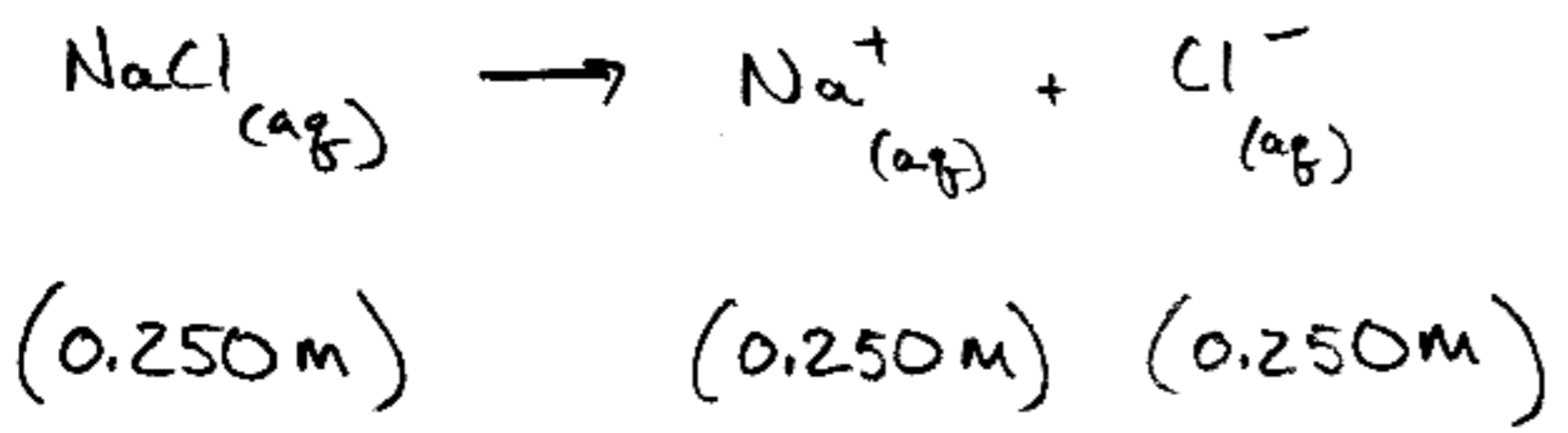
CM:



"CATION EXCHANGER"

$$9) \quad I = \frac{1}{2} \sum_i M_i Z_i^2$$

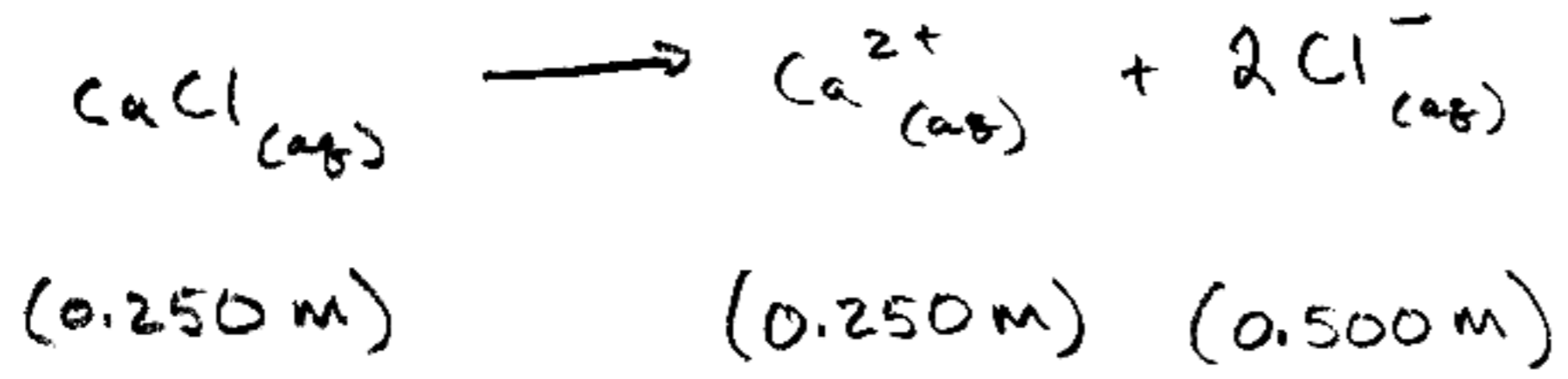
0.250 M NaCl :



$$I = \frac{1}{2} \left[(0.250\text{M})(+1)^2 + (0.250\text{M})(-1)^2 \right]$$

$$I = 0.250\text{M}$$

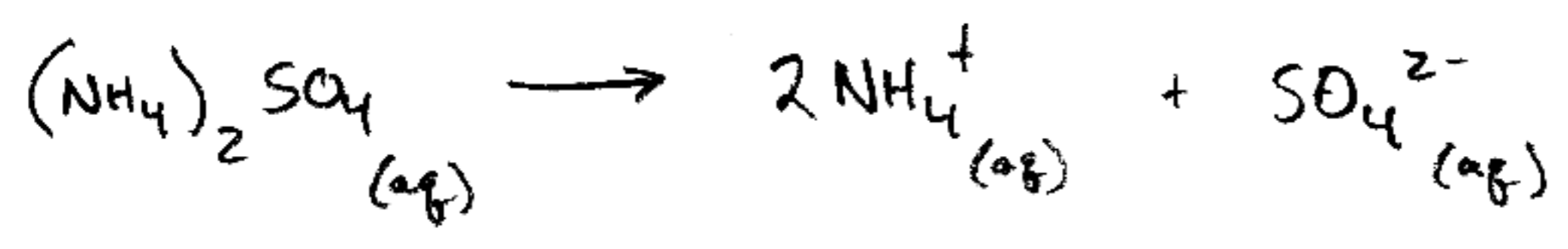
0.250 M CaCl₂ :



$$I = \frac{1}{2} \left[(0.250\text{M})(+2)^2 + (0.500\text{M})(-1)^2 \right]$$

$$I = 0.750\text{M}$$

0.250 M (NH₄)₂SO₄ :



(0.250 M) (0.500 M) (0.250 M)

$$I = \frac{1}{2} \left[(0.500\text{M})(+1)^2 + (0.250\text{M})(-2)^2 \right]$$

$$I = 0.750\text{ M}$$

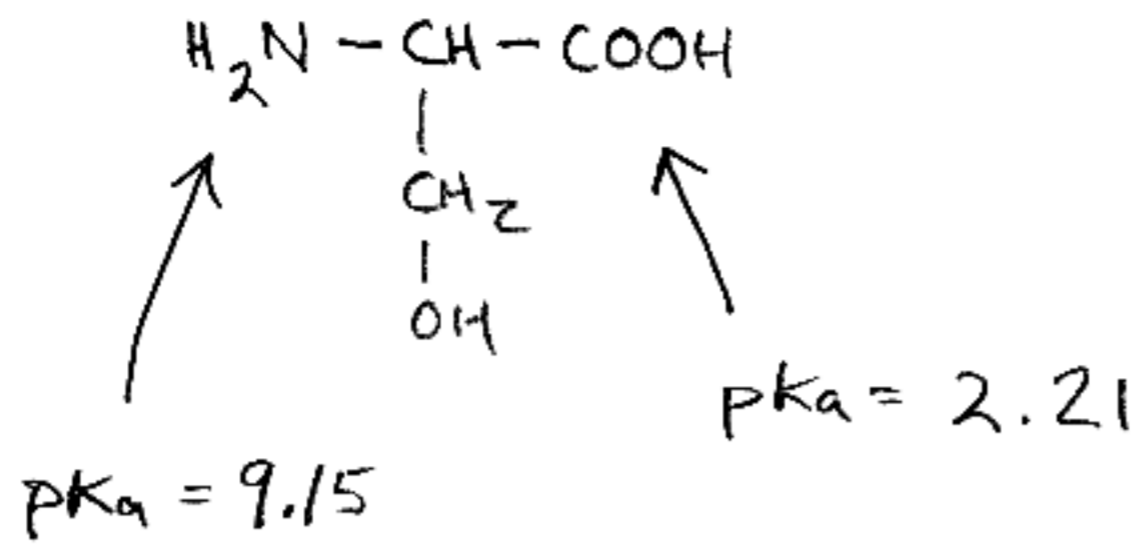
10) a & b → WE DID IN CLASS

c) MANY, MANY OPTIONS!

IF YOU WANT ME TO CHECK YOURS, BRING IT WITH YOU NEXT WEEK.

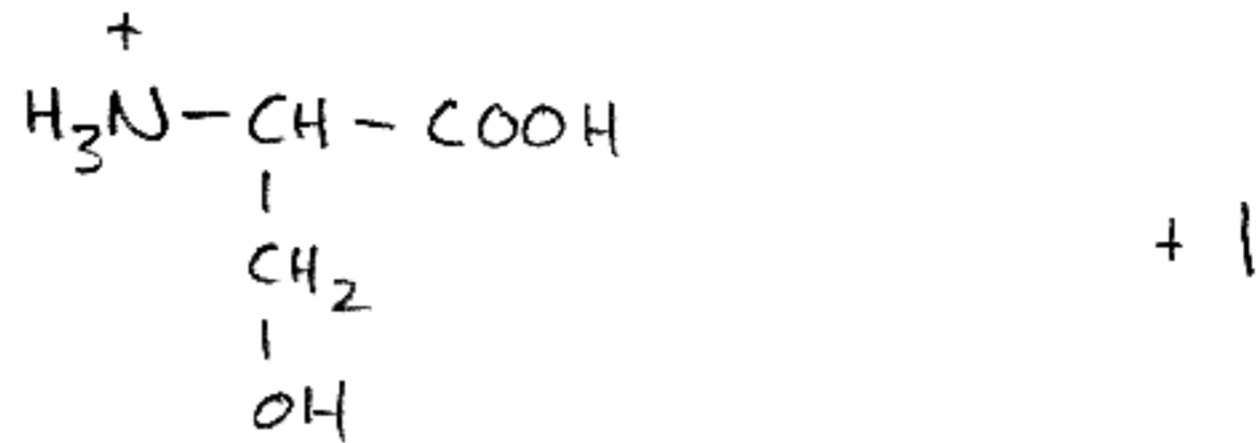
11)

SERINE:

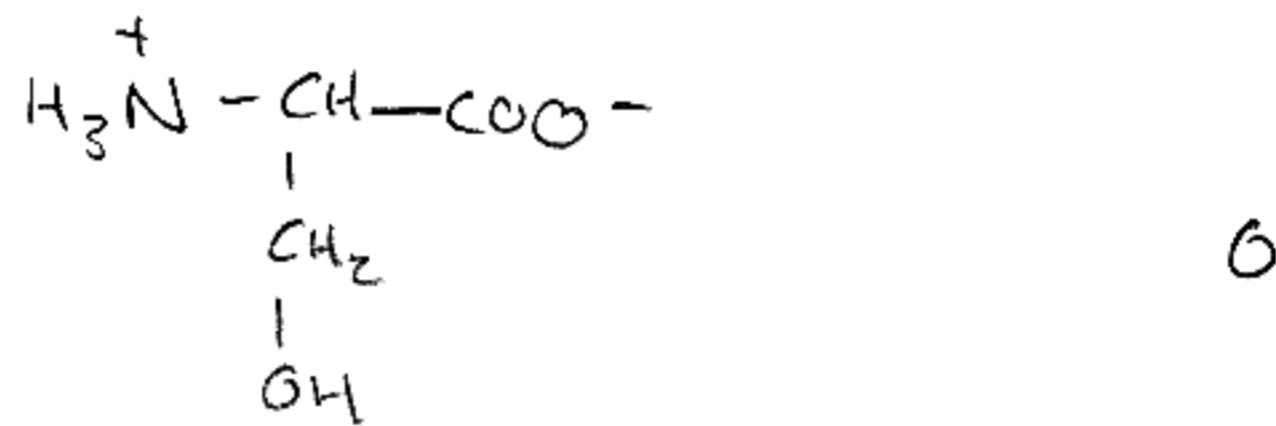


CHARGE

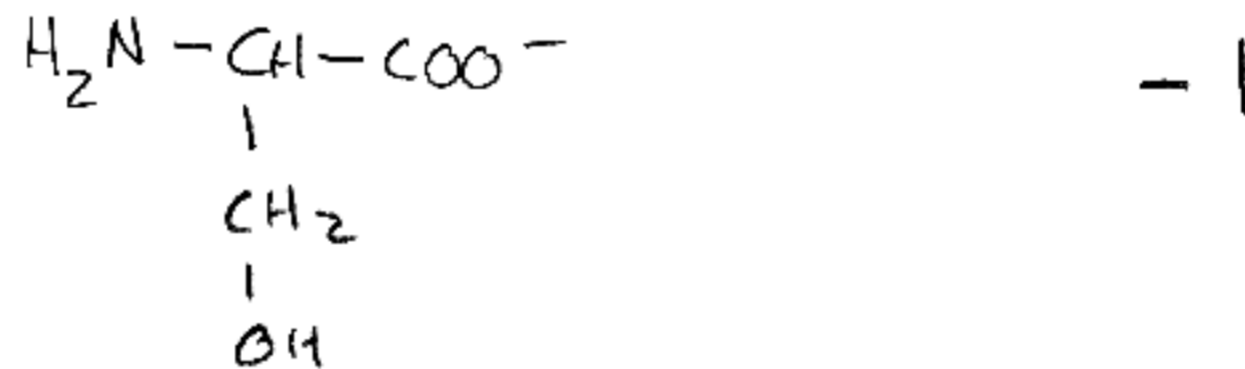
BELOW pH 2.21;



ABOVE 2.21, BELOW 9.15:



ABOVE 9.15:



AVERAGE 2.21 & 9.15:

$$pI = \frac{2.21 + 9.15}{2} = 5.68$$

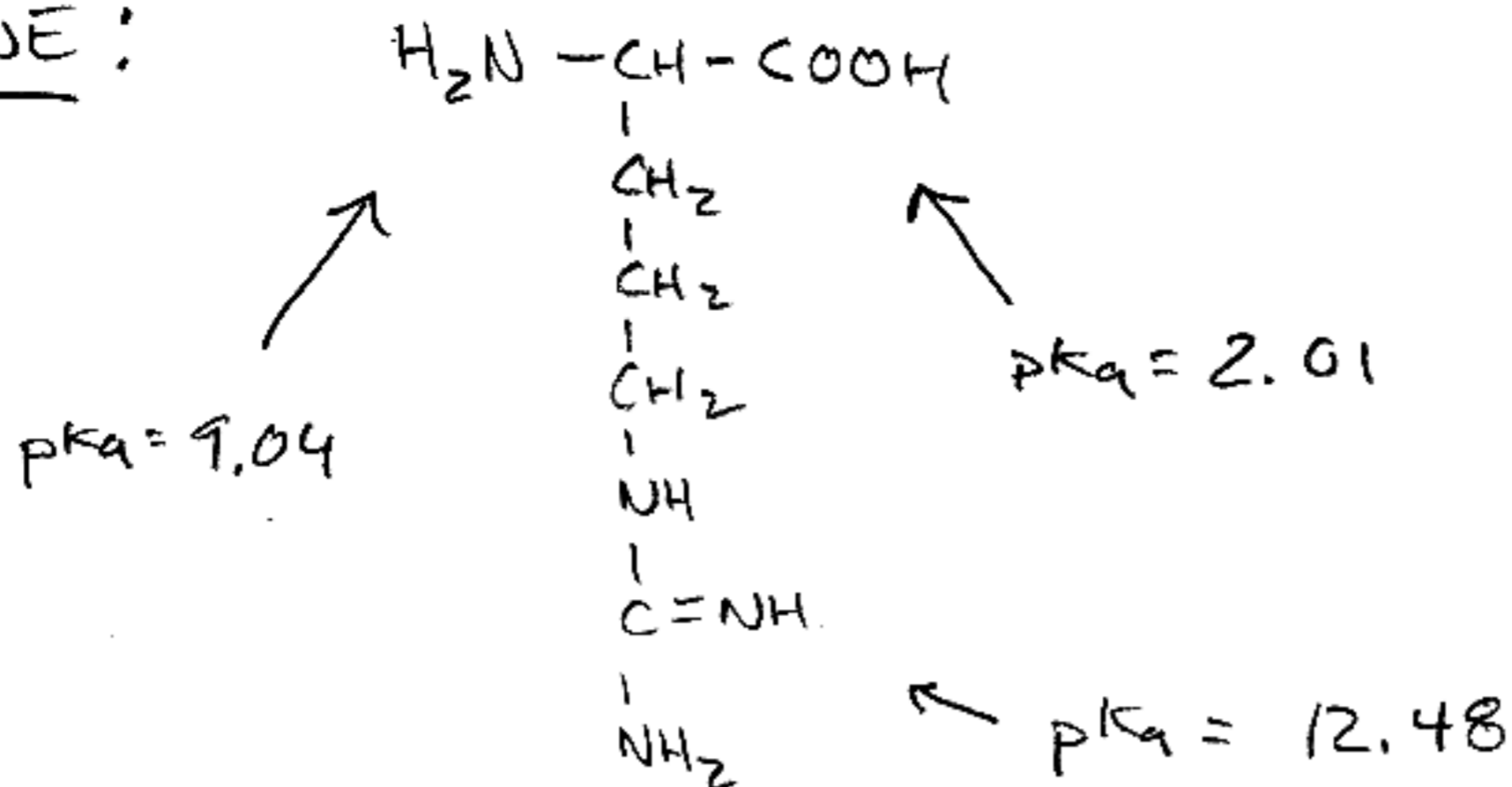
SO:

AT pH 5.68, THE NET CHARGE OF SERINE IS

ZERO

(BELOW, POSITIVE, ABOVE NEGATIVE)

ARGININE:



USING THE SAME APPROACH:

	<u>CHARGE</u>	
BELOW pH 2.01	+2	AVERAGE 9.04 & 12.48
2.01 < pH < 9.04	+1	
9.04 < pH < 12.48	0	$pI = 10.76$
ABOVE 12.48	-1	

ASPARAGINE:

NOT ACIDIC OR BASIC (LIKE SERINE)

AVERAGE 2.02 & 8.80

$pI = 5.41$

LYSINE:

BASIC LIKE ARGININE

AVERAGE 8.95 & 10.53

$pI = 9.74$

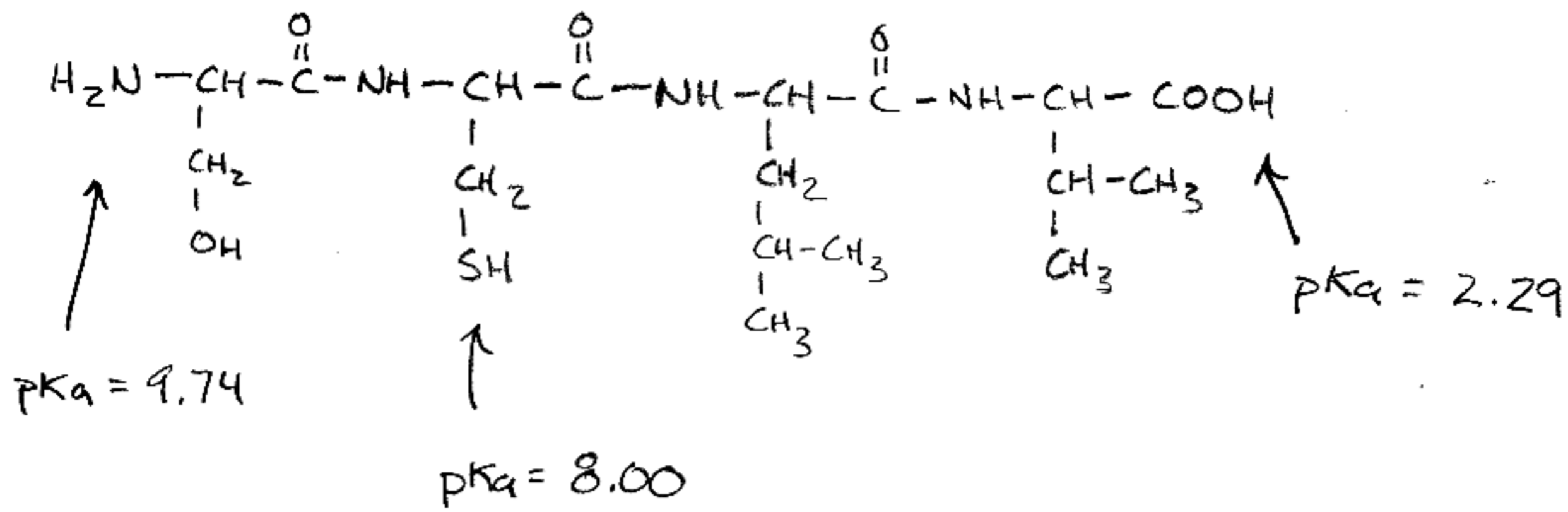
CYSTEINE:

NOT "ACIDIC", BUT SIDE CHAIN LOSES H^+

AVERAGE 1.86 & 8.00

$pI = 4.93$

SER - CYS - LEU - VAL :



BETWEEN PH 2.29 & 8.00, THIS PEPTIDE WILL HAVE A NET CHARGE OF ZERO, SO WE AVERAGE 2.29 & 8.00 :

$\text{pI} = 5.15$

ARG - ILE - LEU - GLY :

AVERAGE 9.04 & 12.48

$\text{pI} = 10.76$