France Educational Curriculum Alignment

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

Physics & Chemistry, High School		Environment and Modern Agriculture	Healthful Eating
Constitution and transformations of matter	1. Constitution of matter from the macroscopic to the microscopic scale ● The objective of this part is to approach the two scales of description of the matter which go explain its physical and chemical properties. ● The concepts of species and entity chemicals introduced at college are thus enriched. ● The chemical species is at the center of the macroscopic description of matter and makes it possible to define and characterize pure substances and mixtures, including aqueous solutions. ● A quantitative approach is approached with the concept of composition of a mixture and mass concentration (essentially expressed in g.L-1) of a solute in a solution watery. ● At the atomic level, the description of chemical entities is completed by the orders of magnitude of size and mass of the atom and the nucleus and by the model of the procession electronic for the first three lines of the periodic table. ● The stability of noble gasses, associated with their electronic configuration, makes it possible to account for the existence of monatomic ions and molecules.	✔	✔

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	● Second, the Lewis diagrams are provided and interpreted. ● The change of scale between the macroscopic and microscopic leads to a first approach to the amount of matter (in moles) in a sample of matter using the definition of mole, a mole containing exactly 6.022 140 76 × 1023 elementary entities. ● An essential place is given to modeling, whether at the macroscopic level or at the microscopic level, from real systems chosen in the fields of food, environment, health, materials, etc. Concepts studied in college (cycle 4) ● Macroscopic scale: chemical species, pure substances, mixtures, air composition, density, properties of changes of state, solutions: solubility, miscibility. ● Microscopic scale: molecules, atoms and ions, constituents of the atom (nucleus and electrons) and nucleus (neutrons and protons), chemical formula of a molecule, O_2 formulas, H_2, N_2, H_2O, CO_2. -Concepts and content -Required capacities -Experimental activities supporting training Students will be able to: ● Describe and characterize matter at the macroscopic scale. Pure bodies and mixtures daily. Chemical species, pure body, mixtures of species chemicals, homogeneous mixtures and heterogeneous. ● Cite common examples of pure bodies and homogeneous and heterogeneous mixtures. ● Identify chemical species in a material sample by physical measures or chemical tests. ● Identify, from reference values, a species chemical by its temperatures of change of state, its density or by chemical tests.		

	• List common chemical tests for the presence of water, dihydrogen, dioxygen, carbon dioxide. • Quote the value of the density of liquid water and compare it with those of other pure substances and mixtures. • Distinguish a mixture from a pure substance from data experimental. • Measure a state change temperature, determine the density of a sample, perform thin layer chromatography, implement chemical tests, to identify a chemical species and, if applicable, qualify the mixture sample. Mass composition of a mix. Volume composition of air. • List the approximate composition of air and the order of magnitude of the value of its density. • Establish the composition of a sample from data experimental. • Measure volumes and masses to estimate the composition of mixtures. Mathematical ability: using percentages and fractions. Aqueous solutions, an example of mixing. Solvent, solute. Mass concentration, maximum concentration of a solute. • Identify solute and solvent from composition or the procedure for preparing a solution. • Distinguish between the density of a sample and the mass concentration of a solute within a solution. • Determine the value of the mass concentration of a solute from the procedure for preparing a solution by dissolution or by dilution. • Measure masses to study volume variability measured by a piece of glassware; choose and use glassware suitable for preparing a solution by dissolution or by dilution. Dosage by calibration. Determine the value of a concentration by mass and of a maximum concentration based on experimental results. • Determine the value of a mass concentration using a calibration scale (hue scale or density measurement).		

	• Mathematical ability: use a quotient quantity to determine the numerator or denominator. Modeling of matter at the microscopic scale From macroscopic to microscopic, of the species chemical to the entity. Molecular species, species ions, electroneutrality of the material at the level macroscopic. • Define a chemical species as a collection of a very high number of identical entities. Exploiting the electroneutrality of matter to associate ionic species and cite compound formulas ionic. Chemical entities: molecules, atoms, ions. • Use the appropriate term among molecule, atom, anion and cation to qualify a chemical entity from a given chemical formula. The nucleus of the atom, seat of its mass and its identity. Atomic number, number of mass, conventional writing: $ZX\ A$ or $X\ A$ Chemical element. Mass and electric charge of an electron, a proton and a neutron, electric charge elementary, neutrality of the atom. • Quote the order of magnitude of the value of the size of an atom. • Compare the size and mass of an atom and its core. • Establish the conventional writing of a kernel from its composition and vice versa. • Math skills: performing the quotient of two quantities to compare them. • Use operations to powers of 10. Express the values of the quantities in scientific writing. The electronic procession of the atom defines its chemical properties. Electronic configuration (1s, 2s, 2p, 3s, 3p) of an atom in the state fundamental and position in the periodic table (s and p blocks). Valence electrons. Chemical families. • Determine the position of the element in the array periodic from the configuration data electronics of the atom in the ground state. • Determine the valence electrons of an atom (Z ⩽ 18) from its		

	electronic configuration in the state fundamental or its position in the periodic table. ● Associate the notion of chemical family with the existence of common properties and identify the family of gasses nobles. Towards more stable entities chemically. Chemical stability of noble gasses and electronic configurations associated. Monatomic ions. ● Establish the link between chemical stability and configuration valence electrons of a noble gas. ● Determine the electric charge of monatomic ions currents from the periodic table. ● Name the ions: H + , Na+ , K+ , Ca2+, Mg2+, Cl- , F- ; to write their formula from their name. -Molecules. Lewis model of the bond of valence, Lewis diagram, bonding and non-binding doublets. Binding energy approach. Students will be able to: ● Describe and use the Lewis diagram of a molecule to justify the stabilization of this entity, with reference to noble gasses, compared to isolated atoms ($Z \leqslant 18$). ● Qualitatively associate the energy of a bond between two atoms with the energy necessary to break this bond. ● Count entities in a material sample. Number of entities in a sample. Definition of mole. Amount of matter in a sample. ● Determine the mass of a feature from its formula gross and the mass of the atoms that compose it. ● Determine the number of entities and the amount of material (in mol) of a species in a sample mass. ● Model the transformations of matter and energy transfer		

	-The objective of this part is to identify and distinguish the three types of processing matter, to model them by reactions and to write the adjusted equations using the laws appropriate storage. A first approach to the energies brought into play during these three types of transformations makes it possible to show that the energy transferred during a transformation depends on the quantities of matter of the species involved. -The study of chemical transformations, begun in college, is supplemented by the notions of stoichiometry, spectator species and limiting reactants. Analysis of the evolution of a system to model its chemical transformation by a reaction illustrates a process of modeling at the macroscopic level. It requires implementing a process rigorous experimental test to pass: ● a description of the visible modifications; ● the chemical species, present in the initial state and which have reacted; ● to those, present in the final state and which have been formed; ● and finally, writing a reaction giving the best account of the changes observed during macroscopic level. For the transformations to be more concrete, examples from life are offered: combustion, corrosion, descaling, syntheses of aroma or perfume, etc. -Concepts covered in college (cycle 4) -Physical transformations: change of state, conservation of mass, variation of volume, state change temperature. -Chemical transformations: conservation of mass, redistribution of atoms, notion of chemical equation, reactions between acidic and basic species in solution, reactions of an acid species on a metal, pH measurement.		

	Concepts and content Required capacities Experimental activities supporting training -Physical transformation -Symbolic writing of a change of state. -Microscopic modeling of a change of state. -Physical transformations endothermic and exothermic. -State changes in energy and apps. Students will be able to: ● Cite examples of changes in the physical state of daily life and in the environment. ● Establish the writing of an equation for a change of state. ● Distinguish between fusion and dissolution. ● Identify the direction of heat transfer during a change of state and link it to the term exothermic or endothermic. ● Exploit the relationship between the energy transferred during a change of state and the specific energy of change status of the species. ● Relate the energy exchanged to the mass of the species that changes state. ● Quote the value of the density of liquid water and compare it with those of other pure substances and mixtures. ● Distinguish a mixture from a pure substance from data experimental. ● Measure a state change temperature, determine the density of a sample, perform thin layer chromatography, implement chemical tests, to identify a chemical species and, if applicable, qualify the mixture sample. Mass composition of a mix. Volume composition of air.		

	• List the approximate composition of air and the order of magnitude of the value of its density. • Establish the composition of a sample from data experimental. • Measure volumes and masses to estimate the composition of mixtures. Mathematical ability: using percentages and fractions. Aqueous solutions, an example of mixing. Solvent, solute. Mass concentration, maximum concentration of a solute. • Identify solute and solvent from composition or the procedure for preparing a solution. • Distinguish between the density of a sample and the mass concentration of a solute within a solution. • Determine the value of the mass concentration of a solute from the procedure for preparing a solution by dissolution or by dilution. • Measure masses to study volume variability measured by a piece of glassware; choose and use glassware suitable for preparing a solution by dissolution or by dilution. Dosage by calibration. • Determine the value of a concentration by mass and of a maximum concentration based on experimental results. • Determine the value of a mass concentration using a calibration scale (hue scale or density measurement). Mathematical ability: use a quotient quantity to determine the numerator or denominator. -Modeling of matter at the microscopic scale from macroscopic to microscopic, of the species chemical to the entity. -Molecular species, species ions, electroneutrality of the material at the level macroscopic. Students will be able to: • Define a chemical species as a collection of a very high number of identical entities.		

	• Exploit the electroneutrality of matter to associate ionic species and cite compound formulas ionic. Chemical entities: molecules, atoms, ions. Students will be able to: • Use the appropriate term among molecule, atom, anion and cation to qualify a chemical entity from a given chemical formula. • Identify the nucleus of the atom, seat of its mass and its identity. • Identify the Atomic number, number of mass, conventional writing: $ZX A$ or $X A$. -Chemical element. -Mass and electric charge of an electron, a proton and a neutron, electric charge elementary, neutrality of the atom. Students will be able to: • Quote the order of magnitude of the value of the size of an atom. • Compare the size and mass of an atom and its core. • Establish the conventional writing of a kernel from its composition and vice versa. Math skills: performing the quotient of two quantities to compare them. • Use operations to powers of 10. Express the values of the quantities in scientific writing. The electronic procession of the atom defines its chemical properties. Electronic configuration (1s, 2s, 2p, 3s, 3p) of an atom in the state fundamental and position in the periodic table (s and p blocks).		

	-Valence electrons. -Chemical families. ● Determine the position of the element in the array periodic from the configuration data electronics of the atom in the ground state. ● Determine the valence electrons of an atom ($Z \leqslant 18$) from its electronic configuration in the state fundamental or its position in the periodic table. ● Associate the notion of chemical family with the existence of common properties and identify the family of gasses nobles. -Towards more stable entities chemically. -Chemical stability of noble gasses and electronic configurations associated. -Monatomic ions. Students will be able to: ● Establish the link between chemical stability and configuration valence electrons of a noble gas. ● Determine the electric charge of monatomic ions currents from the periodic table. ● Name the ions: H^+, Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, F^-; to write their formula from their name. -Molecules. -Lewis model of the bond of valence, Lewis diagram, bonding and non-binding doublets. -Binding energy approach. Students will be able to: ● Describe and use the Lewis diagram of a molecule to justify the stabilization of this entity, with reference to noble gasses, compared to isolated atoms ($Z \leqslant 18$).		

	• Qualitatively associate the energy of a bond between two atoms with the energy necessary to break this bond. • Count entities in a material sample. -Number of entities in a sample. -Definition of mole. -Amount of matter in a sample. Students will be able to: • Determine the mass of a feature from its formula gross and the mass of the atoms that compose it. • Determine the number of entities and the amount of material (in mol) of a species in a sample mass. -Modeling the transformations of matter and energy transfer -The objective of this part is to identify and distinguish the three types of processing matter, to model them by reactions and to write the adjusted equations using the laws appropriate storage. A first approach to the energies brought into play during these three types of transformations makes it possible to show that the energy transferred during a transformation depends on the quantities of matter of the species involved. -The study of chemical transformations, begun in college, is supplemented by the notions of stoichiometry, spectator species and limiting reactants. Analysis of the evolution of a system to model its chemical transformation by a reaction illustrates a process of modeling at the macroscopic level. It requires implementing a process rigorous experimental test to pass: - a description of the visible modifications; - the chemical species, present in the initial state and which have reacted; - to those, present in the final state and which have been formed;		

	- and finally, writing a reaction giving the best account of the changes observed during macroscopic level. -For the transformations to be more concrete, examples from life are offered: combustion, corrosion, descaling, syntheses of aroma or perfume, etc Concepts covered in college (cycle 4) -Physical transformations: change of state, conservation of mass, variation of volume, state change temperature. -Chemical transformations: conservation of mass, redistribution of atoms, notion of chemical equation, reactions between acidic and basic species in solution, reactions of an acid species on a metal, pH measurement. 1. Concepts and content 2. Required capacities 3. Experimental activities supporting training 4. Physical transformation 5. Symbolic writing of a change of state. 6. Microscopic modeling of a change of state. 7. Physical transformations endothermic and exothermic. 8. States change energy and apps. Students will be able to: ● Cite examples of changes in the physical state of daily life and in the environment. ● Establish the writing of an equation for a change of state. ● Distinguish between fusion and dissolution. ● Identify the direction of heat transfer during a change of state and link it to the term exothermic or endothermic. ● Exploit the relationship between the energy transferred during a		

	change of state and the specific energy of change status of the species. ● Relate the energy exchanged to the mass of the species that changes state. -Chemical transformation -Macroscopic modeling of a transformation by a reaction chemical. -Symbolic writing of a reaction chemical. -Notion of spectator species. -Stoichiometry, limiting reactants. -Chemical transformations endothermic and exothermic. Students will be able to: ● Model, from experimental data, a transformation by a reaction, establish the equation of associated reaction and adjust it. ● Identify the limiting reactant from the quantities of matter reactants and the reaction equation. ● Determine the limiting reagent during a transformation total chemical, from species identification chemicals present in the final state. ● Model, by writing a reaction equation, the combustion of carbon and methane, corrosion of a metal by an acid, the action of an acid on the limestone, the action of hydrochloric acid on sodium hydroxide in solution. ● Follow the evolution of a temperature to determine the endothermic or exothermic character of a chemical transformation and study the influence of mass limiting reactants.		

	-Mathematical ability: use proportionality. -Synthesis of a chemical species present in nature. Students will be able to: ● Establish, from experimental data, that a species chemical synthesized in the laboratory may be identical to a chemical species synthesized in nature. ● Draw the captioned diagram of a reflux set-up and a thin-layer chromatography. ● Implement a reflux assembly to synthesize a chemical species present in nature. ● Implement thin layer chromatography to compare a synthesized species and a species extracted from nature. -Nuclear transformation -Isotopes. -Symbolic writing of a nuclear reaction. -Energy aspects of nuclear transformations: Sun, nuclear center. Students will be able to: ● Identify isotopes. ● Connect the converted energy in the Sun and in a power plant nuclear to nuclear reactions. ● Identify the physical, chemical or nuclear nature of a transformation from its description or from a writing symbolic modeling the transformation.		

Movement and interactions	- Mechanics is a very rich field from the point of view of observation and experience, but also from a conceptual and methodological point of view. She permits to illustrate in a way the modeling approach is relevant. Two inherent characteristics of learning mechanics deserve to be underlined: - the omnipresence of situations of movement which made it possible to anchor students spontaneous reasoning, often operative but erroneous and therefore deconstruct; - the necessary mastery of mathematical knowledge and know-how which conditions access to the purposes and concepts specific to mechanics. - This theme prepares the implementation of the fundamental principle of dynamics; it is in effect constructing a precise link between applied force and speed variation. If the writing of the program is voluntarily centered on the concepts and methods, the contexts of study or application are numerous and varied: transport, aeronautics, space exploration, biophysics, sport, geophysics, planetology, astrophysics or even history of science. - During the experimental activities, it is possible to use the current tools of capture and image processing but also the sensors present in smartphones. The simulation activity can also be used to study a system in movement, which provides an opportunity to develop programming skills. Beyond the purposes specific to mechanics, this field allows the development of temporal systems, whatever they are. Thus, the establishment of balance sheets is an important objective of training for and through physics-chemistry, in that it builds skills directly reusable in other disciplines (economics, ecology, etc.).	✔	✔

	-Concepts covered in college (cycle 4) -Speed (direction, sense, value), uniform, rectilinear, circular movements, relativity of movements, interactions, forces, scalar expression of the law of universal gravitation, force of gravity. -Concepts and content -Required capacities -Experimental activities supporting training Students will be able to: ● Describe a movement System. ● Characterize scales of a system. ● Reference and related movement. ● Identify relevant temporal and spatial scales description of a movement. ● Choose a reference frame to describe the movement of a system. ● Explain, in the case of translation, the influence of choice of frame of reference on the description of the movement of a system. Description of the movement of a system by that of a point. Position. Path of a point. ● Describe the motion of a system by that of a point and characterize this modeling in terms of loss information. ● Characterize different trajectories. Numerical ability: representing positions sequences of a system modeled by a point during from a one-dimensional or two-dimensional evolution to using a programming language.		

	-Vector displacement of a point. -Mean velocity vector of a point. -Velocity vector of a point. -Straight movement. Students will be able to: ● Define the average speed vector of a point. ● Approach the velocity vector to a point using the vector shift MM' , where M and M' are the positions successive at neighboring instants separated by Δt; the represent. ● Characterize a uniform rectilinear movement or not uniform. ● Produce and/or use a video or a chronophotography of a moving system and represent velocity vectors; describe the variation of velocity vector. ● Numerical ability: represent velocity vectors of a system modeled by a point during a movement using a programming language. ● Math skills: representing vectors. Use algebraic quantities. ● Model an action on a system. Modeling of an action by a strength. ● Model the action of an external system on the system studied by a force. ● Represent a force by a vector having a norm, a direction, a meaning. -Principle of reciprocal actions (Newton's third law). Students will be able to: ● Use the principle of reciprocal actions. Characteristics of a force. Examples of strengths: - interaction strength gravitational; - weight ; - force exerted by a support and by a wire. ● Distinguish between remote actions and contact actions.		

	- Identify the actions modeled by forces whose mathematical expressions are known a priori. - Use the vector expression of the interaction force gravitational. - Use the vector expression of the weight of an object, approximated by the gravitational interaction force exerted on this object on the surface of a planet. - Qualitatively represent the force modeling the action of a support in simple cases relating to statics. -Principle of inertia -Model of the material point. -Principle of inertia. -Case of situations of immobility and rectilinear movements uniforms. Case of free fall at a dimension. Students will be able to: - Exploit the principle of inertia or its contrapositive to infer information either about the nature of the movement of a system modeled by a material point, or on the strengths. - Connect the variation between two neighboring times of the vector speed of a system modeled by a material point at the existence of external actions modeled by forces whose sum is non-zero, especially in the case of a one-dimensional free fall motion (with or without initial velocity).		

	-Emission and perception of sound -The “Acoustics” part aims to consolidate college knowledge: diagrams explanations of transmission, propagation and reception are now offered. -The study perception of a sound is an opportunity to introduce students to the reading of a non-linear scale and make them aware of the dangers associated with noise exposure. -There are many fields of application: music, medicine, sonar, audiometry, design sound, etc Investigation tools such as sensors (possibly those of a smartphone), microcontrollers, software for analyzing or simulating a sound signal, are also very varied and illustrate the operational nature of physics and chemistry. Concepts covered in college (cycle 4): ● Spread speed. ● Notion of frequency: audible sounds, infrasound and ultrasound. -Concepts and content -Required capacities -Experimental activities supporting training -Emission and propagation of a signal sound Students will be able to: ● Describe the principle of the emission of an audible signal by the vibration of an object and the interest of the presence of a soundboard. ● Explain the role played by the material environment in the sound signal propagation phenomenon. Speed of propagation of a signal sound. ● Quote an approximate value of the speed of propagation of a sound		

	signal in the air and compare it to other commonly encountered speed values. ● Measure the speed of a sound signal. Periodic sound signal, frequency and period. Relationship between period and frequency. ● Define and determine the period and frequency of a signal sound, in particular from its temporal representation. ● Use a measurement chain to get information on the vibrations of an object emitting a sound signal. ● Measure the period of a periodic beep. ● Use a device comprising a microcontroller to produce an audible signal. ● Math skills: identify a function periodically and determine its period. Perception of sound: link between frequency and pitch; link between signal form and timbre; link qualitative between amplitude, intensity sound and loudness level. Scale of intensity levels sound. ● List the frequency ranges of audible sounds, infrasound and ultrasound. ● Qualitatively relate the frequency to the pitch of a sound audible. ● Qualitatively link sound intensity and intensity level sound. ● Use a sound intensity level scale and quote the dangers inherent in noise exposure. ● Record and characterize a sound (pitch, timbre, level sound intensity, etc.) using an experimental device dedicated, a smartphone, etc.		

	Vision and image -The "Optics" part aims to consolidate the model of the light ray, to introduce the notion of spectrum and to show that the phenomena of reflection and refraction are well described by mathematical relationships. The program also offers a first approach to the notion of image of an object and its formation. -Many fields of application are concerned: human vision, photography, astrophysics, scientific imagery, graphic and performing arts. This part of the program is the source of numerous demonstrative and quantitative experiments. Concepts covered in college (cycle 4): ● Light: sources, propagation, speed of propagation. ● Model of the light ray. ● Concepts and content Required capacities ● Experimental activities supporting training ● Straight propagation of the light. ● Speed of the spread of light in a vacuum or in the air. Students will be able to: ● Quote the value of the speed of light in vacuum or in the air and compare it to other speed values commonly encountered. -White light, colored light. -Emission spectra: spectra thermal sources, line spectra. -Wavelength in vacuum or in the air. ● Characterize the spectrum of radiation emitted by a body hot. ● Characterize monochromatic radiation by its wavelength in vacuum or air. ● Use a line spectrum. Snell-Descartes laws for the reflection and refraction. Index optics of a material medium.		

	- Exploit the Snell-Descartes laws for reflection and refraction. - Test the Snell-Descartes laws from a series of measurements and determine the refractive index of a medium. Dispersion of white light by a prism or a grating. - Describe and explain qualitatively the phenomenon of dispersion of light by a prism. - Produce and exploit emission spectra obtained at using a dispersive system and a spectrum analyzer. Lenses, lens model thin convergent: foci, focal distance. Real image of a real object at through a thin lens convergent. Magnification. The eye model of the reduced eye. - Characterize the foci of a thin converging lens using the light ray model. - Use the light ray model to determine graphically the position, size and direction of the image of a real plane object given by a thin lens convergent. - Define and geometrically determine a magnification. - Model the eye. - Produce and characterize the real image of a real planar object formed by a thin converging lens. - Mathematical ability: use Thales' theorem. Signals and sensors -Electrical signals are very present in everyday life. Electricity is a rich field both conceptually and experimentally, but difficult to grasp by students because the electrical quantities are not directly "perceptible". Also we must take particular care to specify their physical significance and to give them meaning, in the continuity of college teaching. In addition to the main laws, the program puts emphasis on the use and behavior of dipoles commonly used as sensors. -The fields of application may relate to transport, the environment,		

	meteorology, health, bioelectricity, etc., where many sensors associated with electrical circuits are used to measure quantities physical and chemical. The experimental component of this teaching will provide an opportunity to make students aware of the safety rules and get them to use multimeters, associated microcontrollers to sensors, oscilloscopes, etc. Concepts covered in college (cycle 4): -Electric circuits, dipoles in series, dipoles in shunt, loop, uniqueness of intensity in a series circuit, law of additivity of voltages, law of additivity of intensities, Ohm's law, rules of electrical safety, energy and power. -Concepts and content -Required capacities -Experimental activities supporting training -Law of knots. Mesh law. Students will be able to: ● Exploit the law of stitches and the law of knots in an electrical circuit comprising at most two meshes. ● Measure voltage and current. Voltage-current characteristic of a dipole. Resistance and systems ohmic behavior. Ohm's law. ● Use the characteristic of an electric dipole: point of operation, modeling by a relation U = f(I) or I = g(U). ● Use Ohm's law. ● Represent and exploit the characteristic of a dipole. ● Numerical skills: representing a cloud of points associated with the characteristic of a dipole and model the characteristic of this dipole using a programming language. ● Mathematical ability: identify a situation of proportionality. ● Electrical sensors. Cite examples of sensors present in the everyday		

	objects. ● Measure a physical quantity using a sensor resistive electric. Produce and use a curve calibration linking the resistance of a system with a quantity of interest (temperature, pressure, intensity light, etc). ● Use a device with a microcontroller and sensor.		