Course Title:	**Chemistry I :** **PHYSICAL AND THEORITICAL CHEMISTRY**
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Cycle/Division:	High School
Grade Level:	Grade 11
Credit Unit:	1
Duration:	2 semesters / 5 periods per week

Department's Vision:	Create Innovators who can link to life, with scientific understanding and learning.
Department's Mission:	Provide students with the proper knowledge, skills and scientific principles through hands on activities, research and experimentations, and thus creating young innovators who are ready for real life challenges and problem solving.

COURSE DESCRIPTION:

This course covers fundamental principles and laws of chemistry. Topics include measurement, atomic and molecular structure, periodicity, chemical reactions, chemical bonding, thermochemistry ,solution, energy and its uses, kinetic molecular theory, laws of chemical combination, electrochemistry, decay of radioactive nuclides, the structure and properties of nuclei. The laboratory work is based on research and open lab design and application with a term lab theoretical and practical assessment.

General Academic Goals:

Understand matter on the macro and the micro level and be able to identify the changes taking place physically and chemically.

Understand the structure of the atom and its ability to form different bonds and eventually forming different compounds and how its nucleus can form radioactive decay.

Write chemical reactions and be able to apply the law of conservation of mass through balancing.

Describe the properties of pure and impure matter and understand the physical internal interactions in the formation of different impure substances.

General Skills:

Evaluation skills: making judgment about knowledge by introducing new text to solve and tackle problems using the related knowledge taught.

Comprehension: given scientific text or diagrams to analyze and answer questions about, summarize, compare, relate, or experiment...

Communication and social skills: Making movies, ppt., projects, interviews, and presenting the work either individually or with a peer or as a group.

Investigative skills: lab work, research, journals, experimentation...

Mathematical skills: related to investigations in the lab and application in projects.

Technological skills used in science and computer labs.

Knowledge skills: list, define, show, demonstrate, invent, relate etc… using the taught concepts.

GENERAL COURSE LEARNING OBJECTIVES:

1. Define Chemistry
2. Identify the different branches of chemistry
3. Identify the different types of research
4. **Distinguish between** :

1. Extensive and intensive properties
2. Physical and chemical properties.
3. Physical and chemical change.
4. The properties of solids, liquids and gases.
5. Mixtures and pure substances
6. Types of mixtures
7. Elements and compounds

5. **Indicate** how the law of conservation of energy applies to changes of matter.
6. **Use a periodic table** to name elements
7. **Use a periodic table** to write the symbols of elements
8. **Describe** the arrangement of the periodic table.
9. **List** the characteristics of metals, nonmetals and metalloids.
10. **Identify** the different stages of scientific method and give examples
11. **Summarize** the properties of cathode rays that led to the discovery of the electron.
12. **Summarize** the experiment of Rutherford that led to the discovery of the nucleus.
13. **List** the properties of ps, ns and es
14. **Define** atom
15. **Explain** what isotopes are
16. **Define** atomic number and mass number and describe how they apply to isotopes.
17. **Determine** the no. of protons, neutrons and electrons
18. **Define**: mole, Avogadros no., Molar mass and how are they related.
19. **Solve** problems involving mass, no. of moles and no. of atoms.
20. **Identify** the dual wave particle nature of light
21. **Define** the concept of quantization of energy
22. **Identify** Bohr's model of the atom
23. **List** the four quantum nos. and describe their significance.

24. **Relate** the no. of sublevels corresponding to each of an atom's main energy levels, the number of orbitals per sublevel and the number of orbitals per main energy level
25. **List** the total no. of (e) needed to fully occupy each main energy level.
26. **State** the Aufbau principle, the pauli exclusion principle, and Hund's rule.
27. **Describe** electron configurations and electron notation and noble gas notation
28. **Describe** the relationship between electron in sublevels and the length of each period of the periodic table.
29. **Locate and name** the four blocks of the periodic table. Explain the reasons for these names.
30. **Define** chemical bond
31. **Explain** why most atoms form chemical bonds
32. **Describe** ionic and covalent bonding
33. **Explain** why most chemical bonding is neither purely ionic nor purely covalent
34. **Classify** bonding type according to electro negativity differences
35. **Define** molecule and molecular formula
36. **Explain** the relationships among potential energy, distance between approaching atoms, bond length, and bond energy.
37. **State** the octet rule
38. **List** the six basic steps used in writing lewis structures.
39. **Explain** how to determine lewis structures for molecules containing single bonds, multiple bonds, or both.
40. **Explain** why scientists use resonance structures to represent some molecules
41. **Compare and contrast** a chemical formula for a molecular compound with one for an ionic compound.
42. **Discuss** the arrangements of ions in crystals
43. **Define** lattice energy and explain its significance
44. **List** and compare the distinctive properties of ionic and molecular compounds.
45. **Write** the lewis structure for a polyatomic ion given the identity of the atoms combined and other appropriate information
46. **Describe** the electron-sea model of metallic bonding and explain why metals are good electrical conductors.
47. **Explain** why metal surfaces are shiny
48. **Explain** why metals are malleable and ductile but ionic crystalline compounds are not
49. **State** VSEPR THEORY and identify the molecular geometry of compounds
50. **Explain** the significance of a chemical formula.
51. **Determine** the formula of an ionic compound formed between two given ions.
52. **Name** an ionic compound given its formula
53. **Using prefixes**, name a binary molecular compound from its formula.
54. **Write** the formula of a binary molecular compound given its name.
55. **List** three requirements for a correctly written chemical equation
56. **Write** a word equation and a formula equation for a given chemical reaction
57. **Balance** a formula equation by inspection
58. **Define** and give general equations for synthesis, decomposition, single replacement, and double replacement
59. **Classify** a reaction as a synthesis, decomposition, single replacement, double replacement, or combustion reaction.
60. **List** 3 kinds of synthesis, and 6 kinds of decomposition reactions.
61. **List** 4 kinds of single replacement reactions and 3 kinds of double displacement reactions
62. **Predict** the products of a simple reaction given the reactants
63. **Explain t**he significance of an activity series

64. **Use an activity series** to predict whether a given reaction will occur and what the products will be
65. **Describe** the processes of boiling, freezing, melting, and sublimation
66. **Interpret** phase diagrams
67. **Distinguish** between heterogeneous and homogeneous mixtures.
68. **List** 3 different solute-solvent combinations.
69. **Compare** the properties of suspensions, colloids, and solutions.
70. **Distinguish** between electrolytes and non electrolytes
71. **List and explain** three factors that affect the rate at which a solid solute dissolves in a liquid solvent.
72. **Explain** solution equilibrium, and distinguish among saturated, unsaturated, and supersaturated solutions.
73. **Explain** the meaning of "like dissolves like" in terms of polar and nonpolar substances.
74. **List** the 3 interactions that contribute to the enthalpy of solution, and explain how they combine to cause dissolution to be exothermic or endothermic.
75. **Compare** the effects of temperature and pressure.
76. Given the mass of solute and volume of solvent**, calculate** the concentration of a solution.
77. Given the concentration of a solution, **determine** the amount of solute in a given amount of solution.
78. Given the concentration of a solution, **determine** the amount of solution that contains a given amount of solute
79. Identify the properties of the nucleus of an atom.
80. Explain why some nuclei are unstable.
81. Calculate the binding energy of various nuclei.
82. Describe the three modes of nuclear decay.
83. Predict the products of nuclear decay.
84. Calculate the decay constant and the half-life of a radioactive substance.
85. Distinguish between nuclear fission and nuclear fusion.
86. Explain how a chain reaction is utilized by nuclear reactors.
87. Compare fission and fusion reactors.
88. Define the four fundamental interactions of nature.
89. Identify the elementary particles that make up matter.

STANDARDS/BENCHMARKS:

HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of

the system are known.
HS-PS4-3 Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-PS1-8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

RESOURCES:

HOLT Chemistry book and online resources
One Stop Planner, Linked Lesson presentations, Extended Visual Labs
You Tube movies
E-games and links
Teacher's Extended Handouts
Lab Handouts

COURSE OUTLINE:

Chapter 1: Matter and change

Section 1: Chemistry is a physical science
Section 2: Matter and its properties
Section 3: Elements

Chapter 2: ***Measurements and calculations***

Section 1: Scientific Method

Chapter 3: Atoms: The Building blocks of Matter

Section 2: the structure of the atom
Section 3: Counting atoms

Chapter 4: Arrangement of electrons in atoms
Section 1: The development of a new atomic model
Section 2: The quantum model of the atom
Section 3: *Electron configurations*

Chapter 5: ***The periodic Law***

Section 2: *Electron configuration and the periodic table*

Chapter 6: Chemical Bonding

Section 1: Introduction to chemical Bonding
Section 2: Covalent Bonding and Molecular Compounds
Section 3: Ionic bonding and ionic compounds
Section 4: Metallic Bonding
Section 5: Molecular Geometry

Chapter 7: Chemical formulas and chemical compounds

Section 1: Chemical names and formulas
Section 3: Using chemical formulas

Chapter 8: Chemical Equations and reactions

Section 1: Describing chemical reactions
Section 2: Types of chemical reactions
Section 3: Activity series of the elements

Chapter 10: States of Matter

Section 4: Changes of states

Chapter 12: Solutions

Section 1: Types of mixtures
Section 2: The solution process
Section 3: Concentration of solutions

Chapter 16: Reaction Energy

Section 1: Thermochemistry
Section 2: Driving force of reactions

Chapter 17: Reaction Kinetics

Section 1: The reaction process
Section 2: Reaction rate

Chapter 19: Oxidation-Reduction reactions

Section 1: Oxidation and reduction
Section 2: Balancing Redox Equations
Section 3: Oxidizing and reducing agent

Chapter 20: Electrochemistry:
Section 1:Introduction to Electrochemistry
Section 2: Voltaic Cells
Section 3: Electrolytic Cells

Chapter 21: Nuclear chemistry
Section 1: The Nucleus
Section 2: Radioactive Decay
Section 3: Nuclear Radiation

Section 4: Nuclear Fission and Nuclear Fusion

GRADING:

1. Quizzes /tests are given every other week as assigned by school. **Our tests and assessments** consist of multiple-choice, short answer, direct application problems, critical thinking situations, refer to

figures, texts, graphs and/or open response items. They are aligned with Michigan benchmarks. A student failing any of his quizzes would have to sit for a **support class and retest** to achieve his 60% which is our passing mark. **A progress report is sent to the parent eventually after sitting for the make up exam.** 40 % is given to students that do not have a medical excuse for missing such an assessment.

2.Skill Based Assignments are done in class where a student has his resources all opened in front of him to answer a set of questions under verbal, nonverbal, quantitative, and spatial domains.

3. Research Sessions are done where students can debate as groups and check the internet for resources and answers to support their ideas. This kind of assessment is under **Research /Project/ Lab Sessions /Journals**. They are evaluated to info, creativity, presentation, discussion and relation to the subject.

4.Daily assessments and drop quizzes take place to check the understanding of students.
5. Laboratory work is checked for research, completeness, accuracy, understanding the experiment, group and individual reports and attendance with the lab coats. Every semester has one term practical assessment.

7. Projects are integrated across and assigned for every term. They are evaluated to accuracy, creativity, info and relation to the subject.

Grade Distribution:

SCIENCE DEPARTMENT GRADE DISTRIBUTION	
HIGH SCHOOL	
End of semester assessment	30%
Quizzes	30%
Skill based Assessment	5%
Project	10%
Research/Journal	5%
Labs	10%
MAP	5%
Drop Quizzes	5%

Cross-Curricular Project(s):

- Once per semester across disciplines.