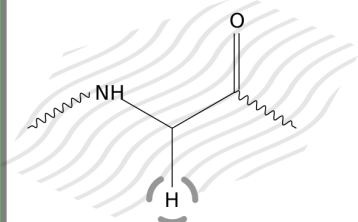






O

# GLYCINE (GLY)

G

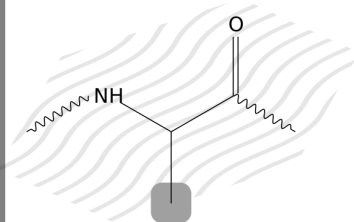






	Molar mass	<b>75.07</b>
	Isoelectric point	<b>5.97</b>
	Solubility	<b>225</b>
	Frequency	<b>7.5</b>

O

# ALANINE (ALA)

A

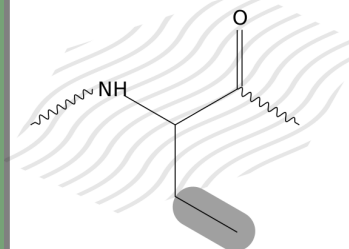






	Molar mass	<b>89.09</b>
	Isoelectric point	<b>6.02</b>
	Solubility	<b>160</b>
	Frequency	<b>9.0</b>

O

# VALINE (VAL)

V

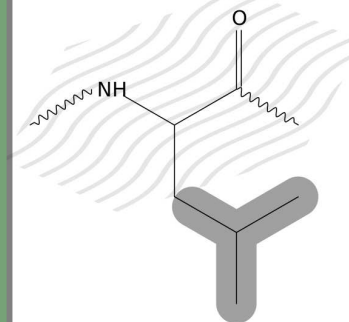






	Molar mass	<b>117.15</b>
	Isoelectric point	<b>5.96</b>
	Solubility	<b>85</b>
	Frequency	<b>6.9</b>

O

# LEUCINE (LEU)

L

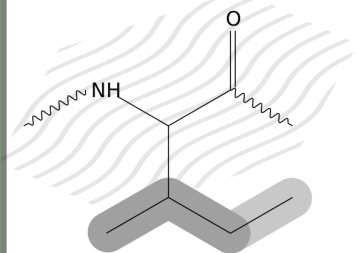






	Molar mass	<b>131.17</b>
	Isoelectric point	<b>5.98</b>
	Solubility	<b>24</b>
	Frequency	<b>7.5</b>

O

# ISOLEUCINE (ILE)

I

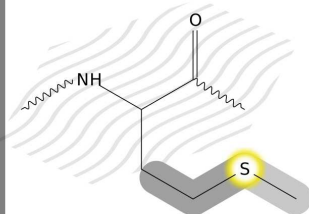






	Molar mass	<b>131.17</b>
	Isoelectric point	<b>5.94</b>
	Solubility	<b>32</b>
	Frequency	<b>4.6</b>

O

# METHIONINE (MET)

M

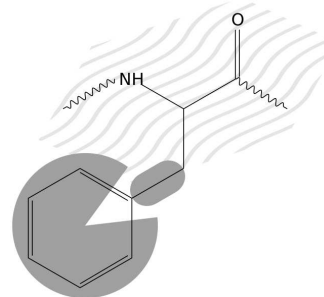






	Molar mass	<b>149.21</b>
	Isoelectric point	<b>5.74</b>
	Solubility	<b>53</b>
	Frequency	<b>1.7</b>

O

# PHENYLALANINE (PHE)

F

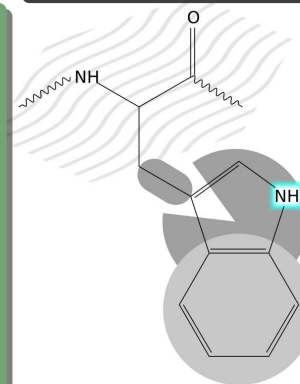






	Molar mass	<b>165.19</b>
	Isoelectric point	<b>5.48</b>
	Solubility	<b>27</b>
	Frequency	<b>3.5</b>

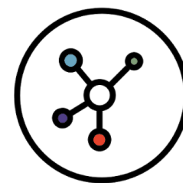
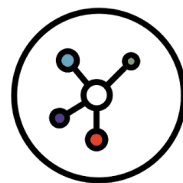
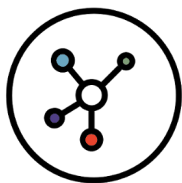
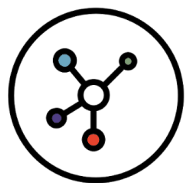
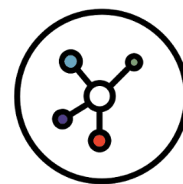
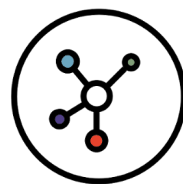
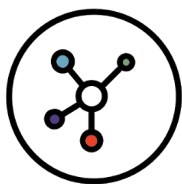
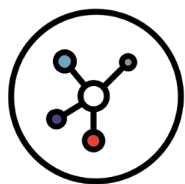
O

# TRYPTOPHAN (TRP)

W



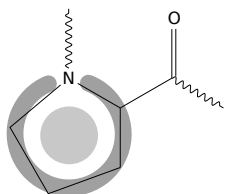
	Molar mass	<b>204.23</b>
	Isoelectric point	<b>5.88</b>
	Solubility	<b>10</b>
	Frequency	<b>1.1</b>



O

**PROLINE**  
(PRO)

P

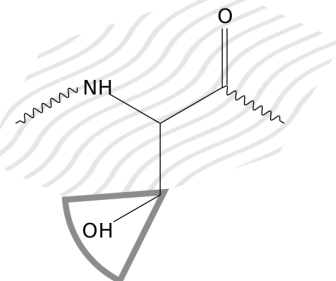


	Molar mass	<b>115.13</b>
	Isoelectric point	<b>6.30</b>
	Solubility	<b>1550</b>
	Frequency	<b>4.6</b>

•

**SERINE**  
(SER)

S

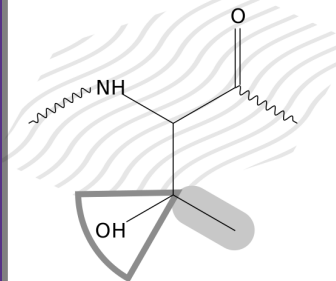


	Molar mass	<b>105.09</b>
	Isoelectric point	<b>5.68</b>
	Solubility	<b>360</b>
	Frequency	<b>7.1</b>

•

**THREONINE**  
(THR)

T

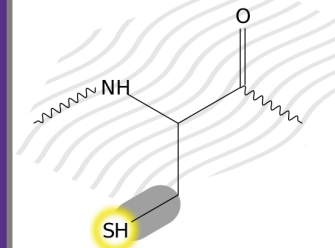


	Molar mass	<b>119.12</b>
	Isoelectric point	<b>5.64</b>
	Solubility	<b>90</b>
	Frequency	<b>6.0</b>

•

**CYSTEINE**  
(CYS)

C

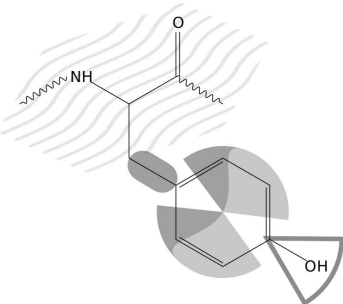


	Molar mass	<b>121.15</b>
	Isoelectric point	<b>5.02</b>
	Solubility	<b>160</b>
	Frequency	<b>2.8</b>

•

**TYROSINE**  
(TYR)

Y

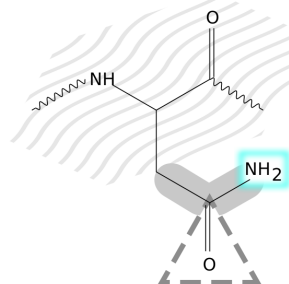


	Molar mass	<b>181.19</b>
	Isoelectric point	<b>5.65</b>
	Solubility	<b>0.38</b>
	Frequency	<b>3.5</b>

•

**ASPARAGINE**  
(ASN)

N

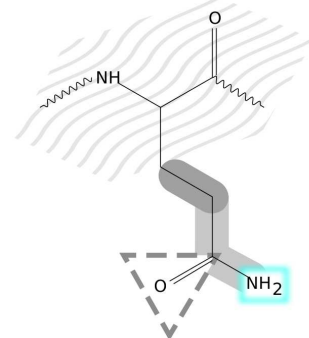


	Molar mass	<b>132.12</b>
	Isoelectric point	<b>5.41</b>
	Solubility	<b>20</b>
	Frequency	<b>4.4</b>

•

**GLUTAMINE**  
(GLN)

Q

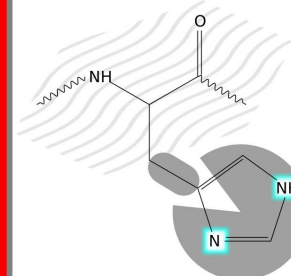


	Molar mass	<b>146.15</b>
	Isoelectric point	<b>5.65</b>
	Solubility	<b>35</b>
	Frequency	<b>3.9</b>

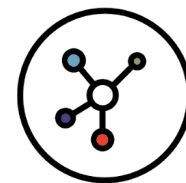
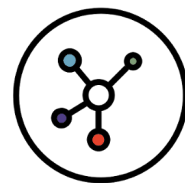
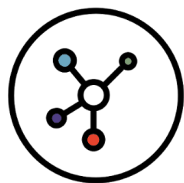
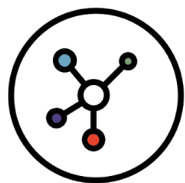
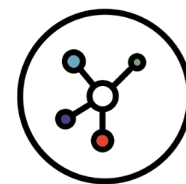
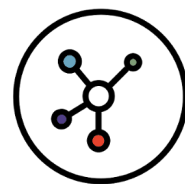
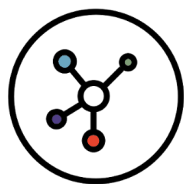
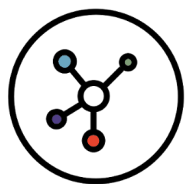
⊕

**HISTIDINE**  
(HIS)

H



	Molar mass	<b>155.15</b>
	Isoelectric point	<b>7.50</b>
	Solubility	<b>38.2</b>
	Frequency	<b>2.1</b>



⊕

LYSINE  
(LYS)

K

⚖️	Molar mass	<b>146.19</b>
⚡	Isoelectric point	<b>9.59</b>
🔬	Solubility	<b>2000</b>
🕒	Frequency	<b>7.0</b>

⊕

ARGININE  
(ARG)

R

⚖️	Molar mass	<b>174.20</b>
⚡	Isoelectric point	<b>11.50</b>
🔬	Solubility	<b>149</b>
🕒	Frequency	<b>4.7</b>

⊖

GLUTAMATE  
(GLU)

E

⚖️	Molar mass	<b>147.13</b>
⚡	Isoelectric point	<b>3.22</b>
🔬	Solubility	<b>7.5</b>
🕒	Frequency	<b>6.2</b>

⊖

ASPARTATE  
(ASP)

D

⚖️	Molar mass	<b>133.10</b>
⚡	Isoelectric point	<b>2.77</b>
🔬	Solubility	<b>4.0</b>
🕒	Frequency	<b>5.5</b>

•

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.

⊕

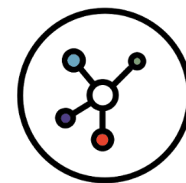
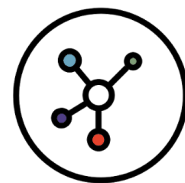
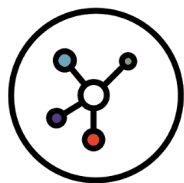
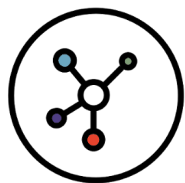
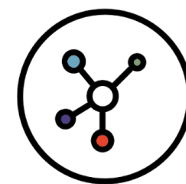
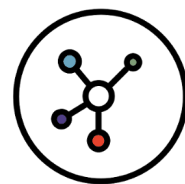
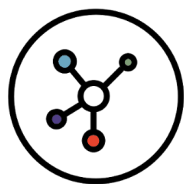
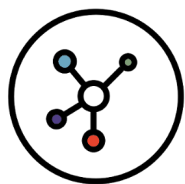
BASIC  
side chains

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°C [g/L]



Frequency in proteins [%]

