COURSE TITLE

Science 107/207/307

LENGTH

Full Year

DEPARTMENT

STEM Department

SCHOOL

Rutherford High School

DATE

September 10, 2018

Initial BOE Approval Date (Born on): 8/17/2015

Science 107/207307

I. Introduction/Overview/Philosophy

Science 107/207/307 is the course intended to introduce students to the study of the physical world around them. It is not a subject to be learned primarily from books or computers. Students in this course will learn about the properties of matter, elements, compounds, electricity, sound and light. Through a variety of laboratory and hands on activities, students will be able to experience the concepts of the physical world around them. The goal of the course is to instill in students the belief that science is an exciting, relevant, human activity that can be enjoyable to study.

II. Objectives

Course Outline:

1. Relate measurement to problem solving by:
    a. Performing calculations using scientific notation.
    b. Defining and calculating the accuracy and precision of a group of measurements.
    c. Identifying and applying appropriate mathematical operations to solve problems.
2. Illustrate motion in one dimension by:
    a. Determining velocity of a moving object.
    b. Differentiating between speed and velocity.
3. Use Newton's Laws of Motion by:
    a. Distinguishing between mass and weight.
    b. Applying the three laws to a variety of problems.
    c. Describing the effects of friction on a moving object.
4. Identify the relationship between work, energy, and simple machines by:
    a. Defining energy in terms of work.
    b. Describing and using simple machines.
5. Distinguish between the forms of energy by illustrating the relationship between kinetic and potential energy.
6. Describe the properties of visible light be examining the characteristics of light.
7. Compare matter and energy by:
    a. Explaining the difference between mass and weight.
    b. Listing some types of energy.
    c. Stating the laws of conservation of mass and energy.
    d. Explaining the gaseous, liquid and solid states in terms of particles.
    e. Distinguishing between physical and chemical properties of matter.
    f. Classifying changes in matter as physical or chemical.
    g. Differentiating between homogeneous and heterogeneous matter, and a pure substance and a mixture.
8. Investigate the chemical elements by:

a. Learning the common names and symbols for elements.
b. Describing the arrangement of the Periodic Table.
c. Differentiating between metals, nonmetals, and metalloids.
d. Explaining the role of Mendeleev in the development of the Periodic Table.
e. Explaining how the Periodic Table can be used to predict the physical and chemical properties of elements.
f. Describing the modern Periodic Table.

9. Measure and solve problems by:
   a. Naming SI and other common units of length, mass, time, volume, and density.
   b. Performing density calculations.
   c. Defining temperature and using its units of measure.
   d. Converting temperatures between Celsius and Kelvin scales.
   e. Defining heat and its units, and performing specific heat calculations.
   f. Distinguishing between accuracy and precision.
   g. Performing mathematical operations involving significant figures.
   h. Using scientific notation to write numbers and to perform arithmetic calculations.
10. Investigate atoms, the building blocks of matter, by:
   a. Summarizing the five essential points of Dalton's atomic theory.
   b. Summarizing the observed properties of cathode rays that led to the discovery of the electron.
   c. Summarizing the experiment conducted by Rutherford that led to the discovery of the nucleus.
   d. Defining and describing the structure of atoms and isotopes.
   e. Determining the number of protons, neutrons, and electrons in a nuclide.

Student Outcomes:

After successfully completing this course, the student will:

- Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations.
- Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories.
- Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.
- Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.
- Build, refine, and represent evidence-based models using mathematical, physical, and computational tools.

New Jersey Student Learning Standards

CAREER READY PRACTICES

CRP1 Act as a responsible and contributing citizen and employee.

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment

of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2 Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation

CRP4 Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of

integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP10. Plan education and career paths-aligned to personal goals.
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career patHS-require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.
Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

TECHNOLOGY STANDARDS
Standard 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
Strand C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
8.1.12.C.1- Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
Strand C. Design: The design process is a systematic approach to solving problems.
8.2.12.C.1- Explain how open source technologies follow the design process.

21ST CENTURY LIFE AND CAREERS
9.2 Career Awareness, Exploration, and Preparation
Strand C: Career Preparation
9.2.12.C.1 Review career goals and determine steps necessary for attainment.
9.2.12.C.2 Modify Personalized Student Learning Plans to support declared career goals.

COMPANION STANDARDS FOR SCIENCE AND TECHNICAL SUBJECTS

RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
WHST.11-12.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
WHST.11-12.9. Draw evidence from informational texts to support analysis, reflection, and research.

NEW JERSEY STUDENT LEARNING STANDARDS- SCIENCE

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-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-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
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-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
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-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
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-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative position of particles (objects).
HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media
HS-PS4-2. Evaluate questions about the advantages of using digital transmission and storage of information
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-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

III. Proficiency Levels

Science 107/207/307 is required for all students in Grades 9, 10, and 11 who meet the necessary criteria for placement in the course.

IV. Methods of Assessment

Student Assessment
The teacher will provide a variety of assessments during the course of the year. The assessment may include but is not limited to: chapter and unit tests and quizzes, application problems, homework, and projects.

Curriculum/Teacher Assessment
The teacher will provide the subject area supervisor with suggestions for changes on an ongoing basis.

V. Grouping

Science 107/207/307 is grouped by ability level. Students are placed in this course per need identified by the Child Study Team.

VI. Articulation/Scope & Sequence/Time Frame

Course length is one year.

VII. Resources

Texts/Supplemental Reading/References

Physical Science. AGS Globe, 2012.

VIII. Suggested Activities

Appropriate activities are listed below in the curriculum map.

IX. Methodologies

The following methods of instruction are suggested: lecture, working in groups/working with a partner, demonstration, and laboratory experiments.

X. Interdisciplinary Connections

This course incorporates math and other science disciplines. Laboratory reports make use of writing skills learned in language art literacy.

XI. Differentiating Instruction for Students with Special Needs: Students with Disabilities, Students at Risk, English Language Learners, and Gifted & Talented Students

Differentiating instruction is a flexible process that includes the planning and design of instruction, how that instruction is delivered, and how student progress is measured. Teachers recognize that students can learn in multiple ways as they celebrate students' prior knowledge. By providing appropriately challenging learning, teachers can maximize success for all students.

Differentiating in this course includes but is not limited to:

Differentiation for Support (ELL, Special Education, Students at Risk)

- Peer mentoring on problems
- Differentiated teacher feedback on assignments
- Modeling out problems on whiteboard
- Visual aids as we project problems on whiteboard
- Study guides
- Tiered assignments
- Scaffolding of materials and assignments
- Re-teaching and review
- Guided note taking
- Exemplars of varied performance levels
- Multi-media approach to accommodating various learning styles

Differentiation for Enrichment

- Supplemental reading material for independent study
- Flexible grouping
- Tiered assignments
- Topic selection by interest
- Enhanced expectations for independent study
- Elevated questioning techniques using Webb's Depth of Knowledge matrix

XII. Professional Development

The teacher will continue to improve expertise through participation in a variety of professional development opportunities.

XII. Curriculum Map/Pacing Guide

Unit Topic	**Time Allocated**	**Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students**	**Standards**	**Assessments**
Measurement • Measuring everyday objects • Measuring using metric vs standard • Scientific Notation • Math Operation	4 weeks	*For Support:* Prompts, Authentic Assessments, Use of a notecard *For Enhancement:* Interest Based Content, Student driven activities, Independent Study	HS-PS1-7 CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.8	*Formative Assessment:* Do nows, homework, questioning on measurement, group work *Summative Assessment:* Quiz on Measuring, Projects on Measurement, Test
One Dimensional Movement • Velocity • Speed vs. Velocity	4 weeks	*For Support:* Testing accommodations, Use of Prompts, Teacher Modeling *For Enhancement:* Curriculum Compacting, Independent Study, Khan Acadmeny	HS-PS3-1. HS-PS2-1. CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.8 RST.11-12.3	*Formative Assessment:* Homework, classwork, group work on velocity, exit questions *Summative Assessment:* Quiz on Speed vs. Velocity, Projects on Velocity
Newton's Laws of Motion • Mass vs. Weight • Three Laws • Effects of friction on moving object	4 weeks	*For Support:* Graphic Organizers, Teacher Modeling, Scaffolding *For Enhancement:* Inquiry-based content, Real-world problems	HS-PS2-1 HS-PS2-4 CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.8 WHST.11-12.9	*Formative Assessment:* Questioning on Newton's Laws, Group work, homework *Summative Assessment:* Quiz on Newton's Laws, Tests, Project on friction
Simple Machines	4 weeks	*For Support:* Pre-teaching of concepts,	HS-PS3-1.	*Formative Assessment:* Homework, group work on simple

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
• Energy • Work		questioning, use of prompts *For Enhancement:* Independent Study, Khan Academy, Higher-order thinking skills	HS-PS3-3 CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.2 RST.11-12.8 WHST.11-12.4	machines *Summative Assessment:* Quiz on Simple Machines, Projects, Test
Forms of Energy • Mass vs. Weight • Types of Energy • Laws of Conservation	5 weeks	*For Support:* Modification of content, authentic assessments, teacher modeling *For Enhancement:* Inquiry-based instruction, student driven projects	HS-PS3-1. HS-PS3-3 CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.8	*Formative Assessment:* Cooperative Work, Homework, Classwork *Summative Assessment:* Quiz on Energy, Quiz on Laws of Conservation, Test
Matter and Energy • Gas, Liquid, Solids • Physical and chemical properties of matter •	5 weeks	*For Support:* Teacher Modeling, testing accommodations, scaffolding *For Enhancement:* Inquiry based instruction, independent stud, critical thinking skills	HS-PS1-5 CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.2 RST.11-12.8	*Formative Assessment:* Do nows, homework, questioning on matter/energy, group work *Summative Assessment:* Quiz on Matter, Projects on Properties of Matter, Test
Chemical Elements • Common Names and Symbols • Periodic Table • Physical vs. Chemical • Differentiate between	5 weeks	*For Support:* Allow errors, use of Periodic Table, Khan Academy, use of manipulatives *For Enhancement:*	HS-PS1-1 HS-PS1-2 CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.8	*Formative Assessment:* Homework, classwork, group work on the Periodic Table, exit questions *Summative Assessment:* Quiz on Periodic Table, Projects on

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
metals, nonmetals, and metalloids		Extension activities, adjusting pace of lessons		Elements, Test
Solving Problems with Measurement • Common units of length, mass, time, volume, and density • Density Calculations • Defining temperature and converting from Kelvin to Celsius • Define heat and perform calculations • Significant Figures • Scientific Notation	5 weeks	*For Support:* Modification of content, guided notes, teacher modeling *For Enhancement:* Khan Academy, interest based content, student driven projects	HS-PS1-7 HS-PS2-4. CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.8	*Formative Assessment:* Cooperative Work, Homework, Classwork *Summative Assessment:* Quiz on Measurement, Quiz on Converting, Test
Atoms • Atomic Theory • Nucleus • Protons, Neutrons, and Electrons	4 weeks	*For Support:* Use of a notecard, Khan Academy, rephrase questions *For Enhancement:* Real-world problems, extension activities	HS-PS1-7 HS-PS1-8 CRP1,2,4,7,8,10,11,12 8.2.12.C.1 RST.11-12.8	*Formative Assessment:* Homework, classwork, group work on velocity, exit questions *Summative Assessment:* Quiz on parts of the atom, Projects on Atoms, Test