

COURSE: General Chemistry I module			
ACADEMIC YEAR: 2019-2020			
TYPE OF EDUCATIONAL ACTIVITY: Fundamental			
TEACHER: Francesco Lelej Garolla Di Bard			
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Language: Italian and/or English			
ECTS: (6 (5 L + 1 EN + 1 EL))	n. of hours: 64 (40 L + 12 EN + 12 EL)	Campus: Potenza Dept./School: Dipartimento di Scienze Program: CdS: CHIMICA (L27)	Semester: I 01/10/2019 to 15 - 20 /1/ 2020

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**Acquired knowledges**

- *Way in which matter exists and modifies at a microscopic level: atoms, molecules and their properties*
- *Particles aggregates and their transformations*
- *Dynamical aspects of particles aggregates*
- *Characteristics forma and quantitative of the Ideal gas: Simple model of real gas*
- *Qualitative and quantitative aspects of the ideal solution*
- *Qualitative and quantitative aspects of chemical reactions end the stoichiometry of a chemical process*
- *Chemical equilibrium and effect of external parameters*
- *Formal and quantitative aspects of the most relevant class of Chemical equilibria in solution*
- *Energetic of the chemical process: some thermodynamic concepts like enthalpy entropy and free energy*
- *Dynamical aspects of a chemical process: model end effect of the external parameters*

Learning outcome

At the end of the course the student should be able to:

- *Identify an atom from the electronic structure and vice versa*
- *Be able to distinguish different state of matter*
- *Handle a chemical system based on number of moles*
- *Handle a gas system and compute some priorities from the knowledge of some external parameter. Relate Volume, pressure, temperature and number of moles*
- *Recognize a solution and its properties and compute some significant properties of solution: vapor tension, ebullioscopy and cryoscopy changes; osmotic pressure.*
- *Recognize some simple chemical reactions and compute some stoichiometric values of the chemical process*
- *Identify a chemical equilibrium, its equilibrium constant and effect of external parameters on the chemical equilibrium*
- *Identify and describe an acid/base system according to Bronsted and Lowry. Identify a strong, week acid and base*
Compute the acidity of an aqueous solution. Compute the pH of different mixtures of acid and bases of different strength.
- *Identify a buffer solution and compute its pH*
- *Identify and discuss the rate of a chemical process and the influence of external perturbation*

PRE-REQUIREMENTS

Just fundamentals of mathematic (rational numbers and their operations, simple function behavior, solve first and second degree equations, elementary system of linear equations) and few knowledges of elementary high school physics.

SYLLABUS

1. Matter and its microscopic organization. Some historical background. Results of tunnel and atomic force microscopy.
 2. Atoms
 3. Atomic structure a general survey
 4. Subatomic structure: Protons, neutrons and electrons
 5. Some key experiments: Electrical discharge, Rutherford and Millikan
 6. Chemical elements as fundamental bricks with definite chemical properties
 7. Some atomic properties: Atomic mass, atomic number
 8. Atom symbols

 9. Time, position, Energy, momentum and angular momentum: The role of symmetry
 10. A "skirmish" with quantum mechanics: "Uncertainty" principle and conjugate observables
 11. Absorption and emission spectra
 12. Stern Gerlach experiment Spin, magnetic properties of electrons, protons and neutrons and Pauli principle
 13. Quantum chemical model of atom. Quantum numbers and atomic orbitals
 14. Ionization potential and Electron affinity
 15. Mullikan and Pauling electronegativity
 16. The periodic table of the elements.
 17. Trends in the periodic table.

 18. Compounds
 19. Naming elementary compounds
 20. Molecular weight
 21. Avogadro's number and mole (new 2018-year definition)
 22. Interaction: Its meaning and relevance in describing matter. Microscopic and macroscopic description
 23. Dynamical aspect of the microscopic behaviour of matter
 24. How and why particles aggregate and their transformation
 25. Gas and their properties as simple model
 26. Pressure and Volume
 27. Temperature: operative definition
 28. Gas behaviour
 29. Simple model: The Ideal gas
 30. State equation: state equation of Ideal gas.
 31. Kinetic theory of gasses. Molecular velocity; Gas diffusion
 32. Temperature and average kinetic energy.

 33. Liquid state: Simple description
 34. Solid state: Simple description
 35. A "skirmish" with Thermodynamics
 36. Energy, work, enthalpy and entropy
 37. Free Energy
 38. Change of state: Dynamic equilibrium
 39. Reaction quotient and reaction constant
 40. State diagram; Simple examples: Sulphur, Carbon dioxide, Water
 41. Equilibrium constant and free energy
 42. Macroscopic and microscopic details of the dynamic equilibrium
 43. Chemical reactions: Simple metathesis reactions. Balancing
 44. Stoichiometric aspect of chemical reactions
 45. Liquid solutions; Simple solution model: The Ideal solution
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46. Physical behaviour of Ideal solution: Effect of concentration on vapor pressure, Boiling and freezing point. Osmotic pressure
 47. Equilibrium in chemical reactions: general aspects
 48. Reaction in solution and solubility
 49. The Acid and base concept: Bronsted e Lowry definition; Acid-base conjugate couple
 50. Aqueous solutions.
 51. Acid-base reaction in aqueous solution and solvent self-ionization.
 52. Acid strength: How can be defined?
 53. Base strength compared to its conjugate acid
 54. Hydronium ion concentration: pH, acidity
 55. Strong acid; Weak acid
 56. Acid-Base reaction in water solution. Reaction between: strong acid and strong base; weak acid and strong base; Buffer solution. pH as function of concentration.

 57. Rate of chemical reaction
 58. Rate of reaction and concentration.
 59. Transition state and its energy
 60. Activation energy of chemical processes
 61. External perturbations and rate of reaction: Temperature effect on reaction rate
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TEACHING METHODS: Classroom lessons, numerical exercises and some practical experiences. Blackboard numerical exercises. PowerPoint slides with graphics and movies with chemical subjects

EVALUATION METHODS Wittena and oral examination. Oral examination is discouraged if student gets a mark lower than 18/30.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- *Chemistry & Chemical Reactivity*
John C. Kotz ,Paul M. Treichel , John R. Townsend, David A. Treichel
- *Chimica Generale*
Mahan B. H. e Myers R. J., Chimica, Casa Editrice Ambrosiana
- *Chimica*
John C. Kotz ,Paul M. Treichel , John R. Townsend, G.Marongiu; Casa Editrice Zanichelli
- *Principi di Chimica*
P. Atkins e L. Jones, Casa Editrice Zanichelli, Terza edizione italiana condotta sulla quinta edizione americana
- *General Chemistry: Principles, Patterns, and Applications* (Free on Internet)
<https://open.umn.edu/opentextbooks/textbooks/69>

Numerical Exercise book or any English book on the Stoichiometry subject

- *Stechiometria: un avvio allo studio della Chimica*
I. Bertini, F. Mani; Casa Editrice Ambrosiana
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INTERACTION WITH STUDENTS

Students can have chat with the teacher on Monday and Tuesday from 5:00 pm to 7:00 pm. More options are chat on *Skype* or *Google Hangouts*

EXAMINATION SESSIONS (FORECAST)¹

19/02/2020; 11/03/2020; 27/05/2020; 30/06/2020; 29/07/2020; 11/09/2020; 23/10/2020; 11/12/2020

SEMINARS BY EXTERNAL EXPERTS YES NO

FURTHER INFORMATION

By Google **Classroom** of the Google University suite further material and information will be available

¹Subject to possible changes: check the web site of the Teacher or the Department/School for updates.