General Information	
Academic subject	ELEMENTS OF CHEMICAL EDUCATION
Degree course	SCIENZE DELLA FORMAZIONE PRIMARIA CLASSE LM/85 BIS
Curriculum	
ECTS credits	4
Compulsory attendance	No; attendance is only recommended
Language	Italian

Subject teacher	Name Surname	Mail address	SSD
	Giovanni LENTINI	giovanni.lentini@uniba.it	CHIM/08

ECTS credits details	Disciplinary scope	SSD	ECTS
Basic teaching activities	Chemical Disciplines	CHIM/03	4

Class schedule	
Period	I SEMESTER
Year	IV
Type of class	Traditional

Time management	
Hours measured	1h= 60 min
In-class study hours	30
Out-of-class study hours	70

Academic calendar	
Class begins	7/10/2019
Class ends	9/03/2020

Syllabus	
Prerequisite requirements	Equivalences. Arithmetic.
Expected learning outcomes	*Knowledge and understanding* Knowledge and understanding in the field of chemistry; ability to discriminate between chemical and physical processes, and between chemical and physical properties; ability to classify a system on the basis of its chemical characteristics. *Applying knowledge and understanding* Ability to design and carry out learning activities in the scientific domain, mainly focused on chemistry, for primary school children. Use of conceptual maps and Gowin's diagrams. *Making informed judgements and choices* Ability to ascertain the acquired knowledge through properly designed assessment tests. Ability to critically evaluate and modify the learning activities in order to make them suited to new varied landscapes while keeping an eye on scientific soundness.

	Communicating knowledge and understanding Ability to describe basic chemical phenomena or systems by means of simple, clear, and rigorous terms. *Capacities to continue learning* Ability to obtain information from the Internet and textbooks in order to deepen and broaden the acquired knowledge in the chemistry domain.
Contents	1) Structure of the course and relevant instruments. 2) Invitation to chemistry: what chemistry is, what does it deal with, what does it matter. 3) The chemical jargon. 4) The particulate nature of matter: atoms and molecules. 5) Classification of matter: from substances to mixtures. 6) Exercises.
Course program	What is needed: teacher, students, program (graphical tools, basic jargon, object, pivotal concepts, practical skills), relationships with other scientific disciplines, theoretical models, texts. The final stakeholder: the child, a natural-born researcher. Curiosity and the pleasure of discovery. Welcome to serendipity. Induction, deduction, abduction. Educational strategies. Good answers: covering-law model (Hempel's model), unifying model, causal model. Meaningful versus mechanical (traditional) learning. The importance of experimentation. Exploration, invention, discovery. Methods: heuristic, problem solving, interactive, generative. The six postulates of constructivism, ten expectations necessary for good teaching in chemistry. Receptive learning, autonomous learning. Chemical education versus chemistry education. Triangular and tetrahedral models. Chemistry education in the first five years of school. Chemistry, the nearest science to figurative art. Instruments: conceptual maps (concepts, linking words, linking phrases, cross linkings, examples); pros and limitations. Gowin's diagrams: focus question, event, theory side, method side; flux diagrams: rectangular boxes, elliptic boxes, diamonds, arrows; problem solving; logical thinking. Static versus dynamic properties. The particle nature of matter (concepts of atom, molecule, and ion). Why beauty is rewarding. Chemistry and the Universe: a deeper pleasure. Chemistry, a pivoltal science. Classification of matter: substances and mixtures. Physical and chemical processes. Matter and energy (the aggregation states of matter). Dimensions of the objects studied by chemists. Matter and space. Elements and compounds. Solids, liquids, and gases. State transitions. Symbols. Units. Scientific notation. The concept of mole. Atomic mass. Energy. Scientific measurements. Error and

	confidence. Accuracy and precision. Systematic and accidental errors. Significant figures. Laboratory equipment. The atom. Lavoisier. Proust. Dalton. The electric nature of matter. The discovery of the electron. Nucleons. The Thomson's atomic model. The Rutherford's atomic model. Atomic number. Mass number. Isotopes. Radioactivity. Dating a fossil. Heisenberg's uncertainty principle. Orbitals. Electron configuration. The periodic table. The periodic law. The octet rule. Ionization potential, electron affinity, and electronegativity. Inter-atomic bonds: ionic interactions, covalent bond (homopolar and heteropolar), metallic bond. Inorganic and organic substances. Inter-molecular interactions: dipole-dipole interaction, hydrogen bond, ion-dipole interactions, van der Waals interactions. Physical and chemical processes. Solutions and dispersed states of matter. Aqueous solubility. pH. Acids and bases. Acid rains. pH in the body. Exercises. 1) Weight, volume, density: (a) Gerone's crown and the genius 2) Weight, volume, density: (b) the bottle in the refrigerator. 3) Air is matter: an experiment with a glass 4) Air is matter: (a) the hypodermic syringe (b) a scale to measure air weight. 5) Conceptual map on 'conceptual maps' 6) Gowin's diagrams (materials, state transitions; intensive properties, air as a kind of matter, combustion, physical phenomena, solubilisation, properties of liquids).
Bibliography	Recommended text: *Insegnare e Apprendere la Chimica*, Valentina Domenici, Mondadori, 2018, Milano; secondary school textbooks. Hard-copies of the slides from the teacher Texts freely available in the Internet: www.leparoledellascienza.it www.indire.it (Risorse Docenti, PON Educazione Scientifica page)
Notes	Texts are suggested and most of the treated subjects are supported by supporting materials that may be freely downloaded from the Internet.
Teaching methods	Slides presentation. Exercises at the blackboard. Self-evaluation tests. Conceptual maps and Gowin's diagrams.
Assessment methods	Oral exam.
Further information	