Integrated Chemistry-Physics

Standard 1: Context of ICP	
1.1	While it is hoped that this course will encourage students to take further courses in science, this may be the last physical science course students take. Therefore, student work that leads to better understand of the nature of science will occur systemically through the year.
1.2	One goal of the course is the development of a science literate voting public. Therefore, examples will, when possible, be on topics of interest to the students.

Standard 2: The Role of Measurement in Science	
2.1	Students will use metric units to measure length, volume, mass and time.
2.2	Students will document, such as in a notebook, all of their investigations including reflections on meaning and outlines for reports as needed.
2.3	Students will be able to convert between metric units.
2.4	Students will be able to explain in their own words the importance of and distinction between accuracy and precision.
2.5	Students will be able to explain in their own words how to determine the uncertainty of measurement and the significance of uncertainty in terms of interpreting results.
2.6	Students will conduct experiments and represent the results graphically.

Standard 3: Constant Velocity	
3.1	Students will be able to analyze constant velocity motion of an object in terms of both a motion map and a graph of position as a function of clock reading.
3.2	Students will be able to draw a best line fit by hand, and determine the slope of the graph.
3.3	Students will be able to explain in their own words the distinction between distance traveled and displacement.
3.4	Students will be able to explain in their own words the distinction between speed, velocity and average velocity.
3.5	Students will be able to translate position vs time graphs into position vs velocity graphs, and vice versa.
3.6	Students will be able to determine the change in position from constant velocity data by using a graph or from an algebraic relation.

Standard 4: Uniform Acceleration	
4.1	Students will be able to analyze constant acceleration motion in terms of motion maps, a graph of velocity and of position as a function of clock reading.
4.2	Student will be able to identify and explain average velocity and instantaneous velocity on a graph of position vs clock reading.
4.3	Students develop, from their own work, algebraic statements relating position, velocity, acceleration, and time.
4.4	Students are able to solve a variety of constant velocity and constant acceleration word problems.
4.5	Students can explain in their own words the velocity and the acceleration of a ball thrown vertically at various points in the motion.

Standard 5: Newton’s Laws of Motion	
5.1	By their own investigation, with guidance from the teacher, students will show that a single applied force changes the velocity of an object, and that when no force acts, an object moves with a constant velocity.
5.2	If more than one force acts on an object in one dimension, students are able to draw force diagrams and combine forces to determine the equivalent single net force acting on the object.
5.3	Students can clearly distinguish between forces acting on a body and forces by the body. They can also distinguish kinds for forces such as contact forces, friction, or action at a distance forces.
5.4	By their own investigation, with guidance from the teacher, students will show that a non-zero net force on an object results in an acceleration of the object. Further they should be able to show, using graphs, that the acceleration of an object of constant mass is proportional to the total force acting on it, and inversely proportional to its mass for a constant applied total force.
5.5	Students should be able to use Newton’s Second Law to predict, quantitatively, the magnitude and direction of forces from observing the motion of an object of known mass.
5.6	Students should be able to use Newton’s Second Law to predict, quantitatively, the acceleration of an object of known mass from observing the forces acting on that object.
5.7	By their own investigation, students will show that when two objects interact, the forces occur in pairs, each acting on the other object with equal magnitude but with motion changes dependent on their relative masses.

Standard 6: Energy	
6.1	Students can explain in their own words that energy is a defined quantity that can be represented as being within a system that is distinct from the remainder of the universe, and is measured in joules.
6.2	Students can identify kinetic energy and various potential energies (gravitational, elastic, etc.), and can use bar graphs or pie graphs to display the amount of each in a system.
6.3	Students can explain in their own words that the energy in a closed system is conserved.
6.4	Students can explain and give examples of how energy can be transmitted into or out of a system by doing work, by heating, or by radiation and solve word problems related to those transfers.

Standard 7: Particle Theory of Matter	
7.1	By their own investigation, with guidance from the teacher, students will show that matter is made of particles.
7.2	Students are able to explain, in their own words, the assumptions used to develop the kinetic theory of gasses.
7.3	Students can explain that temperature is related to the average kinetic energy of the particles in the system and can explain, as the particle level, how a thermometer measures the temperature of a system.
7.4	Students can compare and contrast the Fahrenheit, Celsius, and Kelvin temperature scales, and convert temperatures between them. Further they can distinguish temperature from thermal energy.
7.5	Using graphs and symbolic representation, students can interrelate the pressure, temperature, and volume of a gas and solve word problems associated with them.
7.6	Students can show how the kinetic theory can be extended to describe the properties of liquids and solids by introducing attractive forces between the particles.
7.7	By their own investigation students observe that the temperature of a system remains constant during a phase change. By observing a heating/cooling curve they can identify the melting and freezing temperatures and the phases that are present.
7.8	Students will collect and use experimental data to determine the number of items in a sample without actually counting them and qualitatively relate this to Avogadro's hypothesis.

Standard 8: Describing Substances	
8.1	Students will be able to distinguish, in their own words, between elements, mixtures, and compounds using their physical characteristics, and be able to build or sketch particle diagrams to represent them.
8.2	By their own investigation, with guidance from the teacher, students show that mixtures can be made in any proportion and separated based on the properties of the components of the mixture.
8.3	Students will be able to cite the evidence that supports the idea that some pure substances are “compounded” of elements in a definite ratio, as for example seen in electrolysis of water.
8.4	Students can use the periodic table to identify the atomic mass, atomic number, and common charges for the first 20 elements.
8.5	Students build an understanding of the periodic table and the significance of column location for the first 20 elements by calculation of molar ratios of known compounds.
8.6	Students will be able to determine the density of materials by their own measurements.
8.7	Students will be able to explain in their own words how the concept of density can be used as evidence to distinguish the properties of gases from those of liquids and solids.

Standard 9: Representing Chemical Change	
9.1	Students will be able to represent chemical changes using particle diagrams and chemical equations.
9.2	Students will be able to demonstrate the Law of Conservation of Matter in terms of atoms and mass of substances by balancing equations.
9.3	Students will be able to differentiate the basic types of reactions, for example: synthesis, decomposition, combustion, single replacement, and double replacement.

Standard 10: Electricity, Magnetism and Internal Structure	
10.1	Students can describe in their own words how the flow of charges in a wire can be modeled as the flow of water in a pipe.
10.2	Students will perform experiments to measure the voltage across and the current through a resistor and represent the results graphically.
10.3	Students can, in their own words, distinguish current from voltage and resistance, and explain that for some materials, the resistance is essentially constant (Ohm's Law).
10.4	Students can explain, in their own words, that the electrical resistance of an object depends on the intrinsic and extrinsic properties of that object, and construct a microscopic model consistent with their observations.
10.5	Students can solve problems that relate current, voltage, and resistance.
10.6	Students are able to measure current through and voltage across resistors in series and parallel and explain how the currents and voltages are related in these circuits.
10.7	Students observe the response of iron filings and of a compass to magnets, and observe or simulate the response of a compass to current flowing through a wire and infer the pattern of the resulting magnetic field.
10.8	Students can explain, in their own words, the concept of electric field and apply it to their work in electric circuits.
10.9	Students explore electrostatic interactions between charged objects, including conduction and induction, and can construct a microscopic model to explain their observations.
10.10	Students can explain, in their own words, how their observations are consistent with a microscopic model of the atom.

Standard 11: Waves	
11.1	Students can develop qualitative particle models of mechanical waves and explain the relationship of the particles and their interactions in transverse and longitudinal waves as well as how waves appear in nature as in water waves and tsunamis, ground waves in earth quakes, and sound waves.
11.2	Students will develop and apply a simple mathematical model regarding the relationship among frequency, wavelength, and speed of waves in a medium as well qualitatively understand reflection and transmission at boundaries and interfaces.
11.3	Students will explain how interacting waves produce different phenomena than singular waves in a medium, such as, periodic changes in volume of sound (beats) as well as resonance phenomena.
11.4	Students will explain how some technologies use waves and their interactions to capture and communicate information.

Standard 12: Nuclear Energy	
12.1	At the appropriate stages in development of student understanding of the atom, students will be able to describe the evidence for and the significance of the atomic models suggested by Dalton, JJ Thomson, Rutherford, and Bohr.
12.2	Students can describe the model of the atomic nucleus and can explain in their own words how the nucleus stays together in spite of the repulsion between protons.
12.3	Students can develop simple qualitative models or sketches of the atomic nucleus that illustrate nuclear structures before and after undergoing fusion, fission, or radioactive decay.
12.4	Students can identify energy transfers in fusion, fission, and radioactivity and compare energy released in these processes to conventional chemical processes.
12.5	Students can explain the potential positive and negative applications of nuclear processes such as the generation of energy at nuclear power plants or the potential damage that radioactivity can cause to biological tissues.