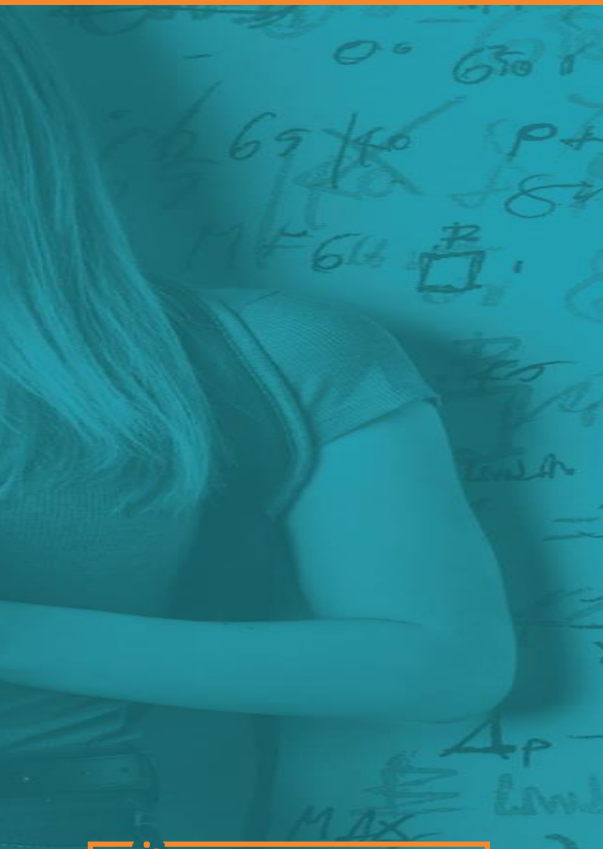
Common Framework of prerequisite knowledge

for Math and Science in 4th-6th and 7th-9th grade



AUGMENTED ASSESSMENT

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The **Common Framework of prerequisite knowledge for Math and Science in 4th-6th grade and 7th-9th** is the first output of the project, and it was developed by the whole partnership of the Augmented Assessment consortium in collaboration with the workgroups of teachers in each country coordinating by the European University of Cyprus.

Augmented Assessment 2021

Creating a framework for assessing Science and Math knowledge

A common foundation on the aspects of knowledge considered critical for the assessment of newly arrived and other migrants' knowledge in each grade is needed to meet teachers' needs in all the different educational systems of the participating countries in the project. For that purpose, each participating country formed a workgroup of experienced teachers who, along with the research teams, proposed and formed the National Framework of Prerequisite Knowledge. That National Framework includes the aspects of prerequisite knowledge that they consider essential for assessing migrant students' knowledge for each grade.

Creating a workgroup of expert and experienced teachers

Each partner from the implementation countries (Greece, Cyprus, Portugal and Finland) participating in this work package formed a workgroup of researchers, scholars and at least five highly qualified or expert teachers of primary and secondary education. These teachers were selected through an application and an interview process. The selection of teachers was based on academic qualifications, teaching experience, previous experience with European projects, and their willingness and availability to participate in the project and to be members of the workgroup. The total number of participants in each workgroup is 7-9 people. All the workgroups have at least two primary education teachers (one with expertise in Math and one in Science) and four secondary education Science teachers (at least one with a major or expertise in Physics, one in Chemistry and one in Biology).

These workgroups worked along with the project's staff members to determine the prerequisite knowledge on their national level.

Determining the prerequisite knowledge on a national level

Each workgroup proposed the prerequisite knowledge for Science and Mathematics at the national level. Scholars and researchers collaborated with the teachers to highlight and determined the essential aspects of prerequisite knowledge for Science and Mathematics in 4^{th} to 9^{th} grade based on the national curriculum's goals and objectives. In some educational systems, the national curriculum overestimates the prerequisite knowledge needed by a student to be included in a grade; that is why the members of the workgroup were asked to use their national curriculum as a reference or base and to develop the aspects of the prerequisite knowledge based on their experience. The purpose of that process is for the Frameworks to be as close as it gets to real classroom conditions and the actual needs of the teachers who are called to include newly arrived and other migrants in their classrooms. Additionally, the teachers (members of the workgroups) were asked to keep in mind that these aspects of knowledge should be representable via multimedia.

At the end of this stage, the workgroup provided a list of the most critical aspects of the prerequisite knowledge in each national context following the quantitative indicators described below:

- Science in 4th to 6th grade: max. fifteen (15) aspects of knowledge for each grade, max. forty-five (45) in total
- Mathematics in 4th to 6th grade: max. fifteen (15) aspects of knowledge for each grade, max. forty-five (45) in total
- Science in 7th to 9th grade: max. twenty (20) for each subject (Physics, Chemistry, and Biology) for all grades, max. sixty (60) in total
- Mathematics in 7th to 9th grade: max. Twenty (20) aspects of knowledge for each grade, max. Sixty (60) in total.

Writing instructions were formed to guide partners on the form of the aspects. The form was based on the ABCD model for writing instructional objectives. The members of the workgroups asked to include three parts in the aspects, namely Audience ("students should be able to…"), Behaviour (action verb and

result) and Context (in what circumstances). Workgroups and staff members in each country worked together to finalize their National Framework. National Frameworks were sent to the leading partner of the task.

Developing a common framework of prerequisite knowledge

The National Framework of prerequisite knowledge were compared to find similarities and differences between participating countries. Unfortunately, this comparison guided us to the conclusions that the differences between the participating countries are significant and a consensus will be very difficult to achieved. That conclusion is aligned with the existing knowledge about the European national educational systems.

Since the common framework' goal is to create a common place for and to represent the needs of all the partners, the consortium decided at the second PAT meeting, to re-examine and change the methodology of developing the common framework of prerequisite knowledge.

Based on the above-mentioned decision, each partner will propose representative aspects from their National Framework, as follows:

- **Science 4th-6th:** Each country will propose 10 aspects from the National Framework to be included in the common framework, at least three from each grade (from all subjects)
- **Math 4th-6th:** Each country will propose 10 aspects from the National Framework to be included in the common framework, at least three from each grade.
- **Science 7th-9th:** Each country will propose 15 aspects from the National Framework to be included in the common framework, at least five from each grade (from all subjects)
- **Math 7th-9th:** Each country will propose 15 aspects from the National Framework to be included in the common framework, at least five from each grade each partner will propose.

The coordinator of the task will combine the proposals to create the common framework of prerequisite knowledge.

That framework will include the following number of aspects:

- **Science 4th-6th:** 40 aspects, ten aspects from each country
- **Math 4th-6th:** 40 aspects, ten aspects from each country framework
- **Science 7th-9th:** 60 aspects, fifteen aspects from each country
- **Math 7th-9th:** 60 aspects, fifteen aspects from each country.

The coordinator worked on the format of the aspects to reach verbal consistency.

Science 4th to 6th grade

A/A	**Country**	**Discipline**	**Grade**	**Topic**	**Aspect of knowledge**
1	CY	Science	4	Life Science	Students should be able to recognize the right life process of reproduction in some plants and animals
2	CY	Science	4	Forces	Students should be able to recognise that magnets attract only some of the materials
3	CY	Science	4	Matter	Students should be able to group objects based on their state of matter: solid, liquid or gas
4	CY	Science	4	States of Matter	Students should be able to choose the right state of matter as a result of cooling or heating
5	CY	Science	5	Electricity	Students should be able to recognise some common conductors and insulators and associate metals with being good conductors
6	CY	Science	5	Light	Students should be able to recognise that they need light in order to see things and that dark is the absence of light
7	CY	Science	5	Human Body	Students should be able to identify that humans and some other animals have skeletons and muscles for support, protection and movement
8	CY	Science	6	Properties of matter	Students should be able to decide how mixtures might be separated, through filtering, sieving and evaporating
9	CY	Science	6	Forces	Students should be able to identify the effects of air resistance, water resistance and friction, that act between moving surfaces
10	CY	Science	6	Earth and Space	Students should be able to recognise the movement of the Earth, and other planets, relative to the Sun in the solar system
11	GR	Science	5	Physics	When given physical quantities and measuring instruments, students should be able to match the quantities to the proper measuring instrument.
12	GR	Science	5	Physics	Students should be able to distinguish between heat and temperature when different representations of them given

13	GR	Science	5	Physics	When different forms of energy are given, students should be able to relate them with the different energy sources that create them.
14	GR	Science	5	Physics	Students should be able to recognize the physical state of a substance, when given a group of solid liquids and gases
15	GR	Science	5	Chemistry	When given some mixtures and pure substances, students should be able to distinguish pure substances from mixtures.
16	GR	Science	6	Physics	When different forms of energy are given, students should be able to relate them with the different energy sources that create them.
17	GR	Science	6	Chemistry	When given subatomic particles, students should be able to distinguish atoms from ions, protons from electrons and neutrons, and structure specific atoms and ions when they are asked
18	GR	Science	6	Chemistry	When given some mixtures and pure substances, students should be able to distinguish pure substances from mixtures.
19	GR	Science	6	Biology	Students should be able to distinguish living organisms from non-living objects. When given a group of random objects they should be able to group them into living and non-living.
20	GR	Science	6	Biology	Students should be able to recognize solar energy as the source of energy for plants when given a group of organisms
21	POR	Environmental Studies	4	Nature	Students should be able to understand that living beings depend on each other, particularly through feeding relations, and on the physical environment when confronted with the importance of nature preservation.
22	POR	Environmental Studies	4	Nature	Students should be able to understand, using a model, that the phases of the moon are a result of its movement around the earth and depend on the earth and the moon's positions relative to the sun through guided tasks based on manipulable models and/or digital tools.
23	POR	Environmental Studies	4	Nature	Students should be able to differentiate the existing differences between solids, liquids, and gases through incentive towards researching, selecting, and processing information with the support of the teacher's and the student's progressive autonomy.
24	POR	Natural Sciences	5	Diversity of living beings and their interactions with the environment	Students should be able to recognize that living beings reproduce and that their descendants have similar characteristics to their parents, but that some are also different, when encouraged to confront arguments in order

					to find similarities, differences, internal consistency and by carrying out practical activities.
25	POR	Natural Sciences	5	Water, air, rocks, and soil - earth materials	Students should be able to identify the existence of reversible transformations (condensation, evaporation, solidification, dissolution, fusion) when faced with the promotion of didactic strategies that involve carrying out tasks or approaching a problem.
26	POR	Natural Sciences	5	Water, air, rocks, and soil - earth materials	Students should be able to associate environmental factors (air, light, temperature, water, soil) with conditions that are indispensable for different stages of the lives of plants and animals by conducting experimental activities that involve the change and measurement of variables.
27	POR	Natural Sciences	5	Water, air, rocks, and soil - earth materials	Students should be able to identify rock and soil samples, as well as group them together according to their properties (colour, texture, hardness, smell, permeability) and recognize their applicability while carrying out practical laboratory experiments.
28	POR	Natural Sciences	6	Diversity of living beings and their interactions with the environment	Students should be able to recognize the need for the intervention of sexual cells in the reproduction of some living beings, as well as their importance in the evolution of species through debates and the analysis of different documents.
29	POR	Natural Sciences	6	Unity in the diversity of living beings	Students should be able to recognize the cell as the basic unit of living beings and differentiate several types of cells and their mains organelles when faced with situations that involve the further development of information and data collection.
30	POR	Natural Sciences	6	Vital processes common to living beings	Students should be able to differentiate, in a simplified manner, the digestive, respiratory, circulatory, excretory, and reproductive systems, acknowledging that their proper functioning implies taking specific cares when asked to describe the functions of each system.
31	FIN	Biology		The human body	Students should be able to describe the structure, vital functions, and/or development of the human body in broad terms.
32	FIN	Biology		Describing natural phenomena	Students should be able to observe and show understanding of natural phenomena, such as food chains, the reproduction of animals and plants, the production and routes of food or the commercial use of forests

33	FIN	Biology		Describing natural phenomena	Students should be able to observe and show understanding of phenomena related to the weather, the soil and/or the bedrock.
34	FIN	Biology/ Health education		Wellbeing and safety	Students should be able to give examples of how they can promote good health in their daily life.
35	FIN	Chemistry		Stages of matter	Students should be able to show understanding of the states of matter.
36	FIN	Chemistry		Properties of substances	Students should be able to observe and show understanding of the properties of familiar substances.
37	FIN	Chemistry		Conservation of mass	Using the law of conservation of mass, students should be able to explain combustion, photosynthesis, or the hydrological cycle
38	FIN	Physics		Force	Students should be able to use the concept of force in everyday situations
39	FIN	Physics		Motion	Students should be able to use the concept of motion in everyday situations
40	FIN	Physics		Energy	Students should be able to use the concept of energy in everyday situations and/or give examples that illustrate the law of conservation of energy

Math 4th to 6th grade

A/A	**Country**	**Discipline**	**Grade**	**Topic**	**Aspect of knowledge**
1	CY	Math	4	Numbers	Students should be able to solve problems of additive and multiplicative structure of one or two operations.
2	CY	Math	4	Geometry/Measurement	Students should be able to recognise 3D shapes [cube, a rectangular parallelepiped (cuboid) pyramid, cylinder, sphere].
3	CY	Math	4	Geometry/Measurement	Students should be able to estimate the length of an object, the weight and the capacity.
4	CY	Math	5	Numbers	Students should be able to compare fractions by employing strategies.
5	CY	Math	5	Algebra	Students should be able to describe patterns and extend patterns by finding the following numbers.
6	CY	Math	5	Geometry/Measurement	Students should be able to measure the perimeter and the surface area of a square and a rectangle.
7	CY	Math	6	Numbers	Students should be able to add, subtract and compare heteronymous fractions, mixed and decimal numbers.
8	CY	Math	6	Numbers	Students should be able to solve problems by finding the least common multiple or maximum common divisor.
9	CY	Math	6	Geometry/Measurement	Students should be able to measure the perimeter and area of a triangle and a parallelogram given the respective sides.
10	CY	Math	6	Statistics	Students should be able to solve problems by drawing and interpreting data from a bar chart, picture graph and table of frequencies.
11	GR	Math	4	Natural numbers	Students should be able to compare pair of numbers up to 10.000 when a group of numbers given.
12	GR	Math	4	Natural numbers	Students should be able to match tests of multiplication table with their results and calculate vertical multiplications and tests, when a group of multiplications and results given.

13	GR	Math	4	Natural numbers	Students should be able to match vertical additions and subtractions with their results, when a group of vertical additions and subtractions and their results given.
14	GR	Math	5	Natural numbers	Students should be able to reach target numbers in a variety of ways when given results.
15	GR	Math	5	Natural numbers	Students should be able to perform operations with mixed numbers when given numbers and results.
16	GR	Math	5	Decimal numbers	Students should be able to perform conversions from decimal numbers to decimal fractions when numbers given.
17	GR	Math	6	Natural numbers	Students should be able to distinguish the lowest common multiple of a number when given multiples of a number.
18	GR	Math	6	Geometry	Students should be able to distinguish types of triangles when given shapes.
19	GR	Math	6	Geometry	Students should be able to calculate the perimeter and area of shapes when given sides and a result.
20	GR	Math	6	Fractions	Students should be able to perform all operations with fractional numbers when given results.
21	POR	Math	4	Numbers and Operations	Students should be able to recognize strategies for solving problems with rational non-negative numbers and evaluate the plausibility of the results through the use of rational non-negative numbers with the meaning of the whole-part, quotient, measure, and operator.
22	POR	Math	4	Geometry and Measurements	Students should be able to identify the properties of plane figures and geometric solids, as well as classify them, justifying the criteria used, using coordinates in squared grids in the geoboard and in dotted paper (quadrangular mesh).
23	POR	Math	4	Data Processing and Organization	Students should be able to recognize and organize the stages of investigation using the cycle of statistical research (developing questions, choosing data gathering methods, selecting ways to organize and represent data, analysing, and concluding), when faced with situations that require interpretation.
24	POR	Math	5	Numbers and Operations	Students should be able to interpret the representation of rational non-negative numbers in the fraction, decimal, and percentage forms,

					as well as establish relations between the different representations and use them when faced with problematic situations.
25	POR	Math	5	Algebra	Students should be able to recognize regularities when solving sequences problems.
26	POR	Math	5	Geometry and Measurements	When presented with questions involving the indication of the measurement of a length, an area, a volume, or a capacity, students should be able to select an appropriate unit of measurement and use it to determine the measurement of the object presented, be it a concrete object or a sketch/drawing that represents it.
27	POR	Math	6	Numbers and Operations	Students should be able to add and subtract rational non-negative numbers in the different representations using mental calculations and algorithms, as well as carry out plausible estimations when faced with problematic situations, exercises, and games.
28	POR	Math	6	Algebra	Students should be able to select appropriate problem-solving strategies that involve numerical expressions when faced with the identification of problematic situations.
29	POR	Math	6	Geometry and Measurements	Students should be able to recognize cases of possibility for the construction of triangles, as well as construct triangles from given elements (angle width, length of the sides) whenever manipulable materials are used in learning tasks.
30	POR	Math	6	Data Processing and Organization	When presented with questions involving collecting data to answer problems that require a statistical analysis, students should be able to decide on one or several adequate ways of collecting data, as well as identify the correct organization said data using absolute or relative frequency tables, stem and leaf diagrams, and bar charts.
31	FIN	Math	4	Addition and subtraction	Students should be able to perform addition and subtraction with natural numbers, and with fractions with the same denominator
32	FIN	Math	4	Division and multiplication	Students understand the connection between division and multiplication, and thus should be able to perform multiplication operations from the multiplication tables 1-10 and division in both quotition and partition with natural numbers
33	FIN	Math	4	Fractions	Students should be able to calculate basic arithmetic operations with fractions with the same denominator

34	FIN	Math	4	Decimal system and unit conversion	Students understand the principles of the decimal system, and should be able to utilise this knowledge to convert units of length in the metric system
35	FIN	Math	5	Decimal numbers	Students should be able to calculate basic arithmetic operations with decimal numbers
36	FIN	Math	5	Area	Students should be able to measure and calculate the circumferences and surface areas of figures of different shapes, and perform conversions between the units of area
37	FIN	Math	5	Sequences	Students should be able to observe the regularities of sequences and continue a number sequence following its rule.
38	FIN	Math	6	Equations	The student should be able to solve simple equations by reasoning and experimentation
39	FIN	Math	6	Percentage values	Students should be able to calculate basic arithmetic operations with percentage values
40	FIN	Math	6	Volume	Students should be able to measure, and calculate the volumes of rectangular prisms, while paying attention to accuracy of measurement, estimation of the measurement results, and verifying measurements.

Science 7th to 9th grade

A/A	Country	Discipline	Grade	Topic	Aspect of knowledge
1	CY	Biology	7	Taxonomy and organisation	Students should be able to group images of organisms into animals, plants, micro-organisms
2	CY	Biology	7	Food chains	Students should be able to be able to identify/place in the right order, the trophic relationship of organisms in a simple food web/chain, i.e., which organism feeds on whom, or to display the feeding relationship between two or more organisms based on their experiences using arrows indicating who feeds on whom (energy flow-dependence)
3	CY	Biology	8	Digestive system	Students should be able to display basic awareness of the main organic macromolecular nutrients; proteins, carbohydrates, fats /nutrient labelling on food products
4	CY	Biology	8	Circulatory	Students should be able to be aware that blood contains cells e.g., to be able to select blood cells and add them to the blood if they are given various possible constituents of the blood
5	CY	Chemistry	8	General	Students should be able to identify chemical products among other products of everyday life
6	CY	Physics	8	Scientific method. Measurements	Students should be able to recognize the relationship between two physical quantities from graphs or formula (whether they are proportional, inversely proportional, or not dependent on each other).
7	CY	Physics	8	Forces	Students should be able to predict what will happen to a body when a force is exerted on it
8	CY	Biology	9	Microbes and Disease	Students should be able to identify basic characteristics of living organisms and be able to characterize an organism as living or non-living- Be able to classify microbes as living
9	CY	Biology	9	Myoskeletal system	Students should be able to identify bones in their body if they are given them in a picture or in a three-dimensional image (to know where they are) (If given a skeleton and a human body to be able to match the bones to the parts of the body they are located)

10	CY	Chemistry	9	Periodic table and elements	Students should be able to match the symbols to the names of chemical elements in basic level
11	CY	Chemistry	9	Periodic table and elements	Students should be able to categorize the metals and non-metals
12	CY	Chemistry	9	Atomic structure	Students should be able to recognize the sub-atomical particles (protons, neutrons, electrons)
13	CY	Physics	9	Energy	Students should be able to correlate the sources of several kinds of energy with everyday phenomena and uses, i.e., a power station with the light in a house.
14	CY	Physics	9	Static electricity	Students should be able to identify the kind of forces that are developed between two electric charges when they are asked to choose between three different representations of forces (attractive, repulsive, no forces)
15	CY	Physics	9	Electric current	Students should be able to identify the basics of an electrical circuit
16	GR	Biology	7	Living/non-living things	Students should be able to distinguish living from non-living matter. When given an illustration of natural environment they should be able to indicate living and non-living elements.
17	GR	Biology	7	Energy source for organisms	Students should be able to recognize solar energy as the source of energy for plants and organic chemical components as energy source for animals. When given a group of organisms they should be able to correspond them to the sun or to organic compounds as their energy source.
18	GR	Biology	8	Cell theory	Students should be able to recognize cells as the fundamental structure unit of all living organisms despite their macroscopic differences. When given a random mixture of organisms they should be able to correspond cells as their common basic structure unit at microscopic level.
19	GR	Biology	9	Animal reproduction	Students should be able to recognize sperm and egg cell as the reproduction cells for animals, and their fusion product, the zygote, as the first cell of the new organism. When given illustrations of the sperm, the egg cell, the zygote and the full organism they should be able to represent the fusion of the gametes and the development of the zygote to a full-grown organism.

20	GR	Physics	7	physical quantities	When given different physical quantities and units, students should be able to match the quantities with its units of measurement.
21	GR	Physics	7	physical quantities	When given bodies with different masses, students should be able to compare the masses of the different bodies.
22	GR	Physics	7	physical quantities	When given bodies with different masses and volumes, students should be able to recognize density as the amount of matter in unit volume and compare densities.
23	GR	Physics	8	diagrams	When given a set of data and a set of diagrams, students should be able to match the set of data with the diagrams.
24	GR	Physics	8	diagrams	When given a diagram and different tables of data, students should be able to extract data from the diagram and match them with tables.
25	GR	Physics	9	Heat and Temperature	When given two bodies in contact with different temperature students should be able to recognize heat as a form of energy exchanged between the two bodies.
26	GR	Physics	9	Interactions-Forces	Students should be able to calculate the net force on an object when a set of forces are exerted on it
27	GR	Chemistry	8	Physical properties	Students should be able to determine the physical state of a substance, when given its physical properties
28	GR	Chemistry	8	Environment-Materials Sciences	Students should be able to recognize logical sequences of changes and transformations of matter in daily routine procedures, when different representations of them given
29	GR	Chemistry	9	Atomic theory	When given molecular models, students should be able to distinguish atoms from molecules, molecules of chemical elements from molecules of compounds, and create their own molecules using the models
30	GR	Chemistry	9	Atomic theory	When given subatomic particles, students should be able to distinguish atoms from ions, protons from electrons and neutrons, and structure specific atoms and ions when they are asked
31	POR	Physics	7	Space	Students should be able to relate information about planets in the solar system (in tables, graphs, texts, etc.) when asked to identify similarities and differences (size, constitution, location, translation, and rotation periods) between the different planets.
32	POR	Physics	7	Space	When the application of a force is observed, students should be able to identify the representation and characterization of a force using a vector.

33	POR	Chemistry	7	Materials	Students should be able to ask questions, raise hypotheses, make inferences, prove results and know how to communicate them, recognizing how knowledge is built when asked to solve a problem situation.
34	POR	Chemistry	7	Materials	Students should be able to identify the properties of different materials (e.g., shape, texture, colour, taste, smell, shine, buoyancy, solubility), when asked to group them according to their characteristics and applications.
35	POR	Physics	7	Energy	Students should be able to distinguish between renewable and non-renewable energy sources when asked to argue about the advantages and disadvantages of using them and their respective consequences for Earth's environmental sustainability and biodiversity management.
36	POR	Biology	8	Cell	Students should be able to recognize the cell as a basic unit of living beings and distinguish different types of cells and their main constituents from representative cards with various types of cells [cell types, classification terms, identification of the main organelles, and their metabolic functions by manipulating tangible and digital models and observing preparations under a microscope.
37	POR	Biology	8	Sustainability	Students should be able to demonstrate the importance of plants for life on Earth by manipulating games that involve the concepts of producers, photosynthesis, oxygen production, and carbon dioxide consumption, in composition with the terms consumers, respiration, oxygen consumption. and oxygen production.
38	POR	Chemistry	8	Chemical reactions	Students should be able to distinguish chemical transformations from physical transformations when asked to observe the occurrence of a physical transformation and a chemical transformation in a laboratory activity.
39	POR	Chemistry	8	Chemical reactions	Students should be able to recognize that (at a given pressure) the melting and ebullition of a substance occur at a well-defined temperature when asked to analyse a graphical representation of the temperature variation over time of a given sample of a solid substance.
40	POR	Physics	8	Light	Students should be able to recall the formation of the rainbow when asked to observe the passage of white light through a glass prism.

41	POR	Biology	9	Respiratory system	Students should be able to distinguish between inhaled and exhaled air, selecting digital schemes that demonstrate changes in the rib cage (muscles, diaphragm, ribs, volume), entry or exit, and their composition.
42	POR	Biology	9	Reproductive system	Students should be able to identify morphological changes that occur throughout the stages of human life (childhood, puberty, adolescence, and adulthood), considering gender (?) and age, from a chronological line that allows for the positioning of terms corresponding to these changes (birth, voice change, menstruation, hip enlargement, appearance of pubic hair, ...).
43	POR	Biology	9	Cardiovascular system	Students should be able to select the main structures of the heart of a mammal by carrying out a simulated laboratory activity which allows for the dissection of the heart into parts/structures that will be deposited in a convergence table (image, name).
44	POR	Physics	9	Motions and forces	Students should be able to distinguish the weight and mass of a body, when asked to relate them, from an experimental activity, communicating the results through tables and graphs.
45	POR	Chemistry	9	Material classification	Students should be able to recognize the constitution of atoms when asked to indicate the number of protons, the number of neutrons, and the number of electrons of a given atom.
46	FIN	Biology		Ecosystems	Students should be able to show understanding of the basic structure and functions of forest, aquatic, marsh, fell and/or urban ecosystems, and to recognise different ecosystems and species in their food webs.
47	FIN	Biology		Genotype, environment, evolution	Students should be able to show how life and biodiversity have developed on Earth as an outcome of evolution.
48	FIN	Biology		The human body	Students should be able to describe the basic structures and vital functions and regulatory systems of the human body.
49	FIN	Biology		Sustainability	Students should be able to show understanding of the limited nature of natural resources on Earth and the significance of ecosystem services and should be able to demonstrate basic knowledge of a sustainable way of living.
50	FIN	Biology		Sustainability	Students should be familiar with the goals, means and achievements of nature conservation and, using examples, students should be able to

					describe how to act in nature in a sustainable manner while preserving biodiversity.
51	FIN	Physics		Electricity	Students should be able to use key concepts, objects, phenomena, features, quantities, models or laws related to electricity in familiar situations.
52	FIN	Physics		Heat	Students should be able to describe some phenomena of heat on the qualitative level.
53	FIN	Physics		Energy	Students should be able to show understanding of the law of conservation of energy
54	FIN	Physics		Mechanical work, power and energy	Students should be able to connect mechanical work and power to energy qualitatively.
55	FIN	Physics		Electricity and magnetism	Students should be able to connect electrical charge and magnetism to any of the various phenomena of electric circuits qualitatively
56	FIN	Chemistry		The language of chemistry	Students should be able to describe and explain phenomena using key concepts of chemistry.
57	FIN	Chemistry		Conservation of energy	Students should be able to show understanding of the laws of conservation of energy.
58	FIN	Chemistry		Mixtures and pure substances	Students should be able to examine the properties of mixtures and pure substances, such as water solubility or fat solubility
59	FIN	Chemistry		Atoms	Based on the characteristics of chemical elements, students should be able to outline the atomic structure of matter, the structure of an atom, and/or the periodic table
60	FIN	Chemistry		Chemical reactions	Students should be able to describe the changes of energy and substances in chemical reactions

Math 7th to 9th grade

A/A	**Country**	**Discipline**	**Grade**	**Topic**	**Aspect of knowledge**
1	CY	Math	7	Numbers	Students should be able to use percentages when they are given a word problem.
2	CY	Math	7	Numbers	Students should be able to understand positive and negative numbers and use them into problems.
3	CY	Math	7	Geometry/Measurement	Students should be able to construct a point, a line, a semi line, a line segment, and be able to follow instructions to construct a more complicated figure in the plane.
4	CY	Math	7	Geometry/Measurement	Students should be able to find the area and perimeter of a rhombus, trapezoid and circle.
5	CY	Math	7	Algebra	Students should be able to use ratios when they are given a word problem.
6	CY	Math	8	Geometry/Measurement	Students should be able to know the secondary elements of a triangle (bisector, median, altitude) and use them to solve geometric problems.
7	CY	Math	8	Geometry/Measurement	Students should be able to apply Pythagorean Theorem.
8	CY	Math	8	Geometry/Measurement	Students should be able to understand the notion of the cord, radius, diameter, and use them to solve geometric problems.
9	CY	Math	8	Algebra	Students should be able to calculate powers of natural numbers.
10	CY	Math	8	Statistics	Students should be able to understand the meaning of probability, random experiment and sample space.
11	CY	Math	9	Algebra	Students should be able to graph a linear function f(x)=ax+b as a straight line when they are given its equation.
12	CY	Math	9	Algebra	Students should be able to know the conditions when two lines are parallel, vertical or coincide.
13	CY	Math	9	Algebra	Students should be able to find the domain and the range of a function when they are given different representations (Venn diagram, graph) of a function.

14	CY	Math	9	Geometry/Measurement	Students should be able to know the properties of isosceles triangles and use them when they solve geometric problems.
15	CY	Math	9	Statistics	Students should be able to find the average, median and mode when they are given a set of observations.
16	GR	Math	7	Areas of flat shapes (Geometry)	When given flat shapes: rectangle, triangle, rectangle, trapezoid, students should be able to calculate the area of them, using formulas.
17	GR	Math	7	Angles (Geometry)	When given angles, students should be able to compare it.
18	GR	Math	7	Area problems (Geometry)	Students should be able to calculate the areas of triangle, rectangle, trapezoid and circle and solve related problems, when shapes are given
19	GR	Math	7	Fractions (Algebra)	Students should be able to do operations with fractions when random numerical expressions are given in fractions.
20	GR	Math	7	Equations (Algebra)	Students should be able to solve equations, identifying the number they need by applying one of the basic calculations to find a third number, when random equations and results given.
21	GR	Math	8	Types of Triangles (Geometry)	When given triangles, students should be able to recognize the types of them, in terms of their sides and properties.
22	GR	Math	8	Types of Angles (Geometry)	When given angles (zero, convex, acute, right, obtuse, straight, non-convex, full angle), students should be able to recognize them.
23	GR	Math	8	Equations (Algebra)	Students should be able to check if a given number is a solution of a given equation. To solve equations of the form with the help of the definition of operations: α+x=β, x-α=β, α-x=β, αx=β, α:x=β και x:α=β
24	GR	Math	8	Absolute value of explicit number (Algebra)	Students should be able to correspond the explicit number with a given point of the axis.
25	GR	Math	8	Explicit number operations (Algebra)	When they are given two explicit numbers, students should be able to find the sum-difference of them. To calculate arithmetic expressions with additions and subtractions.
26	GR	Math	9	Areas of flat shapes (Geometry)	When they are given flat shapes: rectangle, triangle, trapezoid, students should be able to calculate the area of them.
27	GR	Math	9	Pythagorean theorem (Geometry)	Students should know the Pythagorean theorem and its inverse. Should be able to check if a triangle with known sides is a right triangle.

28	GR	Math	9	Inscribed angles (Geometry)	When they are given a circle and, students should be able to distinguish the central angle from the inscribed angle and know the relationship between the measure of them.
29	GR	Math	9	Regular polygons (Geometry)	Students should be able to calculate the angle and centre angle when regular polygons are given.
30	GR	Math	9	Square root of a positive number (Algebra)	Students should know the meaning of the symbol $\sqrt{\alpha}$, with $\alpha \geq 0$, and to be able to calculate square roots of positive numbers.
31	POR	Math	7	Numbers and operations	Students should be able to recognize and apply the priorities of basic operations to perform the calculation of a numerical expression when performing tasks of a diverse nature, namely in solving problems with a ludic nature.
32	POR	Math	7	Algebra	To solve sequence problems, students should be able to determine the generating expression by analysing the regularity between the terms presented, either by figures or by numbers, in the face of the solution of problems.
33	POR	Math	7	Algebra	To relate two directly proportional quantities, students should be able to identify the missing term in a given proportion in the context of problem solving.
34	POR	Math	7	Geometry and measurements	Students should be able to identify a prism and a cylinder to calculate the volumes of each solid in problem solving.
35	POR	Math	7	OTD	For students to be able to solve problems involving the analysis of a set of data, they must apply the concepts of mean, mode, and range to interpret and make decisions when faced with situations that require interpretation.
36	POR	Math	8	Numbers and operations	Students should be able to use the square root when solving problems related to area measurements, namely geometric situations involving areas of spaces.
37	POR	Math	8	Numbers and operations	Students should be able to recognize and apply the priorities of basic operations to perform the calculation of a numerical expression when performing tasks of a diverse nature, namely in solving problems with a ludic character.

38	POR	Math	8	Algebra	Students should be able to solve an equation of the 1st degree, applying the practical rules of solving the equation in equivalence, in mathematical contexts.
39	POR	Math	8	Functions, Sequences, and Successions	When presented with graphs and descriptions of real-life events, students should be able to identify the graphs that translate them, properly justifying the established correspondence.
40	POR	Math	8	Geometry and measurements	Students should be able to solve problems involving the calculation of perimeters and areas of similar figures in different contexts.
41	POR	Math	9	Numbers and operations	To simplify and calculate the value of numerical expressions involving the four arithmetic operations, the potentiation, radiation, and the use of parentheses, students should be able to recognize the priorities of the operations and apply the operating rules in different contexts.
42	POR	Math	9	Geometry and measurements	Students should be able to apply the reciprocal theorem of the Pythagorean theorem in the face of mathematical situations.
43	POR	Math	9	Algebra	Students should be able to solve a literal equation of the first degree applied to other sciences.
44	POR	Math	9	Algebra	Students should be able to geometrically interpret a system of two equations of the first degree with two unknowns in a mathematical context.
45	POR	Math	9	OTD	Students should be able to solve problems involving different graphs and diagrams of extremes and quartiles when faced with situations that imply real-life interpretation.
46	FIN	Math	7	Variables and expressions	Students are familiar with the concepts of the variable and polynomials and should be able to calculate the value of a mathematical expression
47	FIN	Math	7	The concept of variables and mathematical expression	Students should be able to form and reduce expressions
48	FIN	Math	7	Decimal numbers and fractions	Students understand the connection between fractions and decimal numbers and should be able to perform basic arithmetic operations with fractions and decimal numbers.
49	FIN	Math	7	Exponents	Students are familiar with the concept of exponents and should be able to calculate exponentials using whole-number exponents.

50	FIN	Math	7	Coordinate system and programming	Students should be able to use the coordinate system to program locations in a graphic environment
51	FIN	Math	8	Percentages	Students should be able to calculate percentages, the amount a percentage expresses of a whole, and the percentage of change and comparison, and to use their knowledge in different situations.
52	FIN	Math	8	Equations	Students should be able to solve a first-degree equation symbolically.
53	FIN	Math	8	Proportionality	Students are familiar with direct and inverse proportionality and should be able to use proportion in solving problems.
54	FIN	Math	8	Angles	Students know the sum of the angles of a triangle and should be able to utilise this knowledge to calculate an unknown angle.
55	FIN	Math	8	Area	Students should be able to calculate the circumferences and areas of plane figures – including polygons, circles and the sector of a circle - and perform conversions between the units of length and area
56	FIN	Math	9	Properties of the right-angle triangle	Students should be able to use the Pythagorean theorem
57	FIN	Math	9	Statistics	Students should be able to calculate statistical key figures – average and mode - and should be able to give examples of them.
58	FIN	Math	9	Statistics	Students should be able to show understanding of frequency, relative frequency, median, and/or the concept of dispersion
59	FIN	Math	9	Probability	Students should be able to determine both classical and statistical probabilities.
60	FIN	Math	9	Volume	Students should be able to calculate volumes of objects - including the sphere, the cylinder, and the cone, and perform conversions between the units of volume