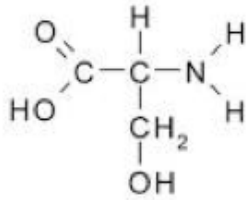


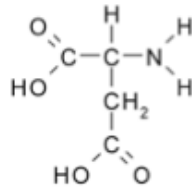
Series 2 (week 3)

Question 1

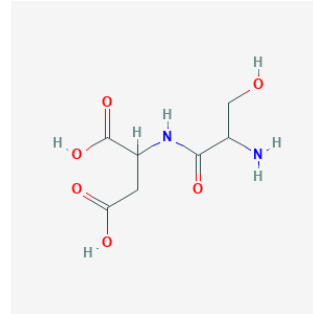
Serine (ser) :



Aspartic acid (Asp):



Draw the dipeptide Ser-Asp:

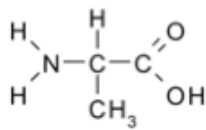


When numbering the amino acids of a protein, by convention the number 1 is assigned to

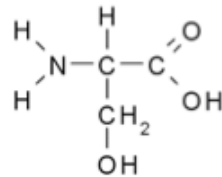
- the amino acid at the N terminus
- the amino acid at the C terminus

Question 2

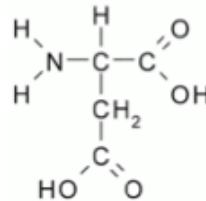
Alanine



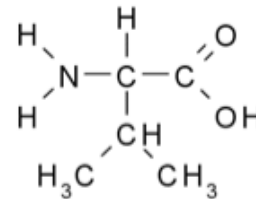
Serine



Aspartic acid



Valine



Order these amino acids from the most hydrophilic to the least hydrophilic :

most hydrophilic:

least hydrophilic:

aspartic acid serine alanine valine

-3.5

-0.8

1.8

4.2 (Kyte Doolittle scale)

Aspartic acid carries a negative charge on the side chain: $\text{COOH} \rightarrow \text{COO}^-$

Serine has a polar side chain

Alanine and valine have nonpolar side chains.

Valine is more hydrophobic than alanine because the nonpolar side chain of valine is longer than the nonpolar side chain of alanine

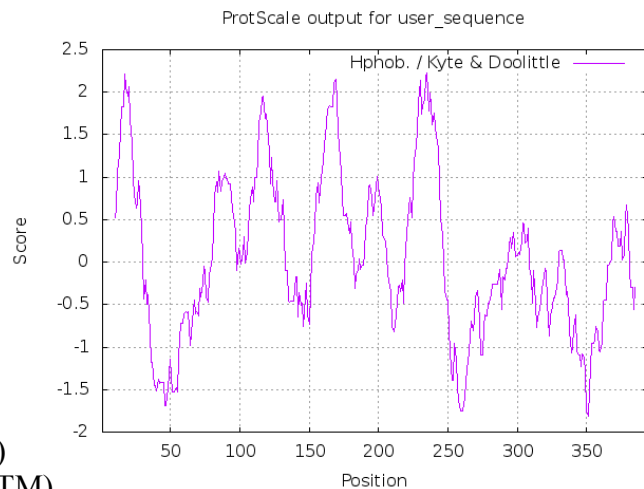
Question 3

Ions channels must be embedded in the plasma membrane.

As indicated at the end of the class, potassium channels are classified into 4 families.

Based on the hydropathy plot shown, to which family belongs the potassium channel encoded by the gene KCNK3

- a. Inward rectifier (2 TM)
- b. Leakage channel (4 TM)
- c. voltage gated potassium channel (6 TM)
- d. calcium activated potassium channel (7TM)



What is the threshold value indicating a putative transmembrane domain? 1.5

Usually hydropathy plot are generated with a window size of

- a. 10 amino acids
- b. 20 amino acids
- c. 30 amino acids
- d. 40 amino acids

Using the Kyte & Dolittle scale, what is the highest possible value in an hydropathy plot ?

4.5 (20 isoleucines)

Using the Kyte & Dolittle scale, what is the lowest possible value in an hydropathy plot ?

-4.5 (20 arginines)

Question 4 Weblem (= problem based on applications available online)

You use an application generating random protein sequences and you generate the hydropathy plots for these random protein sequences.

4.1

Estimate the probability that the hydropathy plot of a random protein sequence will show a putative transmembrane domain.

Let's assume that 10 of the 20 amino acids are hydrophobic

The probability that a sequence of 20 amino acids is made of 20 hydrophobic a.a. is

$$(1/2)^{20} = 1/1000000$$

The analysis of a 400 a.a. protein is based on 381 windows of 20 a.a.

The probability that 1 window is made of 20 hydrophobic a.a. is $381/100000 = 0.000381$

4.2

Check your prediction by observing the presence or absence of putative transmembrane domains in 3 hydropathy plots based on random protein sequences.

How many plots show a putative transmembrane domain ? usually 0 plot show a peak > 1.5

The probability to see a peak > 1.5 in of the 3 plots is about 0.001 (0.001143)