Sec IV Environmental Science and Technology Program		Facile Learning Online Topics
The Material World		Lesson-Topic
A. Properties - 3. Properties of solutions		Lessons 3,12
d. Concentration	v. Determines the concentration of an aqueous solution (g/L, percentage, ppm, mol/L)	L3-8,9, L12-6
f. Strength of electrolytes	i. Qualitatively speaking, associates the strength of an electrolyte with its degree of dissociation	L3-6
B. Changes - 3. Chemical changes		Lessons 3,10,11
c. Oxidation	iii. Associates a chemical equation in which oxygen is one of the reactants with one of the possible cases of an oxidation reaction	L2-5
h. Salts	i. Determines the molecular formula of the salt produced by the neutralization of a given acid and a given base	L3-4
i. Types of bonds	i. Covalent - Defines a covalent bond as a bond resulting from a sharing of electrons	L10-2,3
i. Types of bonds	i. Covalent - Makes a schematic representation of a covalent bond	L10-2,3
i. Types of bonds	i. Covalent - Identifies molecules that feature a covalent bond (e.g. N_2, CO_2)	L10-2,7
i. Types of bonds	i. Ionic - Defines an ionic bond as a bond resulting from the gain or loss of electrons	L10-1
i. Types of bonds	i. Ionic - Makes a schematic representation of an ionic bond	L10-1
i. Types of bonds	i. Ionic - Identifies molecules that feature an ionic bond (e.g. $NaCl$, NH_4OH)	L10-1,4
i. Types of bonds	i. Ionic - Associates an ionic bond with an electrolytic substance	L3-3
l. Stoichiometry	i. Determines the quantities of reactants or products using stoichiometric calculations (gram or mole)	L12
m. Endothermic and exothermic reactions	i. Distinguishes an endothermic reaction from an exothermic reaction according to perceptible signs (e.g. temperature variations, emission of light)	L11-1
m. Endothermic and exothermic reactions	ii. Distinguishes an endothermic reaction from an exothermic reaction according to the position of the energy term in the chemical equation	L11-1
B. Changes - 4. Nuclear changes		Lesson 11
a. Nuclear stability	i. Explains nuclear stability as the case where the nucleus of the atom is held together by an optimal number of neutrons	L11-2
b. Radioactivity	i. Associates the use of radioactivity with technological applications (e.g. radiotherapy, dating)	L11-2
b. Radioactivity	ii. Defines radioactivity as the emission of particles or energy by the nuclei of atoms following nuclear transformations	L11-2
c. Fission and fusion	i. Distinguishes nuclear fission from nuclear fusion	L11-5
B. Changes - 5. Transformation of energy		Lesson 14
e. Relationship between thermal energy, specific heat capacity, mass and temperature variation	i. Describes qualitatively the relationship between the change in thermal energy (quantity of heat) of a substance, its mass, its specific heat capacity and the variations in temperature to which it is exposed	L14-1

e. Relationship between thermal energy, specific heat capacity, mass and temperature variation	ii. Applies the mathematical relationship between thermal energy, mass, specific heat capacity and temperature variation ($\Delta E = Q = mc\Delta T$)	L14-2,3
f. Effective force	i. Defines effective force as the component of the applied force parallel to the direction of travel	L14-4
f. Effective force	ii. Determines graphically the magnitude of the effective force in a given situation	L14-4
g. Relationship between work, force and distance travelled	i. Describes qualitatively the relationship between the work done, the force applied on a body and the distance travelled by the body	L14-8
g. Relationship between work, force and distance travelled	ii. Applies the mathematical relationship between work, effective force and distance travelled ($W = F\Delta d$)	L14-8
h. Relationship between mass and weight	i. Describes qualitatively the relationship between mass and weight	L14-5,6
h. Relationship between mass and weight	ii. Applies the mathematical relationship between mass and weight ($Fg = mg$)	L14-7
i. Relationship between potential energy, mass, acceleration and distance travelled	i. Describes qualitatively the relationship between the potential energy of a body, its mass, its gravitational acceleration and the distance it travels	L14-7
i. Relationship between potential energy, mass, acceleration and distance travelled	ii. Applies the mathematical relationship between potential energy, mass, gravitational acceleration and the distance travelled ($Ep = mgh$)	L14-7
j. Relationship between kinetic energy, mass and speed	i. Describes qualitatively the relationship between the kinetic energy of a body, its mass and its speed	L14-7
j. Relationship between kinetic energy, mass and speed	ii. Applies the mathematical relationship between kinetic energy, mass and speed ($Ek = \frac{1}{2}mv$)	L14-7
k. Relationship between work and energy	i. Describes qualitatively the relationship between the work done on a body and the variation in energy within that body	L14-8
k. Relationship between work and energy	ii. Applies the mathematical relationship between work and energy ($W = \Delta E$)	L14-8
C. Organization - 1. Structure of matter		Lessons 1,9,12
i. Neutron	i. Describes the position and electrical charge of the neutron in an atom	L1-2
j. Simplified atomic model	i. Represents an atom of a given element using the simplified atomic model	L9-3
l. Nomenclature and notation rules	i. Applies nomenclature and notation rules to name the molecule or write the molecular formula of binary compounds	L10-5,6,7,8,9
m. Polyatomic ions	i. Recognizes the common polyatomic ions (e.g. $NH4$, OH , $NO3$, $CO3$, $SO4$, $PO4$) by their name, their formula or their composition	L10-4
n. Concept of the mole	i. Defines the mole as the unit of measure of the amount of a substance	L12-1,2,3,4,5
n. Concept of the mole	ii. Expresses an amount of a substance in moles	L12-1,2,3,4,5
o. Avogadro's number	i. Expresses a quantity of particles using Avogadro's number	L12-1,2,3,4,5
C. Organization - 2. Periodic classification		Lessons 1,9,11
a. Atomic number	i. Associates the atomic number of an element with the number of protons it has	L1-3
b. Isotopes	i. Defines isotopes as atoms of the same element whose nuclei have different numbers of neutrons and therefore different atomic masses	L9-2
b. Isotopes	ii. Defines a radioactive isotope as an isotope whose atomic nucleus is unstable	L11-2
c. Relative atomic mass	i. Explains qualitatively the concept of relative atomic mass	L9-2
d. Periodicity of properties	i. Describes the periodicity of certain properties of elements (e.g. chemical reactivity, atomic radius, electronegativity)	L9-1,..7
F. Electricity and electromagnetism - 1. Electricity		Lessons 4 and 15

f. Kirchhoff's laws	i. Describes the distribution of current in various components of an electrical circuit	L15-2
f. Kirchhoff's laws	ii. Determines the value of the current flowing in various components of a series or parallel circuit	L15-2
f. Kirchhoff's laws	iii. Describes the distribution of the voltage across various components of an electrical circuit	L15-1
f. Kirchhoff's laws	iv. Determines the value of the voltage across various components of a series or parallel circuit	L15-1
f. Kirchhoff's laws	v. Determines the value of the equivalent resistance of a series or parallel circuit using Ohm's law and Kirchhoff's laws	L15-3
g. Electrical field	i. Describes qualitatively the effect of an electrical field on electrically charged particles	L4-2
h. Coulomb's law	i. Applies the mathematical relationship between the electrical force, the magnitude of the electrical charges and the distance separating these charges ($F = kq\,q\,/r$)	L4-2
F. Electricity and electromagnetism - 2. Electromagnetism		Lesson 15
c. Magnetic field of a solenoid	i. Describes the magnetic field produced by a solenoid (right-hand rule or left-hand rule)	L15-11,12
c. Magnetic field of a solenoid	ii. Names ways of changing the intensity of the magnetic field produced by a solenoid (nature of the core, intensity of the current, number of turns)	L15-13
c. Magnetic field of a solenoid	iii. Explains the use of solenoids in technological applications (e.g. earphones, electric motor, magnetic crane)	L15-13

The Living World

A. Diversity of life forms - 1. Ecology		Lesson 16
h. Ecological footprint	i. Explains the concept of ecological footprint	L16-11
i. Ecotoxicology	i. Contaminant - Defines a contaminant as an agent that causes changes in the physical, chemical or biological properties of an environment or an organism	L16-11
i. Ecotoxicology	ii. Bioaccumulation - Defines bioaccumulation as the process by which a contaminant from the environment or food supply accumulates in an organism	L16-11
i. Ecotoxicology	ii. Bioaccumulation -Explains bioaccumulation in food chains (biomagnification)	L16-11
i. Ecotoxicology	iii. Bioconcentration - Defines bioconcentration as a special case of bioaccumulation by which an organism accumulates a contaminant through direct contact with its environment (from sources other than food)	L16-11
i. Ecotoxicology	iv. Toxicity threshold - Defines the toxicity threshold of a substance as the minimum concentration of a substance that produces a significant harmful effect in an organism (mg/kg of the organism's mass)	L16-11
i. Ecotoxicology	iv. Toxicity threshold - Describes factors that influence the toxicity of a contaminant (e.g. concentration, characteristics of the environment into which it is released, nature of the organisms with which it is in contact, duration of exposure)	L16-11
A. Diversity of life forms - 3. Genetics		Lesson 16
a. Heredity	i. Defines heredity	L16-4,5,6
b. Gene	i. Defines a gene as being, in most cases, a DNA segment that carries the code for synthesizing one or more proteins	L16-6
b. Gene	ii. Describes the composition (nitrogen bases, sugar, phosphate) and the overall structure (bonding of bases on the double helix) of a DNA molecule	L16-3
c. Character trait	i. Defines what an hereditary trait is	L16-6

c. Character trait	ii. Names hereditary traits in an individual or population	L16-6
d. Allele	i. Defines an allele as a possible form of a gene	L16-6
e. Homozygotes and heterozygotes	i. Defines a homozygote as an individual with two identical alleles for a particular character trait	L16-7,8,9
e. Homozygotes and heterozygotes	ii. Defines a heterozygote as an individual with two different alleles for a particular character trait	L16-7,8,9
f. Dominant and recessive	i. Describes the phenomena of dominant and recessive character traits	L16-7,8,9
g. Genotype and phenotype	i. Defines genotype	L16-7,8,9
g. Genotype and phenotype	ii. Defines phenotype	L16-7,8,9
g. Genotype and phenotype	iii. Describes an individual's genotype and phenotype for a character trait (e.g. a bean with a Yellow phenotype may have a Yellow-Yellow genotype or a Yellow-Green genotype)	L16-4-9
h. Protein synthesis	i. Describes the role of DNA in protein synthesis	L16-1,2,3
h. Protein synthesis	ii. Explains the phenomena of transcription and translation of a strand of DNA	L16-1,2,3
i. Crossbreeding	i. Explains the relationship between the crossbreeding carried out by humans on animals and plants and the desired traits obtained	L16-9
The Earth and Space		
A. Characteristics of the Earth - 2. Lithosphere		Lesson 16
m. Soil depletion	i. Explains how human activities contribute to soil depletion	L16-11
n. Buffering capacity of the soil	i. Defines the buffering capacity of a soil as its ability to limit pH variations	L16-11
n. Buffering capacity of the soil	ii. Explains the advantages of a good soil buffering capacity	L16-11
o. Contamination	i. Names soil contaminants	L16-11
p. Biogeochemical cycle	iii. Phosphorous cycle - Describes transformations related to the circulation of phosphorous (e.g. erosion of rocks, breakdown of fertilizers, metabolism of algae)	L16-10
A. Characteristics of the Earth - 3. Hydrosphere		
f. Contamination	i. Names water contaminants	L16-11
g. Eutrophication	i. Explains the natural process of eutrophication of a body of natural water	L16-11
A. Characteristics of the Earth - 4. Atmosphere		
d. Atmospheric circulation	i. Describes the effect of prevailing winds on the dispersal of air pollutants in a given region	L16-11
f. Contamination	i. Names air contaminants	L16-11
The Technological World		
A. Graphical language		In production
B. Mechanical engineering - 3. Engineering		Lessons 8,15
d. Degree of freedom of a part	Explains the purpose of limiting motion (degree of freedom) in a technical object (e.g. some hinges limit how far a cupboard door can open, preventing it from hitting the wall)	L15-4
g. Adhesion and friction of parts	i. Describes the advantages and disadvantages of the adhesion and friction of parts in a technical object	L15-4

m. Construction and characteristics of motion transformation systems	Ii. Explains the choice of a motion transformation system (screw gear, cams,connecting rods, cranks, slider-crank mechanism, rack-and-pinion drive,eccentric) in a technical object	L8-4
C. Electrical engineering - 3. Engineering		Lesson 15
b. Conduction, insulation and protection	v. Uses the colour code to determine the electrical resistance of a resistor	L15-8
b. Conduction, insulation and protection	vi. Describes the operation of a printed circuit	L15-9
c. Control	iii. Distinguishes between unipolar and bipolar switches	L15-9
c. Control	iv. Distinguishes between unidirectional and bidirectional switches	L15-9
e. Other functions	i. Describes the function of certain electronic components (condenser, diode)	In production
D. Materials - 2. Mechanical properties of materials		In production
E. Manufacturing		In production
F. Biotechnology		Lesson 16
a. Processes	vi. Cloning - Defines cloning as a reproductive process that results in an identical copy of an organism, a tissue or a cell, whether genetically modified or not	In production
a. Processes	vi. Cloning - Describes the main advantages and disadvantages of cloning	In production
a. Processes	vii. Wastewater treatment - Describes treatments used to decontaminate wastewater	L16-11
a. Processes	viii. Biodegradation of pollutants - Describes ways to promote biodegradation of pollutants (e.g. phytoremediation)	L16-11