

**ENERGY AND THE CHEMISTRY OF LIFE****Interactive Video Quiz for Part One**

1. Two or more atoms combine together to form a \_\_\_\_\_.
2. Silver, copper, carbon and hydrogen are examples of different kinds of \_\_\_\_\_.
3. A mouse trap which has been set may be said to possess \_\_\_\_\_ energy.
4. The energy of motion is also know as \_\_\_\_\_ energy.
5. True or False: All atoms possess protons and electrons, but at least one type lacks neutrons.

**ENERGY AND THE CHEMISTRY OF LIFE****Interactive Video Quiz for Part Two**

1. ATP is used by cells of all living things as a source of readily-available \_\_\_\_\_.
2. ATP levels in cells are renewed from ADP and inorganic phosphate through the important metabolic process called \_\_\_\_\_.
3. In most cases, the sugar called \_\_\_\_\_ is critical to the ATP renewal process.
4. In photosynthesis, carbon dioxide and \_\_\_\_\_ are combined in the presence of sunlight and chlorophyll.
5. True or False: Most chlorophyll is found in the green-colored organelles called mitochondria.

## ENERGY AND THE CHEMISTRY OF LIFE

### Vocabulary List

**ACTIVE TRANSPORT:** The movement of substances across membranes by the expenditure of energy usually moving against a concentration gradient.

**ACTIVATION ENERGY:** The minimum amount of energy required to get a chemical reaction started.

**ADENOSINE DIPHOSPHATE:** A compound formed in the breakdown of ATP.

**ADENOSINE TRIPHOSPHATE** (see ATP)

**ADP:** The abbreviation for adenosine diphosphate.

**AEROBIC:** Refers to the presence of oxygen.

**AMINO ACID:** The chemical subunits from which proteins are made. Proteins are long chains of amino acids.

**ANAEROBIC:** Refers to the absence of oxygen. Anaerobic cellular respiration can result in the production of ATP in the absence of oxygen.

**ATOM :** The smallest particle of an element that has all the properties of the element and can enter into chemical combination. The word atom is derived from the Greek language and means "A": not or without, and "TOMOS": to cut. Thus A-TOMOS means cannot be cut into smaller pieces. The Greeks first proposed the existence of atoms over 2000 years ago.

**ATP:** Abbreviation for the molecule known as adenosine triphosphate. Biological systems utilize the free energy released from breaking the third phosphate bond of ATP.

**CARBOHYDRATE:** Any of a class of compounds composed of carbon, hydrogen and oxygen in a ratio of 1:2:1. Sugars and starches are carbohydrates.

**CAROTENOIDS:** Pigment molecules, usually red, yellow, and orange, that interact with chlorophylls to absorb the light energy needed for photosynthesis.

**CELLULAR RESPIRATION:** A series of cellular chemical reactions that oxidize carbohydrates, in particular glucose, to produce ATP, carbon dioxide, and water.

**CELLULOSE:** A long chain, or polymer, of glucose molecules which is the principle ingredient of the cell walls of plants.

**CHEMICAL BOND:** The bonds which join atoms together and which are based either on sharing electrons or on differences in electrostatic charge.

**CHEMICAL FORMULA:** A group of symbols showing the number and type of each atom in a molecule or compound. For example, the chemical formula for glucose is  $C_6H_{12}O_6$ , indicating it is composed of 6 carbon atoms, 12 hydrogen atoms, and 6 oxygen atoms.

**CHEMICAL REACTION:** The interaction of chemical substances (whether atoms, molecules, or compounds) to create new chemical substances.

**CHLOROPLAST:** A greenish-colored subcellular organelle found in plants and most algae that contains chlorophyll and is the site of photosynthesis.

**CHLOROPHYLL:** A unique magnesium-containing molecule capable of trapping the energy of sunlight. Chlorophyll is found in plants, most algae, and some bacteria.

**CITRIC ACID CYCLE:** A stage of cellular respiration that takes place in the mitochondria that results in the production of ATP and  $CO_2$ . Also known as the Krebs Cycle.

**COMPOUND:** A chemical combination of two or more elements.

**COVALENT CHEMICAL BOND:** A chemical bond in which atoms share electrons.

**DNA (Deoxyribonucleic Acid):** The large nucleic acid molecules that chemically store instructions inside of cells. Chromosomes contain large amounts of DNA.

**ELECTRON:** A negatively-charged, subatomic particle that orbits the nucleus of an atom.

**ENERGY AND THE CHEMISTRY OF LIFE****Vocabulary List (Page 2)**

**ELECTRON TRANSPORT SYSTEM:** The last stage of cellular respiration where water and quite a lot of ATP is produced. This system is made up of a group of enzymes located inside the mitochondria that harness energy from the flow of electrons produced by the oxidation of certain substances, especially glucose.

**ELEMENT:** A primary material that cannot be chemically broken down into simpler materials. Silver, copper, carbon, hydrogen, phosphorous, and nitrogen are all elements. Ninety-two elements occur naturally on earth.

**ENDERGONIC CHEMICAL REACTION:** A chemical reaction that requires free energy in addition to enzymes and activation energy.

**ENERGY:** The ability to do work.

**ENZYME:** Protein molecules that change the rates of chemical reactions. Most chemical reactions inside cells require the presence of enzymes.

**EXERGONIC CHEMICAL REACTION:** A chemical reaction that releases free energy.

**FREE ENERGY:** Energy that is available to do biological work.

**FRUCTOSE:** A type of six-carbon sugar commonly called fruit sugar.

**GLUCOSE:** A six-carbon sugar produced from carbon dioxide and water during photosynthesis. Glucose and oxygen are combined in aerobic cellular respiration to provide energy for living cells.

**GRANA:** Stacked thylakoid membranes in chloroplasts where the light reactions of photosynthesis occur.

**GLYCOGEN:** A polymer of glucose, similar to starch, which is stored in the liver and muscles of animals.

**GLYCOLYSIS:** Chemical reactions that take place in the cytoplasm of cells and that occur at the start of cellular respiration in which glycogen or glucose begin to be broken down into smaller component molecules.

**KINETIC ENERGY:** The energy of motion.

**KREBS CYCLE:** See citric acid cycle.

**LIPIDS:** Fats, oils, and waxes. Organic compounds of carbon, hydrogen, and oxygen that store large amounts of chemical energy.

**MACROMOLECULE:** A very large molecule. Most proteins and nucleic acids are macromolecules.

**MASS:** The amount of material in an object expressed in kilograms.

**MATTER:** Anything that occupies space and has mass is known as matter.

**METABOLISM:** The sum of all the chemical reactions that occur inside a cell or living organism.

**MITOCHONDRION:** The subcellular organelle known as the "powerhouse of the cell" and which is the site of cellular respiration.

**MOLECULE:** Two or more atoms joined together by a covalent chemical bond.

**MONERAN:** The most primitive kingdom of living things composed of the bacteria and blue-green algae. Monerans lack membrane-bound nuclei and possess neither chloroplasts nor mitochondria. (Despite these shortcomings, some monerans can perform photosynthesis and all can carry out cellular respiration.)

**NEUTRON:** Subatomic particles found in the nuclei of most atoms that possess no electrical charge.

**NUCLEIC ACIDS:** Biological compounds, such as DNA or RNA, that store and/or carry instructions inside of cells.

**NUCLEOTIDES:** The components that make up nucleic acids. Nucleotides themselves are very complicated and are composed of a phosphate group, a sugar molecule, and a nitrogen base.

**ORGANELLES:** A word meaning "tiny organs." Organelles are found inside of cells. Mitochondria, chloroplasts, and ribosomes are all examples of organelles.

**ENERGY AND THE CHEMISTRY OF LIFE****Vocabulary List (Page 3)**

**ORGANIC COMPOUNDS:** Chemical compounds that contain carbon.

**PHOTON:** A packet of light energy that, in certain ways, behaves like a particle of matter.

**PHOTOSYNTHESIS:** A complex series of chemical reactions that occurs in plants and some algae and bacteria whereby carbon dioxide and water are combined to form glucose and oxygen. This process requires the presence of both light and chlorophyll in order to proceed.

**POLYMER:** A long chain of identical or similar chemical subunits. Starch, for example, is a polymer of glucose.

**POLYMERIZATION:** The process of creating polymers.

**POTENTIAL ENERGY:** Hidden energy, such as is possessed by water stored behind a dam.

**PROTEIN:** Organic molecules composed of long chains of amino acids. Proteins function in many ways: they can transport oxygen in red blood cells, make muscles contract, act as enzymes, fight disease, and transport particles out of cells.

**PROTON:** A positively-charged, subatomic particle found in the nuclei of atoms. The hydrogen nucleus is a proton.

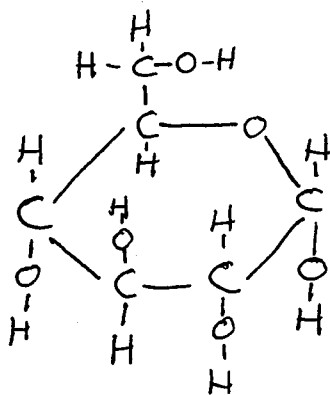
**RADIATION:** The transfer of energy in the form of waves that does not require a material medium. Light energy radiates from the sun to the earth. Radiation also refers to the energy emissions given off by radioactive atoms.

**RNA (Ribonucleic Acid):** A class of nucleic acids that can store information, act as chemical messengers, or are essential in manufacturing proteins.

**STOMATA:** Tiny openings in the leaves of plants through which gases are exchanged.

**STROMA:** The fluid part of the chloroplast that contains the molecules used to synthesize sugars during photosynthesis.

**STRUCTURAL FORMULA:** A method of writing out the name of an organic compound that provides more information than the chemical formula. For example, the chemical formula for glucose is  $C_6H_{12}O_6$ , whereas its structural formula can be written:



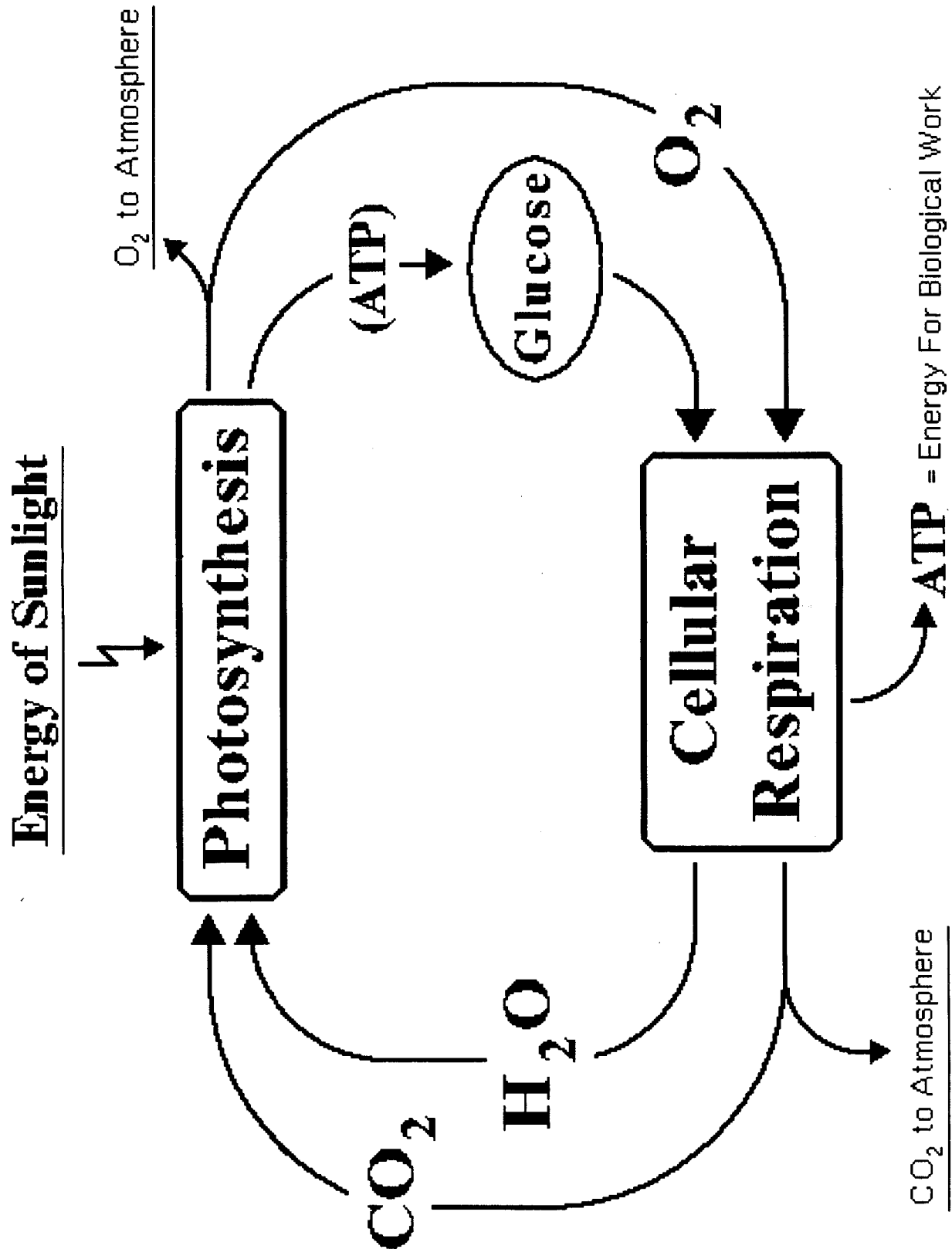
By looking at this formula, chemists can understand the precise ways that the atoms of glucose are bonded to one another.

**SUCROSE:** Common table sugar. Sucrose is made up of one molecule of glucose chemically bonded to one molecule of the sugar fructose.

**THYLAKOID MEMBRANES:** Membranes found in chloroplasts where chlorophyll molecules are located.

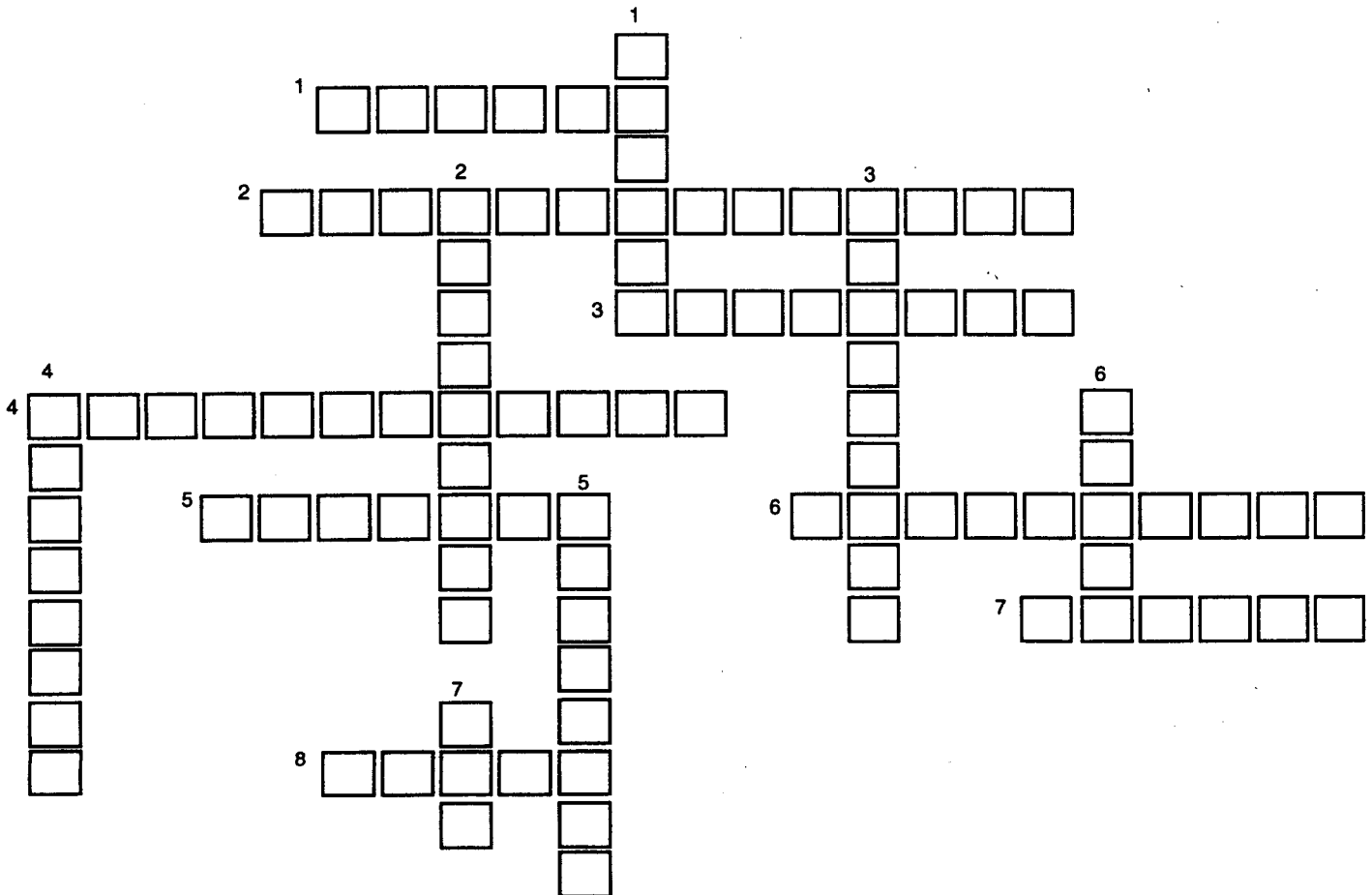
**WEIGHT:** The effect of the force of gravity on the mass of an object.

**WORK:** The measurement of a force (the energy that can make things move) times the distance through which the force is applied.

**ENERGY AND THE CHEMISTRY OF LIFE****Diagram of the Relationship Between Photosynthesis and Cellular Respiration**

## ENERGY AND THE CHEMISTRY OF LIFE

### Crossword Puzzle



#### ACROSS

1. The gas called \_\_\_\_\_ that is essential to animal life, is released by green plants.
2. During the very important biochemical process called \_\_\_\_\_, carbon dioxide molecules are combined with water to form glucose, a simple sugar.
3. Silver, copper, hydrogen, carbon and helium are different types of chemical \_\_\_\_\_.
4. The cells of plants possess unique chlorophyll containing organelles called \_\_\_\_\_.
5. A simple sugar called \_\_\_\_\_, whose formula is  $C_6H_{12}O_6$ , is broken down during glycolysis.
6. Chemical reactions that consume free energy are called \_\_\_\_\_ reactions.
7. Plants, like potatoes, store energy in a polymer of glucose commonly known as \_\_\_\_\_.
8. A simple chemical compound consisting of a single oxygen atom combined with two atoms of hydrogen is called \_\_\_\_\_.

#### DOWN:

1. A type of protein that affects the speed of a chemical reaction is called an \_\_\_\_\_.
2. Chlorophyll, found inside of plant cells within the organelles described in number four across, is bound inside these organelles to the \_\_\_\_\_ membranes.
3. \_\_\_\_\_ chemical reactions release free energy.
4. During the process called aerobic \_\_\_\_\_ respiration, both carbon dioxide and water are produced.
5. The negatively-charged particle that spins around the nucleus of a hydrogen atom is called an \_\_\_\_\_.
6. A small "packet" of \_\_\_\_\_ energy is called a photon.
7. To carry out their life processes, cells of living things rely on the free energy provided by molecules of adenosine triphosphate, also called \_\_\_\_.

**ENERGY AND THE CHEMISTRY OF LIFE****Vocabulary Match**

**Directions:** Match the definitions on the right with the correct word or term on the left.

- |                         |  |
|-------------------------|--|
| 1. _____ anaerobic      | A. Organic compounds composed of long chains of amino acids.   |
| 2. _____ aerobic        | B. The ability to do work.   |
| 3. _____ carotenoids    | C. Pigment molecules, usually red, yellow, and orange, that interact with chlorophylls to absorb the light energy needed for photosynthesis. |
| 4. _____ energy         | D. Refers to the presence of oxygen.   |
| 5. _____ free energy    | E. Refers to the absence of oxygen.  |
| 6. _____ kinetic energy | F. The energy of motion.   |
| 7. _____ mass           | G. The amount of material in an object expressed in kilograms.   |
| 8. _____ matter         | H. Energy that is available to do biological work.   |
| 9. _____ metabolism     | I. Anything that occupies space and has mass.  |
| 10. _____ protein       | J. The sum of all the chemical reactions that occur inside a cell or living organism.  |



**ENERGY AND THE CHEMISTRY OF LIFE****Quiz**

**Directions:** Complete the following...

1. As a result of photosynthesis, two different kinds of molecules are produced namely those of \_\_\_\_\_ and \_\_\_\_\_.
2. During aerobic cellular respiration, two different kinds of molecules, namely those of \_\_\_\_\_ and \_\_\_\_\_, are combined with the result that carbon dioxide and water are produced.
3. With few exceptions atoms are composed of three basic subatomic particles \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
4. If a molecule is made up of two or more different elements, it is called a chemical \_\_\_\_\_.
5. Photons of light are trapped by \_\_\_\_\_ molecules found in the chloroplasts of plant cells.
6. ATP is broken down to ADP and inorganic phosphate. Because this chemical reaction releases energy, it is called an \_\_\_\_\_ reaction.
7. Matter is different from energy in that it occupies \_\_\_\_\_ and possesses \_\_\_\_\_.
8. All organic chemical compounds possess one thing in common – all of them contain the element \_\_\_\_\_.
9. Carbohydrates are made up of three different elements in the ratio of 1:2:1. In order, these elements are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
10. Very few chemical reactions inside cells can occur on their own. Most reactions require the help of special protein molecules called \_\_\_\_\_ which usually speed up the reactions.