France Educational Curriculum Alignment

The presentations offered by The Educated Choices Program provide support for teaching and learning of the following standards:

Science Education, High School		Environment and Modern Agriculture	Healthful Eating
1 - A long history of matter	1.1 - A level of organization: the chemical elements Knowledge Know-how: ● The nuclei of the atoms of the hundred of stable chemical elements result from nuclear reactions that occur within stars from the initial hydrogen. The matter known to the Universe is formed mainly of hydrogen and helium so that the Earth is mostly made up of oxygen, hydrogen, iron, silicon, magnesium and carbon living things, hydrogen, oxygen and nitrogen. The students: ● Produce and analyze different graphical representations of abundance chemical elements (proportions) in the Universe, the Earth, living beings. Knowledge Know-how: ● The equation of a stellar nuclear reaction being provided, recognizes whether it falls within fusion or fission. Some nuclei are unstable and disintegrate (radioactivity). The decay time of a nucleus individual radioactive is random. The half-life of a radioactive nucleus is the time necessary so that half of the nuclei initially present in a sample		✔

	macroscopic has disintegrated. This half-life is characteristic of the nucleus being radioactive. The students: ● Calculate the number of nuclei remaining at after n half-lives ● Estimate the time required to obtain a certain proportion of remaining nuclei. ● Use a graphical representation to determine a half-life. ● Use radioactive decay to a date (example of carbon 14). 1.2 - Orderly buildings: Knowledge Know-how: ● The crystal, solid sodium chloride (found in rocks, or resulting from the evaporation of seawater) consists of a regular stack of ions: this is the crystalline state. The students: ● Use a 3D representation computerized chloride crystal sodium. ● Link the organization of the mesh to the microscopic level to structure crystals at the macroscopic level. More generally, a crystal structure is defined by a unit cell repeated periodically. A crystal type is defined by the geometric shape of the mesh, the nature and the position in this mesh entities that constitute it. The simplest crystals can be described by a cubic mesh that the geometry of the cube allows to characterize. The position of the entities in this lattice distinguishes simple cubic and cubic lattices with centered faces. The microscopic structure of the crystal conditions some of its macroscopic properties, including its Volumic mass. For each of the two networks (simple cubic and cubic with faces centered): - represent the mesh in cavalier perspective; - calculate the compactness in the case spherical chemical entities tangents;		

	- count the atoms per cell and calculate the density of the crystal. A compound with a given chemical formula can crystallize under different types of structures which have different macroscopic properties. Thus minerals are characterized by their chemical composition and their crystalline organization. -A rock is formed from the association of crystals of the same mineral or several minerals. Crystalline structures also exist in biological organisms (shell, skeleton, calculus renal, etc). ● Distinguish, in terms of scale and spatial organization, mesh, crystal, mineral, rock. ● Identify them on a sample or a picture. In the case of amorphous solids, the stacking entities is done without geometric order. It's the case glass. Some volcanic rocks contain glass, resulting from the very rapid solidification of lava. ● Connect the structure amorphous or crystalline of a rock and sound conditions cooling. 1.3 - A complex structure: the living cell Knowledge Know-how: ● The discovery of the cellular unit is linked to the invention of the microscope. ● The observation of similar structures in many organizations has led to state the general concept of cells and to construct the cell theory. More recently, the invention of the microscope electronics allowed the exploration of inside the cell and understanding the link between molecular and cellular scale.		

	The students: ● Analyze and interpret documents history relating to cell theory. ● Locate the orders of magnitude: atom, molecule, organelle, cell, organism. The cell is a space separated from the outside through a plasma membrane. This membrane consists of a bilayer lipid and protein. The structure membrane is stabilized by the character hydrophilic or lipophilic of certain constituent molecules. ● Link the scale of the cell and that of the molecule (example of the membrane plasma). ● Schematize the plasma membrane from molecules whose parts hydrophilic/lipophilic are identified.		

Science & Laboratory- tech path, specialist courses, High School		Environment and Modern Agriculture	Healthful Eating
-References for teaching -Evaluation	● This optional course offers stimulating and innovative themes and promotes project dynamics. This approach allows the progressive development of autonomy and the expression of imagination and creativity. The use of sensors and microcontrollers, the use of digital tools such as the spreadsheet-grapher, data acquisition and processing, simulation and coding are privileged. ● The project approach begins with the identification of a problem specifying the resolution of which constitutes an objective for the students to achieve.	✔	✔

	In this context, the students are led: ● to reinvest knowledge and know-how acquired but also to identify and acquire new ones; ● to identify and implement all the tasks to be performed in which all students can get involved and play an active role within a team; ● to communicate about their work. -This teaching contributes to the development of oral skills through especially the practice of argumentation. -This leads to clarifying one's thinking and explaining their reasoning in a convincing way. -This form of learning reinforces skills related to the scientific process and those related to teamwork. ● The student must become aware of his abilities to solve problems by evolving in an experimental context thanks to an evaluation that supports their learning and helps them to specify its orientation project. This assessment is based on the table of scientific process skills as identified in the program of physics-chemistry of general and technological second. The teacher also provides students with the necessary elements so that they can assess their progress.		
Earth's atmosphere	Students will be able to Identify, define, analyze and interpret: ● Air - Air quality, pollution ● Solar radiation ● Rainbows, halos. ● Greenhouse effect. ● Sunscreen. ● Meteorology - Atmospheric phenomena, rain, snow, cyclones.	✔	

	● Weather forecast. ● Coupling atmosphere / geosphere ● Water cycle. ● Ocean/atmosphere gaseous exchanges. ● Ocean/atmosphere energy exchanges.		
Uses of nature's resources	Students will be able to Identify, define, analyze and interpret: ● Water - Water quality, water treatments. ● Desalination ● Energy resources - ● Renewable - Solar energy, solar cells, solar ovens and water heaters. - Wind and hydropower. - Biomass. ● Agro-resources, production and use - Extraction of natural substances. - Sugars, oils, vegetable proteins. - Active principles, semi-synthesis, drugs. - Perfumes and essential oils. - Phytosanitary products, dyes. - Agro-fuels, biopolymers.	✔	
Blends and Formulation	Students will be able to Identify, define analyze, and interpret: ● Perfumes and cosmetics - Solvents. - Textures. - Emulsions and powders. - Essential oils. - Chromatography. ● Medications		✔

	- Active ingredient, excipient. - Encapsulation. - Nanoparticles. ● Food additives - Sweeteners. - Preservatives and antioxidants. - Dyes. - Aromas. - Acidifiers.		
Risk prevention	Students will be able to Identify, define, analyze, and interpret: ● Domestic waste and industrial - Sorting, separation techniques. - Effluent treatment. - Storage. ● Risk prevention chemical and biological - Aseptic techniques. - Filters, activated carbon, dust extractor. - Domestic products and risks. ● Chemistry and environment - Volatile organic compounds. - Green solvents. - Biomolecules. ● Security and waves - Radiography. - Radioactivity. - Acoustics, sound level. - Mobile phone.	✔	

SVT Sciences, High School		Environment and Modern Agriculture	Healthful Eating
1. The Earth, life and the organization of living organisms 2. Eukaryotic cell divisions 3. DNA replication	Students will be able to: ● Make and observe microscopic preparations of eukaryotic cells during division, stained to show the chromosomes. - From images, create karyotypes using software and analyze them. - Identify, extract and use information to characterize the phases of a eukaryotic cell cycle. ● Present a historical approach to the identification or chemical composition of chromosomes. ● Calculate the total length of a DNA molecule in a chromosome and of the whole DNA from a human cell; compare with the diameter of a cell. Calculate the DNA length of all human cells. ● Use the information from a historical experience that has shown that the replication is a semi-conservative mechanism. ● Use software or analyze documents to understand the mechanism semi-conservative replication.	✔	✔

	● Observe images showing DNA molecules being replicated. ● Calculate the speed and duration of replication in a bacterium (E. coli) and in a eukaryotic. ● Design and/or carry out a PCR reaction (polymerase chain reaction) by determining the duration of each step of the PCR cycle. Calculate the number of copies obtained after each cycle. DNA mutations and genetic variability Students will be able to: ● Design and carry out a protocol to study the action of a mutagenic agent (for example UV) on cell survival and on the appearance of mutants. Quantify. ● Identify and use information to show the influence of agents physical (radiation) or chemical (molecules) mutagens. ● Identify and use information to characterize mutations. ● Identify and exploit information on allelic diversity within populations (e.g. human). ● List and exploit research information on the genomes of the trios (father, mother, child) in order to get an idea of the frequency and nature of the mutations spontaneous in humans. ● Use databases to relate mutations and their effects. Human history read in its genome Students will be able to: ● Search and exploit documents showing the first human genome sequence. ● Explore some strategies and computational tools for sequence comparisons between individual genomes.		

	• Calculate the number of successive human generations in one thousand, ten thousand and one hundred thousand years and deduce the theoretical number of ancestors of each of us on these dates. • Research and exploit documents on the genomes of Neanderthals and/or Denisovans. • Search and exploit documents showing the existence of Neanderthal alleles in current human genomes. The expression of the genetic heritage Students will be able to: • Calculate the number of possible combinations of sequences of n nucleotides of length as n grows. • Compare to a binary code used in computing. • Calculate the number of possible combinations of sequences of n amino acids when n grows. • Compare to the calculation made for DNA. • Carry out a historical approach or a documentary study on the sequencing of macromolecules (proteins, RNA and DNA). • Carry out a historical process or a documentary study to understand how messenger RNAs were discovered. • Search and exploit documents showing the synthesis and the presence of RNA in different cell types or under different experimental conditions. • Study historical experiments to understand how the genetic code has been elucidated. • Design an algorithm for translating an RNA sequence and possibly the program in a computer language (e.g. Python). • Search and exploit documents showing the synthesis of heterologous proteins after transgenesis (illustrating the universality of the genetic		

	code). ● Characterize, using an example, the different scales of a phenotype (molecular, cell, organism). Enzymes, biomolecules with catalytic properties Students will be able to: ● Study the enzyme-substrate relationships at the active site level using modeling software molecular. ● Design and carry out experiments using enzymes and allowing the identification of their specificities. ● Study expression profiles of differentiated cells showing their equipment enzymatic. ● Study the enzyme-substrate interaction by comparing the initial rates of the reactions and varying either the substrate concentration; either in enzymes. Use tangents to calculate the initial velocity. The structure of the earth globe Students will be able to: ● Connect maps and/or relief visualization software with the curve bimodal distribution. ● Use geological maps (world geological map) as data direct observation (VEMA fault, boreholes) to identify the compositions of the crust oceanic and continental. ● Use the map of France to the millionth to identify the distribution of the main types of rocks on the territory. ● Perform density measurements on continental and oceanic rocks. ● Conduct a comparative observation of the rocks of the oceanic and continental crusts (composition, structure, etc.).		

	The contribution of seismological and thermal studies to knowledge of the terrestrial globe Students will be able to: ● Consult and use a seismological database. ● Process seismological data. ● Design analog modeling and perform measurements using devices computer-assisted experimentation, or microcontrollers to study the propagation of waves through materials of a different petrographic nature or different mechanical behavior. ● Study by computer-assisted experimentation and/or analog modeling the parameters at the origin of the modifications of the speed of the waves (nature of the material, its rigidity/plasticity, effect of temperature). ● Study the deep propagation of waves (shadow zone, highlighting of discontinuities) using the laws of Snell-Descartes and/or implementing a model analog to show gray areas. ● Use velocity and density profiles from the PREM model. ● Analyze temperature increase curves as a function of depth (mines, drilling); cross thermal data, chemical composition data, with seismic data to understand the model of the thermal structure of the Earth. ● Calculate the temperature at the center of the Earth using the geothermal gradient of the surface and assess its validity with regard to the physical state of the materials. ● Create analog models to understand conduction and convection. ● Show the existence of thermal heterogeneities in the mantle using data from seismic tomographies, while drawing attention to the amplitude of the variations by comparison to the PREM model.		

	The dynamics of the lithosphere Students will be able to: ● Identify lithospheric plates using seismic data. ● Analyze travel speed databases (laser measurement, GPS measurements). ● Analyze and relate the surface geothermal flow and the context geodynamics from surface geothermal flow maps. ● Study magnetic or sedimentary data allowing to establish the divergence of either side of the ridge. ● Study of data on ridges (bathymetry, boreholes, etc.). The dynamics of divergence zones Students will be able to: ● Studies of the rock outcrop of basalts/gabbros/peridotites and their equivalents hydrated (serpentinite, hornblende gabbros, etc.). ● Calculation of the average density of the whole crust - lithospheric mantle according to its thickness, then its age using an empirical law linking thickness and age. The dynamics of convergence zones Students will be able to: ● Analyze the results of different methods to identify the Wadati-Benioff plane. ● Link the mineralogy of the rocks (presence of hydroxylated minerals) put in place (andesite, rhyolite, granites) and the hydration state of the magma. ● Use the peridotite phase diagram to show the effects of hydration.		

	• Compare the mineralogy of samples illustrating the dehydration of the lithosphere (blue shale; eclogite). • Discuss the relationship between accretion rate and percentage of subduction at the boundaries of plates. • Considering the average density of the lithosphere and that of the asthenosphere, determine the thickness and age of the lithosphere that would induce a gravity imbalance. • Compare the values to the situations actually observed. Collision zones Students will be able to: • Identify, extract and organize field data, among other things, during an outing. • Observe the ECORS profiles (Study of the Continental and Oceanic Crust by Reflection Seismic). • Locate at different scales, simple clues of tectonic changes, shortening and stacking (e.g. with string data Himalayan).		
Contemporary issues of the planet Ecosystems: dynamic interactions between living things and between them and their environment	Students will be able to: • Extract and organize information, resulting from direct observation in the field, to be able to describe the elements and interactions within a system. To understand the importance of the reproducibility of sampling protocols to monitor the spatio-temporal dynamics of a system. • Use simple sampling tools to highlight the distribution of certain species depending on the environmental conditions. • Describe with the help of observations and microscopic preparations and experiments the modalities of certain interactions (example:	✔	

	mycorrhizal symbiosis, parasitism with a gall on a leaf, etc.). ● Know how to represent a network of biotic interactions in order to highlight its structure (links) and its richness. ● Measure the biomass and production of an ecosystem at different levels of the network trophic. ● Build a simplified biogeochemical cycle with these reservoirs and these flows (we recommend the carbon) in which the ecosystem intervenes. ● Calculate a material balance, considering the ecosystem as open. Humanity and ecosystems: ecosystem services and their management Students will be able to: ● Include the human species in the constructed representation of the network of interactions. ● Become aware of our interdependence with the living world around us. Understand that most of today's forests (and other ecosystems) also reflect a development project. ● Collect and analyze data before, during and after the disruption of an ecosystem (fire, destruction, etc.). ● Identify, extract and organize information, particularly historical and field information, to identify the impacts of human activities on ecosystems. ● Implement a project approach (documentary research, collection and treatment data, etc.) to understand ecosystem services (its actors and its mechanisms) and propose solutions for the sustainable management of ecosystems. ● Know the existing debates around the monetization of ecosystem services. ● Understand the importance of the scientific approach in an		

	enlightened management and of ecosystems in order to sustainably benefit from ecosystem services. ● Become aware of human responsibility and debate face to face the environment and the living world.		
Human body and health Mutations and health	Students will be able to: ● List, extract and organize information to: • establish the genetic origin of a disease or syndrome from trees genealogy; • predict the genetic risks of new generations by calculating their probability (genetic counseling). ● Identify, extract and organize information relating to a genetic disease monogenic sufficiently frequent for us to have a catalog of alleles linking a genotype to a phenotype. Cystic fibrosis is suggested due to the diversity of mutated alleles in the population, but the professor may prefer other examples (sickle cell disease, -thalassemia, Duchenne muscular dystrophy, etc.). ● Identify, extract and organize information relating to medical treatments possible depending on the variety of pathological manifestations observed (affected tissues, average age of onset of symptoms, severity of the syndrome, etc.). Genetic heritage and health Students will be able to: ● List, extract and organize information to identify: • the multigenic origin of certain pathologies; • the influence of environmental factors. ● Identify, in the case of a disease with multifactorial causation, the principles, interests and the limits of epidemiology (descriptive or analytical) and its methods (study of cohorts and controls). ● Conduct a simple statistical analysis on health data; map a pathology		✔

	by visualizing it on a geoscientific information system, for example. ● Critically apprehend the conditions of validity of statements read or understood concerning the responsibility of a gene or an environmental factor in the development of a disease. ● Knowing how to explain one's behavior in the face of a health risk in order to exercise one's individual or collective responsibility. Genome alterations and cancerization Students will be able to: ● List, extract and organize information to identify the factors of cancerization (mutagens, viral infections, genetic susceptibility). ● Estimate the increase in the mutation rate induced by a mutagen. ● Identify the multiple causes that may contribute to the development of certain cancers pulmonary, hepatic, skin) and possible preventive measures (limitation of exposure to UV rays and various chemical pollution, anti-smoking policy, etc.). ● Identify the importance, in terms of public health, of certain viruses associated with cancerization (hepatitis B, papillomavirus) and know the methods of prevention possible (vaccination). Variation génétique bactérienne et résistance aux antibiotiques Students will be able to: ● Study an experimental protocol to show the sensitivity or resistance of microorganisms to different antibiotics. ● Design and implement an experimental protocol to study the appearance of antibiotic-resistant mutants from a culture of susceptible bacteria, in the expected security conditions. ● List, extract and organize information to: • identify the sensitivity or resistance of microorganisms to different		

	antibiotics; • calculate the rate of appearance of resistance in a population; • analyze databases on antibiotic resistance in France and in Europe (type, incidence in populations, relationships with health practices and breeding, etc.). ● Identify, in an example, the interest of applying evolutionary reasoning in materia medica (taking into account the competitive advantage of resistance fighters). How the human immune system works Students will be able to: ● Identify, extract and exploit information on cells and molecules involved in the acute inflammatory reaction. ● Observe and compare a histological section or documents under microscopy before and during an acute inflammatory reaction. ● Observe phagocytosis by immune cells (macrophages). ● Identify, extract and exploit information, including experimental information, on the effects of analgesic and anti-inflammatory drugs. Adaptive immunity Students will be able to: ● Identify, extract and exploit information, including experimental information, on cells and molecules involved in adaptive immunity. ● Estimate the number and diversity of cells and molecules necessary for immunity adaptive. Insist on the notion of combinatorics. ● Design and carry out an experiment to characterize the specificity of the molecules involved in adaptive immunity. ● Design and carry out experiments to highlight the immunoglobulins		

	during the immune reaction. The use of adaptive immunity in human health Students will be able to: ● Identify, extract and exploit historical information on the principle of vaccination and its success against major pandemics (smallpox, poliomyelitis, etc.). ● Identify, extract and use information on the composition of a vaccine and its instructions for use (vaccination reminder). ● Model and calculate the effective vaccination coverage rate for a vaccine (by example: measles). ● Show that certain vaccines can indirectly fight against cancers (hepatitis B, HPV). ● Become aware that vaccination is a process in which the benefit collective is very much higher than the individual vaccination risk. ● Identify, extract and exploit information on the way in which data are obtained from monoclonal antibodies. ● Identify, extract and exploit information on the use of monoclonal antibodies in the treatment of cancers (for example: breast and colon), including in its economic components.		