

# CONCEPT AND SKILL ANALYSIS AND ALLOCATION OF NGSS STANDARDS: HIGH SCHOOL (Grades 9-11)

The NGSS standards have been allocated to transferable concepts and skills embedded within comprehensive structures for each. Both comprehensive structures are organized cognitively according to generality, complexity, and abstractness, three properties that characterize intellectual growth.

BASIC CONCEPT	SUB-CONCEPT		SUB-SUB-CONCEPT
<b>LANGUAGE OF SCIENCE</b> A <ul style="list-style-type: none"> <li>• nature of matter</li> </ul>	<b>ENTITY, SYSTEM, MATTER</b> A <ul style="list-style-type: none"> <li>• things and substances (intensive, extensive properties)</li> <li>• delineation, naming</li> <li>• wave as entity</li> <li>• system</li> <li>• environment, context</li> </ul>	<b>HIERARCHY OF MATTER</b> A <ul style="list-style-type: none"> <li>• elements, compounds, mixtures</li> <li>• kinetic theory of matter</li> <li>• Periodic table</li> </ul>	<b>BULK SCALE</b> A HS-PS1-3 Structure of bulk-scale substances depend on the inter-molecular forces.
			<b>MOLECULAR SCALE</b> B HS-PS2-6 The molecular-level structure affects the functioning of designed materials.
			<b>ATOMS AND ATOMIC STRUCTURE</b> C HS-PS1-1 Relative properties of elements are based on the patterns of the valence electrons.
			<b>NUCLEUS AND ELEMENTARY PARTICLES</b> <ul style="list-style-type: none"> <li>• Radioactivity d</li> </ul> HS-ESS1-3 Stars, over their life cycles, produce the elements.
			<b>MOLECULAR LEVEL OF LIFE</b> a
			<b>CELLULAR LEVEL OF LIFE</b> B <ul style="list-style-type: none"> <li>• organelles</li> </ul>
			<b>TISSUE</b>
			<b>ORGAN</b>
		<b>ORGAN SYSTEM</b>	
		<b>ORGANISM</b>	
		<b>POPULATION</b>	
		<b>COMMUNITY</b>	
		<b>PROPERTY/MEASUREMENT</b> A	
<b>CHANGE/ PROCESS</b> B <ul style="list-style-type: none"> <li>• change-over-time</li> </ul> HS-ESS1-2 The Big Bang theory is based on light spectra, galaxy motion, and the composition of the universe.  HS-ESS1-5 Plate tectonics.  HS-ESS1-6 Earth's formation and early history can be inferred from rocks, meteorites, and planetary surfaces.  HS-ESS2-1 Earth's surface features are formed by a wide variety of processes.  HS-ESS2-2 Feedback from a change to Earth's surface can induce changes in other Earth systems.	<b>RATIO, PERCENTAGE</b> A <b>SEQUENCE of EVENTS, TIME, RATE</b> A <b>CYCLE</b> B <ul style="list-style-type: none"> <li>• input-output</li> <li>• dynamic equilibrium</li> </ul> HS-ESS2-5 The water and rock cycles are linked through the effects of water.  HS-ESS2-6 Carbon cycles among the hydrosphere, atmosphere, geosphere, and biosphere.		
	<b>CORRELATION, CAUSALITY</b> B <ul style="list-style-type: none"> <li>• (in)dependent, controlled variable</li> </ul> HS-ESS3-6 The relationships among Earth's systems are being modified by human activity.		

	<p>HS-ESS2-3 Matter cycles by convection in Earth's interior.</p> <p>HS-ESS2-4 Climate changes are induced by variations in energy flow through Earth's systems.</p> <p>HS-ESS2-7 Earth's systems and life have evolved in tandem.</p> <p>HS-ESS3-5 Both the magnitude and rate of climate change will cause impacts to Earth's systems.</p>	<p>GRAPH, EQUATION</p> <p>B</p>
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BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
<p><b>INTERDEPENDENCE/ ECOSYSTEM</b> B</p> <ul style="list-style-type: none"> <li>• predator/prey</li> <li>• food chain/web</li> <li>• symbiosis: parasitism, commensalism, mutualism</li> <li>• natural and mechanical systems</li> </ul> <p>HS-LS2-2 Various factors affect biodiversity and populations at different scales.</p> <p>HS-LS2-3 Matter cycles and energy flows in both aerobic and anaerobic conditions.</p> <p>HS-LS2-4 Matter cycles and energy flows among organisms in an ecosystem.</p> <p>HS-LS2-8 Group behavior affects an individual and species' chances of surviving and reproducing.</p> <p>HS-ESS3-1 Natural resources, hazards, and climate changes affect human activity.</p>	<p><b>NATURAL ENVIRONMENT</b> A</p> <ul style="list-style-type: none"> <li>• surroundings, context</li> <li>• biome</li> </ul>	<p>HABITAT, NICHE A</p> <p>RESOURCE, POLLUTANT A</p> <p>DESIGNED or CONSTRUCTED ENVIRONMENT b</p> <p>CONSERVATION, RESTORATION B</p>
	<p><b>DIVERSITY</b> A</p> <ul style="list-style-type: none"> <li>• community</li> </ul>	<p>SPATIAL , TEMPORAL DISTRIBUTION B</p> <p>STATISTICAL DISTRIBUTION b</p> <ul style="list-style-type: none"> <li>• Normal (bell) distribution</li> </ul>
	<p><b>COMPLEMENTARITY</b> B</p> <ul style="list-style-type: none"> <li>• equilibrium of flows and reservoirs</li> </ul>	<p>FORM AND FUNCTION A</p>
	<p>HS-LS2-6 Equilibrium flows and reservoirs may be altered to produce new ecosystems.</p>	<p><b>CARRYING CAPACITY (NATURAL LIMITS)</b> A</p> <p>HS-LS2-1 Various factors affect carrying capacity at various scales.</p>
	<p>HS-ESS3-3 Biodiversity, resource management and healthy human populations are inter-dependent.</p>	<p>SUCCESSION, CLIMAX a</p>
		<p><b>CYCLE</b> B</p> <p>HS-LS2-5 Photosynthesis and cellular respiration affect the carbon cycle.</p>

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT		
<b>ENERGY</b> B <ul style="list-style-type: none"> <li>energy resources and uses</li> </ul>	<b>ENERGY FORMS &amp; TRANSFORMATION</b> A <ul style="list-style-type: none"> <li>groupings: potential, mechanical</li> <li>photosynthesis, cellular respiration</li> <li>metabolism/respiration</li> </ul> <p>HS-PS3-1 An object's energy is calculated from energy inputs, outputs or changes in other objects' energy.</p> <p>HS-PS3-2 The forms of energy are based in particle motion or field potential energy.</p> <p>HS-PS3-3 Many devices convert one form of energy into another.</p> <p>HS-PS3-5 Changing forces between electro-magnetically interacting objects changes their potential energies.</p> <p>HS-LS1-5 Photosynthesis transforms light to chemical energy.</p>	<b>POSITION (GRAVITATIONAL) ENERGY, KINETIC ENERGY</b> A <ul style="list-style-type: none"> <li>mechanical energy</li> </ul>		
		<b>THERMAL, CHEMICAL ENERGIES</b> A		
		<b>ELASTIC ENERGY</b> A		
		<b>WAVE ENERGY</b> B		
		<b>ELECTRICAL-MAGNETIC ENERGY</b> B		
		<b>NUCLEAR/MASS ENERGY</b> B  <p>HS-PS1-8 The atomic nucleus changes composition and releases energy during decay, fission, and fusion..</p> <p>HS-ESS1-1 Nuclear fusion, the sun's radiant emissions and life cycle.</p>		
			<b>HEAT TRANSFER</b> a	<b>CONDUCTION</b> A
				<b>CONVECTION</b> A
				<b>RADIATION</b> B
		<b>ADVECTION</b> b <ul style="list-style-type: none"> <li>transfer thru latent heat</li> </ul>		
<b>CONSERVATION OF ENERGY</b> B				
<b>EFFICIENCY</b> C				
<b>ENERGY FLOW, WORK</b> C <ul style="list-style-type: none"> <li>bulk flow vs. molecular flow</li> </ul>				
<b>POWER</b> D				
<b>ENERGY DEGRADATION</b> d	<b>ENTROPY</b> A <ul style="list-style-type: none"> <li>molecular disorder</li> <li>2<sup>nd</sup> law of thermodynamics</li> </ul>			

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
<p>WAVES C</p> <ul style="list-style-type: none"> <li>• representation</li> <li>• type/media: surface, sound, light/radiation, vibration</li> <li>• properties: wavelength, frequency, amplitude, speed, direction, energy</li> </ul> <p>HS-PS4-1 Properties of waves and their relationships.</p> <p>HS-PS4-2 Digital transmission and storage of information is advantageous.</p>	<p>PRODUCTION, ABSORPTION, PROPAGATION A</p> <ul style="list-style-type: none"> <li>• color of things and substances</li> <li>• transmission and capture of information/energy</li> <li>• transverse, longitudinal, polarized waves</li> <li>• perception, spectra</li> </ul> <p>HS-PS4-4 Different frequencies of EM radiation have varying effects when absorbed by matter.</p> <p>HS-PS4-5 Devices can absorb or emit waves to transmit or capture information or energy.</p>	<p>INTERFACE A</p> <p>partial reflection, transmission, absorption</p> <p>SUPERPOSITION, INTERFERENCE, RESONANCE B</p> <p>DOPPLER EFFECT C</p> <ul style="list-style-type: none"> <li>• shock wave, wake</li> </ul> <p>OPTICS A</p> <ul style="list-style-type: none"> <li>• focus</li> <li>• optical instruments</li> </ul> <p>REFLECTION A</p> <ul style="list-style-type: none"> <li>• luster/sheen</li> <li>• specular, diffuse reflection</li> <li>• scattering</li> </ul> <p>REFRACTION B</p> <ul style="list-style-type: none"> <li>• Snell's Law</li> <li>• total internal reflection</li> </ul> <p>DISPERSION a</p> <p>DIFFRACTION c</p>
	<p>DUALITY (WAVE-PARTICLE) a</p> <p>HS-PS4-3 EM radiation can be described as either wave or particle, whichever is more useful.</p>	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
GROWTH, DEVELOPMENT C	STAGE/PHASE <span style="float: right;">A</span> <ul style="list-style-type: none"> <li>• embryo, infancy, childhood, adolescence, adult, elder</li> <li>• life cycle</li> </ul>	GENESIS <span style="float: right;">A</span> MATURATION <span style="float: right;">A</span> METAMORPHOSIS <span style="float: right;">A</span> <ul style="list-style-type: none"> <li>• molting</li> </ul> DEGENERATION, SENESCENCE <span style="float: right;">a</span> REGENERATION <span style="float: right;">b</span>
	DIFFERENTIATION, SPECIALIZATION <span style="float: right;">B</span> <ul style="list-style-type: none"> <li>• cell division (mitosis)</li> </ul> HS-LS1-4 Cellular division and differentiation produce and maintain complex systems.	
	LINEAR, EXPONENTIAL, GEOMETRICAL INCREASE B	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
<p><b>CHEMICAL REACTION</b> D</p> <ul style="list-style-type: none"> <li>reactants, products</li> <li>the mole</li> <li>number/mass/volume stoichiometry</li> <li>solutions stoichiometry</li> </ul> <p>HS-PS1-2 Relative properties of elements are based on the patterns of the valence electrons.</p> <p>HS-PS1-7 Atoms and therefore mass are conserved during chemical reactions.</p> <p>HS-LS1-6 Sugar molecules provide the atoms that form amino acids and other large molecules.</p> <p>HS-LS1-7 Cellular respiration breaks and forms molecular bonds for a net energy transfer.</p>	<p><b>PATTERNS IN CHEMICAL REACTIONS</b> a</p> <ul style="list-style-type: none"> <li>synthesis/decomposition</li> <li>single/dbl displacement</li> </ul>	<p><b>COMBUSTION</b> A</p> <ul style="list-style-type: none"> <li>reduction/oxidation</li> </ul> <p><b>POLYMERIZATION</b> b</p> <ul style="list-style-type: none"> <li>plastics</li> <li>organic macro-molecules</li> </ul> <p><b>ACID/BASE, NEUTRALIZATION</b> b</p>
	<p><b>BONDING</b> A</p> <ul style="list-style-type: none"> <li>octet rule</li> <li>ionic/covalent bonds</li> <li>molecular structure (Lewis, VSEPR)</li> <li>inter-molecular forces (dipole, hydrogen, metallic and dispersion bonds)</li> <li>solvent-solute interaction</li> </ul>	<p><b>CARBON-BASED BONDING</b> A</p>
	<p><b>CHEMICAL ENERGY, THERMAL ENERGY</b> b</p> <ul style="list-style-type: none"> <li>thermochemistry</li> <li>sensible, latent heat</li> <li>ionization energy, bond energy</li> <li>heat of reaction, heat of formation</li> <li>activation energy, exo/endermic reactions</li> <li>Hess's Law</li> </ul> <p>HS-PS1-4 Heat flows during a chemical reaction depend on changes in bond energy.</p>	<p><b>ENTROPY, FREE ENERGY</b> a</p>
	<p><b>KINETICS</b> b</p> <ul style="list-style-type: none"> <li>catalyst</li> </ul> <p>HS-PS1-5 Changing the temp. or concentration affects the rate of a chemical reaction.</p>	<p><b>CHEMICAL EQUILIBRIUM</b> a</p> <ul style="list-style-type: none"> <li>Le Chatelier's principle</li> </ul> <p>HS-PS1-6 Changing the conditions of a chemical reaction changes the equilibrium between reactants &amp; products.</p>

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT	
<b>REPRODUCTION, HEREDITY</b> D <ul style="list-style-type: none"> <li>• inherited traits</li> <li>• dominant/recessive traits</li> <li>• Punnett squares</li> <li>• succession, pedigree</li> </ul>	<b>SEXUAL, ASEXUAL REPRODUCTION</b> A <ul style="list-style-type: none"> <li>• cellular reproduction</li> </ul>		
	<b>FERTILITY, FERTILIZATION</b> a <ul style="list-style-type: none"> <li>• pollination</li> <li>• ovulation, menstruation</li> </ul>		
	<b>GENETIC CODE, CODE</b> B <ul style="list-style-type: none"> <li>• genetic variation, gene/allele</li> </ul> <p>HS-LS3-1 DNA and chromosomes code the traits passed from parents to offspring.</p> <p>HS-LS3-2 Genetic variations result from meiosis, replication errors, and/or externally-caused mutations.</p> <p>HS-LS3-3 The distribution of expressed traits varies in a population.</p>	<b>TRANSLATION</b> A <ul style="list-style-type: none"> <li>▪ transcription, replication</li> <li>▪ RNA functions</li> </ul>	
		<b>TRANSMISSION</b> b	
		<b>EXPRESSION</b> B <ul style="list-style-type: none"> <li>• Epi-genetics</li> </ul>	
		<b>MUTATION</b> b <ul style="list-style-type: none"> <li>• genetic drift</li> <li>• environment affects</li> </ul>	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
EVOLUTION D  HS-LS4-1 Common ancestry and biological evolution are supported by empirical evidence.	SELECTION A <ul style="list-style-type: none"> <li>• natural selection</li> <li>• sexual selection</li> <li>• forced selection</li> </ul> HS-LS4-2 Natural selection: pop. increase + indiv. variation + competition = survival & reproduction.  HS-LS4-3 Organisms with an advantageous heritable trait tend to increase relative to those without.  HS-LS4-4 Natural selection leads to adaptation of populations.  HS-LS4-5 Environmental changes may cause population changes, speciation, or extinction.	VARIATION, ADAPTATION A
		EXTINCTION A
		SPECIATION B <ul style="list-style-type: none"> <li>• convergence</li> <li>• co-evolution</li> </ul>
	GENETIC EVOLUTION a	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
<b>MOTION, FORCES</b> E <ul style="list-style-type: none"> <li>types of motion (ir/regular, repetitive, accelerated, etc.)</li> <li>interaction</li> <li>types of forces (contact, gravity, elastic, electro-magnetic, etc.)</li> <li>gravity, weight, mass</li> </ul>	<b>VELOCITY, DISPLACEMENT</b> A <ul style="list-style-type: none"> <li>Displacement versus path distance</li> <li>speed plus direction</li> </ul>	<b>FRAMES OF REFERENCE</b> b <b>SPECIAL RELATIVITY</b> c
	<b>FORCES, NET FORCE, NEWTON'S 1<sup>ST</sup> and 3<sup>RD</sup> LAWS</b> A <ul style="list-style-type: none"> <li>types of forces</li> <li>force vector manipulation: scaled diagram, components</li> </ul> <p>HS-PS2-4 Universal gravitation and electrostatic forces.</p> <p>HS-ESS1-4 The motion of orbiting objects can be predicted mathematically.</p>	<b>FRICTION</b> A <b>GRAVITY</b> A <ul style="list-style-type: none"> <li>Universal gravitation</li> </ul> <b>ELECTROSTATIC FORCE</b> b <b>STATIC FLUID FORCES</b> b <b>DYNAMIC FLUID FORCES</b> b <ul style="list-style-type: none"> <li>Lift, drag</li> </ul> <b>SURFACE TENSION, CAPILLARY EFFECT</b> b <b>TORQUE/MOMENTS, CENTER OF GRAVITY</b> b <ul style="list-style-type: none"> <li>balance</li> </ul> <b>PRESSURE</b> b <ul style="list-style-type: none"> <li>tension, compression</li> <li>shear</li> <li>lift</li> <li>static fluid forces</li> </ul> <b>STRENGTH</b> c <ul style="list-style-type: none"> <li>stress, strain</li> </ul>
	<b>FLUID FLOW</b> a	<b>LAMINAR FLOW, TURBULENCE</b> A <ul style="list-style-type: none"> <li>current, streamlines</li> </ul> <b>BOUNDARY CONDITIONS</b> b
	<b>ACCELERATION, NEWTON'S 2<sup>ND</sup> LAW</b> B <ul style="list-style-type: none"> <li>kinematics</li> <li>linear dynamics</li> <li>impulse-momentum</li> </ul> <p>HS-PS2-1 Newton's Second law.</p> <p>HS-PS2-3 Solutions can be designed to minimize the forces during a collision.</p>	<b>FICTITIOUS FORCE</b> a <ul style="list-style-type: none"> <li>Accelerated frames of reference</li> <li>Coriolis force</li> </ul>
	<b>2- &amp; 3-DIMENSIONAL MOTION</b> C <ul style="list-style-type: none"> <li>vectors for d, v, &amp; a</li> <li>central force, universal gravitation</li> </ul>	<b>PROJECTILE MOTION</b> A <b>CIRCULAR MOTION</b> B <b>HARMONIC MOTION</b> b
	<b>CONSERVATION OF MOMENTUM</b> C <p>HS-PS2-2 Conservation of momentum.</p>	
	<b>ROTATIONAL DYNAMICS</b> d <ul style="list-style-type: none"> <li>angular motion properties</li> </ul>	<b>CONSERVATION OF ANGULAR MOMENTUM, ANGULAR ENERGY</b> A <b>ROLLING</b> b
	<b>QUANTUM MECHANICS</b> e	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
REGULATION (CONTROL) E  HS-LS1-3 Feedback mechanisms maintain homeostasis.	SWITCH A • trigger	
	FEEDBACK A • positive, negative feedback • connectivity	
	EQUILIBRIUM B • homeostasis • health	RESTORING MECHANISM A
		SUSTAINABILITY a THRESHOLD, CRITICAL MASS b • tipping point
	PERTURBATION, MALFUNCTION B • disease • abnormality	CONTAGION VECTOR A • propagation of perturbation
		EPIDEMIC a
		ADDICTION b

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
ELECTRICITY, MAGNETISM                      E <ul style="list-style-type: none"> <li>• charge, polarity</li> <li>• conductors, insulators</li> <li>• attraction/repulsion</li> <li>• mapping elec &amp; mag fields</li> </ul> HS-PS2-5 Electric currents produce magnetic fields; Changing magnetic fields produce electric currents.	SIMPLE CIRCUIT, OHM'S LAW                      A <ul style="list-style-type: none"> <li>• load, source/supply</li> <li>• current, resistance, voltage</li> <li>• open circuit, short circuit</li> <li>• alternating and direct current</li> </ul>	
	CONSERVATION OF CURRENT, VOLTAGE    b <ul style="list-style-type: none"> <li>• Kirchoff's Laws</li> <li>• series, parallel, combination circuits</li> </ul>	CONTROL MECHANISM                      a <ul style="list-style-type: none"> <li>• relay, diode, transistor/gate, integrated circuit, transformer</li> </ul>
	ELECTRIC FORCE FIELD, ELECTRIC POTENTIAL    c <ul style="list-style-type: none"> <li>• Coulomb's Law; Inverse square law</li> </ul>	GAUSS'S LAW                      a <ul style="list-style-type: none"> <li>• line of force</li> <li>• flux</li> </ul>
		CAPACITANCE                      b
	MOTOR, GENERATOR , TRANSFORMER    c	
		AMPERE'S LAW                      a
	MAGNETIC FORCE FIELD                      d <ul style="list-style-type: none"> <li>• Force on moving charges</li> <li>• Bio-Savart law</li> </ul>	ELECTROMAGNETIC INDUCTANCE    b <ul style="list-style-type: none"> <li>• Lenz's Law</li> <li>• magnetic flux</li> <li>• transformers</li> <li>• AC inductance</li> </ul>
		FARADAY'S LAW                      c <ul style="list-style-type: none"> <li>• (Self-) inductance</li> </ul>
		LR, LC, LRC CIRCUITS                      d
	MAXWELL'S EQUATIONS                      d	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
BEHAVIOR <span style="float: right;">E</span> <ul style="list-style-type: none"> <li>• stimulus-response</li> <li>• classical, operant conditioning</li> <li>• survival, self-interest, cooperation</li> <li>• nature vs. nurture</li> </ul>	INSTINCT <span style="float: right;">A</span>	MATING <span style="float: right;">A</span> <ul style="list-style-type: none"> <li>• female choice</li> </ul>
	COMMUNICATION <span style="float: right;">A</span>	AGGRESSION <span style="float: right;">A</span>
	LEARNING <span style="float: right;">b</span> <ul style="list-style-type: none"> <li>• memory</li> <li>• language</li> </ul>	COGNITION <span style="float: right;">A</span> <ul style="list-style-type: none"> <li>• Accommodation, Assimilation, Adaptation</li> <li>• Thinking and reasoning</li> </ul>
	KNOWLEDGE TRANSFER <span style="float: right;">B</span> <ul style="list-style-type: none"> <li>• higher-order thinking</li> <li>• problem solving, decision making</li> </ul>	
	MOTIVATION, EMOTION <span style="float: right;">b</span> <ul style="list-style-type: none"> <li>• curiosity</li> <li>• hierarchy of needs</li> </ul>	
	COMPETENCE, INTELLIGENCE <span style="float: right;">c</span>	
	PERSONALITY <span style="float: right;">b</span>	ALTRUISM <span style="float: right;">b</span> <ul style="list-style-type: none"> <li>• reciprocity</li> </ul>
	STATES OF CONSCIOUSNESS <span style="float: right;">c</span> <ul style="list-style-type: none"> <li>• sleep and dreams</li> <li>• hypnosis, meditation</li> <li>• drug induced</li> </ul>	

# TRANSFERABLE SKILLS FOR SCIENCE, TECHNOLOGY, ENGINEERING, AND DESIGN.

MAJOR CATEGORY	SUB-CATEGORY	SUB-SUB-CATEGORY
EXPERIMENTAL DESIGN / INQUIRY	QUESTION, HYPOTHESIS, PURPOSE	INDEPENDENT, DEPENDENT, CONTROLLED VARIABLES
	PROCEDURE, METHOD	OBSERVATION, MEASUREMENT
		MODELING, SIMULATION
		TRIAL AND ERROR
		CONTROLLED EXPERIMENT
		SURVEY
	PRIMARY SOURCE • diary & journals, interview, letter, periodical of time, oral tradition, official records.	
	SECONDARY SOURCE • texts, reference books, author commentary, library/internet research.	
	RESULTS, DATA, OBSERVATIONS	
	ANALYSIS, CONCLUSION	ERROR, VALIDITY, RELIABILITY
LAB SAFETY		
INFERENTIAL & PROCEDURAL PROBLEM SOLVING	SEQUENCE, COORDINATION • dating, timelines	
	AND, OR	
	IF...THEN	
<p><b>THE DESIGN PROCESS</b></p> <p>HS-PS3-3 Design, build, and refine a device within given constraints that converts one form of energy into another.</p> <p>HS-LS2-7 Solutions can be designed to reduce humans' impact on ecosystems.</p> <p>HS-ESS3-4 Solutions can be designed that reduce the impact of humans on natural systems.</p> <p>HS-ETS1-1 Quantitative and qualitative criteria and constraints for solutions to global challenges.</p> <p>HS-ETS1-2 Complex problems can often be solved by breaking them into smaller, component problems.</p> <p>HS-ETS1-3 Design trade-offs: cost, safety, reliability, aesthetics, social, cultural, envir. impacts.</p> <p>HS-ETS1-4 Computers can simulate complex real-world problems.</p>	IDENTIFY PROBLEM/GOAL • divide into smaller components	CRITERIA, CONSTRAINTS RESOURCES, MATERIALS
	GATHER INFORMATION • evidence	KNOWLEDGE AND SKILL REQUIREMENTS
	DEVELOP MULTIPLE OPTIONS	
	SELECT, REFINE, DESIGN a SOLUTION	
	CONSTRUCT SOLUTION or PROTOTYPE	
	EVALUATE SOLUTION	COSTS, BENEFITS, TRADE-OFFS HS-ESS3-2 Design solutions to energy and resource problems are evaluated on cost-benefit ratios.
		EFFICIENCY, EFFECTIVENESS
	COMMUNICATE SOLUTION	
	RE-DESIGN SOLUTION	

MAJOR CATEGORY	SUB-CATEGORY	SUB-SUB-CATEGORY
MODELING picturing, 3-D modeling faithfulness, accuracy, precision Perspective, labeling, scaling.	MAPPING <ul style="list-style-type: none"> <li>• incl. topographical, political, social, resource, climatic</li> </ul>	
	GRAPHIC ORGANIZERS <ul style="list-style-type: none"> <li>• diagram, flow chart, web, concept map</li> </ul>	
	GRAPHIC DISPLAY <ul style="list-style-type: none"> <li>• pie, bar, line graphs</li> </ul>	
MATHEMATICAL MANIPULATION	BASIC OPERATIONS <ul style="list-style-type: none"> <li>• Add, subtract, multiply, divide</li> </ul>	
	UNIT CONVERSION	
	ALGEBRAIC MANIPULATION	
	GEOMETRY	
	VECTORS, TRIGONOMETRY	
	DIFFERENTIALS, INTEGRALS	
	MISC. MATH SKILLS	