MASTER STRUCTURE of TRANSFERABLE CONCEPTS FOR SCIENCE

UP-DATED: 3-24-14

KEY: SLASH: major synonyms
COMMA: closely linked, synergistic concepts
BULLET: other synonyms and common associations

SEQUENCE LETTERS:
- A before B before C, etc.
- capitals indicate an essential concept
- lower case indicates could be skipped
- same letter indicates order doesn't matter

BASIC CONCEPT	SUB-CONCEPT		SUB-SUB-CONCEPT
LANGUAGE OF SCIENCE A • nature of matter • pattern language	ENTITY, SYSTEM, MATTER A • things and substances (intensive, extensive properties) • delineation, naming • wave as entity • system • environment, context	HIERARCHY OF MATTER A • elements, compounds, mixtures • kinetic theory of matter • Periodic table	BULK SCALE A
			MOLECULAR SCALE B
			ATOMIC SCALE C • atomic structure, Bohr model
			NUCLEAR, ELEM. PARTICLE SCALE • Radioactivity d
			QUARKS AND LEPTONS e
		HIERARCHY OF LIFE A	MOLECULAR LEVEL OF LIFE a
			CELLULAR SCALE B • Organelles
			TISSUE SCALE
			ORGAN SCALE
			ORGAN SYSTEM
			ORGANISM
			POPULATION
			COMMUNITY
	PROPERTY/MEASUREMENT A • observation, value, unit • comparison, difference/similarity • ratio, percentage • error, accuracy • misc properties: hardness, melting/boiling T°'s, (non)-conductor		SCALE/SIZE A
			NUMBER B
			PHASE, STRUCTURE B
			COMPOSITION B
			TEMPERATURE B
			DISTANCE, AREA, VOLUME C • dimensions
			SHAPE, ANGLE, CONFIGURATION c
			SPEED C
			LOCATION, DIRECTION, ORIENTATION c
			TEXTURE d
			HARDNESS, CLEAVAGE d
			POROSITY, PERMEABILITY E
			MASS F
			DENSITY, CONCENTRATION G
			UNIFORMITY h
			CHARGE, POLARITY h
			SOLUBILITY h
	CHANGE/ PROCESS B		RATIO, PERCENTAGE A
			SEQUENCE of EVENTS, TIME, RATE A • change-over-time
			CYCLE B • input-output • dynamic equilibrium
			CORRELATION, CAUSALITY B (in)dependent, controlled variable
			GRAPH, EQUATION B

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
INTERDEPENDENCE/ ECOSYSTEM B • predator/prey • food chain/web • symbiosis: parasitism, commensalism, mutualism • natural and mechanical systems	NATURAL ENVIRONMENT A • surroundings, context • biome	HABITAT, NICHE A
		RESOURCE, POLLUTANT A
		DESIGNED or CONSTRUCTED ENVIRONMENT b
		CONSERVATION, RESTORATION B
	DIVERSITY A • community	SPATIAL , TEMPORAL DISTRIBUTION B
		STATISTICAL DISTRIBUTION b • Normal (bell) distribution
	COMPLEMENTARITY B • equilibrium of flows and reservoirs	FORM AND FUNCTION A
		CARRYING CAPACITY (NATURAL LIMITS) A
		SUCCESSION, CLIMAX a
		CYCLE B

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
ENERGY B • energy resources and uses	ENERGY FORMS & TRANSFORMATION A • groupings: potential, mechanical • photosynthesis, cellular respiration • metabolism/respiration	POSITION (GRAVITATIONAL) ENERGY, KINETIC ENERGY A • mechanical energy
		THERMAL, CHEMICAL ENERGIES A
		ELASTIC ENERGY A
		WAVE ENERGY B
		ELECTRICAL-MAGNETIC ENERGY B
		NUCLEAR/MASS ENERGY B
	HEAT TRANSFER a	CONDUCTION A
		CONVECTION A
		RADIATION B
		ADVECTION b • transfer thru latent heat
	CONSERVATION OF ENERGY B	
	EFFICIENCY C	
	ENERGY FLOW, WORK C • bulk flow vs. molecular flow	
	POWER D	
	ENERGY DEGRADATION d	ENTROPY A • molecular disorder • 2nd law of thermodynamics

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
WAVES C • representation • type/media: surface, sound, light/radiation, vibration • properties: wavelength, frequency, amplitude, speed, direction, energy	PRODUCTION, ABSORPTION, PROPAGATION A • color of things and substances • transmission and capture of information/energy • transverse, longitudinal, polarized waves • perception & spectra	INTERFACE A partial reflection, transmission, absorption
		SUPERPOSITION, INTERFERENCE, RESONANCE B
		DOPPLER EFFECT C • shock wave, wake
	OPTICS A • focus • optical instruments	
	REFLECTION A • luster/sheen • specular, diffuse reflection • scattering	
	REFRACTION B • Snell's Law • total internal reflection	DISPERSION a
	DIFFRACTION c	
	DUALITY (WAVE-PARTICLE) a	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
GROWTH, DEVELOPMENT C	STAGE/PHASE A • embryo, infancy, childhood, adolescence, adult, elder • life cycle	GENESIS A
		MATURATION A
		METAMORPHOSIS A • molting
		DEGENERATION, SENESCENCE a
		REGENERATION b
	DIFFERENTIATION, SPECIALIZATION B • cellular division (mitosis)	
	LINEAR, EXPONENTIAL, GEOMETRICAL INCREASE B	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
CHEMICAL REACTION D • reactants, products • the mole • number/mass/volume stoichiometry • solutions stoichiometry	PATTERNS IN CHEMICAL REACTIONS a • synthesis/decomposition • single/dbl displacement	COMBUSTION A • reduction/oxidation
		POLYMERIZATION b • plastics • organic macro-molecules
		ACID/BASE, NEUTRALIZATION b
	BONDING A • octet rule • ionic/covalent bonds • molecular structure (Lewis, VSEPR) • inter-molecular forces (dipole, hydrogen, metallic and dispersion bonds) • solvent-solute interaction	CARBON-BASED BONDING A
	CHEMICAL ENERGY, THERMAL ENERGY b • thermochemistry • sensible, latent heat • ionization energy, bond energy • heat of reaction, heat of formation • activation energy, exo/endothermic reactions • Hess's Law	ENTROPY, FREE ENERGY a
	KINETICS b • catalyst	CHEMICAL EQUILIBRIUM a • Le Chatelier's principle

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
REPRODUCTION, HEREDITY D • inherited traits • dominant/recessive traits • Punnett squares • succession, pedigree	SEXUAL, ASEXUAL REPRODUCTION A • cellular reproduction	
	FERTILITY, FERTILIZATION a • pollination • ovulation, menstruation	
	GENETIC CODE, CODE B • genetic variation, gene/allele	TRANSLATION A ▪ transcription, replication ▪ RNA functions
		TRANSMISSION b
		EXPRESSION B • epigenetics
		MUTATION b • genetic drift • environment affects

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
EVOLUTION D	SELECTION A • natural selection • sexual selection • forced selection	VARIATION, ADAPTATION A
		EXTINCTION A
		SPECIATION B • convergence • co-evolution
	GENETIC EVOLUTION a	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
MOTION, FORCES E • types of motion (ir/regular, repetitive, accelerated, etc.) • interaction • types of forces (contact, gravity, elastic, electro-magnetic, etc.) • gravity, weight, mass	VELOCITY, DISPLACEMENT A • Displacement versus path distance • speed plus direction	FRAMES OF REFERENCE b
		SPECIAL RELATIVITY c
	FORCES, NET FORCE, NEWTON'S 1st and 3RD LAWS A • types of forces • force vector manipulation: scaled diagram, components	FRICTION A
		GRAVITY A • Universal gravitation
		ELECTROSTATIC FORCE b
		STATIC FLUID FORCES b
		DYNAMIC FLUID FORCES b • Lift, drag
		SURFACE TENSION, CAPILLARY EFFECT b
		TORQUE/MOMENTS, CENTER OF GRAVITY b • balance
		PRESSURE b • tension, compression • shear • lift • static fluid forces
		STRENGTH c • stress, strain
	FLUID FLOW a	LAMINAR FLOW, TURBULENCE A • current, streamlines
		BOUNDARY CONDITIONS b
	ACCELERATION, NEWTON'S 2ND LAW B • kinematics • linear dynamics • impulse-momentum	FICTITIOUS FORCE a • Accelerated frames of reference • Coriolis force
	2- & 3-DIMENSIONAL MOTION C • vectors for d, v, & a • central force, universal gravitation	PROJECTILE MOTION A
		CIRCULAR MOTION B
		HARMONIC MOTION b
	CONSERVATION OF MOMENTUM C	
	ROTATIONAL DYNAMICS d • angular motion properties	CONSERVATION OF ANGULAR MOMENTUM, ANGULAR ENERGY A
		ROLLING b
	QUANTUM MECHANICS e	

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
REGULATION (CONTROL) E	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 • charge, polarity • conductors, insulators • attraction/repulsion • mapping elec & mag fields	SIMPLE CIRCUIT, OHM'S LAW A • load, source/supply • current, resistance, voltage • open circuit, short circuit • alternating and direct current	
	CONSERVATION OF CURRENT, VOLTAGE b • Kirchoff's Laws • series, parallel, combination circuits	CONTROL MECHANISM a • relay, diode, transistor/gate, integrated circuit, transformer
	ELECTRIC FORCE FIELD, ELECTRIC POTENTIAL c • Coulomb's Law; Inverse square law	GAUSS'S LAW a • line of force • flux
		CAPACITANCE b
	MOTOR, GENERATOR , TRANSFORMER c	
	MAGNETIC FORCE FIELD d • Force on moving charges • Bio-Savart law	AMPERE'S LAW a
		ELECTROMAGNETIC INDUCTANCE b • Lenz's Law • magnetic flux • transformers • AC inductance
		FARADAY'S LAW c • (Self-) inductance
		LR, LC, LRC CIRCUITS d
		MAXWELL'S EQUATIONS d

BASIC CONCEPT	SUB-CONCEPT	SUB-SUB-CONCEPT
BEHAVIOR E • stimulus-response • classical, operant conditioning • survival, self-interest, cooperation • nature vs. nurture	INSTINCT A	MATING A • female choice
		AGGRESSION A
	COMMUNICATION A	PERSUASION a
	LEARNING b • memory • language	COGNITION A • Accommodation, Assimilation, Adaptation • Thinking and reasoning
		KNOWLEDGE TRANSFER B • higher-order thinking • problem solving, decision making
		MOTIVATION, EMOTION b • curiosity • hierarchy of needs
		COMPETENCE, INTELLIGENCE c
	PERSONALITY b	ALTRUISM b • reciprocity
	STATES OF CONSCIOUSNESS c • sleep and dreams • hypnosis, meditation • drug induced	