Genetic code codon table and translation steps

Use this sheet when you translate mRNA into a protein. Codons are written as mRNA, with U in place of T.

The standard codon table

Amino acid	mRNA codons	Number
Alanine (Ala)	GCU, GCC, GCA, GCG	4
Arginine (Arg)	CGU, CGC, CGA, CGG, AGA, AGG	6
Asparagine (Asn)	AAU, AAC	2
Aspartic acid (Asp)	GAU, GAC	2
Cysteine (Cys)	UGU, UGC	2
Glutamine (Gln)	CAA, CAG	2
Glutamic acid (Glu)	GAA, GAG	2
Glycine (Gly)	GGU, GGC, GGA, GGG	4
Histidine (His)	CAU, CAC	2
Isoleucine (Ile)	AUU, AUC, AUA	3
Leucine (Leu)	UUA, UUG, CUU, CUC, CUA, CUG	6
Lysine (Lys)	AAA, AAG	2
Methionine (Met)	AUG (start)	1
Phenylalanine (Phe)	UUU, UUC	2
Proline (Pro)	CCU, CCC, CCA, CCG	4
Serine (Ser)	UCU, UCC, UCA, UCG, AGU, AGC	6
Threonine (Thr)	ACU, ACC, ACA, ACG	4
Tryptophan (Trp)	UGG	1
Tyrosine (Tyr)	UAU, UAC	2
Valine (Val)	GUU, GUC, GUA, GUG	4
Stop	UAA, UAG, UGA	3

Source: NCBI genetic codes, standard code (table 1). Last checked: November 17, 2026.

How to translate mRNA

1. If you were given DNA, write the mRNA first. From the template strand, pair A with U, T with A, C with G and G with C. From the coding strand, swap every T for U.
2. Scan from the 5' end for the first AUG. This is the start codon and sets the reading frame.

3. Split the sequence into codons of three bases from the AUG.
4. Look up each codon in the table above.
5. Stop when you reach UAA, UAG or UGA. A stop codon adds no amino acid.

Point mutations at a glance

- Silent: the new codon codes for the same amino acid (GAA to GAG, still Glu).
- Missense: the new codon codes for a different amino acid (GAA to GUA, Glu to Val).
- Nonsense: the new codon is a stop codon (GAA to UAA), so the protein is cut short.
- Frameshift: inserting or deleting one base changes every codon after it.

Quick checks

- 64 codons in total: 61 code for amino acids and 3 are stop codons.
- Number of mRNA bases coding for a polypeptide = number of amino acids × 3, plus 3 if you include the stop codon.
- Unless a question says otherwise, use the standard code. Vertebrate mitochondria use a variant in which UGA codes for tryptophan.