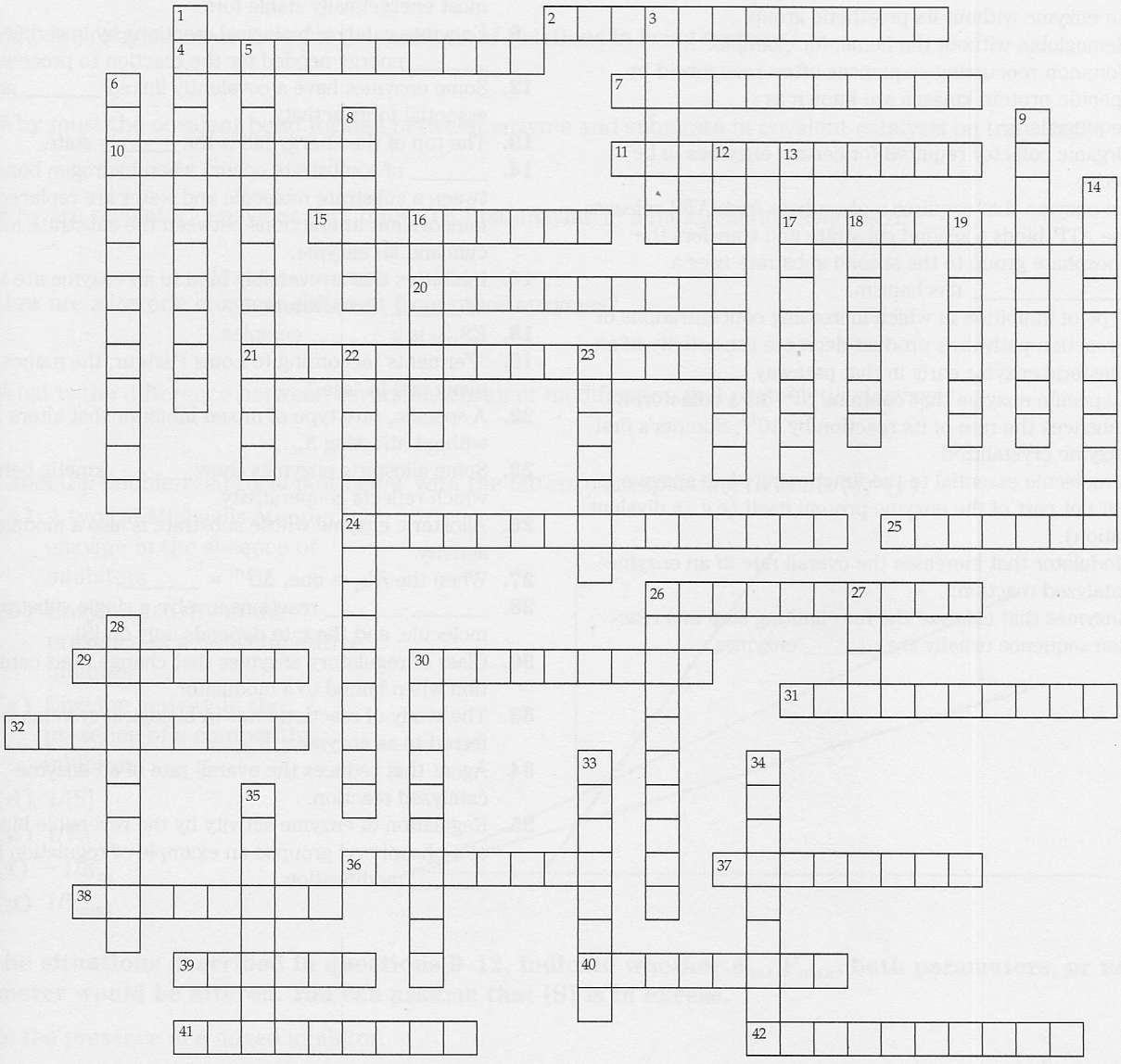
# SELF-TEST

Enzymes and the study of enzyme reaction rates (enzyme kinetics) are among the most difficult areas of biochemistry for students to assimilate. Consequently, more problems have been included in this chapter's Self-Test. If you work through these problems carefully, your understanding of this material will be greatly enhanced. However, these problems will be beneficial only if you work through them to completion without looking at the answers.

## Do You Know the Terms?



### ACROSS

**2.** The slowest reaction in a sequence is the _____-_____ step.

**4.** State of a system in which no further net change is occurring.

**7.** The assumption that the rate of formation of ES is exactly equal to the rate of breakdown of ES is called the _____ _____ assumption. (2 words)

**10.** $k_{cat}$ is known as the _____ number. At saturating substrate concentrations, $k_{cat} = V_{max}/[E_t]$.

**11.** Type of inhibitor that alters the $K_m$ of an enzyme without altering $V_{max}$.

**15.** Molecule that binds to the active site of an enzyme.

**17.** Relatively small portion of an enzyme that is involved in substrate binding. (2 words)

**20.** Describes changes in the conformation of an enzyme upon substrate binding. (2 words)
**21.** A _____-_____ analog binds more tightly to the active site than does the substrate molecule.
**24.** _____-_____ kinetics describes the enzymatic activity of an idealized enzyme.
**25.** Trypsin is to trypsinogen as active enzyme is to _____.
**26.** Complete enzyme complex including all the protein subunits and prosthetic groups.
**29.** Type of energy derived from enzyme-substrate interactions that lowers the activation energy for a reaction.
**30.** An enzyme without its prosthetic group.
**31.** Hemoglobin without the heme, for example.
**32.** Common reocurring sequences often recognized by specific protein kinases are known as _____ sequences.
**36.** Organic cofactor required for certain enzymes to be active.
**37.** An enzyme that acquires a phosphate from ATP, releases the ATP, binds a second substrate and transfers the phosphate group to the second substrate uses a _____-_____ mechanism.
**38.** Type of inhibition in which increasing concentrations of a reaction pathway's product decrease the activity of an allosteric enzyme early in that pathway.
**39.** A specific enzyme that contains $Ni^{2+}$ as a cofactor; it enhances the rate of its reaction by $10^{14}$; Sumner's first enzyme crystallized.
**40.** A molecule essential to the functioning of an enzyme, but not part of the enzyme protein itself (e.g., a divalent cation).
**41.** Modulator that increases the overall rate of an enzyme-catalyzed reaction.
**42.** Enzymes that catalyze the rate-limiting step in a reaction sequence usually are _____ enzymes.

## DOWN

**1.** An enzyme whose activity is regulated by a modulator other than its substrate.
**3.** Binding of a substrate molecule to an enzyme promotes catalysis by reducing the relative motions of the participants, and so reducing _____.
**5.** Inhibitor that binds only to the ES complex, and therefore cannot bind to the substrate-binding site.
**6.** EP and ES are examples of reaction _____.
**8.** Energetic state of a substrate or product molecule in its most energetically stable form.
**9.** Enzymes catalyze biological reactions by lowering the _____ energy needed for the reaction to proceed.
**12.** Some enzymes have a covalently linked _____ group essential to its activity.
**13.** The top of the energy hill is the _____ state.
**14.** _____ of a substrate occurs when hydrogen bonds between a substrate molecule and water are replaced by noncovalent interactions between the substrate molecule and an enzyme.
**16.** Inhibitors that irreversibly bind to an enzyme are known as _____ inactivators.
**18.** $ES_1S_2$ is a _____ complex.
**19.** "Ferments" according to Louis Pasteur; the names of many end in "ase."
**22.** A specific, rare type of mixed inhibitor that alters $V_{max}$ without affecting $K_m$.
**23.** Some allosteric enzymes show _____ kinetic behavior, which reflects cooperativity.
**26.** Allosteric enzyme whose substrate is also a modulator of activity.
**27.** When the $K'_{eq}$ = one, $\Delta G'^0$ = _____.
**28.** _____-_____ reactions involve a single substrate molecule, and the rate depends only on [S].
**30.** Class of regulatory enzymes that change their conformation when bound to a modulator.
**33.** The study of reaction rates in biological systems is referred to as enzyme _____.
**34.** Agent that reduces the overall rate of an enzyme-catalyzed reaction.
**35.** Regulation of enzyme activity by the reversible binding of a phosphoryl group is an example of regulation by _____ modification.