## Scoring matrices and gap penalty combinations with statistics for protein searches

BLOSUM matrices

| Score matrix | Gap open penalty | Gap extension penalty |
|---|---|---|
| BLOSUM45 | 13 | 3 |
| BLOSUM45 | 12 | 3 |
| BLOSUM45 | 11 | 3 |
| BLOSUM45 | 10 | 3 |
| BLOSUM45 | 16 | 2 |
| BLOSUM45 | 15 | 2 |
| BLOSUM45 | 14 | 2 |
| BLOSUM45 | 13 | 2 |
| BLOSUM45 | 12 | 2 |
| BLOSUM45 | 19 | 1 |
| BLOSUM45 | 18 | 1 |
| BLOSUM45 | 17 | 1 |
| BLOSUM45 | 16 | 1 |
| | | |
| BLOSUM50 | 13 | 3 |
| BLOSUM50 | 12 | 3 |
| BLOSUM50 | 11 | 3 |
| BLOSUM50 | 10 | 3 |
| BLOSUM50 | 9 | 3 |
| BLOSUM50 | 16 | 2 |
| BLOSUM50 | 15 | 2 |
| BLOSUM50 | 14 | 2 |
| BLOSUM50 | 13 | 2 |
| BLOSUM50 | 12 | 2 |
| BLOSUM50 | 19 | 1 |
| BLOSUM50 | 18 | 1 |
| BLOSUM50 | 17 | 1 |
| BLOSUM50 | 16 | 1 |
| BLOSUM50 | 15 | 1 |
| | | |
| BLOSUM62 | 11 | 2 |
| BLOSUM62 | 10 | 2 |
| BLOSUM62 | 9 | 2 |
| BLOSUM62 | 8 | 2 |
| BLOSUM62 | 7 | 2 |
| BLOSUM62 | 6 | 2 |
| BLOSUM62 | 13 | 1 |
| BLOSUM62 | 12 | 1 |
| BLOSUM62 | 11 | 1 |
| BLOSUM62 | 10 | 1 |
| BLOSUM62 | 9 | 1 |
| | | |
| BLOSUM80 | 25 | 2 |
| BLOSUM80 | 13 | 2 |
| BLOSUM80 | 9 | 2 |
| BLOSUM80 | 8 | 2 |
| BLOSUM80 | 7 | 2 |
| BLOSUM80 | 6 | 2 |
| BLOSUM80 | 11 | 1 |
| BLOSUM80 | 10 | 1 |
| BLOSUM80 | 9 | 1 |
| | | |
| BLOSUM90 | 9 | 2 |
| BLOSUM90 | 8 | 2 |
| BLOSUM90 | 7 | 2 |
| BLOSUM90 | 6 | 2 |
| BLOSUM90 | 11 | 1 |
| BLOSUM90 | 10 | 1 |
| BLOSUM90 | 9 | 1 |

PAM matrices

| Score matrix | Gap open penalty | Gap extension penalty |
|---|---|---|
| PAM30 | 7 | 2 |
| PAM30 | 6 | 2 |
| PAM30 | 5 | 2 |
| PAM30 | 10 | 1 |
| PAM30 | 9 | 1 |
| PAM30 | 8 | 1 |
| | | |
| PAM70 | 8 | 2 |
| PAM70 | 7 | 2 |
| PAM70 | 6 | 2 |
| PAM70 | 11 | 1 |
| PAM70 | 10 | 1 |
| PAM70 | 9 | 1 |
| | | |
| PAM250 | 15 | 3 |
| PAM250 | 14 | 3 |
| PAM250 | 13 | 3 |
| PAM250 | 12 | 3 |
| PAM250 | 11 | 3 |
| PAM250 | 17 | 2 |
| PAM250 | 16 | 2 |
| PAM250 | 15 | 2 |
| PAM250 | 14 | 2 |
| PAM250 | 13 | 2 |
| PAM250 | 21 | 1 |
| PAM250 | 20 | 1 |
| PAM250 | 19 | 1 |
| PAM250 | 18 | 1 |
| PAM250 | 17 | 1 |

## Match/mismatch scores and gap penalty combinations with statistics for nucleotide searches

Parameter combinations on lines indicated with yellow uses ungapped statistics.

| Match score | Mismatch score | Gap open penalty | Gap extension penalty |
|---|---|---|---|
| 1 | -5 | 3 | 3 |
| 1 | -5 | ≥ 3 | ≥ 3 |
| 1 | -4 | 1 | 2 |
| 1 | -4 | 0 | 2 |
| 1 | -4 | 2 | 1 |
| 1 | -4 | 1 | 1 |
| 1 | -4 | ≥ 2 | ≥ 2 |
| 2 | -7 | 2 | 4 |
| 2 | -7 | 0 | 4 |
| 2 | -7 | 4 | 2 |
| 2 | -7 | 2 | 2 |
| 2 | -7 | ≥ 4 | ≥ 4 |
| 1 | -3 | 2 | 2 |
| 1 | -3 | 1 | 2 |
| 1 | -3 | 0 | 2 |
| 1 | -3 | 2 | 1 |
| 1 | -3 | 1 | 1 |
| 1 | -3 | ≥ 2 | ≥ 2 |
| 2 | -5 | 2 | 4 |
| 2 | -5 | 0 | 4 |
| 2 | -5 | 4 | 2 |
| 2 | -5 | 2 | 2 |
| 2 | -5 | ≥ 4 | ≥ 4 |
| 1 | -2 | 2 | 2 |
| 1 | -2 | 1 | 2 |
| 1 | -2 | 0 | 2 |
| 1 | -2 | 3 | 1 |
| 1 | -2 | 2 | 1 |
| 1 | -2 | 1 | 1 |
| 1 | -2 | ≥ 2 | ≥ 2 |
| 2 | -3 | 4 | 4 |
| 2 | -3 | 2 | 4 |
| 2 | -3 | 0 | 4 |
| 2 | -3 | 3 | 3 |
| 2 | -3 | 6 | 2 |
| 2 | -3 | 5 | 2 |
| 2 | -3 | 4 | 2 |
| 2 | -3 | 2 | 2 |
| 2 | -3 | ≥ 6 | ≥ 4 |
| 3 | -4 | 6 | 3 |
| 3 | -4 | 5 | 3 |
| 3 | -4 | 4 | 3 |
| 3 | -4 | 6 | 2 |
| 3 | -4 | 5 | 2 |
| 3 | -4 | 4 | 2 |
| 4 | -5 | 6 | 5 |
| 4 | -5 | 5 | 5 |
| 4 | -5 | 4 | 5 |
| 4 | -5 | 3 | 5 |
| 4 | -5 | ≥ 4 | ≥ 2 |
| 1 | -1 | 3 | 2 |
| 1 | -1 | 2 | 2 |
| 1 | -1 | 1 | 2 |
| 1 | -1 | 0 | 2 |
| 1 | -1 | 4 | 1 |
| 1 | -1 | 3 | 1 |
| 1 | -1 | 2 | 1 |
| 3 | -2 | 5 | 5 |
| 5 | -4 | 10 | 6 |
| 5 | -4 | 8 | 6 |