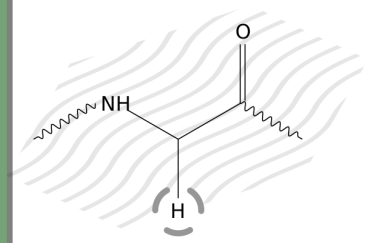
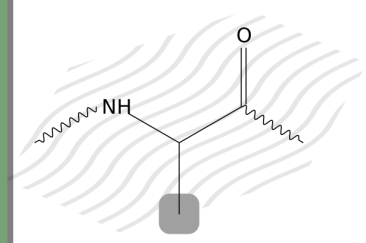
## GLYCINE (GLY) — G



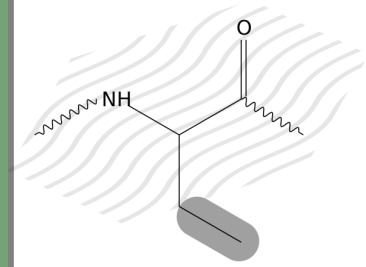

| | |
|---|---|
| Molar mass | **75.07** |
| Isoelectric point | **5.97** |
| Solubility | **225** |
| Frequency | **7.5** |

## ALANINE (ALA) — A



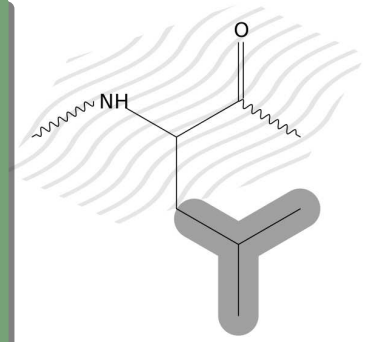

| | |
|---|---|
| Molar mass | **89.09** |
| Isoelectric point | **6.02** |
| Solubility | **160** |
| Frequency | **9.0** |

## VALINE (VAL) — V



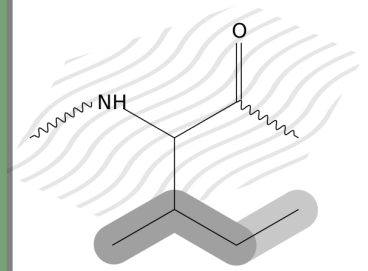

| | |
|---|---|
| Molar mass | **117.15** |
| Isoelectric point | **5.96** |
| Solubility | **85** |
| Frequency | **6.9** |

## LEUCINE (LEU) — L



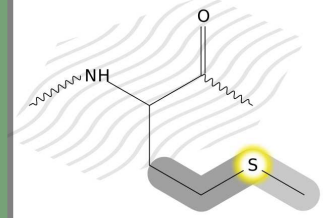

| | |
|---|---|
| Molar mass | **131.17** |
| Isoelectric point | **5.98** |
| Solubility | **24** |
| Frequency | **7.5** |

## ISOLEUCINE (ILE) — I



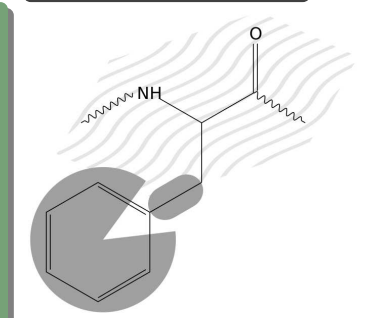

| | |
|---|---|
| Molar mass | **131.17** |
| Isoelectric point | **5.94** |
| Solubility | **32** |
| Frequency | **4.6** |

## METHIONINE (MET) — M



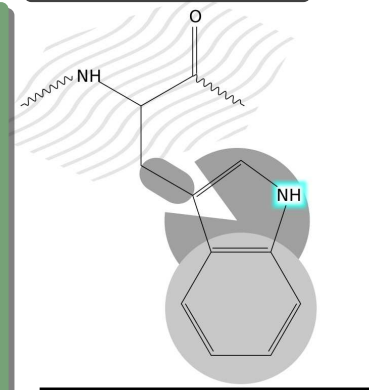

| | |
|---|---|
| Molar mass | **149.21** |
| Isoelectric point | **5.74** |
| Solubility | **53** |
| Frequency | **1.7** |

## PHENYLALANINE (PHE) — F

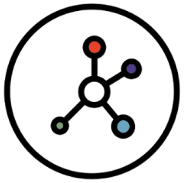
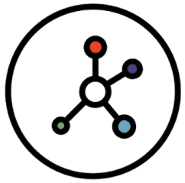
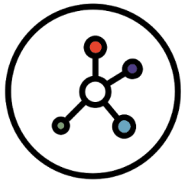
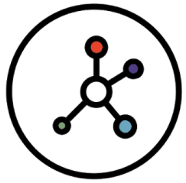
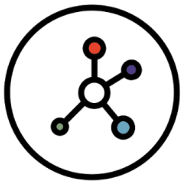
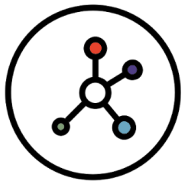
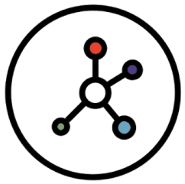
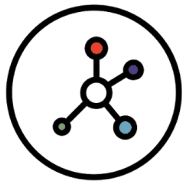



| | |
|---|---|
| Molar mass | **165.19** |
| Isoelectric point | **5.48** |
| Solubility | **27** |
| Frequency | **3.5** |

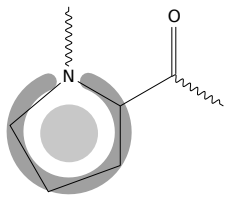
## TRYPTOPHAN (TRP) — W




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

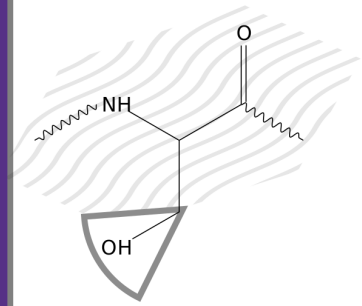









## PROLINE (PRO) — P



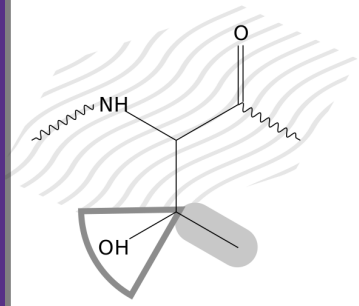

| | |
|---|---|
| Molar mass | 115.13 |
| Isoelectric point | 6.30 |
| Solubility | 1550 |
| Frequency | 4.6 |

## SERINE (SER) — S



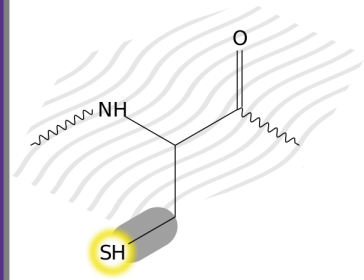

| | |
|---|---|
| Molar mass | 105.09 |
| Isoelectric point | 5.68 |
| Solubility | 360 |
| Frequency | 7.1 |

## THREONINE (THR) — T



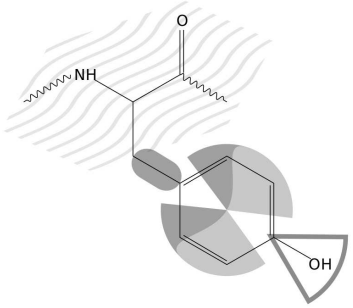

| | |
|---|---|
| Molar mass | 119.12 |
| Isoelectric point | 5.64 |
| Solubility | 90 |
| Frequency | 6.0 |

## CYSTEINE (CYS) — C



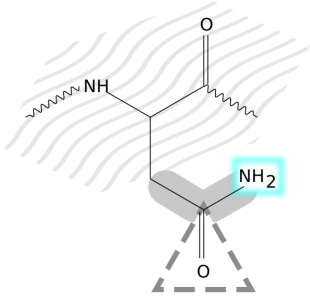

| | |
|---|---|
| Molar mass | 121.15 |
| Isoelectric point | 5.02 |
| Solubility | 160 |
| Frequency | 2.8 |

## TYROSINE (TYR) — Y



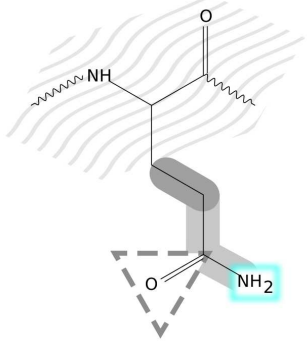

| | |
|---|---|
| Molar mass | 181.19 |
| Isoelectric point | 5.65 |
| Solubility | 0.38 |
| Frequency | 3.5 |

## ASPARAGINE (ASN) — N



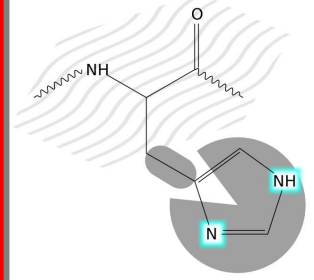

| | |
|---|---|
| Molar mass | 132.12 |
| Isoelectric point | 5.41 |
| Solubility | 20 |
| Frequency | 4.4 |

## GLUTAMINE (GLN) — Q

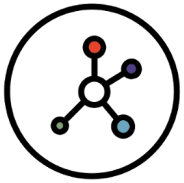
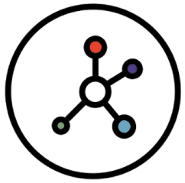
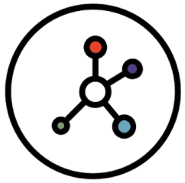
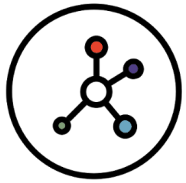
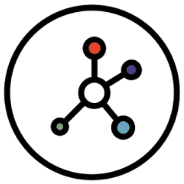
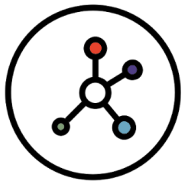
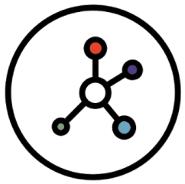
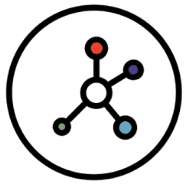



| | |
|---|---|
| Molar mass | 146.15 |
| Isoelectric point | 5.65 |
| Solubility | 35 |
| Frequency | 3.9 |

## HISTIDINE (HIS) — H

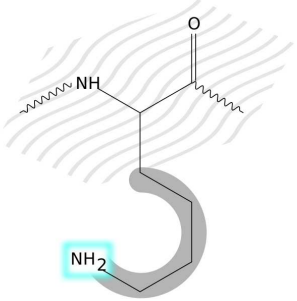



| | |
|---|---|
| Molar mass | 155.16 |
| Isoelectric point | 7.50 |
| Solubility | 38.2 |
| Frequency | 2.1 |

## LYSINE
( LYS )

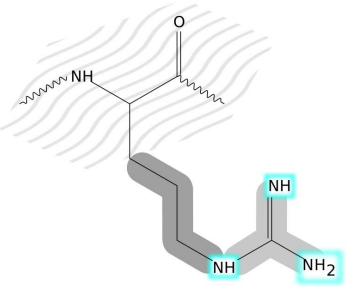
K




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

## ARGININE
( ARG )

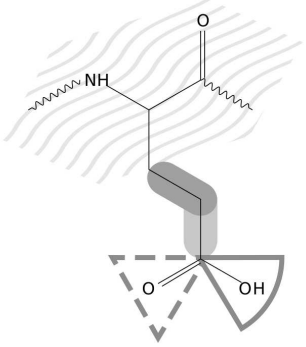
R




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

## GLUTAMATE
( GLU )

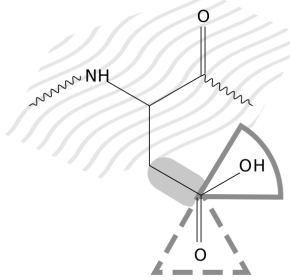
E




| | |
|---|---|
| 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

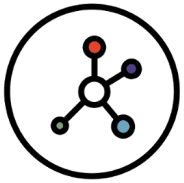
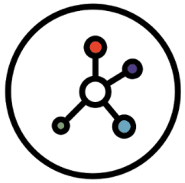
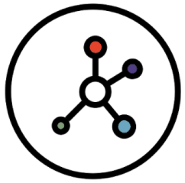
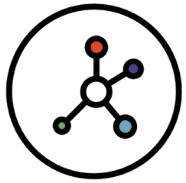
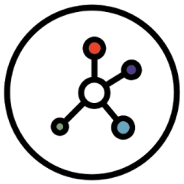
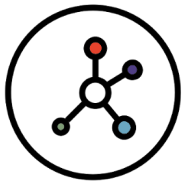
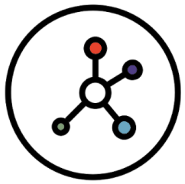
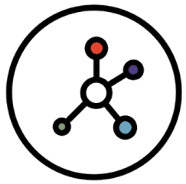
Nine amino acids have side chains that are non-polar. These side chains are composed mostly of C and H and have very small dipole moments. These amino acids are usually buried within the core of proteins.

## 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 [%]