|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Conceptual Physics 2018 - 2019 | | | | | |
| ***Date Range*** | ***Unit*** | ***Essential Question(s)*** | ***List of Labs and Activities*** | ***Course Content Unit/Instructional Objectives*** | ***Summative Assessment*** |
| August 16 –Aug 28 | Lab Safety,  Scientific hypothesis and  Problem solving | What is scientific hypothesis?  What are the steps for problem solving? | * Drops of water * Marshmallow challenge | * Distinguish between a hypothesis that is scientific and one that is not. * Distinguish between an independent variables, dependent variables, and control variables. * Evaluate merits and limitations of two different models. (Atomic   models, Earth Shape models,  particle and wave models of light)   * Describe circumstances under which a hypothesis or law must be changed or abandoned.   ● Analyze the limitation of models | Quiz at the end of each lesson.  Unit Test on all lessons at the end of the unit. |
| Aug 29 – Sept 25 | Oscillation, Wave, and Sound | How to describe the motion of a wave?    What are some properties of waves? | * Period of a pendulum * Make an instrument * Speed of Sound | * Oscillation, vibration, waves, amplitude, wavelength, frequency, period speed of wave, doppler effect, interference (constructive interference, destructive interference), diffraction, S waves, P waves, transverse wave, longitudinal waves, Standing waves, hertz, crest, trough, wave speed, node, antinode, simple harmonic motion, Huygens's Principle * Pitch, loudness beats, forced vibration, resonance, infrasonic, ultrasonic, loudness, decibel, medium, natural frequency, | Quiz at the end of each lesson.  Unit Test on all lessons at the end of the unit. |
| Sept 25 – Oct 23 | Light, color and optics,  Invisible light, | How to use ray diagram to describe waves that are reflected, refracted by mirror and lenses?  Is light particle or wave? | * Lenses and mirror | * Coherent light, laser, monochromatic light, additive primary colors, pigment, white light, spectrum, cones, electromagnetic waves, mechanical waves, ray, transparent, and polarization. * Law of Reflection * Snell law, Critical angle/ total internal reflection * Virtual image/real image, Plane mirror ray diagram, Concave lens/ convex lens, Concave mirror/ convex mirror | Quiz at the end of each lesson.  Unit Test on all lessons at the end of the unit. |
| Oct 24 – Nov 20 | climate change and thermodynamics  Heat and Thermodynamics | How global warming works? | * Greenhouse effect | * Radio wave, Microwave, Infrared light, visible light, Ultraviolet light, x-ray, gamma ray, black body radiation. * Fossil fuels, Greenhouse effect, carbon emission trend, human activities lead to global warming, global warming consequences * Temperature, heat, thermal energy, thermal expansion, phase change, vaporization, condensation, melting, sublimation, freezing, deposition, newton’s cooling law, absolute zero, kinetic energy, conduction, convection, radiation, heat conduction time scale * Entropy, internal energy, heat, system, First law of thermodynamics, second law of thermodynamics | Quiz at the end of each lesson.  Unit Test on all lessons at the end of the unit. |
| Nov 26 – Dec 7 | Nuclear Physics | What is the smallest element? | * Radioactivy decay | * Proton, neutron and electron (size and mass), electron as wave (入= h/ mv) * Uncertainty principle * Radioactive isotopes, half-life, parent isotopes, daughter isotopes, half-life of carbon 14. * Fusion, fission, and chain reaction * Mass–energy equivalence equation | Quiz at the end of each lesson. |
|  | | | | | |
| Jan 7 – Feb 11 | Linear Motion and Projectile Motion | What is the difference between vector and scalar?  How can one describe the motion of an object?    How can one describe the motion of an object through a graph?    How does reference frame affect an observer’s description of an object’s motion?    What is projectile motion and how to predict the path of a projectile motion? | * Linear Motion | * Describe motion in terms of position, velocity, and acceleration * Identify the factors involved during free fall and their effects on the motion of the falling object * Express motion in terms of a vector and combinations of vectors * Predict the motion of projectiles | Quiz at the end of each lesson.  Unit Test on all lessons at the end of the unit. |
| Feb 12 – March 5 | Newton’s Law | If there is no force, what will be the motion of an object?    What is Newton’s 3 laws of motion? | * Projectile Motion * Newton 2nd law | * Identify the effect of inertia on both moving and stationary objects * Describe the relationship between force, mass, and acceleration when a force is applied to an object * Distinguish between static and kinetic friction and determine the effects on the motion of objects. * Create free body diagrams of the interactions between objects and forces * Identify the effect of air resistance on falling objects | Quiz at the end of each lesson.  Unit Test on all lessons at the end of the unit. |
| March 6 – April 12 | Momentum and Energy | How does one  determine the  mechanical  (kinetic and  potential) energy  of an object or  system of objects?  How can the law  of conservation of  energy be used to  determine the  motion of an  object? | * Egg drop experiments * Roller coaster Design lab | * Recognize the relationship between momentum and impulse and predict the impacts they have on each other. * Apply the principle of the conservation of momentum to colliding objects. * Recognize the relationship between work and energy and apply the principle of the conservation of energy to falling objects. * Apply conservation of work to determining how simple machines harness mechanical advantage. | Quiz at the end of each lesson.  Unit Test on all lessons at the end of the unit. |
| March 22 – May 3 | Special Relativity | If you could not see out the windows, if there any way to determine whether your car was moving with constant velocity or was at rest.  What would a light beam look like if you traveled along beside it ? |  | * Motion is relative * Every law of physics is the same for all inertial reference frame * The speed of light is the same everywhere * Time dilation * Length contraction * Special Relativity and the Twin Paradox * Special relativity applications | Quiz at the end of each lesson. |
| May 6 – May 17 | Electricity and Magnetism | What is the nature of changes and how do charges interact with one another?  What is Ohm’s  law?  What are  parallel circuits  and series  circuits?  What are some  electrical  safety rules? | * Virtual lab magnetic field, electric field. * Circuit | * Know what electric current is, and how voltage and resistance affect it (Ohm’s Law) * Know what a circuit is and how different circuit elements would fit in it * Know how to analyze series & parallel circuits in terms of total resistance, voltage across resistance, and current * Familiar with magnetic materials * Know what magnetic fields are, how they are created, and how they affect objects * Know that Earth has a magnetic field that affects life on Earth * Know that changing electric fields produce changing magnetic fields and different phenomena related to this | Quiz at the end of each lesson.  Unit Test on all lessons at the end of the unit. |