STAFFORD COUNTY PUBLIC SCHOOLS

Curriculum Overview
Physics

Course Description:
This course covers the laws of mechanics, electricity and magnetism, the gas laws, thermo-dynamics, electro-magnetic wave theory, elementary nuclear physics and relativity. It requires competence in the metric system and conversions, scientific notation, and manipulation of algebraic equations. This course is strongly recommended for students planning careers in science or engineering.

Essential Skills/Processes:
The goals of the course are to educate the student in the material content of Physics, to increase science inquiry skills and logical thinking, and foster positive attitudes for further science study.

- The student will investigate and understand how to analyze and interpret data
- The student will investigate and understand how to demonstrate scientific reasoning and logic
- The student will investigate and understand how applications of physics affect the world
- The student will investigate and understand the interrelationships among mass, distance, force, and time through mathematical and experimental processes
- The student will investigate and understand that quantities including mass, energy, momentum, and charge are conserved
- The student will investigate and understand properties of fluids
- The student will investigate and understand that energy can be transferred and transformed to provide usable work
- The student will investigate and understand how to use models of transverse and longitudinal waves to interpret wave phenomena
- The student will investigate and understand that different frequencies and wavelengths in the electromagnetic spectrum are phenomena ranging from radio waves through visible light to gamma radiation
- The student will investigate and understand, in describing optical systems, how light behaves in the fundamental processes of reflection, refraction, and image formation
- The student will investigate and understand how to use the field concept to describe the effects of gravitational, electric, and magnetic forces
- The student will investigate and understand how to diagram and construct basic electrical circuits and explain the function of various circuit components
- The student will investigate and understand that extremely large and extremely small quantities are not necessarily described by the same laws as those studied by Newtonian physics

Essential Knowledge:
Essential knowledge and skills is categorized into six strands.

Science as Process:
- Information recorded and presented in an organized format.
- Analysis of scientific sources to develop and refine research hypotheses and analysis of how science explains and predicts relationships.
- Metric units used in measurements and calculations with conversions when necessary.
- Instruments and techniques used in observations and measurements of mass, volume, temperature, heat exchange, energy transformations, motion, fields, and electrical charge.
- Appropriate technology including computers, graphing calculators, and probeware used for gathering and analyzing data and communicating results.
- Descriptions of physical problems translated into mathematical statements to find a solution.

- Relationships between physical quantities are determined using the shape of a curve passing through experimentally obtained data.
- The slope of a linear relationship is calculated and includes appropriate units.
- Examples of physics principles affecting the world and an examination of how new discoveries result in modifications of existing theories or establishment of new paradigms.
- Construction and defense of a scientific viewpoint.
- An emphasis on laboratory safety.

Mechanics:

- Interrelationships among mass, distance, force, and time using mathematical and experimental processes including Newton's laws of motion.
- Conservation of mass, energy, momentum, and charge.
- Transformation of energy among forms, including mechanical, thermal, electrical, gravitational, chemical, and nuclear.
- The concept of stability including center of mass, center of gravity, gravitational fields and interactions.
- Simple machines.
- Linear motion, projectile motion, planetary motion, gravitation.
- Aspects of circular motion including centripetal force, centrifugal force, and angular momentum.

Mechanics continued:

- Properties of fluids including density and pressure; fluids in motion
- Archimedes' principal of buoyancy, Pascal's principle, and Bernouilli's principle.

Heat:

- Change of state involving evaporation, condensation, freezing, melting, latent heat of fusion, and latent heat of vaporization.
- Laws of thermodynamics and transmission of heat, including conduction, convection, and radiation.

Waves:

- Models of waves used to interpret wave phenomena.
- Wave characteristics (period, wavelength, frequency, amplitude and phase).
- Fundamental wave processes (reflection, refraction, diffraction, interference, polarization, Doppler effect).
- Light and sound in terms of wave models.
- Properties and behaviors of radio, microwaves, infrared, visible light, ultraviolet, x-rays, and gamma rays and applications based on their wave properties.
- Image formation in describing optical systems.
- Construction and interpretation of ray diagrams.
- Development of use of mirror and lens equations.
- Predictions of type, size, and position of real and virtual images.

Electricity and Magnetism:

- Construction and diagramming of electrical circuits with explanations of circuit components including Ohm's law, series, parallel, and combined circuits.
- Circuit components including resistors, batteries, generators, fuses, switches, and capacitors.
- Use of the field concept to describe electric and magnetic fields including Coulomb's law.
- Operating principles of motors, generators, transformers, and cathode ray tubes.

Atomic and Nuclear:

- Atomic nature of matter including atomic structure, states of matter.
- Nuclear physics including radioactivity, half-life, fission, and fusion.
- An awareness that extremely large and extremely small quantities are not necessarily described by the same laws as those studied in Newtonian physics.
- Quantum mechanics and uncertainty.
- Wave/particle duality.
- The photoelectric effect. Relativity.