

# SALINE AREA SCHOOLS COURSE OUTCOMES

## SCIENCE I

## 9TH GRADE

### **Biology/Earth Sciences**

1. Describe the structure and organization of cells and the processes taking place within the cells. (cells)
2. Evaluate the organization of life. (organization)
  - a. Define the required conditions for a living organism.
  - b. Describe how life is maintained.
    - (1) DNA
    - (2) Protein synthesis
  - c. Classify living organisms.
3. Comprehend and apply concepts of heredity. (heredity)
4. Understand the evolving nature of life. (evolution)
5. Apply environmental principles to everyday life. (ecosystems)
6. Describe the processes that take place to form and change the Earth.
7. Recognize the importance of oceans and water to our planet.
8. Describe the mechanics and composition of the universe and compare to our planet.
9. Understand and apply the factors related to weather and weather systems.
  
12. Use basic measurement techniques and various systems of units.
13. Become familiar with the scientific process.

# SALINE AREA SCHOOLS COURSE OUTCOMES

## SCIENCE II

## GRADES 9-10

### **Physical Science/Chemistry**

1. Compare and contrast the relationships among matter, energy, and motion.
  - a. Understand and explain the laws of conservation
  - b. Understand and explain Newton's laws of motion and relate it to everyday occurrences.
  - c. Understand and explain kinetic theory
  - d. Perform calculations and measurements of speed and direction of an object and properly use units when doing so.
  
2. Apply the laws of magnetism, electricity, and heat transfer
  - a. Describe and use Ohm's Law
  - b. Design a simple circuit; both series and parallel. Explain the function of each item in a circuit.
  - c. Understand the principles behind static electricity and current electricity and how electric currents can be produced by interacting wires and magnets (i.e. electromagnetic induction)
  - d. Calculate the power usage of household appliances
  - e. Explain changes in matter and energy involved in heat transfer
    1. Be able to identify the mechanisms of heat transfer (conduction convection, and radiation)
  
3. Understand and describe the relationships between work, energy, machines, and power.
  - a. Calculate work, potential energy, and kinetic energy.
  - b. Distinguish the difference between power and work.
  - c. Understand the principle behind simple machines
    1. How they change the direction of the force as well as the distance the force is being applied.
    2. Evaluate the efficiency and the mechanical advantage of a simple/complex machine.
  - d. Describe how energy is conserved during transformations

4. Understand the characteristics of waves and apply to observed phenomena. Compare and contrast the properties of light and sound.
  - a. Describe how to assess the energy of light and sound waves
  - b. Describe waves in terms of their properties: amplitude, wavelength, frequency, wave velocity—as related to mechanical waves and EM waves
  - c. Understand wave interactions such as interference, refraction, diffraction, and reflection
  - d. Calculate wave speed using distance and frequency
  - e. Gain working knowledge of the Doppler Effect and how it influences pitch
    1. Relate characteristics of sounds that we hear to properties of sound waves.
    2. Explain how sound recording devices work.
  - f. Relate colors to wavelengths of light
    1. Be able to use and understand the production of spectra
  - g. Explain how we see colors of light.
    1. Explain the difference between emission, reflection, adsorption, and transmission.
  - h. Describe different types of waves and their technological applications, i.e., ultrasound, microwaves, etc.
5. Describe and depict composition of matter
  - a. Identify the difference between compounds, mixtures, elements, and solutions.
  - b. Employ the proper separation technique given a particular mixture
  - c. Quantitatively and qualitatively assess the amount of heat that is released or absorbed by a system and relate it to potential energy.
  - d. Distinguish between chemical and physical changes and explain how mass is conserved in changes.
    1. Identify the common physical and chemical changes-state change, changes in size.
    2. Describe how common materials are made and disposed of or recycled ( i.e. refining, mining, water treatment, incinerators etc.
    3. Describe chemical changes by their typical characteristics
    4. Provide examples of chemical and physical changes
  - e. Distinguish between chemical and physical properties
  - f. Understand kinetic theory and how it relates to state changes and reaction rate.
6. Understand chemical bonding, chemical reactions, and stoichiometry
  - a. Explain how families of elements are related by common properties
  - b. Analyze properties of common household and agricultural materials in terms of risk/benefit balance
  - c. Use the stock and root naming systems appropriately
  - d. Distinguish the differences between ionic compounds and molecules
  - e. Understand why elements bond together to form compounds

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- f. Predict bonding based on the charge of the elements
  - g. Categorize chemical reactions into the 5 major groupings (synthesis, decomposition, single displacement, double displacement, and combustion).
  - h. Determine the amount of product produced given the starting amount of reactants by balancing equations and using mole ratios (solving mass-mass equations as well as volume-volume equations)
7. Understand the principles behind nuclear changes
- a. Describe nuclear changes in terms of properties of reactants and products
  - b. Compare and contrast changes in atoms and/or molecules during physical, chemical, and nuclear changes
  - c. Apply these concepts to natural and technological systems (i.e. nuclear power plants, natural radioactive decay, etc)
8. Analyze and draw conclusions from charts, graphs, and calculations
- a. Identify dependent and independent variables within a lab setting
  - d. Organize and present data for an audience logically and accurately
  - e. Identify trends and develop theories to explain trends
  - f. Be able to use computer programs to chart data and perform simple statistical analysis
  - g. Analyze trends on a graph and articulate what the trend applies.
9. Use scientific processes to design and conduct experiments.
- b. Develop an experiment to research a problem or test a hypothesis—they will develop their own procedures.
  - c. Relate scientific principles to everyday phenomena
10. Using Scientific Tools and Measurement
- a. Record data using significant figures and scientific notation.
  - b. Convert between the American and the SI system of measurement using the factor label method.
  - c. Calculate the density of an object using a graduated cylinder and balance.
  - d. Use appropriate SI dimension and prefix when describing the size or amount of an object as well as compare and contrast the density of different objects.
  - e. Measure and pick the appropriate measuring tool for a given task.
11. Lab skills
- a. Write a more sophisticated lab report with conclusions that use data to support their ideas.
  - b. Identify lab equipment including crucibles, evaporation dishes, water baths, and condensers.



# SALINE AREA SCHOOLS COURSE OUTCOMES

## PLANT SCIENCE II (Landscape Horticulture)

### Abilities Outcome

1. Apply science to life (apply the following to each outcome).
  - a. Use knowledge of science to develop abilities.
    - (1) Higher thinking (analyze, solve, decide, evaluate, classify, develop, create, predict, estimate, generalize).
    - (2) Communications (present, persuade, demonstrate, explain, defend, consider, deduce, recommend, share).
    - (3) Goal setting and attainment (research, envision, brainstorm, plan, organize, conduct, persist).
    - (4) Experience (collaborate, ethics, relate, summarize, record, interpret, compare, simplify, conclude).
  - b. Use the scientific method with problems and experiments (research, hypothesis, experiment, observe, evaluate).
  - c. Use scientific equipment in a proper manner.
  - d. Use technology to assist in problem solving.
  - e. Understand the relationship between humans, the environment, earth's resources.
    - (1) Effects of pollution (on plant production of food, fiber, ornamentals, and building materials).
    - (2) Practices of conservation (reuse, reduce, recycle, refuse, tillage practices).
    - (3) What we can do to promote a healthy world and establish sustainable systems.

### Content Outcomes

2. Use a microscope to work with plant cells, tissue, and pests.
  - a. Know the parts and functions of a microscope.
  - b. Know how to properly focus the microscope and observe a specimen.
  - c. Identify key features on plant parts and pests using magnification.
3. Classify and identify plants and pests using characteristics.
  - a. Utilize binomial nomenclature and a dichotomous key to identify plant species by genus, species, variety, or cultivar.
  - b. Germinate seeds, observe roots, and classify as fibrous/tap root type and mono or dicot.
  - c. Identify ornamental plants, vegetables and pests by common and botanical name.

4. Understand the soil/water plant media environment and its interrelationship to plant growth.
  - a. Use a soil texture triangle to identify and classify soil types.
  - b. Prepare soil less plant media mix, which matches the needs of the plant species selected.
  - c. Take a soil sample using a soil auger to determine soil horizon, texture, color, and drainage.
  - d. Use a slope finder to determine percent slope, potential for erosion, and suggest possible land uses to minimize erosion.
  - e. Use a county soil survey report to evaluate potential problems with planned plant species to be planted.
  - f. Compare plant growth rates in different soil mediums versus hydroponic methods.
  - g. Use scientific test equipment to determine the nutrient content and pH of a soil or water sample.
  - h. Experiment with nutrient and trace mineral levels, observe plant growth, draw conclusions.
  
5. Organize, plan, construct, and maintain outdoor landscape designs and propagate plants.
  - a. Use common nursery/landscape industry tools to design and construct a landscape plan, utilizing harmony, unity, color, balance, proportion, scale, focal point, rhythm, line, form, space, depth, and texture.
  - b. Demonstrate proper care and safe handling of plant materials, equipment, and tools.
  - c. Select plants for harvesting, replanting, and distribution.
  - d. Propagate plants by seed, cuttings, micropropagation, separation, division, and layering.
  - e. Construct a class landscape project on school grounds or in the community.
  - f. Prune a landscape plant, using nursery industry tools to industry standards.
  
6. Explain the essential elements for operation of a retail/wholesale nursery/landscape, turf, or greenhouse crop business.
  - a. List and explain the types and location of a successful plant industry operation.
  - b. Draw and explain product presentation and floor layout using visual merchandising, service area, work area, storage, and refrigeration.
  - c. List, explain, and role play the duties of plant industry employees and their role in marketing, salesmanship, and customer relations.
  - d. Explore a career title in the plant industry and communicate the results, both orally and in written form.
  - e. Perform various leadership skills needed in the industry.
  - f. Design and implement an Integrated Pest Management program (IPM).
  - g. Manage the complete cycle of a nursery, turf, or greenhouse crop from seed to market.
  - h. Measure a landscape site using geometric formulas and prepare a cost estimate for services.

# **SALINE AREA SCHOOLS COURSE OUTCOMES**

## **ENVIRONMENTAL SCIENCE**

1. Analyze plate tectonics and the tectonic cycle.
  - a. Distinguish between different plate boundaries.
  - b. Apply various plate boundaries to geological occurrences and formations.
2. Trace the process of the rock cycle.
  - a. Differentiate between the three types of rock.
  - b. Correlate rock layers from evidence found in rock.
  - c. Interpret earth processes associated with rock type.
3. Research hazardous processes, such as volcanoes, earthquakes, flooding and coastal erosion.
  - a. Investigate service functions of natural processes.
  - b. Explore process of prediction and prevention.
  - c. Analyze causes of hazardous processes.
  - d. Interpret risk assessment.
  - e. Determine human influence.
  - f. Explore control methods.
4. Investigate methods of recovery from environmental disasters.
  - a. Explore the role of the U.S. Army Corps of Engineers, FEMA, and the American Red Cross.
  - b. Evaluate relocation and zoning.
5. Identify the component parts of an ecosystem and the principal necessary for an ecosystem to function.
  - a. Investigate an ecosystem.
6. Recognize how systems change over time.
7. Differentiate between types of soils and determine the relationship between soil, plants and human activities.
8. Analyze the hydrologic cycle and assess its influence on the earth and living organisms.
9. Trace the path of waste disposal.
10. Interpret assumptions about pollution problems.

# SALINE AREA SCHOOLS COURSE OUTCOMES

## CHEM COM

1. Describe and compare objects in terms of mass, volume, and density.
2. Show how common themes of science, mathematics, and technology apply in real world contexts.
3. Discuss topics in groups being able to restate or summarize what others have said, ask for clarification or elaboration, and take alternative perspectives.
4. Analyze properties of common household and agricultural materials in terms of risk/benefit balance.
5. Describe how human activities affect the quality of water in the hydrosphere.
6. Evaluate alternative long range plans for resource use and byproduct disposal in terms of environmental and economic impact.
7. Explain how and why earth materials are conserved and recycled.
8. Describe and explain the structural parts and electrical charges of atoms.
9. Explain how mass is conserved in physical and chemical changes.
10. Describe how common materials are made and disposed of or recycled.
11. Explain chemical changes in terms of the arrangement and motion of atoms and molecules.
12. Explain how families of elements are related by common properties.
13. Trace, to an original source, the energy used by living things and machines.
14. Explain the importance of petroleum by stating the products derived from it as well as the energy use it provides.
15. State the three major food types and be able to state how they are used by the body.

16. Differentiate between two classes of vitamins and state which is needed daily.
17. State the major types of food additives and give their purpose in foods.
18. Describe, compare, and contrast changes in atoms/molecules during physical, chemical, and nuclear changes.
19. Describe nuclear changes in terms of the properties of reactants and products.
20. Describe technology used in the prevention, diagnosis, and treatment of diseases.

# SALINE AREA SCHOOLS COURSE OUTCOMES

## CHEM COM

1. State how science influences their lives in political, economic, and environmental ways.
2. Investigate problems man is creating on the planet, study these problems, and create and assess solutions.
3. Perform measurements and accurately collect and organize data.
4. Interpret graphs and charts verbally.
5. Gain skills working in teams to gather and analyze data in identifying and solving problems.
6. Use information to make informed often opinionated, decisions regarding environmental and societal issues surrounding science.
7. Evaluate risks versus benefits in the way humans use their resources and affect their environment.

# SALINE AREA SCHOOLS

## COURSE OUTCOMES

### AP BIOLOGY

1. Understand molecules and cells.
  - a. Understand basic biological chemistry.
  - b. Understand the structures and functions of cells and cell components.
  - c. Describe the energy transformations that occur within the cell.
  
2. Understand genetics and evolution.
  - a. Describe the structures and processes involved in molecular genetics.
  - b. Comprehend and apply concepts and laws of heredity.
  - c. Understand life's evolving nature.
  
3. Describe organisms and populations.
  - a. Survey the kingdoms of Monera, Protista, and Fungi.
  - b. Comprehend the diversity, anatomy, physiology, homeostasis development and behavior of animals.
  - c. Understand the diversity, development, response, structure and physiology of plants.
  - d. Apply the concepts of ecology.

# **SALINE AREA SCHOOLS COURSE OUTCOMES**

## **EARTH SCIENCE**

1. Evaluate the relationship between structure and function of the earth and earth systems.
2. Use a scientific approach to analyze social, personal and environmental problems related to the study of the earth.
3. Examine the role of matter and energy as they relate to the earth.
4. Explain how earth systems change over time.
5. Understand the impact of earth science on careers.

# SALINE AREA SCHOOLS

## COURSE OUTCOMES

### AP CHEMISTRY

1. Understand structure of matter.
  - a. Know how to determine atomic masses by chemical and physical means.
  - b. Know how to determine atomic number and mass number of isotopes.
  - c. Know how to use a periodic table to obtain relationships for atomic radii, ionization energies, electron affinities and oxidation states.
2. Understand chemical bonding.
  - a. Know how to classify types of bonding.
  - b. Know how to predict polarity of bonds based on electron negativities.
  - c. Know how to use Lewis structures.
  - d. Know how to explain the geometry of molecules and ions and the relation of properties to structure.
3. Understand states of matter.
  - a. Know how to use laws for ideal gases.
  - b. Know how to interpret kinetic-molecular theory of gases.
  - c. Know how to interpret liquids and solids for the kinetic-molecular view point.
  - d. Know how to classify solutions.
  - e. Know methods of expressing concentration.
  - f. Know how to explain non-ideal behavior of gases.
4. Understand reactions.
  - a. Know how to use concepts on acid-base reactions.
  - b. Know how to balance oxidation-reactions.
5. Understand stoichiometry.
  - a. Know how to balance equations and use the mole ratios.
  - b. Know how to use mass and volume relationships.
6. Understand equilibrium.
  - a. Know what is meant by dynamic equilibrium.
  - b. Know how to calculate and use equilibrium constants.
  - c. Know the common ion effect, buffers and hydrolysis.
7. Understand kinetics.
  - a. Know how to use differential rate laws to determine order of reaction.
  - b. Know how to calculate energy of activation and the role of catalysts.
8. Understand thermodynamics.
  - a. Know how to use the first, second, and third law of thermodynamics.
  - b. Know how to use the free energy relationship between enthalpy and entropy.
  - c. Know how to find electrode potentials.

# SALINE AREA SCHOOLS

## COURSE OUTCOMES

### CHEMISTRY

1. Understand structure of matter.
  - a. Know how to classify matter.
  - b. Know how to determine atomic number and mass number of isotopes.
  - c. Know how to use a periodic table to obtain relationships for atomic radii, ionization energies, electron affinities and oxidation states.
2. Understand measurements and solving problems.
  - a. Know how to use factor label method for solving problems.
  - b. Know how to use a scientific calculator.
3. Understand the Periodic Law.
  - a. Know how to write electron configuration.
  - b. Know how to write quantum numbers.
4. Understand the language of chemistry.
  - a. Know how to write chemical formulas.
  - b. Know how to name chemical compounds.
  - c. Know how to balance chemical equations.
5. Understand chemical bonding.
  - a. Know how to classify types of bonding.
  - b. Know how to predict polarity of bonds based on electron negativities.
  - c. Know how to use Lewis structures.
  - d. Know how to explain the geometry of molecules and ions and the relation of properties to structure.
6. Understand phases of matter.
  - a. Know how to use laws for ideal gases.
  - b. Know how to interpret kinetic-molecular theory of gases.
  - c. Know how to interpret liquids and solids for the kinetic-molecular view point.
  - d. Know how to classify solutions.
  - e. Know methods of expressing concentration.
  - f. Know how to explain non-ideal behavior of gases.
7. Understand chemical reactions.
  - a. Know how to use concepts on acid-base reactions.
  - b. Know how to balance oxidation-reactions.
8. Understand stoichiometry.
  - a. Know how to balance equations and use the mole ratios.
  - b. Know how to use mass and volume relationships.

9. Understand equilibrium.
  - a. Know what is meant by dynamic equilibrium.
  - b. Know how to calculate and use equilibrium constants.
  - c. Know the common ion effect, buffers and hydrolysis.
  
10. Understand kinetics.
  - a. Know how to use differential rate laws to determine order of reaction.
  - b. Know how to calculate energy of activation and the role of catalysts.
  
11. Understand thermodynamics.
  - a. Know how to use the first, second, and third law of thermodynamics.
  - b. Know how to use the free energy relationship between enthalpy and entropy.
  - c. Know how to find electrode potentials.
  
12. Understand nuclear chemistry.
  - a. Know how to balance nuclear reaction.
  - b. Know how to calculate half-life.
  - c. Know how to measure radioactivity.

# SALINE AREA SCHOOLS

## COURSE OUTCOMES

### GENERAL PHYSICS

Upon completion of general physics each student will:

1. Perform measurements and accurately collect data.
  - a. Estimate distances in SI and English units.
  - b. Convert between SI and English units.
  - c. Propagate error in data and follow rules for significant digits.
  - d. Use lab tools to make measurements to specified uncertainty.
  
2. Use computers to analyze and interpret physical data.
  - a. Make computer graphs of data.
  - b. Produce lab reports using a computer.
  - c. Perform experiments using a computer interface and test probes.
  
3. Apply the laws of Newtonian mechanics to solve problems.
  - a. Solve statics problems ( $\Sigma F=0$ ).
  - b. Solve dynamic problems ( $\Sigma F=ma$ ).
  - c. Describe space travel and planetary motion.
  - d. Equate impulse and change in momentum to solve problems.
  - e. State and apply Newton's 3 laws.
  
4. Solve problems using the law of conservation of energy.
  - a. Describe the five forms of energy.
  - b. Explain energy transformations in the real world.
  - c. State and apply the Work-Energy theorem
  - d. Calculate the kinetic and potential energy of a body.
  
5. Describe the laws of thermodynamics and heat transfer.
  - a. Convert between Fahrenheit, Celsius, and Kelvin.
  - b. Solve linear expansion problems.
  - c. Define latent heat and phase change.
  - d. Solve calorimetry problems.
  - e. Describe the 3 methods of heat transfer.
  - f. Define heat, temperature, and thermal energy.
  - g. State and apply the 1st and 2nd laws of thermodynamics.
  - h. Define entropy.
  
6. Explain the laws of electrostatics.
  - a. Describe three methods of charging.
  - b. Explain how charges interact.
  - c. Calculate the force of electrostatic attraction and repulsion.

7. Explain the nature of Fluid mechanics.
  - a. Calculate densities.
  - b. State and apply Archimede's principals.
  - c. State and apply Bernoulli's principals.
  - d. Calculate pressure on a surface and in a fluid.
  
8. Analyze and understand AC and DC circuits and their components.
  - a. State and apply Ohm's law.
  - b. Draw schematic diagrams.
  - c. Build series and parallel circuits.
  - d. Apply Kirchoff's laws to simple circuits.
  - e. Describe and explain the function of capacitors, resistors, voltage sources, and switches.
  
9. Explain the relationship between electricity and magnetism.
  - a. Explain how a motor/generator works.
  - b. Describe the magnetic field of a bar magnet.
  - c. Discuss the function of a compass.
  - d. Explain the concept of induction and give applications.
  
10. Describe the nature and behavior of light.
  - a. Explain the particle/wave duality of light.
  - b. Demonstrate reflection, refraction, and diffraction.
  - c. Identify all forms of electromagnetic radiation.
  - d. Explain how lenses and combinations of lenses affect light.
  - e. Build a simple optical device (telescope, camera, glasses).
  
11. Describe the atomic nature of matter.
  - a. Describe the nature of matter.
  - b. Define and explain the function of elementary particles.
  - c. Explain how nuclear reactions take place.
  
12. Describe and explain the applications of special relativity.
  - a. State Einstein's two postulates.
  - b. Explain time dilation and length contraction.
  - c. Calculate realistic energy, momentum, and velocities.
  - d. State and explain the "Twin Paradox".

# SALINE AREA SCHOOLS

## COURSE OUTCOMES

### PT PHYSICS

1. Perform measurements and accurately collect data.
2. Perform conversions between SI units and various other systems of measurement.
3. Understand and describe the inter-relatedness between the concepts of FORCE, WORK, RATE and RESISTANCE.
4. Understand and apply concepts involving mechanical forces.
5. Describe force-like quantities and their interactions in thermal, electrical, and fluid systems.
6. Understand and apply concepts involving mechanical work.
7. Calculate work done in mechanical, electrical, and fluid systems.
8. Understand and apply concepts involving rate and flow rate in mechanical, fluid, electrical, and thermal systems.
9. Understand and apply concepts involving resistance in mechanical, fluid, electrical, and thermal systems.
10. Use computers and electronic devices to analyze and interpret physical data.
11. Build a balsa wood structure based on experimental and computer aided analysis of various truss types.
12. Apply laws of electricity and electronics to build a simple electronic device to carry out a task in the real world.
13. Demonstrate the ability to work responsibly with a group of peers towards a common goal.
14. Produce technical reports using CAD and Desktop Publishing software.

# SALINE AREA SCHOOLS

## COURSE OUTCOMES

### AP PHYSICS C

#### **The Course**

AP Physics C consists of a full high school academic year of work (2 credits) that is comparable to first year physics courses taught in colleges and universities. The Physic C course ordinarily forms the first part of the college sequence that serves as the foundation in physics for students majoring in engineering or the physical sciences. The sequence is parallel to or is preceded by mathematics courses that include calculus. The subject matter of AP Physics C is principally mechanics.

#### **Prerequisites**

Before studying AP Physics, it is recommended that students complete the introductory physics course. This first year course permits the student to explore concepts in the laboratory and provides a richer experience in the process of science and better prepares them for more analytical approaches taken in the AP course. Students who have not taken an introductory physics course should have taken one of the following: Chemistry, AP Chemistry or AP Biology.

A previous or concurrent enrollment in a calculus class is also required for the study of AP Physics C. At Saline High School, either AP Calculus AB or AP Calculus BC will satisfy this requirement.

#### **Philosophy**

Advanced Placement Physics C is primarily concerned with preparing the student for the Advanced Placement Examination in Physics C (Mechanics) administered each May by the College Board by developing the students' understanding of the concepts of physics and providing experiences with its methods and applications. Strong emphasis is placed on solving a variety of challenging problems, some requiring calculus.

It is expected that **all** students who take this AP course will seek college credit, advanced placement, or both, from institutions of higher learning by sitting for and passing the Advanced Placement Examination. Students who are not interested in seeking college credit should elect the one semester introductory physics course.

### **Objectives**

In this course, basic knowledge of the discipline of physics is emphasized, including its theories, techniques and generalizing principles. The students ability to ask physical questions and obtain solutions to physical questions using intuition, experimentation and formal logic is developed through a variety of problem solving opportunities. The overall goal is to foster students' appreciation, curiosity, creativity and reasoned skepticism of the physical world and the way it works.

1. Students should be able to read, understand and interpret physical information presented in verbal, mathematical and graphical form.
2. Students should be able to describe and explain the sequence of steps in the analysis of a particular physical phenomenon or problem, including:
  - Describe the idealized model to be used in the analysis, including simplifying assumptions where necessary.
  - State the principles or definitions that are applicable.
  - Specify relevant limitations on applications of these principles.
  - Carry out and describe the steps of the analysis, verbally or mathematically.
  - Interpret the results or conclusions, including discussion of the particular cases of special interest.
3. Students should be able to basic mathematical reasoning – arithmetic, algebraic, geometric, trigonometric or calculus, where appropriate – in a physical situation or problem.
4. Students should be able to perform experiments and interpret the results of observations, including making an assessment of experimental uncertainties.

### **Topical Outline**

The outline of topics is intended to indicate the scope of the course, but it is not necessarily the order in which topics are taught. Although the Advanced Placement Examination in Physics C is based on the topics listed in this topical outline, teachers may enrich the course with additional topics.

1. **Kinematics**
  - Analyze vectors using vector algebra and vector components.
  - Solve motion problems in one dimension.
  - Solve motion problems in two dimensions, including projectile motion and circular motion.

2. **Newton's Laws of Motion**
  - Draw and analyze Free Body Diagrams.
  - Apply Newton's First Law to solve static equilibrium problems.
  - Apply Newton's Second Law to solve dynamics problems of a single particle.
  - Apply Newton's Third Law to solve systems of two or more bodies.
  - Analyze systems involving static and kinetic friction.
  
3. **Work, Energy and Power**
  - Apply the Work-Energy Theorem.
  - Define and compute power, potential energy and kinetic energy.
  - Apply the concept of conservation of energy.
  
4. **Systems of Particles and Linear Momentum**
  - Compute the center of mass of a discrete system.
  - Apply the Impulse-Momentum Theorem.
  - Apply conservation of linear momentum in one and two dimensions.
  - Analyze elastic, inelastic and completely inelastic collisions.
  
5. **Rotation**
  - Compute torques and solve rigid body equilibrium problems.
  - Solve rotational kinematics problems.
  - Define and compute moments of inertia.
  - Solve Rotational dynamics problems.
  - Define angular momentum and apply the law of Conservation of Angular Momentum.
  
6. **Oscillations**
  - Analyze mass-spring systems oscillating in simple harmonic motion.
  - Analyze the dynamics of a simple pendulum.
  
7. **Gravitation**
  - Apply Newton's Universal Law of Gravitation.
  - Analyze circular orbits.
  - Analyze general orbits using Kepler's Laws of Planetary Motion.