STEAM Exploratory

Course Description:

STEAM provides a unique learning environment that incorporates science, technology, engineering, art, and mathematics. Students will learn to work together to share ideas and problem solve, developing creative solutions to real world, complex problems by engaging in multifaceted hands-on learning experiences. The student teams design goals, generate ideas, investigate, compare/select designs, build, and test their final products. This 10-week course provides an authentic learning experience that will develop students' 21st century skills.

Suggested Course Sequence:

Unit 1: Learning Skills / Styles – 2 weeks

Unit 2: Engineering Design Process – 2 weeks

Unit 3: Helmet Safety and the Egg Drop – 2 weeks

Unit 4: Bridge Building and a Spaghetti Bridge – 2 weeks

Unit 5: Motion and a Downhill Racer – 2 weeks

Unit Overview	
Content Area:	STEAM
Unit Title:	Unit 1: Learning Skills / Styles
Grade Level:	6

Unit Summary:
Students will learn the demonstration and understanding of several types of learning styles and skills. Lesson will be driven by student survey results. Students will learn how different learning styles can work together to create a better product.

Interdisciplinary Connections:
Science, Technology, Engineering, Art, and Mathematics

21st Century Themes and Skills:

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2.** Apply appropriate academic and technical skills.
- **CRP3.** Attend to personal health and financial well-being.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP5.** Consider the environmental, social and economic impacts of decisions.
- **CRP6.** Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11.** Use technology to enhance productivity.
- **CRP12.** Work productively in teams while using cultural global competence.

Learning Targets

Standards (Content and Technology)**:**

CPI#:	Statement:
5.1.4.A.2.	Use outcomes of investigations to build and refine questions, models, and explanations.
5.1.8.B.1	Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.
5.1.8.B.2.	Gather, evaluate, and represent evidence using scientific tools, technologies, and computational strategies.
5.1.8.D.1.	Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.
5.1.8.D.2	Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model building.
8.1.8.A.1.	Demonstrate knowledge of a real world problem using digital tools.
8.1.8.D.4.	Assess the credibility and accuracy of digital content.
8.1.8.E.1.	Produce a position statement about a real world problem by developing a systematic plan of

	investigation with peers and experts synthesizing information from multiple sources.

Unit Essential Question(s):	**Unit Enduring Understandings:**
• What is your learning style and why is it important? • How do learning styles relate to teamwork?	• Students have different learning styles, which offer unique strengths in a teambuilding situation.

Unit Learning Targets/Objectives:

Students will…

- Complete a questionnaire showing their dominant learning style(s)
- Complete the reflection form to determine the best way to utilize their knowledge of learning styles in a teambuilding setting.

Evidence of Learning

Formative Assessments:

- Learning styles questionnaire
- Reflection Form
- Class Participation

Summative/Benchmark Assessment(s):

- Reflection essay in which students will evaluate his/her learning style and how it works well with others

Resources/Materials:

- Websites pertinent to the topic, PowerPoint presentation, learning style survey, computers

Modifications:

- **Special Education Students** - Allow errors, Rephrase questions, directions, and explanations, Allow use of calculator
- **English Language Learners** - Allow errors in speaking, Rephrase questions, directions, and explanations
- **At-Risk Students** - Consult with Guidance Counselors and follow I&RS procedures/action plans
- **Gifted and Talented Students** – Make Peer Leaders, Provide extension activities

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
1	Learning Styles Inventory	2 days
2	Team-Building Inventory	2 days
3	Team-Building Exercises	2 days
4	Conflict Resolution Strategies	2 days
5	Getting to the Goal	2 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview	
Content Area:	STEAM
Unit Title:	Unit 2: Engineering Design Process
Grade Level:	6

Unit Summary:
The organized method of the engineering design process where students work through a chart detailing the design process and then use its steps to consider how to solve three different problems.

Interdisciplinary Connections:
Science, Technology, Engineering, Art, and Mathematics

21st Century Themes and Skills:

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2.** Apply appropriate academic and technical skills.
- **CRP3.** Attend to personal health and financial well-being.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP5.** Consider the environmental, social and economic impacts of decisions.
- **CRP6.** Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11.** Use technology to enhance productivity.
- **CRP12.** Work productively in teams while using cultural global competence.

Learning Targets

Standards (Content and Technology)**:**

CPI#:	Statement:
5.1.4.A.2.	Use outcomes of investigations to build and refine questions, models, and explanations.
5.1.8.B.1	Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.
5.1.8.B.2.	Gather, evaluate, and represent evidence using scientific tools, technologies, and computational strategies.
5.1.8.C.1	Monitor one's own thinking, as understandings of scientific concepts are refined.
5.1.8.D.1.	Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.
5.1.8.D.2	Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model building.
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.

8.1.8.A.5.	Create a database query, sort and create a report and describe the process, and explain the report results.
8.1.8.D.4.	Assess the credibility and accuracy of digital content.
8.1.8.E.1.	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.

Unit Essential Question(s):

- What are the six steps in the engineering design process?
- How does this process help solve problems?

Unit Enduring Understandings:

- The engineering design process is a useful way to solve problems.

Unit Learning Targets/Objectives:

Students will…

- Apply and document an engineering design process that includes identifying criteria and constraints, making representation, testing and evaluation, and refining the design as needed to construct a product or system that solves a problem.

Evidence of Learning

Formative Assessments:

- Engineering design process chart
- Pipe cleaner tower activity
- Class participation

Summative/Benchmark Assessment(s):

- Students will work in teams to solve three different types of problems using the engineering design process.

Resources/Materials:

- Websites pertinent to the topic, PowerPoint(s), worksheets, computers

Modifications:

- **Special Education Students** - Allow errors, Rephrase questions, directions, and explanations, Allow use of calculator
- **English Language Learners** - Allow errors in speaking, Rephrase questions, directions, and explanations
- **At-Risk Students** - Consult with Guidance Counselors and follow I&RS procedures/action plans
- **Gifted and Talented Students** – Make Peer Leaders, Provide extension activities

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
1	Engineering Steps 1 -2	2 days
2	Engineering Steps 3-4	2 days
3	Engineering Steps 5-6	2 days
4	Engineering Project Presentation Preparation	2 days
5	Engineering Project Presentations	2 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview	
Content Area:	STEAM
Unit Title:	Unit 3: Helmet Safety and The Egg Drop
Grade Level:	6

Unit Summary:
Students will learn the basic engineering related to helmet design, specifically about the physics of collisions and the biomechanical considerations of design. Students will identify and solve a design challenge to keep a raw egg safe from a 30-foot drop.

Interdisciplinary Connections:
Science, Technology, Engineering, Art, and Mathematics

21st Century Themes and Skills:

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2.** Apply appropriate academic and technical skills.
- **CRP3.** Attend to personal health and financial well-being.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP5.** Consider the environmental, social and economic impacts of decisions.
- **CRP6.** Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11.** Use technology to enhance productivity.
- **CRP12.** Work productively in teams while using cultural global competence.

Learning Targets

Standards (Content and Technology)**:**

CPI#:	Statement:
5.1.4.A.2.	Use outcomes of investigations to build and refine questions, models, and explanations.
5.1.8.A.3	Use scientific principles and models to frame and synthesize scientific arguments and pose theories.
5.1.8.B.1	Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.
5.1.8.B.2.	Gather, evaluate, and represent evidence using scientific tools, technologies, and computational strategies.
5.1.8.B.4.	Use quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
5.1.8.C.1	Monitor one's own thinking, as understandings of scientific concepts are refined.
5.1.8.C.2.	Revise predictions or explanations on the basis of discovering new evidence, learning new information, or using models.

5.1.8.C.3.	Generate new and productive questions to evaluate and refine core explanations.
5.1.8.D.1.	Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.
5.1.8.D.2	Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model building.
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.
8.1.8.A.5.	Create a database query, sort and create a report and describe the process, and explain the report results.
8.1.8.D.4.	Assess the credibility and accuracy of digital content.
8.1.8.E.1.	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
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.

Unit Essential Question(s):

- What are the basic physics and biomechanical aspects of helmet design?
- How can you use these aspects to create a safe device?

Unit Enduring Understandings:

- The importance of good design when creating a safety helmet.
- The importance of helmet safety and the risks of not wearing a helmet.

Unit Learning Targets/Objectives:

Students will…

- Identify the importance of a helmet as a piece of safety equipment
- Describe how the helmet absorbs and dissipates energy in a collision
- Create a solution strategy for a helmet design challenge (egg drop)
- Present and explain their design solution to the class

Evidence of Learning

Formative Assessments:

- Complete all worksheets related to learning basic engineering and helmet safety
- Written summary and presentation of helmet safety report
- Class participation

Summative/Benchmark Assessment(s):

- Egg drop design project – students will work in teams to design and create a safety product to protect a raw egg when dropped 30-feet.

Resources/Materials:

- Websites pertinent to the topic, PowerPoint(s), computers, examples of helmets, poster board, one raw egg per group, building materials

Modifications:

- **Special Education Students** - Allow errors, Rephrase questions, directions, and explanations, Allow use of calculator
- **English Language Learners** - Allow errors in speaking, Rephrase questions, directions, and explanations
- **At-Risk Students** - Consult with Guidance Counselors and follow I&RS procedures/action plans
- **Gifted and Talented Students** – Make Peer Leaders, Provide extension activities

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
1	Basic Physics of a Helmet	2 days
2	Biomechanical Aspects of a Helmet	2 days

3	Engineering Design Process	2 days
4	Preparation for Project Presentation	2 days
5	Project Presentations	2 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview	
Content Area:	STEAM
Unit Title:	Unit 4: Bridge Building and The Spaghetti Bridge
Grade Level:	6

Unit Summary:
Students will learn the basic design of a truss bridge, specifically, the triangulated framework that acts primarily in tension and compression. Students will identify and solve a design challenge to create a model bridge using spaghetti that must hold weight.

Interdisciplinary Connections:
Science, Technology, Engineering, Art, and Mathematics

21st Century Themes and Skills:

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2.** Apply appropriate academic and technical skills.
- **CRP3.** Attend to personal health and financial well-being.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP5.** Consider the environmental, social and economic impacts of decisions.
- **CRP6.** Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11.** Use technology to enhance productivity.
- **CRP12.** Work productively in teams while using cultural global competence.

Learning Targets

Standards (Content and Technology)**:**

CPI#:	Statement:
5.1.4.A.2.	Use outcomes of investigations to build and refine questions, models, and explanations.
5.1.8.A.3	Use scientific principles and models to frame and synthesize scientific arguments and pose theories.
5.1.8.B.1	Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.
5.1.8.B.2.	Gather, evaluate, and represent evidence using scientific tools, technologies, and computational strategies.
5.1.8.B.4.	Use quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
5.1.8.C.1	Monitor one's own thinking, as understandings of scientific concepts are refined.
5.1.8.C.2.	Revise predictions or explanations on the basis of discovering new evidence, learning new information, or using models.

5.1.8.C.3.	Generate new and productive questions to evaluate and refine core explanations.
5.1.8.D.1.	Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.
5.1.8.D.2	Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model building.
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.
8.1.8.A.5.	Create a database query, sort and create a report and describe the process, and explain the report results.
8.1.8.D.4.	Assess the credibility and accuracy of digital content.
8.1.8.E.1.	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
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.

Unit Essential Question(s):

- How is a truss bridge designed?
- How can you design a truss bridge to hold the most weight?

Unit Enduring Understandings:

- The importance of an effective design to create the strongest bridge.

Unit Learning Targets/Objectives:

Students will…

- Use their knowledge of truss bridges to create a bridge using spaghetti to hold as much weight as possible.

Evidence of Learning

Formative Assessments:

- Complete all worksheets related to learning about truss bridges
- Class participation

Summative/Benchmark Assessment(s):

- Spaghetti Bridge project – students will work in teams to design and create a truss bridge out of spaghetti with the ability to hold the most weight possible. Each team will be responsible for a blueprint, planning log, and actual model bridge.

Resources/Materials:

- Websites pertinent to the topic, video, computers, spaghetti, glue

Modifications:

- **Special Education Students** - Allow errors, Rephrase questions, directions, and explanations, Allow use of calculator
- **English Language Learners** - Allow errors in speaking, Rephrase questions, directions, and explanations
- **At-Risk Students** - Consult with Guidance Counselors and follow I&RS procedures/action plans
- **Gifted and Talented Students** – Make Peer Leaders, Provide extension activities

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
1	Background and Introduction to Bridges and Trusses	2 days
2	Engineering Design Process	2 days
3	Engineering Design Process	2 days
	Preparation for Project	2 days

4	Presentation	
5	Project Presentations	2 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview	
Content Area:	STEAM
Unit Title:	Unit 5: Motion and a Downhill Racer
Grade Level:	6

Unit Summary:
Students will learn about the motion of car, specifically, about inclined planes, friction, gravity, momentum, and potential vs. kinetic energy. Students will identify and solve a design challenge to create a downhill racer that can go the distance.

Interdisciplinary Connections:
Science, Technology, Engineering, Art, and Mathematics

21st Century Themes and Skills:

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2.** Apply appropriate academic and technical skills.
- **CRP3.** Attend to personal health and financial well-being.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP5.** Consider the environmental, social and economic impacts of decisions.
- **CRP6.** Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11.** Use technology to enhance productivity.
- **CRP12.** Work productively in teams while using cultural global competence.

Learning Targets

Standards (Content and Technology)**:**

CPI#:	Statement:
5.1.4.A.2.	Use outcomes of investigations to build and refine questions, models, and explanations.
5.1.8.A.3	Use scientific principles and models to frame and synthesize scientific arguments and pose theories.
5.1.8.B.1	Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.
5.1.8.B.2.	Gather, evaluate, and represent evidence using scientific tools, technologies, and computational strategies.
5.1.8.B.4.	Use quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
5.1.8.C.1	Monitor one's own thinking, as understandings of scientific concepts are refined.
5.1.8.C.2.	Revise predictions or explanations on the basis of discovering new evidence, learning new information, or using models.

5.1.8.C.3.	Generate new and productive questions to evaluate and refine core explanations.
5.1.8.D.1.	Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.
5.1.8.D.2	Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model building.
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.
8.1.8.A.5.	Create a database query, sort and create a report and describe the process, and explain the report results.
8.1.8.D.4.	Assess the credibility and accuracy of digital content.
8.1.8.E.1.	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
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.

Unit Essential Question(s):

- How does a simple machine work?
- How can you create a car that produces minimal friction and allows the car to the farthest with little energy input?

Unit Enduring Understandings:

- The importance of design when creating a simple machine with the conservation of energy.

Unit Learning Targets/Objectives:

Students will…

- Learn the science of motion, momentum, friction, and kinematics by designing and constructing a downhill simple machine (model car).

Evidence of Learning

Formative Assessments:

- Complete all worksheets related to learning about motion
- Class participation

Summative/Benchmark Assessment(s):

- Downhill Racer project – students will work in teams to design and create a model car with the ability to travel a suitable distance. Each team will be responsible for a blueprint, planning log, and actual model car.

Resources/Materials:

- Websites pertinent to the topic, computers, Legos

Modifications:

- **Special Education Students** - Allow errors, Rephrase questions, directions, and explanations, Allow use of calculator
- **English Language Learners** - Allow errors in speaking, Rephrase questions, directions, and explanations
- **At-Risk Students** - Consult with Guidance Counselors and follow I&RS procedures/action plans
- **Gifted and Talented Students** – Make Peer Leaders, Provide extension activities

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
1	Motion and Momentum	2 days
2	Friction and Kinematics	2 days
3	Engineering Design Process (model car)	2 days
	Preparation for Project	2 days

4	Presentation	
5	Project Presentations	2 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit: