COURSE TITLE

STEM- Grade 6

LENGTH

One Quarter

DEPARTMENT

STEM Department

SCHOOL

Pierrepont Elementary School

DATE

September 10, 2018

Initial BOE Approval Date (Born on): 8/22/2016

STEM- Grade 6

I. Introduction/Overview/Philosophy

In this course, students will explore a variety of science concepts with a STEM focus. Students will use problem-solving skills to explore grade level Next Generation Science Standards. Students will explore concepts including Motion, Forces and Interactions, Energy, Energy Transfer and Engineering Design skills. Students will be introduced to various science concepts, including practical skills, lab report writing, and problem solving skills and applications.

II. Objectives

Course Outline:

1. Forces and Motion
    a. Newton's 1st Law
    b. Newton's 2nd Law
    c. Newton's 3rd Law
    d. Friction
    e. Inertia
2. Energy
    a. Potential Energy
    b. Kinetic Energy
    c. Thermal Energy
    d. Conservation of Energy
3. Engineering Design Skills

Student Outcomes:

After successfully completing this course, the student will:

- Apply Newton's Third Laws to design a solution to a problem involving the motion of two colliding objects.
- Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and the speed of an object.
- Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- Use problem solving and engineering design skills to solve a global problem.

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.

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.

TECHNOLOGY

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 A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.8.A.1- Demonstrate knowledge of a real world problem using digital tools.

8.1.8.A.3- Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

Strand E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

8.1.8.E.1- Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

Strand F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.1.8.F.1- Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.

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 A. The Nature of Technology: Creativity and Innovation Technology systems impact every aspect of the world in which we live.

8.2.8.A.1- Research a product that was designed for a specific demand and identify how the product has changed to meet new demands (i.e. telephone for communication - smart phone for mobility needs).

8.2.8.A.2- Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.

8.2.8.A.3- Investigate a malfunction in any part of a system and identify its impacts.

8.2.8.A.4- Redesign an existing product that impacts the environment to lessen its impact(s) on the environment.

8.2.8.A.5- Describe how resources such as material, energy, information, time, tools, people, and capital contribute to a technological product or system.

Strand C. Design: The design process is a systematic approach to solving problems.

8.2.8.C.1- Explain how different teams/groups can contribute to the overall design of a product.

8.2.8.C.2- Explain the need for optimization in a design process.
8.2.8.C.3- Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.C.4- Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.C.5- Explain the interdependence of a subsystem that operates as part of a system.
8.2.8.C.5.a- Create a technical sketch of a product with materials and measurements labeled.
8.2.8.C.6- Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
8.2.8.C.7- Collaborate with peers and experts in the field to research and develop a product using the design process, data analysis and trends, and maintain a design log with annotated sketches to record the developmental cycle.
8.2.8.C.8- Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers.
Strand D. Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.
8.2.8.D.3- Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

21ST CENTURY LIFE AND CAREERS

9.1 Personal Financial Literacy

Strand B: Money Management

9.1.8.B.2 Construct a simple personal savings and spending plan based on various sources of income.

9.2 Career Awareness, Exploration, and Preparation

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

COMPANION STANDARDS FOR SCIENCE AND TECHNICAL SUBJECTS

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
RST.6-8.7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
WHST.6-8.5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

NEW JERSEY STUDENT LEARNING STANDARDS- SCIENCE

MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

III. Proficiency Levels

This is a cycle course for Grade 6.

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: report writing, teacher observation, student journals, tests, quizzes, and projects.

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

V. Grouping

This is a required Grade 6 cycle course.

VI. Articulation/Scope & Sequence/Time Frame

Course length is one quarter.

VII. Resources

Texts/Supplemental Reading/References

Resources include but are not limited to:

1. Next Generation Science Standards
2. Science World Magazine
3. Online STEM Resources
4. Various Videos, may include but not limited to
    A. www.brainpop.com
    B. www.pbs.org
    C. www.teachertube.org
    D. www.howstuffworks.com

VIII. Suggested Activities

Appropriate activities are listed in the curriculum map.

IX. Methodologies

The following methods of instruction are suggested: lecture, group projects, demonstration, hands-on applications, and class presentations.

X. Interdisciplinary Connections

At this grade level, connections to many other disciplines are appropriate and natural. Reading and writing become an integral part of the STEM process. Connections with mathematics are frequent throughout the curricula. Technology plays an important role in the STEM classroom.

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
Forces and Motion • Newton's 1st Law • Newton's 2nd Law • Newton's 3rd Law • Friction • Inertia	3 weeks	*For Support:* • Guided Notes • Allow errors • Rephrase Questions, directions, explanations *For Enhancement:* • Provide extension activities • adjusting pacing of lessons • inquiry based instruction	MS-PS2-1 MS-PS2-2 MS-PS2-3 MS-PS2-4 MS-PS2-5 CRP1,4,7,8,10,11,12 8.1.8.A.1,3 8.1.8.E.1 8.1.8.F.1 8.2.8.A.1,2,3,4,5 8.2.8.C.1,2,3,4,5,6,7,8 8.2.8.D.3 9.1.8.B.2 9.2.8.B.3 RST.6-8.3,7,9 WHST.6-8.5,6,8	*Formative Assessment:* ● Questioning ● Entry/Exit Tickets (Google Forms) ● Group Work *Summative Assessment* ● Projects: Hands on Lab Activities with Reporting ● Quizzes (Lab Report Write-ups)
Energy • Potential Energy • Kinetic Energy • Thermal Energy • Conservation of Energy	3 weeks	*For Support:* • Pre-teaching of concepts • Pairing students with beginning English language skills with students who have more advanced • Teacher modeling	MS-PS3-1 MS-PS3-2 MS-PS3-3 MS-PS3-4 MS-PS3-5 CRP1,4,7,8,10,11,12 8.1.8.A.1,3 8.1.8.E.1 8.1.8.F.1	*Formative Assessment:* • Blog Reflections • Science Activities using Virtual Land and Write-up Reflections *Summative Assessment* ● Science Activities using

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
		• Use of visual formats *For Enhancement:* • Critical/Analytical Thinking Tasks • Real world scenarios • Higher Order Thinking Skills	8.2.8.A.1,2,3,4,5 8.2.8.C.1,2,3,4,5,6,7,8 8.2.8.D.3 9.1.8.B.2 9.2.8.B.3 RST.6-8.3,7,9 WHST.6-8.5,6,8	Virtual Labs and Write-up Reflections • Quizzes (Google Forms)
Engineering Design Skills	4 weeks	*For Support:* • Authentic assessments • Visual Learning *For Enhancement:* • Student driven projects • Internet-based content • Provide extension activities	MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4 CRP1,4,7,8,10,11,12 8.1.8.A.1,3 8.1.8.E.1 8.1.8.F.1 8.2.8.A.1,2,3,4,5 8.2.8.C.1,2,3,4,5,6,7,8 8.2.8.D.3 9.1.8.B.2 9.2.8.B.3 RST.6-8.3,7,9 WHST.6-8.5,6,8	*Formative Assessment* • Questioning • Cooperative Group Work *Summative Assessment* • Engineering Design Project • Project/Communication Presentations (Google Sites/Slideshows)