

Table 6.1 Rate enhancement by selected enzymes

| Enzyme | Nonenzymatic half-life | Uncatalyzed rate ($k_{\text{un}} \text{ s}^{-1}$) | Catalyzed rate ($k_{\text{cat}} \text{ s}^{-1}$) | Rate enhancement ($k_{\text{cat}} \text{ s}^{-1} / k_{\text{un}} \text{ s}^{-1}$) |
|----------------------------|------------------------|---|--|---|
| OMP decarboxylase | 78,000,000 years | 2.8×10^{-16} | 39 | 1.4×10^{17} |
| Staphylococcal nuclease | 130,000 years | 1.7×10^{-13} | 95 | 5.6×10^{14} |
| AMP nucleosidase | 69,000 years | 1.0×10^{-11} | 60 | 6.0×10^{12} |
| Carboxypeptidase A | 7.3 years | 3.0×10^{-9} | 578 | 1.9×10^{11} |
| Ketosteroid isomerase | 7 weeks | 1.7×10^{-7} | 66,000 | 3.9×10^{11} |
| Triose phosphate isomerase | 1.9 days | 4.3×10^{-6} | 4,300 | 1.0×10^9 |
| Chorismate mutase | 7.4 hours | 2.6×10^{-5} | 50 | 1.9×10^9 |
| Carbonic anhydrase | 5 seconds | 1.3×10^{-11} | 1×10^6 | 7.7×10^9 |

Abbreviations: OMP, orotidine monophosphate; AMP, adenosine monophosphate.
Source: After A. Radzicka and R. Wolfenden, *Science* 267:90-93, 1995.

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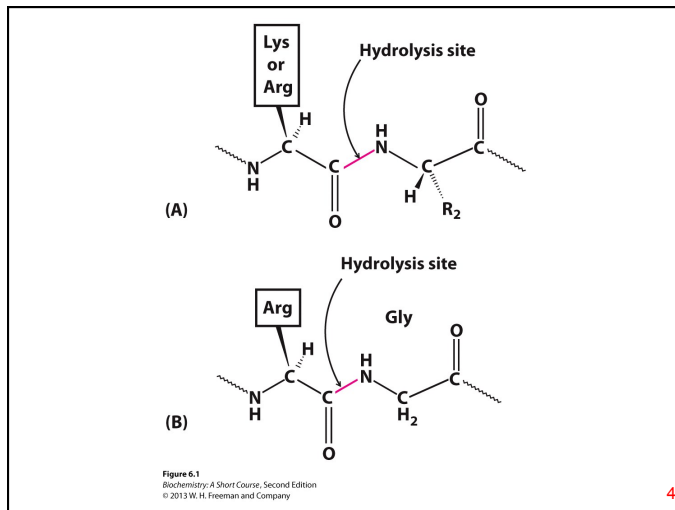
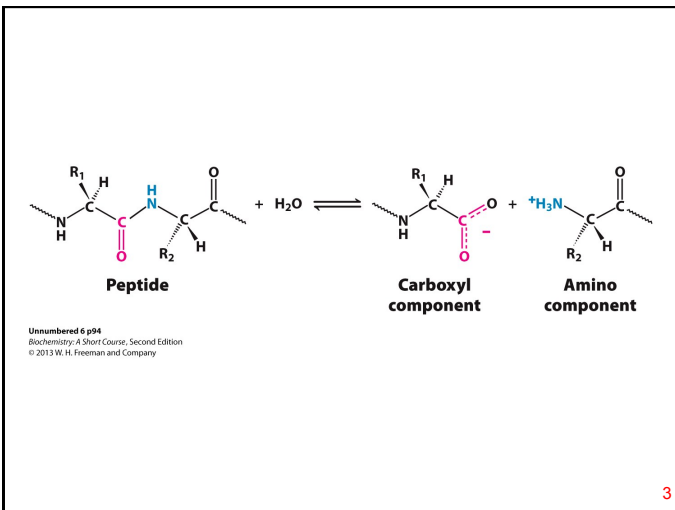


TABLE 5.1 Enzyme Classification Based on Type of Chemical Reaction Catalyzed

| Class | Type of Chemical Reaction Catalyzed | Examples |
|----------------|---|---|
| Oxidoreductase | Oxidation-reduction in which oxygen and hydrogen are gained or lost | Cytochrome oxidase, lactate dehydrogenase |
| Transferase | Transfer of functional groups, such as an amino group, acetyl group, or phosphate group | Acetate kinase, alanine deaminase |
| Hydrolase | Hydrolysis (addition of water) | Lipase, sucrase |
| Lyase | Removal of groups of atoms without hydrolysis | Oxalate decarboxylase, isocitrate lyase |
| Isomerase | Rearrangement of atoms within a molecule | Glucose-phosphate isomerase, alanine racemase |
| Ligase | Joining of two molecules [using energy usually derived from the breakdown of ATP] | Acetyl-CoA synthetase, DNA ligase |

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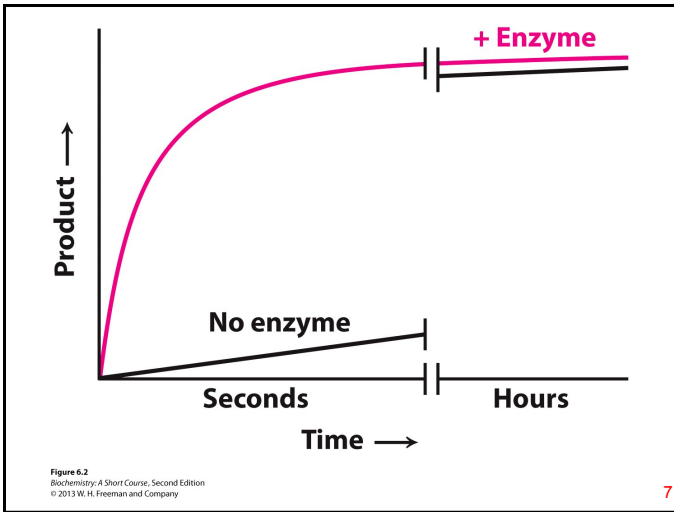
Table 6.2 Enzyme cofactors

| Cofactor | Enzyme* |
|---|--------------------------|
| Coenzyme[†] | |
| Thiamine pyrophosphate (TPP) | Pyruvate dehydrogenase |
| Flavin adenine nucleotide (FAD) | Monoamine oxidase |
| Nicotinamide adenine dinucleotide (NAD ⁺) | Lactate dehydrogenase |
| Pyridoxal phosphate (PLP) | Glycogen phosphorylase |
| Coenzyme A (CoA) | Acetyl CoA carboxylase |
| Biotin | Pyruvate carboxylase |
| 6'-Deoxyadenosyl cobalamin | Methylmalonyl mutase |
| Tetrahydrofolate | Thymidylate synthase |
| Metal | |
| Zn ²⁺ | Carbonic anhydrase |
| Mg ²⁺ | EcoRV |
| Ni ²⁺ | Urease |
| Mo | Nitrogenase |
| Se | Glutathione peroxidase |
| Mn ^{2+→3+} | Superoxide dismutase |
| K ⁺ | Acetoacetyl CoA thiolase |

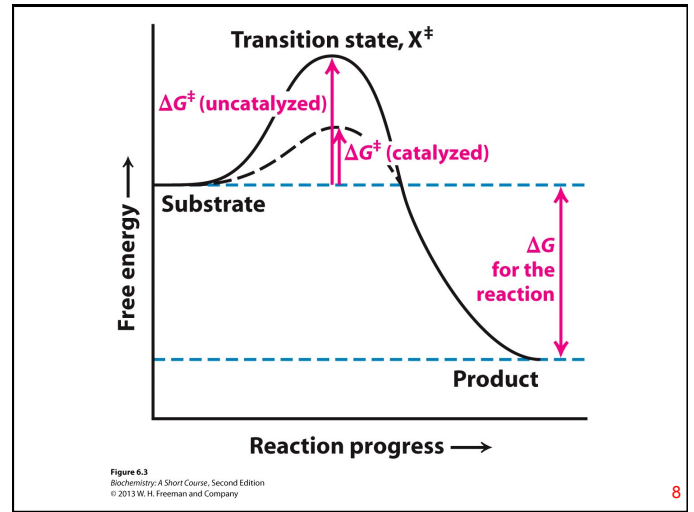
*The enzymes listed are examples of enzymes that employ the indicated cofactor.
†Often derived from vitamins, coenzymes can be either tightly or loosely bound to the enzyme.

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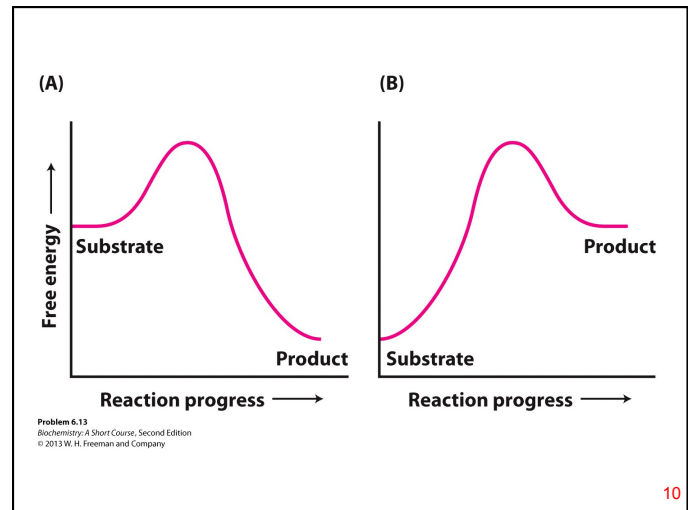
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Table 6.3 Relation between $\Delta G'^{\circ}$ and K'_{eq} (at 25°C)

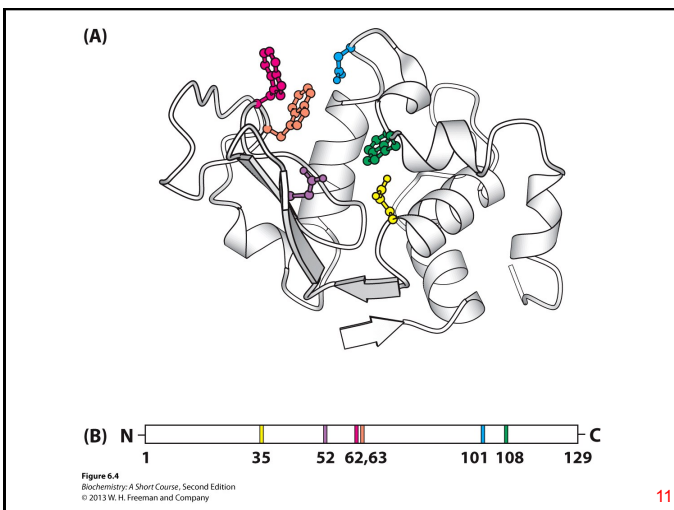
| K'_{eq} | $\Delta G'^{\circ}$ | |
|-----------|----------------------|------------------------|
| | kJ mol^{-1} | kcal mol^{-1} |
| 10^{-5} | 28.53 | 6.82 |
| 10^{-4} | 22.84 | 5.46 |
| 10^{-3} | 17.11 | 4.09 |
| 10^{-2} | 11.42 | 2.73 |
| 10^{-1} | 5.69 | 1.36 |
| 1 | 0 | 0 |
| 10 | -5.69 | -1.36 |
| 10^2 | -11.42 | -2.73 |
| 10^3 | -17.11 | -4.09 |
| 10^4 | -22.84 | -5.46 |
| 10^5 | -28.53 | -6.82 |

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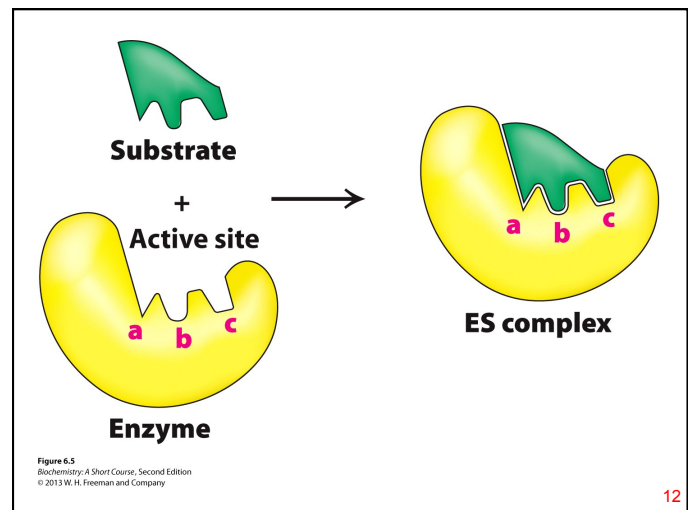
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