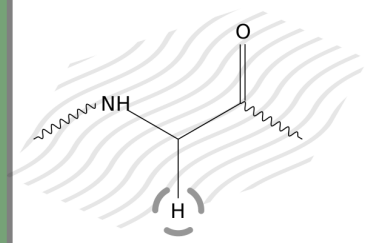
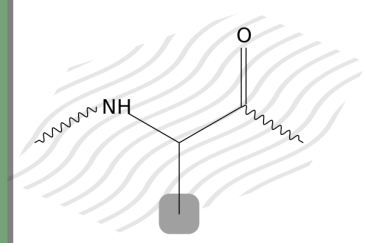
GLYCINE (GLY) — G



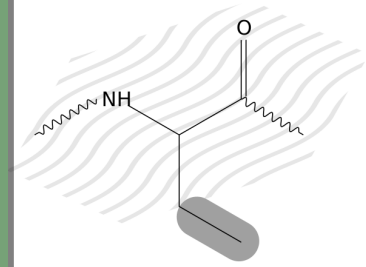
Molar mass	**75.07**
Isoelectric point	**5.97**
Solubility	**225**
Frequency	**7.5**

ALANINE (ALA) — A



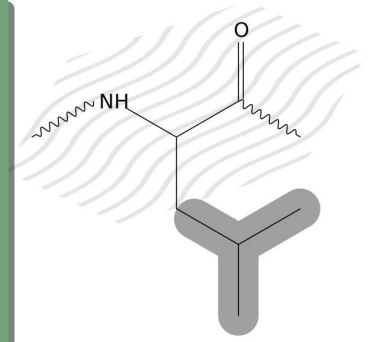
Molar mass	**89.09**
Isoelectric point	**6.02**
Solubility	**160**
Frequency	**9.0**

VALINE (VAL) — V



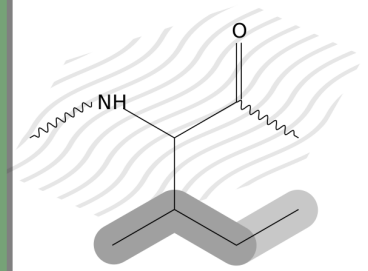
Molar mass	**117.15**
Isoelectric point	**5.96**
Solubility	**85**
Frequency	**6.9**

LEUCINE (LEU) — L



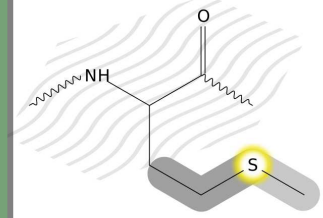
Molar mass	**131.17**
Isoelectric point	**5.98**
Solubility	**24**
Frequency	**7.5**

ISOLEUCINE (ILE) — I



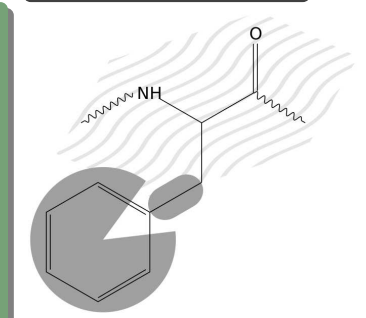
Molar mass	**131.17**
Isoelectric point	**5.94**
Solubility	**32**
Frequency	**4.6**

METHIONINE (MET) — M



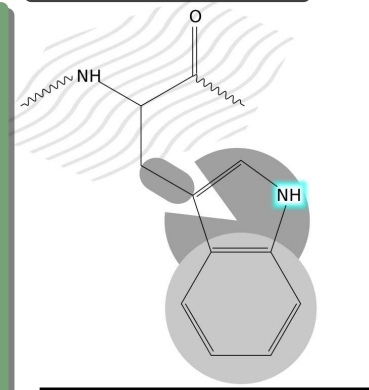
Molar mass	**149.21**
Isoelectric point	**5.74**
Solubility	**53**
Frequency	**1.7**

PHENYLALANINE (PHE) — F

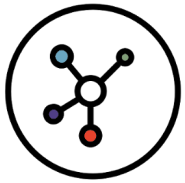
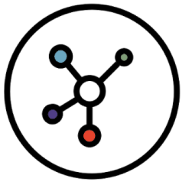
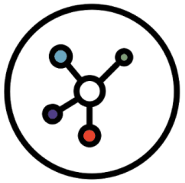
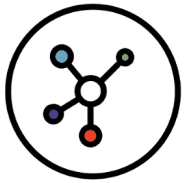
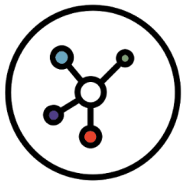
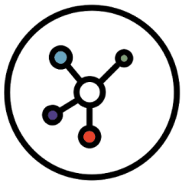
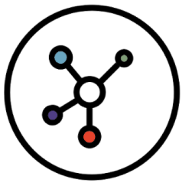
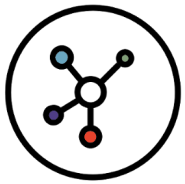


Molar mass	**165.19**
Isoelectric point	**5.48**
Solubility	**27**
Frequency	**3.5**

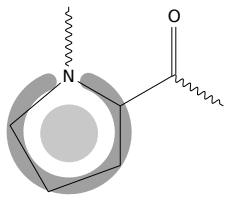
TRYPTOPHAN (TRP) — W



Molar mass	**204.23**
Isoelectric point	**5.88**
Solubility	**10**
Frequency	**1.1**

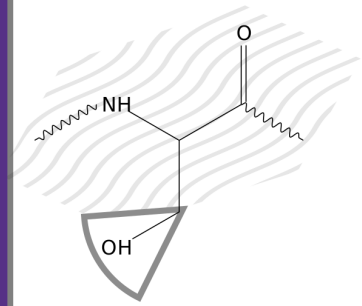









PROLINE (PRO) — P



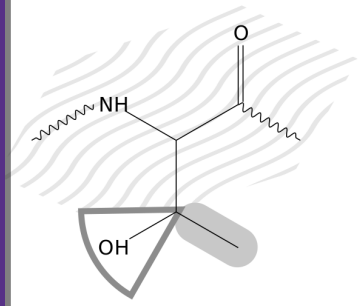
Molar mass	115.13
Isoelectric point	6.30
Solubility	1550
Frequency	4.6

SERINE (SER) — S



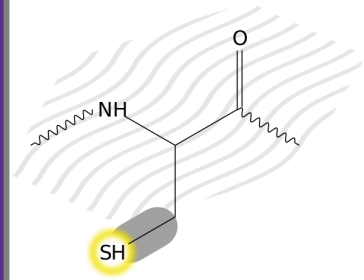
Molar mass	105.09
Isoelectric point	5.68
Solubility	360
Frequency	7.1

THREONINE (THR) — T



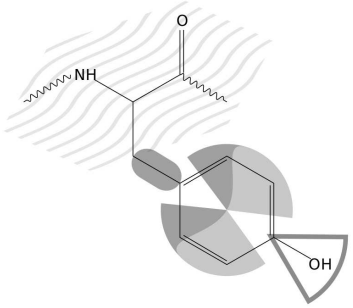
Molar mass	119.12
Isoelectric point	5.64
Solubility	90
Frequency	6.0

CYSTEINE (CYS) — C



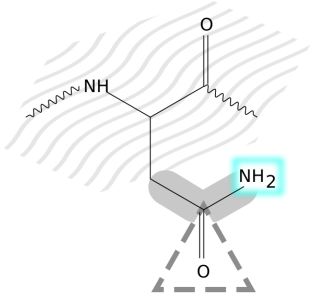
Molar mass	121.15
Isoelectric point	5.02
Solubility	160
Frequency	2.8

TYROSINE (TYR) — Y



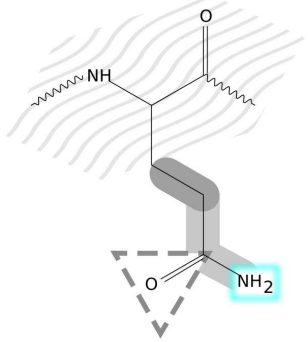
Molar mass	181.19
Isoelectric point	5.65
Solubility	0.38
Frequency	3.5

ASPARAGINE (ASN) — N



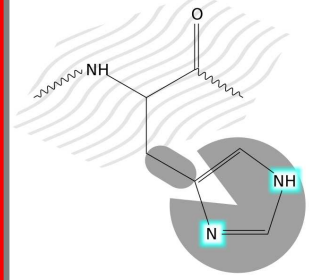
Molar mass	132.12
Isoelectric point	5.41
Solubility	20
Frequency	4.4

GLUTAMINE (GLN) — Q

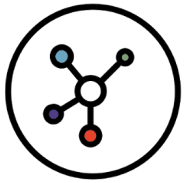
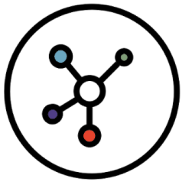
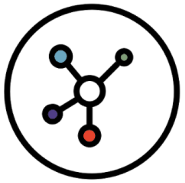
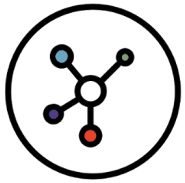
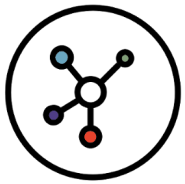
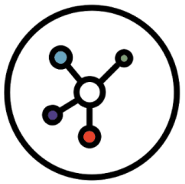
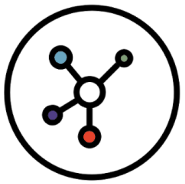
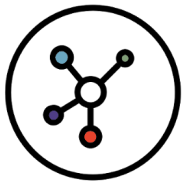


Molar mass	146.15
Isoelectric point	5.65
Solubility	35
Frequency	3.9

HISTIDINE (HIS) — H

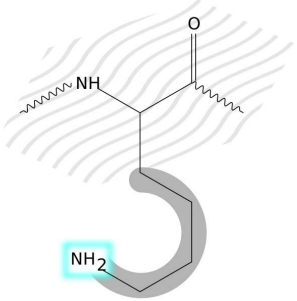


Molar mass	155.16
Isoelectric point	7.50
Solubility	38.2
Frequency	2.1

LYSINE
(LYS)

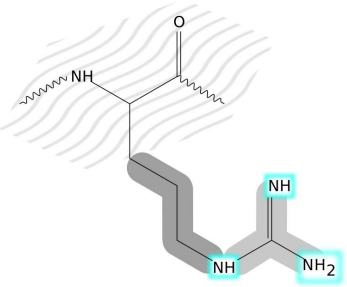
K



Molar mass	**146.19**
Isoelectric point	**9.59**
Solubility	**2000**
Frequency	**7.0**

ARGININE
(ARG)

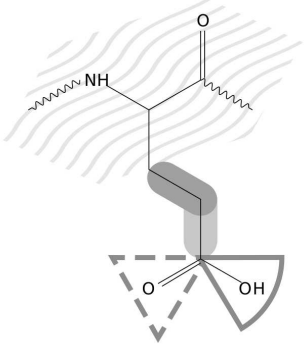
R



Molar mass	**174.20**
Isoelectric point	**11.50**
Solubility	**149**
Frequency	**4.7**

GLUTAMATE
(GLU)

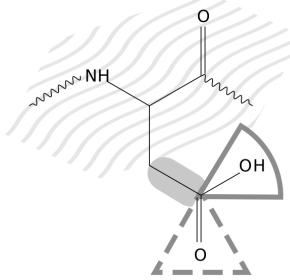
E



Molar mass	**147.13**
Isoelectric point	**3.22**
Solubility	**7.5**
Frequency	**6.2**

ASPARTATE
(ASP)

D



Molar mass	**133.10**
Isoelectric point	**2.77**
Solubility	**4.0**
Frequency	**5.5**

POLAR side chains

Six amino acids have side chains that are polar but not charged. These amino acids may participate in H bonds and are usually found at the surface of proteins.

NON-POLAR side chains

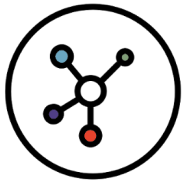
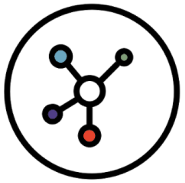
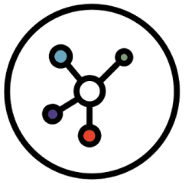
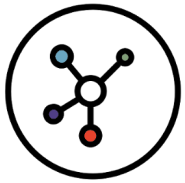
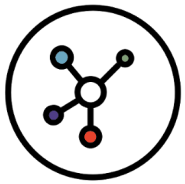
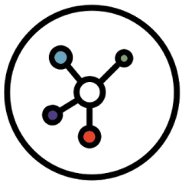
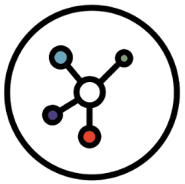
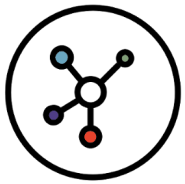
Nine amino acids have side chains that are non-polar. These side chains are composed mostly of C and H and have very small dipole moments. These amino acids are usually buried within the core of proteins.

BASIC side chains

Three basic amino acids are polar and highly hydrophilic. Their side chains contain N and resemble ammonia, which is a base, whose pKa's are high enough that they tend to bind protons, gaining a positive charge in the process.

ACIDIC side chains

Two acidic amino acids are polar and negatively charged. Their side chains have a second carboxylic acid groups whose pKa's are low enough to lose protons, gaining a negative charge in the process.

RULES

Distribute all cards *amongst all players. Last seated player,* **challenges** *any other player for :*

- any amino acid card
- a card of a specific colour
- a particular amino acid

Next turn, *the player who lost a card speaks up to try and gain another player's card.*
To win, *collect cards of the same colour. Protect your completed colour by folding the cards in front of you.*

Molar mass $[g/mol]$

Isoelectric point

Solubility in water at $20^{\circ}C$ $[g/L]$

Frequency in proteins [%]