

# Curriculum Survey of Essential Skills

## National Rank Order

### Science

International Center for Leadership in Education (January 12, 2000) Science Topic Statements	National Ranking	Priority		
		High	Medium	Low
		1-35	36-70	71-113
Know and apply the principles of scientific inquiry. <i>(Implicit in this statement are the processes of prediction, estimation, developing hypotheses, drawing conclusions, evaluation, and following ethical principles and professional procedures.)</i>	Not Ranked (s114)	<b>X</b>		
Plan and apply real or hypothetical models and constructions to facilitate investigation and learning and the solution to practical problems.	Not Ranked (s115)	<b>X</b>		
Understand the impact upon society and the environment of scientific and technological discoveries and the contributions of scientists. Understand how society may accept or reject scientific discoveries based upon need or refusal to change.	Not Ranked (s116)	<b>X</b>		
Understand how and why the rotation and revolution of the earth around the sun affects the length of night and day, the changing of seasons, and weather patterns.	<b>1</b>	<b>X</b>		
Identify and understand the structure and parts that comprise the systems (i.e., cardiovascular, nervous, lymphatic, muscular, etc.) and regions (i.e., head and neck, upper limb, thorax, abdominopelvic, back, and lower limb) of the human body.	<b>2</b>	<b>X</b>		
Understand nutrition - the need for food and a good diet, ingestion, digestion, egestion and related disorders such as ulcers, appendicitis, etc.	<b>3</b>	<b>X</b>		
Know the metric system and the units of metric measure and convert metric units to English units.	<b>4</b>	<b>X</b>		
Make observations using senses and instruments. Inferences and interpretations are arrived at based on observations. Classify observable properties and organize observations in a meaningful and logical way.	<b>5</b>	<b>X</b>		
Understand how humans, through technology, cause environmental change by disrupting the equilibrium or balance of nature by introducing pollutants into the environment.	<b>6</b>	<b>X</b>		
Know the processes involved in the water cycle, (i.e., evaporation, condensation, precipitation, surface runoff, percolation) and their effects on climate patterns.	<b>7</b>	<b>X</b>		
Know that reproduction is a characteristic of all living things as a function of cell division and species survival.	<b>8</b>	<b>X</b>		
Identify the cell as a common unit between living things; understand cell structure and the functions they perform.	<b>9</b>	<b>X</b>		
Understand the human impact on the environment through pollution (air, water, and soil), and ways to improve it through education, research, laws, and conservation.	<b>10</b>	<b>X</b>		
Know the structure and functions of roots, stems, leaves flowers and other parts of plants..	<b>11</b>	<b>X</b>		
Examine the foundations of genetics involving heredity and inherited traits passed on through generations, understand the gene-chromosome concept, and apply classical genetic studies (Mendelian genetics).	<b>12</b>	<b>X</b>		
Understand ecology as the study of the interactions and relationships of organisms with their living and nonliving environments (i.e., the ecosystem, communities, and populations).	<b>13</b>	<b>X</b>		
Understand that sexual reproduction involves the union of special sex cells that are usually produced by two separate parents with half of the genes coming from each parent allowing for a high degree of genetic diversity. Most plants and animals use sexual reproduction.	<b>14</b>	<b>X</b>		
Identify and describe the levels of organization in living systems (i.e., tissues, organs, organ systems, and organisms).	<b>15</b>	<b>X</b>		
Know the relationships between local atmospheric variables (e.g., temperature, pressure, moisture, wind, etc.).	<b>16</b>	<b>X</b>		

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Identify and comprehend the concepts involving the earth's water, i.e., ground water (infiltration, permeability, porosity, and capillarity), surface water (runoff), and pollution (sources, types, concentration, and long range effects).	17	X		
Identify the factors of weathering, i.e., weathering processes (exposure, breakdown, effect of climatic conditions), weathering rates (particle size relationships, mineral composition), soil formation (as a result of weathering), and soil solution (the end product of weathering in the form of minerals in surface and ground water).	18	X		
Exhibit good data management skills by collecting, organizing, and graphing data.	19	X		
Understand muscles and skeleton and how their interaction produces support and locomotion.	20	X		
Know the characteristics and roles of simple organisms (i.e., viruses, bacteria, fungi, algae, and protozoa).	21	X		
Understand the characteristics of density and how it varies in materials with the change of temperature, pressure, and phase (gas, liquid, solid).	22	X		
Measure properties of the environment using dimensional quantities such as time, length, mass, pressure, volume, acceleration, etc. Compare, estimate and predict measurements.	23	X		
Understand the nature of change in the environment and how it occurs through the occurrence of an event (e.g., altering the properties of matter or of a system). Describe and measure change using time and space relationships as a frame of reference.	24	X		
Know the properties of electromagnetic energy (energy radiated from all objects not at a temperature of absolute zero), solar energy (energy from the sun), and earth energy (energy released from the decay of radioactive matter). Understand that weather and climate involve energy transfer in and out of the atmosphere by means of conduction, convection, and radiation.	25	X		
Describe or measure positions on the earth's surface using coordinate systems (lines of latitude - longitude), and fields of isolines, isobars, and iso-surfaces.	26	X		
Understand that because of the tilt of the earth's axis, sunlight and heat are more intense on one part of the earth during its one-year revolution around the sun; the change in the amount of heat produces the seasons.	27	X		
Identify and comprehend factors that affect climate patterns such as latitude, elevation, large water bodies and ocean currents, mountain barriers, wind belts, and storm tracks.	28	X		
Understand electric current (i.e., the flow of electric charge) and apply it to conductivity, amperage, resistance, and circuits in parallel and series.	29	X		
Know the characteristics, roles, and divisions of complex organisms (i.e., plants and animals).	30	X		
Know the concepts of temperature and absolute temperature. Know the temperature scales (Fahrenheit, Celsius, and Kelvin) and their relationships.	31	X		
Understand earthquakes by examining the different types of seismic waves, wave velocities, how waves are transmitted through solids and/or fluids, and how to locate an epicenter by analyzing the travel times of seismic waves.	32	X		
Know how to obtain accuracy and precision using common measuring devices.	33	X		
Identify evidence of erosion by examining displaced sediments and the properties of transported materials, as well as factors affecting transportation (e.g., gravity, water erosion, wind and ice erosion, etc.).	34	X		
Know the chronology of embryological development from conception to birth in each trimester of pregnancy as well as the potential risks the developing embryo, and later the newborn infant, may encounter.	35	X		
Know the concepts and theories of acids and bases including pH and alkalinity.	36		X	

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Use gradients within contour maps to understand and describe changes in elevation from place to place.	37		X	
Identify the components of soil and other factors that influence soil texture, fertility, and resistance to erosion (e.g., plant roots and debris, bacteria, fungi, worms, rodents).	38		X	
Understand the transport (absorption and circulation) of materials throughout the body and related disorders such as high blood pressure, leukemia, anemia, and coronary thrombosis.	39		X	
Know the survival requirements of animals and plants and the history and implications of population growth.	40		X	
Understand gas exchange - the function of breathing, cellular respiration, the respiration system and related disorders such as bronchitis, asthma, lung cancer, etc.	41		X	
Understand the chemical reactions involved in cell functions (e.g., food molecules taken into cells are broken down to provide the chemical constituents needed to synthesize other molecules).	42		X	
Compare characteristic similarities and differences between rocks, sediments, and minerals.	43		X	
Examine evolution as it relates to theories concerning the origin of life and natural selection.	44		X	
Understand nerve regulation - the nervous system and related disorders such as cerebral palsy, meningitis, and polio; and chemical regulation - the endocrine system, hormones and related disorders such as goiter and diabetes.	45		X	
Understand excretion - metabolic wastes, the role of blood, the excretory system and related disorders such as kidney stones, skin problems, and cirrhosis of the liver.	46		X	
Observe, measure, and examine various landscape characteristics (e.g., hill slopes, stream patterns, and soil associations), and the relationship of characteristics between landscape regions.	47		X	
Predict weather as a probability of occurrence by examining the factors that produce change in atmospheric variables.	48		X	
Understand the concepts and uses of machines (e.g., levers and pulleys).	49		X	
Identify and comprehend celestial observations (i.e., motions of objects in the sky) such as star paths, planetary motions, satellite motions, and sun motions.	50		X	
Know about nuclear reactions and the concepts of radioactivity, half-life, conservation of mass-energy, nuclear fission, fusion, etc..	51		X	
Understand and apply the concepts of potential energy (energy related to the position of an object) and kinetic energy (energy related to the motion of an object).	52		X	
Know how landscape development is influenced by environmental factors (e.g., uplift, climate, bedrock, time, and humans).	53		X	
Know the features of genetic patterns such as sex inheritance and sex linkage and how dominant and recessive traits explain variations that are hidden in one generation can be expressed in the next.	54		X	
Identify types of energy (e.g., heat, light, and electricity) and know how to apply measurements of energy (e.g., the calorie, and thermometry).	55		X	
Know the chemical and structural properties of DNA and its role in specifying the genetic characteristics of an organism.	56		X	
Understand physical/chemical change (e.g., change of phase between gases, liquids, and solids).	57		X	
Apply the geocentric and heliocentric solar system models to explain celestial and/or terrestrial objects or events. Learn the geometry of the earth's orbit around the sun and the gravitational force and energy effects on the earth relative to its position in the orbit.	58		X	
Know the classification system into which organisms are separated and grouped based on common characteristics. The classification groups include (from largest to smallest): kingdom, phylum, class, genus, and species.	59		X	

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Observe and interpret energy and change relationships with the understanding that change occurs simultaneously at the interface between two parts of the environment where there is an energy exchange.	60		X	
Understand the environmental factors necessary for rock formation realizing that sedimentary, igneous, and metamorphic rocks contain evidence of the minerals, temperatures, and forces that created them.	61		X	
Learn techniques to determine the dimensions of the earth (i.e., size, shape, and atmospheric extent).	62		X	
Understand that asexual reproduction involves the production of offspring from a single parent organism with all the genes coming from that parent. Asexual reproduction occurs with unicellular organisms and some plants.	63		X	
Examine evidence of crustal movement by identifying minor changes in the earth's crust (e.g., deformed rock strata, displaced fossils, and displaced strata), and major changes in the earth's crust (e.g., zones of frequent crustal activity, geosynclines, vertical movements, ocean floor spreading, and continental drift).	64		X	
Sequence geologic events by analyzing the chronology of layers, igneous intrusions and extrusions, faults, joints and folds, and internal characteristics such as cracks, veins, and mineral cement.	65		X	
Know the symbols that represent one atom or one mole of atoms of an element. Name and write molecular and empirical formulas of chemical compounds. A formula is a statement comprised of chemical symbols that represent the composition of a substance.	66		X	
Examine the fossil record to understand ancient life forms and evolutionary development.	67		X	
Know how the local water budget is influenced by environmental variables, (e.g., precipitation, potential evapotranspiration, and moisture). Examine how stream discharge relates to available surface water and ground water depletion.	68		X	
Know how to classify matter as a substance or mixture.	69		X	
Understand and apply the concepts of work and power and how they relate to energy. An object experiences work when a force displaces the object; power is the time-rate of doing work.	70		X	
Analyze the properties of the earth's crust and interior (i.e., solid and liquid zones, crustal thickness, crustal composition, density, temperature and pressure, and interior composition).	71			X
Know the processes involved in the rock cycle (i.e., old rocks at the surface gradually weather and form sediments that are buried, compacted, heated, and often recrystallized into new rock which is eventually brought to the surface by the forces that drive plate motions).	72			X
Learn how earth motions determine frames of reference of time (e.g., mean time differs from apparent solar time by an amount that varies with seasons).	73			X
Understand the concepts of magnetic forces and magnetic fields.	74			X
Understand nuclear energy involves a reaction where mass is converted to energy.	75			X
Identify parts of a compound light microscope, perform functions, and focus in low and high power.	76			X
Understand and apply kinematics (i.e., the mathematical methods of describing motion without regard to the forces that produce it, such as velocity, acceleration and deceleration, and displacement).	77			X
Understand the historical development of the periodic table and apply the principles inherent in its development, including the properties and atomic structure of elements and resultant chemical compounds, the forces acting between and among atoms and molecules, and changes in substances as a result of chemical combination.	78			X

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Understand that enzymes facilitate the breakdown and synthesis of molecules.	79			X
Understand the concepts of reflection (images formed in plane, concave, and convex mirrors) and refraction (images formed through converging and diverging lenses).	80			X
Know how to round off numbers according to the correct number of significant figures.	81			X
Know how to derive atomic number (the number of protons in the nucleus) and mass number (the total number of protons and neutrons).	82			X
Explore the chemical basis for genetics by examining genes, gene mutations and mutagenic agents, and the benefits and drawbacks of genetic engineering.	83			X
Understand and apply statics (i.e., the relation between forces acting on an object at rest) and dynamics (i.e., the relation between the forces acting on an object and the resulting motion).	84			X
Understand the definitions and characteristics of organic compounds (i.e., isomers, bonding, saturated and unsaturated compounds, alcohols, and organic acids).	85			X
Know how to neutralize acids and bases and form a conjugate acid-base pair in acid-base reactions.	86			X
Identify and comprehend insolation factors at the earth's surface such as angle of insolation versus intensity; the duration of insolation with regards to temperature; absorption of ultraviolet and infrared radiation; reflection off clouds, snow and ice; scattering as a result of aerosols in the atmosphere; and energy conservation by evaporation and melting.	87			X
Analyze synoptic weather data such as airmass characteristics, airmass source regions, and airmass tracks on the basis of pressure, moisture, and temperature characteristics.	88			X
Identify the factors affecting the deposition of particles (e.g., size, shape, density, and velocity) and analyze the sorting of sediments in a system.	89			X
Know the characteristics and phenomena of sound waves and light waves.	90			X
Know how images are formed from light rays as well as the difference between real and virtual images.	91			X
Know how to determine percent error wherever applicable.	92			X
Know the concepts and theories of waves (i.e., a vibratory disturbance that propagates through a material or space, and how energy transfer, pulses and periodic waves, and wave motion is incorporated).	93			X
Understand the concept of internal energy (the total potential and kinetic energies associated with the motion and relative position of the molecules of an object) and heat (the energy transfer from a warm body to a cold body).	94			X
Understand the technique of measuring geologic ages by absolute dating of rocks/fossils using known decay rates of radioactive isotopes.	95			X
Identify and comprehend terrestrial observations that suggest motion at the earth's surface by investigating Foucault's pendulum and the Coriolis effect.	96			X
Identify and comprehend terrestrial radiation factors such as material radiation (outgoing radiation from the earth's surface), gases (water vapor and carbon dioxide as absorbers of infrared radiation), and the balance of radiation in the environment.	97			X
Know the characteristics of the erosional - depositional system by differentiating between an erosional process and a depositional process, locating the interface between erosion and deposition, and obtaining dynamic equilibrium between the two processes.	98			X
Understand and apply organic reactions involving substitution, addition, fermentation, oxidation, polymerization, etc.	99			X
Analyze two-dimensional motion and trajectories by separating the motion of a projectile or object into x and y components of the vector quantities displacement, velocity, and acceleration.	100			X

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Know correlation techniques to match rocks and geologic events in one place to another by examining continuity, similarity of rock, fossil evidence, and volcanic time markers.	101			X
Determine geologic history by examining the rock record.	102			X
Know that the dual nature of light supports the idea that light appears to exhibit the characteristics of either waves or particles.	103			X
Understand the concept and interpretation of the mole and the gram atomic mass, gram molecular mass, and molar volume of a gas.	104			X
Understand that fusion is the process of combining two light nuclei to form a heavier one, wherein the energy is far greater than in a fission reaction.	105			X
Know that quantum theory was developed to explain phenomena that could not be explained by the classical theory of light. Examine the quantum and photon.	106			X
Know the three most prominent models of the atom: The Rutherford, Bohr, and Cloud models. Examine how each theorizes the way in which electrons orbit about the nucleus.	107			X
Understand that fission reactions involve the capturing of an atom's neutron. The result is fission fragments, liberation of energy (conversion of mass to energy), and the release of two or more neutrons.	108			X
Know the characteristics of periodic waves (i.e., frequency, period, amplitude, phase, wavelength, speed, the Doppler Effect, and wave fronts).	109			X
Know methods of indicating concentrations of solutions (e.g., compute the molarity of a solution).	110			X
Use stoichiometry to compute quantitative relationships implied by chemical formulas (e.g., find the percent composition by mass of an element in a compound and the simplest ratio in which the atoms combine to form a compound) and chemical equations (e.g., solve mass, mass-volume, and volume problems).	111			X
Understand artificial radioactivity wherein elements can be made radioactive by bombarding their nuclei with high-energy particles.	112			X
Understand uniform circular motion of an object to analyze centripetal acceleration and force.	113			X

\*The science essential skills need a special notation. After the Curriculum Survey was disseminated, it was found that the list of science topics would better reflect the new state standards and curriculum with the addition of three areas. These were appended to the essential skills for purposes of doing the crosswalks, and a team of teachers determined that they would have been ranked High by Survey respondents if they had been included.