absolute temperature Temperature measured on the absolute scale, which has its origin at absolute zero. See also Kelvin scale.

absorption The process of taking up by capillary, osmotic, chemical, or solvent action, as a sponge absorbs water.

acid A water solution that has an excess of hydrogen ions; an acid turns litmus paper pink or red, has a sour taste, and neutralizes bases to form salts.

acidic anhydride A nonmetallic oxide that, when placed in water, reacts to form an acid solution.

acid salt A salt formed by replacing part of the hydrogen ions of a dibasic or tribasic acid with metallic ions. Examples: NaHSO₄, NaH₂PO₄.

actinide series The series of radioactive elements starting with actinium, No. 89, and ending with lawrencium, No. 103.

activated charcoal A specially treated and finely divided form of carbon, which possesses a high degree of adsorption.

activation energy The minimum energy necessary to start a reaction.

adsorption The adhesion (in an extremely thin layer) of the molecules of gases, of dissolved substances, or of liquids to the surfaces of solid or liquid bodies with which they come into contact.

alcohol An organic hydroxyl compound formed by replacing one or more hydrogen atoms of a hydrocarbon with an equal number of hydroxyl (OH) groups.

aldehyde An organic compound formed by dehydrating oxidized alcohol; contains the characteristic —CHO group.

alkali Usually, a strong base, such as sodium hydroxide or potassium hydroxide.

alkaline Referring to any substance that has basic properties.

alkyl A substitutent obtained from a saturated hydrocarbon by removing one hydrogen atom. Examples: methyl (CH₃), ethyl (C₂H₅).

allotropic forms Forms of the same element that differ in their crystalline structures.

alloy A substance composed of two or more metals, which are intimately mixed; usually made by melting the metals together.

alpha particles Positively charged helium nuclei.

amine A compound such as CH₃NH, derived from ammonia by substituting one or more hydrocarbon radicals for hydrogen atoms.
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**amino acid** One of the “building blocks” of proteins; contains one or more NH₂ groups that have replaced the same number of hydrogen atoms in an organic acid.

**amorphous** Having no definite crystalline structure.

**amphoteric** Referring to a hydroxide that may have either acidic or basic properties, depending on the substance with which it reacts.

**analysis** The breaking down of a compound into two or more simpler substances.

**anhydride** A compound derived from another compound by the removal of water; it will combine with water to form an acid (acidic anhydride) or a base (basic anhydride).

**anhydrous** Containing no water.

**anion** An ion or particle that has a negative charge and thus is attracted to a positively charged anode.

**anode** The electrode in an electrolytic cell that has a positive charge and attracts negative ions.

**antichlor** A substance used to remove the excess of chlorine in the bleaching process.

**aromatic compound** A compound whose basic structure contains the benzene ring; it usually has an odor.

**atmosphere** The layer of gases surrounding the earth; also, a unit of pressure (1 atm = approx. 760 mm of Hg or torr).

**atom** The smallest particle of an element that retains the properties of that element and can enter into a chemical reaction.

**atomic energy** *See nuclear energy*, a more accurate term.

**atomic mass (relative atomic mass or atomic weight)** The average mean value of the isotopic masses of the atoms of an element. It indicates the relative mass of the element as compared with that of carbon-12, which is assigned a mass of exactly 12 atomic mass units.

**atomic mass unit** One twelfth of the mass of a carbon-12 atom; equivalent to $1.660531 \times 10^{-27}$ kilogram (abbreviation: amu or μ).

**atomic number** The number that indicates the order of an element in the periodic system; numerically equal to the number of protons in the nucleus of the atom, or the number of negative electrons located outside the nucleus of the atom.

**atomic radius** One-half the distance between adjacent nuclei in the crystalline or solid phase of an element; the distance from the atomic nucleus to the valence electrons.

**atomic weight** *See atomic mass.*

**Aufbau Principle** The principle that states that an electron occupies the lowest energy orbital that can receive it.

**Avogadro’s hypothesis** *See under laws.*
Avogadro’s number  The number of molecules in 1 gram–molecular volume of a substance, or the number of atoms in 1 gram–atomic mass of an element; equal to $6.022169 \times 10^{23}$. See also mole.

barometer  An instrument, invented by Torricelli in 1643, used for measuring atmospheric pressure.

gaseous  A substance or element in the gaseous state.

gas A substance that is not in the solid or liquid state.

base  A water solution that contains an excess of hydroxide ions; a proton acceptor; a base turns litmus paper blue and neutralizes acids to form salts.

basic anhydride  A metallic oxide that forms a base when placed in water.

beta particles  High-speed, negatively charged electrons $^0_1\beta$ or $^0_0\beta$ emitted in radiation.

binary  Referring to a compound composed of two elements, such as H₂O.

boiling point  The temperature at which the vapor pressure of a liquid equals the atmospheric pressure.

bond energy  The energy needed to break a chemical bond and form a neutral atom.

bonding  The union of atoms to form compounds or molecules by filling their outer shells of electrons. This can be done through giving and taking electrons (ionic) or by sharing electrons (covalent).

Boyle’s Law  See under laws.

brass  An alloy of copper and zinc.

breeder reactor  A nuclear reactor in which more fissionable material is produced than is used up during operation.

Brownian movement  Continuous zigzagging movement of colloidal particles in a dispersing medium, as viewed through an ultramicroscope.

buffer  A substance that, when added to a solution, makes changing the pH of the solution more difficult.

calorie  A unit of heat; the amount of heat needed to raise the temperature of 1 gram of water 1 degree on the Celsius scale.

calorimeter  An instrument used to measure the amount of heat liberated or absorbed during a change.

carbonated water  Water containing dissolved carbon dioxide.

carbon dating  The use of radioactive carbon-14 to estimate the ages of ancient materials, such as archeological or paleontological specimens.

catalyst  A substance that speeds up or slows down a reaction without being permanently changed itself.

cathode  The electrode in an electrolytic cell that is negatively charged and attracts positive ions.
cathode rays Streams of electrons given off by the cathode of a vacuum tube.
cation An ion that has a positive charge.
Celsius scale A temperature scale divided into 100 equal divisions and based on water freezing at 0° and boiling at 100°. Synonymous with centigrade.
chain reaction A reaction produced during nuclear fission when at least one neutron from each fission produces another fission, so that the process becomes self-sustaining without additional external energy.
Charles’s Law See under laws.
chemical change A change that alters the atomic structures of the substances involved and results in different properties.
chemical property A property that determines how a substance will behave in a chemical reaction.
chemistry The science concerned with the compositions of substances and the changes that they undergo.
colligative property A property of a solution that depends primarily on the concentration, not the type, of particles present.
colloids Particles larger than those found in a solution but smaller than those in a suspension.
Combining Volumes See Gay-Lussac’s, under laws.
combustion A chemical action in which both heat and light are given off.
compound A substance composed of elements chemically united in definite proportions by weight.
condensation (a) A change from gaseous to liquid state; (b) the union of like or unlike molecules with the elimination of water, hydrogen chloride, or alcohol.
Conservation of Energy See under laws.
Conservation of Matter See under laws.
control rod In a nuclear reactor, a rod of a certain metal such as cadmium, which controls the speed of the chain reaction by absorbing neutrons.
coordinate covalence Covalence in which both electrons in a pair come from the same atom.
covalent bonding Bonding accomplished through the sharing of electrons so that atoms can fill their outer shells.
critical mass The smallest amount of fissionable material that will sustain a chain reaction.
critical temperature The temperature above which no gas can be liquefied, regardless of the pressure applied.
crystalline Having a definite molecular or ionic structure.
crystallization The process of forming definitely shaped crystals when water is evaporated from a solution of the substance.

cyclotron A device used to accelerate charged particles to high energies for bombarding the nuclei of atoms.

Dalton’s Law of Partial Pressures See under laws.

decomposition The breaking down of a compound into simpler substances or into its constituent elements.

Definite Composition See under laws.

dehydrate To take water from a substance.

dehydrating agent A substance able to withdraw water from another substance, thereby drying it.

deliquescence The absorption by a substance of water from the air, so that the substance becomes wet.

denatured alcohol Ethyl alcohol that has been “poisoned” in order to produce (by avoiding federal tax) a cheaper alcohol for industrial purposes.

density The mass per unit volume of a substance; the mathematical formula is \( D = \frac{m}{V} \), where \( D \) = density, \( m \) = mass, and \( V \) = volume.

destructive distillation The process of heating an organic substance, such as coal, in the absence of air to break it down into solid and volatile products.

deuterium An isotope of hydrogen, sometimes called heavy hydrogen, with an atomic weight of 2.

dew point The highest temperature at which water vapor condenses out of the air.

dialysis The process of separation of a solution by diffusion through a semipermeable membrane.

diffusion The process whereby gases or liquids intermingle freely of their own accord.

dipole-dipole attraction A relatively weak force of attraction between polar molecules; a component of van der Waals forces.

displacement A change by which an element takes the place of another element in a compound.

dissociation (ionic) The separation of the ions of an ionic compound due to the action of a solvent.

distillation The process of first vaporizing a liquid and then condensing the vapor back into a liquid, leaving behind the nonvolatile impurities.

double bond A bond between atoms involving two electron pairs. In organic chemistry: unsaturated.

double displacement A reaction in which two chemical substances exchange ions with the formation of two new compounds.
**dry ice** Solid carbon dioxide.

**ductile** Capable of being drawn into thin wire.

**effervescence** The rapid escape of excess gas that has been dissolved in a liquid.

**efflorescence** The loss by a substance of its water of hydration on exposure to air at ordinary temperatures.

**effusion** The flow of a gas through a small aperture.

**Einstein equation** \( E = mc^2 \), which relates mass to energy; \( E \) = energy in ergs, \( m \) = mass in grams, and \( c \) = velocity of light, \( 3 \times 10^8 \) centimeters/second.

**electrode** A terminal of an electrolytic cell.

**electrode potential** The difference in potential between an electrode and the solution in which it is immersed.

**electrolysis** The process of separating the ions in a compound by means of electrically charged poles.

**electrolytic cell** A cell in which electrolysis is carried out.

**electrolyte** A liquid that will conduct an electric current.

**electron** A negatively charged particle found outside the nucleus of the atom; it has a mass of \( 9.109 \times 10^{-28} \) gram.

**electron dot symbol** See Lewis dot symbol.

**electronegativity** The numerical expression of the relative strength with which the atoms of an element attract valence electrons to themselves; the higher the number, the greater the attraction.

**electron volt** A unit for expressing the kinetic energy of subatomic particles; the energy acquired by an electron when it is accelerated by a potential difference of 1 volt; equals \( 1.6 \times 10^{-12} \) erg or 23.1 kilocalories/mole (abbreviation: eV).

**electroplating** Depositing a thin layer of (usually) a metallic element on the surface of another metal by electrolysis.

**element** One of the more than 100 “building blocks” of which all matter is composed. An element consists of atoms of only one kind and cannot be decomposed further by ordinary chemical means.

**empirical formula** A formula that shows only the simplest ratio of the numbers and kinds of atoms, such as CH.

**emulsifying agent** A colloidal substance that forms a film about the particles of two immiscible liquids, so that one liquid remains suspended in the other.

**emulsion** A suspension of fine particles or droplets of one liquid in another, the two liquids being immiscible in each other; the droplets are surrounded by a colloidal (emulsifying) agent.
endothermic Referring to a chemical reaction that results in an overall absorption of heat from its surroundings.

energy The capacity to do work. In every chemical change energy is either given off or taken in. Forms of energy are heat, light, motion, sound, and electrical, chemical, and nuclear energy.

enthalpy The heat content of a chemical system.

entropy The measure of the randomness or disorder that exists in a system.

equation A shorthand method of showing the changes that take place in a chemical reaction.

equilibrium The point in a reversible reaction at which the forward reaction is occurring at the same rate as the opposing reaction.

erg A unit of energy or work done by a force of 1 dyne (1/980 g of force) acting through a distance of 1 centimeter; equals $2.4 \times 10^{-11}$ kilocalorie.

ester An organic salt formed by the reaction of an alcohol with an organic (or inorganic) acid.

esterification A chemical reaction between an alcohol and an acid, in which an ester is formed.

ether An organic compound containing the $-\text{O}-$ group.

eudiometer A graduated glass tube into which gases are placed and subjected to an electric spark; used to measure the individual volumes of combining gases.

evaporation The process in which molecules of a liquid (or a solid) leave the surface in the form of vapor.

exothermic Referring to a chemical reaction that results in the giving off of heat to its surroundings.

Fahrenheit scale The temperature scale that has 32° as the freezing point of water and 212° as the boiling point.

fallout The residual radioactivity from an atmospheric nuclear test, which eventually settles on the surface of the earth.

Faraday’s Law See under laws.

filtration The process by which suspended matter is removed from a liquid by passing the liquid through a porous material.

First Law of Thermodynamics See under laws.

fission A nuclear reaction that releases energy because of the splitting of large nuclei into smaller ones.

fixation of nitrogen Any process for converting atmospheric nitrogen into compounds, such as ammonia and nitric acid.

flame The glowing mass of gas and luminous particles produced by the burning of a gaseous substance.
flammable Capable of being easily set on fire; combustible (same as inflammable).

fluorescence Emission by a substance of electromagnetic radiation, usually visible, as the immediate result of (and only during) absorption of energy from another source.

fluoridation Addition of small amounts of fluoride (usually NaF) to drinking water to help prevent tooth decay.

flux In metallurgy: a substance that helps to melt and remove the solid impurities as slag. In soldering: a substance that cleans the surface of the metal to be soldered. In nucleonics: the concentration of nuclear particles or rays.

formula An expression that uses the symbols for elements and subscripts to show the basic makeup of a substance.

formula mass The sum of the atomic mass units of all the atoms (or ions) contained in a formula.

fractional crystallization The separation of the components in a mixture of dissolved solids by evaporation according to individual solubilities.

fractional distillation The separation of the components in a mixture of liquids having different boiling points by vaporization.

free energy See Gibbs free energy.

freezing point The specific temperature at which a given liquid and its solid form are in equilibrium.

fuel Any substance used to furnish heat by combustion. See also nuclear fuel.

fuel cell A device for converting an ordinary fuel such as hydrogen or methane directly into electricity.

functional group A group of atoms that characterizes certain types of organic compounds, such as —OH for alcohols, and that reacts more or less independently.

fusion A nuclear reaction that releases energy because of the union of smaller nuclei to form larger ones.

fusion melting Changing a solid to the liquid state by heating.

galvanizing Applying a coating of zinc to iron or steel to protect the latter from rusting.

gamma rays A type of radiation consisting of high-energy waves that can pass through most materials. Symbol: γ

gas A phase of matter that has neither definite shape nor definite volume.

Gay-Lussac’s Law See under laws.

Gibbs free energy Changes in Gibbs free energy, ΔG, are useful in indicating the conditions under which a chemical reaction will occur. The equation is
$$\Delta G = \Delta H - T \Delta S$$, where $\Delta H$ = change in enthalpy and $\Delta S$ = change in entropy. If $\Delta G$ is negative, the reaction will proceed spontaneously to equilibrium.

glass An amorphous, usually translucent substance consisting of a mixture of silicates. Ordinary glass is made by fusing together silica and sodium carbonate and lime; the various forms of glass contain many other silicates.

Graham’s Law See under laws.

gram A unit of weight in the metric system; the weight of 1 milliliter of water at 4°C (abbreviation: g).

gram-atomic mass The atomic mass, in grams, of an element.

gram-formula weight The formula weight, in grams, of a substance.

group A vertical column of elements in the periodic table that generally have similar properties.

half-life The time required for half of the mass of a radioactive substance to disintegrate.

half-reaction One of the two parts, either the reduction part or the oxidation part, of a redox reaction.

halogen Any of the five nonmetallic elements (fluorine, chlorine, bromine, iodine, astatine) that form part of Group 17 of the Periodic Table.

heat A form of molecular energy; it passes from a warmer body to a cooler one.

heat capacity (specific heat) The quantity of heat, in calories, needed to raise the temperature of 1 gram of a substance 1 degree on the Celsius scale.

heat of formation The quantity of heat either given off or absorbed in the formation of 1 mole of a substance from its elements.

heat of fusion The amount of heat, in calories, required to melt 1 gram of a solid; for water, 80 calories.

heat of vaporization The quantity of heat needed to vaporize 1 gram of a liquid at constant temperature and pressure; for water at 100°C, 540 calories.

heavy water (deuterium oxide, D₂O) Water in which the hydrogen atoms are replaced by atoms of the isotope of hydrogen, deuterium.

Henry’s Law See under laws.

Hess’s Law See under laws.

homogeneous Uniform; having every portion exactly like every other portion.

homologous Alike in structure; referring to series of organic compounds, such as hydrocarbons, in which each member differs from the next by the addition of the same group.

humidity The amount of moisture in the air.
hybridization The combination of two or more orbitals to form new orbitals.

hydrate A compound that has water molecules included in its crystalline makeup.

hydride Any binary compound containing hydrogen, such as HCl.

hydrogenation A process in which hydrogen is made to combine with another substance, usually organic, in the presence of a catalyst.

hydrogen bond A weak chemical linkage between the hydrogen of one polar molecule and the oppositely charged portion of a closely adjacent molecule.

hydrolysis Of carbohydrates: the action of water in the presence of a catalyst upon one carbohydrate to form simpler carbohydrates. Of salts: a reaction involving the splitting of water into its ions by the formation of a weak acid, a weak base, or both.

hydronium ion A hydrated ion, H$_2$O · H$^+$ or H$_3$O$^+$.

hydroponics Growing plants without the use of soil, as in nutrient solution or in sand irrigated with nutrient solution.

hydroxyl Referring to the —OH radical.

hygroscopic Referring to the ability of a substance to draw water vapor from the atmosphere to itself and become wet.

hypothesis A possible explanation of the nature of an action or phenomenon; a hypothesis is not as completely developed as a theory.

Ideal Gas Law See under laws.

immiscible Referring to the inability of two liquids to mix.

indicator A dye that shows one color in the presence of the hydrogen ion (acid) and a different color in the presence of the hydroxyl ion (base).

inertia The property of matter whereby it remains at rest or, if in motion, remains in motion in a straight line unless acted upon by an outside force.

ion An atom or a group of combined atoms that carries one or more electric charges. Examples: NH$_4^+$, OH$^-$.

ionic bonding The bonding of ions due to their opposite charges.

ionic equation An equation showing a reaction among ions.

ionization The process in which ions are formed from neutral atoms.

ionization equation An equation showing the ions set free from an electrolyte.

isomerization The rearrangement of atoms in a molecule to form isomers.

isomers Two or more compounds having the same percentage composition but different arrangements of atoms in their molecules and hence different properties.

isotopes Two or more forms of an element that differ only in the number of neutrons in the nucleus and hence in their mass numbers.
IUPAC International Union of Pure and Applied Chemistry, an organization that establishes standard rules for naming compounds.

joule The SI unit of work or of energy equal to work done; 1 joule = 0.2388 calorie; 1 calorie = 4.18 joule.

Kelvin scale A temperature scale based on water freezing at 273 and boiling at 373 Kelvin units; its origin is absolute zero. Synonymous with absolute scale.

kernel (atomic) The nucleus and all the electron shells of an atom except the outer one; usually designated by the symbol for the atom.

ketone An organic compound containing the $\text{-CO-}$ group.

kilocalorie A unit of heat; the amount of heat needed to raise the temperature of 1 kilogram of water 1 degree on the Celsius scale.

kindling temperature The temperature to which a given substance must be raised before it ignites.

Kinetic-Molecular Theory The theory that all molecules are in motion; this motion is most rapid in gases, less rapid in liquids, and very slow in solids.

lanthanide series The “rare earth” series of elements starting with lanthanum, No. 57, and ending with lutetium, No. 71.

law (in science) A generalized statement about the uniform behavior in natural processes.

class

Avogadro’s Equal volumes of gases under identical conditions of temperature and pressure contain equal numbers of particles (atoms, molecules, ions, or electrons).

Boyle’s The volume of a confined gas is inversely proportional to the pressure to which it is subjected, provided that the temperature remains the same.

Charles’s The volume of a confined gas is directly proportional to the absolute temperature, provided that the pressure remains the same.

Combining Volumes See Gay-Lussac’s under laws.

Conservation of Energy Energy can be neither created nor destroyed, so that the energy of the universe is constant.

Conservation of Matter Matter can be neither created nor destroyed (or weight remains constant in an ordinary chemical change).

Dalton’s When a gas is made up of a mixture of different gases, the pressure of the mixture is equal to the sum of the partial pressures of the components.
Definite Composition A compound is composed of two or more elements chemically combined in a definite ratio by weight.

Faraday’s During electrolysis, the weight of any element liberated is proportional (1) to the quantity of electricity passing through the cell, and (2) to the equivalent weight of the element.

First Law of Thermodynamics The total energy of the universe is constant and cannot be created or destroyed.

Gay-Lussac’s The ratio between the combining volumes of gases and the product, if gaseous, can be expressed in small whole numbers.

Graham’s The rate of diffusion (or effusion) of a gas is inversely proportional to the square root of its molecular mass.

Henry’s The solubility of a gas (unless the gas is very soluble) is directly proportional to the pressure applied to the gas.

Hess’s If a series of reactions are added together, the enthalpy change for the total reaction is the sum of the enthalpy changes for the individual steps.

Ideal Gas Any gas that obeys the gas laws perfectly. No such gas actually exists.

Multiple Proportions When any two elements, A and B, combine to form more than one compound, the different masses of B that unite with a fixed mass of A bear a small whole-number ratio to each other.

Periodic The chemical properties of elements vary periodically with their atomic numbers.

Second Law of Thermodynamics Heat cannot, of itself, pass from a cold body to a hot body.

Le Châtelier’s Principle If a stress is placed on a system in equilibrium, the system will react in the direction that relieves the stress.

lepton An elementary particle; the electron and neutrino are believed to consist of leptons.

Lewis dot symbol The chemical symbol (kernel) for an atom, surrounded by dots to represent its outer level electrons. Examples: K · , Sr ::

liquid A phase of matter that has a definite volume but takes the shape of the container.

liquid air Air that has been cooled and compressed until it liquefies.

litmus An organic substance, obtained from the lichen plant and used as an indicator; it turns red in acidic solution and blue in basic solution.

London force The weakest of the van der Waals forces between molecules. These weak, attractive forces become apparent only when the molecules approach one another closely (usually at low temperatures and high pressure). They are due to the way the positive charges of one molecule attract the negative charges of another molecule because of the charge distribution at any one instant.
luminous Emitting a steady, suffused light.

malleable Capable of being hammered or pounded into thin sheets.

manometer A U-tube (containing mercury or some other liquid) used to measure the pressure of a confined gas.

mass The quantity of matter that a substance possesses; it can be measured by its resistance to a change in position or motion, and is not related to the force of gravity.

mass number The nearest whole number to the combined atomic mass of the individual atoms of an isotope when that mass is expressed in atomic mass units.

mass spectograph A device for determining the masses of electrically charged particles by separating them into distinct streams by means of magnetic deflection.

matter A substance that occupies space, has mass, and cannot be created or destroyed easily.

melting The change in phase of a substance from solid to liquid.

melting point The specific temperature at which a given solid changes to a liquid.

meson Any unstable, elementary nuclear particle having a mass between that of an electron and that of a proton.

metal (a) An element whose oxide combines with water to form a base; (b) an element that readily loses electrons and acquires a positive valence.

metallurgy The process involved in obtaining a metal from its ores.

meter The basic unit of length in the metric system; defined as 1,650,763.73 times the wavelength of krypton-86 when excited to give off an orange-red spectral line.

MeV A unit for expressing the kinetic energy of subatomic particles; equals 106 electron volts.

micron One thousandth of a millimeter (abbreviation: μ).

mineral An inorganic substance of definite composition found in nature.

miscible Referring to the ability of two liquids to mix with one another.

mixture A substance composed of two or more components, each of which retains its own properties.

moderator A substance such as graphite, paraffin, or heavy water used in a nuclear reactor to slow down neutrons.

molal solution A solution containing 1 mole of solute in 1,000 grams of solvent (indicated by m).

molar mass The mass arrived at by the addition of the atomic masses of the units that make up a molecule of an element or compound. Expressed in grams/mole,
the molar mass of a gaseous substance at STP occupies a molar volume equal to 22.4 liters.

**molar solution** A solution containing 1 mole of solute in 1,000 milliliters of solution (indicated by M).

**mole** A unit of quantity that consists of $6.02 \times 10^{23}$ particles.

**molecular mass** The sum of the masses of all the atoms in a molecule of a substance.

**molecular theory** See Kinetic-Molecular Theory.

**molecule** The smallest particle of a substance that retains the physical and chemical properties of that substance. Example: He, Br₂, H₂O

**monobasic acid** An acid having only one hydrogen atom that can be replaced by a metal or a positive radical.

**mordant** A chemical, such as aluminum sulfate, used for fixing colors on textiles.

**multiple proportions** See under laws.

**nascent (atomic)** Referring to an element in the atomic form as it has just been liberated in a chemical reaction.

**neutralization** The union of the hydrogen ion of an acid and the hydroxyl ion of a base to form water.

**neutron** A subatomic particle found in the nucleus of the atom; it has no charge and has the same mass as the proton.

**neutron capture** A nuclear reaction in which a neutron attaches itself to a nucleus; a gamma ray is usually emitted simultaneously.

**nitriding** A process in which ammonia or a cyanide is used to produce case-hardened steel; a nitride is formed instead of a carbide.

**nitrogen fixation** Any process by which atmospheric nitrogen is converted into a compound such as ammonia or nitric acid.

**noble gas** A gaseous element that has a complete outer level of electrons; any of a group of rare gases (helium, neon, argon, krypton, xenon, and radon) that exhibit great stability and very low reaction rates.

**noble gas structure** The outer energy level electron configuration characteristic of the inert gases—two electrons for helium; eight electrons for all others.

**nonelectrolyte** A substance whose solution does not conduct a current of electricity.

**nonmetal** (a) An element whose oxide reacts with water to form an acid; (b) an element that takes on electrons and acquires a negative valence.

**nonpolar compound** A compound in whose molecules the atoms are arranged symmetrically so that the electric charges are uniformly distributed.

**normal salt** A salt in which all the hydrogen of the acid has been displaced by a metal.
normal solution  A solution that contains 1 gram of H (or its equivalent: 17 g of OH, 23 g of Na⁺, 20 g of Ca²⁺, etc.) in 1 liter of solution (indicated by N).

nuclear energy  The energy released by spontaneously or artificially produced fission, fusion, or disintegration of the nuclei of atoms.

nuclear fuel  A substance that is consumed during nuclear fission or fusion.

nuclear reaction  Any reaction involving a change in nuclear structure.

nuclear reactor  A device in which a controlled chain reaction of fissionable material can be produced.

nucleonics  The science that deals with the constituents and all the changes in the atomic nucleus.

nucleus  The center of the atom, which contains protons and neutrons.

nuclide  A species of atom characterized by the constitution of its nucleus.

orbital  A subdivision of a nuclear shell; it may contain none, one, or two electrons.

ore  A natural mineral substance from which an element, usually a metal, may be obtained with profit.

organic acid  An organic compound that contains the –COOH group.

organic chemistry  The branch of chemistry dealing with carbon compounds, usually those found in nature.

oxidation  The chemical process by which oxygen is attached to a substance; the process of losing electrons.

oxidation number (state)  A positive or negative number representing the charge that an ion has or an atom appears to have when its electrons are counted according to arbitrarily accepted rules: (1) electrons shared by two unlike atoms are counted with the more electronegative atom; (2) electrons shared by two like atoms are divided equally between the atoms.

oxidation potential  An electrode potential associated with the oxidation half-reaction.

oxidizing agent  A substance that (a) gives up its oxygen readily, (b) removes hydrogen from a compound, (c) takes electrons from an element.

ozone  An allotropic and very active form of oxygen, having the formula O₃.

paraffin series  The methane series of hydrocarbons.

pascal  The SI unit of pressure, equal to 1 newton per square meter.

pasteurization  Partial sterilization of a substance, such as milk, by heating to approximately 65°C for ½ hour.
Pauli Exclusion Principle Each electron orbital of an atom can be filled by only two electrons, which have opposite spins.

period A horizontal row of elements in the Periodic Table.

Periodic Law See under laws.

petroleum (meaning “oil from stone”) A complex mixture of gaseous, liquid, and solid hydrocarbons obtained from the earth.

pH A numerical expression of the hydrogen or hydronium ion concentration in a solution; defined as $-\log [H^+]$, where $[H^+]$ is the concentration of hydrogen ions, in moles per liter.

phenolphthalein An organic indicator; it is colorless in acid solution and red in the presence of $\text{OH}^-$ ions.

photosynthesis The reaction taking place in all green plants that produces glucose from carbon dioxide and water under the catalytic action of chlorophyll in the presence of light.

physical change A change that does not involve any alteration in chemical composition.

physical property A property of a substance arrived at through observation of its smell, taste, color, density, and so on, which does not relate to chemical activity.

pi bond A bond between $p$ orbitals.

pile A general term for a nuclear reactor; specifically, a graphite-moderated reactor in which uranium fuel is distributed throughout a “pile” of graphite blocks.

pitchblende A massive variety of uraninite that contains a small amount of radium.

plasma Very hot ionized gases.

polar covalent bond A bond in which electrons are closer to one atom than to another. See also polar molecule.

polar dot structure Representation of the arrangements of electrons around the atoms of a molecule in which the polar characteristics are shown by placing the electrons closer to the more electronegative atom.

polar molecule A molecule that has differently charged areas because of unequal sharing of electrons.

polyatomic ion A group of chemically united atoms that react as a unit and have an electric charge.

polymerization The process of combining several molecules to form one large molecule (polymer).

(a) Additional polymerization: The addition of unsaturated molecules to each other. (b) Condensation polymerization: The reaction of two molecules by loss of a molecule of water.
**positron** A positively charged particle of electricity with about the same weight as the electron.

**potential energy** Energy due to the position of a body or to the configuration of its particles.

**precipitate** An insoluble compound formed in the chemical reaction between two or more substances in solution.

**proteins** Large, complex organic molecules, with nitrogen an essential part, found in plants and animals.

**proton** A subatomic particle found in the nucleus that has a positive charge.

**qualitative analysis** A term applied to the methods and procedures used to determine any or all of the constituent parts of a substance.

**quantitative analysis** A term applied to the methods and procedures used to determine the definite quantity or percentage of any or all of the constituent parts of a substance.

**quenching** Cooling a hot piece of metal rapidly, as in water or oil.

**radiation** The emission of particles and rays from a radioactive source; usually alpha and beta particles and gamma rays.

**radioactive** Referring to substances that have the ability to emit radiations (alpha or beta particles or gamma rays).

**radioisotope** An isotopes that is radioactive, such as uranium-235.

**reactant** A substance involved in a reaction.

**reaction** A chemical transformation or change. The four basic types are combination (synthesis), decomposition (analysis), single replacement or single displacement, and double replacement or double displacement.

**reaction potential** The sum of the oxidation potential and reduction potential for a particular reaction.

**reagent** Any chemical taking part in a reaction.

**recrystallization** A series of crystallizations, repeated for the purpose of greater purification.

**redox** A shortened name for a reaction that involves reduction and oxidation.

**reducing agent** From an electron standpoint, a substance that loses its valence electrons to another element; a substance that is readily oxidized.

**reduction** A chemical reaction that removes oxygen from a substance; a gain of electrons.

**reduction potential** An electrode potential associated with a reduction half-reaction.

**refraction (of light)** The bending of light rays as they pass from one material into another.
relative humidity The ratio, expressed in percent, between the amount of water vapor in a given volume of air and the amount the same volume can hold when saturated at the same temperature.

resonance The phenomenon in a molecular structure that exhibits properties between those of a single bond and those of a double bond and thus possesses two or more alternative structures.

reversible reaction Any reaction that reaches an equilibrium, or that can be made to proceed from right to left as well as from left to right.

roasting Heating an ore (usually a sulfide) in an excess of air to convert the ore to an oxide, which can then be reduced.

salt A compound, such as NaCl, made up of a positive metallic ion and a negative nonmetallic ion or radical.

saturated solution A solution that contains the maximum amount of solute under the existing temperature and pressure.

Second Law of Thermodynamics See under laws.

sigma bond A bond between s orbitals or between an s orbital and another kind of orbital.

significant figures All the certain digits, that is, those recorded in a measurement, plus one uncertain digit.

slag The product formed when the flux reacts with the impurities of an ore in a metallurgical process.

solid A phase of matter that has a definite size and shape.

solubility A measure of the amount of solute that will dissolve in a given quantity of solvent at a given temperature.

solute The material that is dissolved to make a solution.

solution A uniform mixture of a solute in a solvent.

solvent The dispersing substance that allows the solute to go into solution.

specific gravity (mass) The ratio between the mass of a certain volume of a substance and the mass of an equal volume of water (or, in the case of gases, an equal volume of air); expressed as a single number.

specific heat The ratio between the number of calories needed to raise the temperature of a certain mass of a substance 1 degree on the Celsius scale and the number of calories needed to raise the temperature of the same mass of water 1 degree on the Celsius scale.

spectroscope An instrument used to analyze light by separating it into its component wavelengths.

spectrum The image formed when radiant energy is dispersed by a prism or grating into its various wavelengths.
spinthariscope A device for viewing through a microscope the flashes of light made by particles from radioactive materials against a sensitized screen.

spontaneous combustion (ignition) The process in which slow oxidation produces enough heat to raise the temperature of a substance to its kindling temperature.

stable Referring to a substance not easily decomposed or dissociated.

standard conditions An atmospheric pressure of 760 millimeters or torr or 1 atmosphere (mercury pressure) and a temperature of 0° C (273 K) (abbreviation: STP).

stratosphere The upper portion of the atmosphere, in which the temperature changes but little with altitude, and clouds of water never form.

strong acid (or base) An acid (or a base) capable of a high degree of ionization in water solution.
Example: sulfuric acid (sodium hydroxide).

structural (graphic) formula A pictorial representation of the atomic arrangement of a molecule.

sublime To vaporize directly from the solid to the gaseous state, and then condense back to the solid.

substance A single kind of matter, element, or compound.

substitution product A product formed by the substitution of other elements or radicals for hydrogen atoms in hydrocarbons.

tsulfation An accumulation of lead sulfate on the plates and at the bottom of a (lead) storage cell.

supersaturated solution A solution that contains a greater quantity of solute than is normally possible at a given temperature.

suspension A mixture of finely divided solid material in a liquid, from which the solid settles on standing.

symbol A letter or letters representing an element of the periodic table.
Examples: O, Mn.

synthesis The chemical process of forming a substance from its individual parts.

Système International d’Unités The modernized metric system of measurements universally used by scientists. There are seven base units: kilogram, meter, second, ampere, kelvin, mole, and candela.

temperature The intensity or the degree of heat of a body, measured by a thermometer.

tempering The heating and then rapid cooling of a metal to increase its hardness.

ternary Referring to a compound composed of three different elements, such as H$_2$SO$_4$. 
theory An explanation used to interpret the “mechanics” of nature’s actions; a theory is more fully developed than a hypothesis.

thermochemical equation An equation that includes values for the calories absorbed or evolved.

thermoplastic Capable of being softened by heat; may be remolded.

thermosetting Capable of being permanently hardened by heat and pressure; resistant to the further effects of heat.

tincture An alcoholic solution of a substance, such as a tincture of iodine.

torr A unit of pressure defined as 1 millimeter of mercury; 1 torr equals 133.32 pascals.

tracer A minute quantity of radioactive isotope used in medicine and biology to study chemical changes within living tissues.

transmutation Conversion of one element into another, either by bombardment or by radioactive disintegration.

tribasic acid An acid that contains three replaceable hydrogen atoms in its molecule, such as H₃PO₄.

tritium A very rare, unstable, “triple-weight” hydrogen isotope (H₃) that can be made synthetically.

Tyndall effect The scattering of a beam of light as it passes through a colloidal material.

ultraviolet light The portion of the spectrum that lies just beyond the violet; therefore of short wavelength.

U.S.P. (United States Pharmacopeia) chemicals Chemicals certified as having a standard of purity that demonstrates their fitness for use in medicine.

valence The combining power of an element; the number of electrons gained, lost, or borrowed in a chemical reaction.

valence electrons The electrons in the outermost level or levels of an atom that determine its chemical properties.

van der Waals forces Weak attractive forces existing between molecules.

vapor The gaseous phase of a substance that normally exists as a solid or liquid at ordinary temperatures.

vapor pressure The pressure exerted by a vapor given off by a confined liquid or solid when the vapor is in equilibrium with its liquid or solid form.

volatile Easily changed to a gas or a vapor at relatively low pressure.

volt A unit of electrical potential or voltage, equal to the difference of potential between two points in a conducting wire carrying a constant current.
of 1 ampere when the power dissipated between these two points is equal to 1 watt (abbreviation: V).

**volume** The amount of three-dimensional space occupied by a substance.

**VSEPR** The valence shell electron pair repulsion model. It expresses the non-$90^\circ$ variations in bond angles for $p$ orbitals in the outer energy levels of atoms in molecules because of electron repulsions.

**water of hydration** Water that is held in chemical combination in a hydrate and can be removed without essentially altering the composition of the substance. *See also* Hydrate.

**weak acid (or base)** An acid (or base) capable of being only slightly ionized in an aqueous solution. Example: acetic acid (ammonium hydroxide).

**weak electrolyte** A substance that, when dissolved in water, ionizes only slightly and hence is a poor conductor of electricity.

**weight** The measure of the force with which a body is attracted toward Earth by gravity.

**work** The product of the force exerted on a body and the distance through which the force acts; expressed mathematically by the equation $W = Fs$, where $W =$ work, $F =$ force, and $s =$ distance.

**X-rays** Penetrating radiations, of extremely short wavelength, emitted when a stream of electrons strikes a solid target in a vacuum tube.

**zeolite** A natural or synthesized silicate used to soften water.