GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

CTAE PROGRAM AREA

PATHWAY: Engineering and Technology

COURSE: Foundations of Engineering and Technology

UNIT: Hot-Air Balloons

INTRODUCTION

Annotation: In this unit students will build a model hot-air balloon using basic mathematical principals to determine surface area.

Grade(s):

X	9th
X	10th
X	11th
X	12th

Time: (5-7) 50 minute periods

Author: Teresa Johnson

Additional Author(s):

Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.

FOCUS STANDARDS

GPS Focus Standards:.

- **CTAE-FS-2 Academic Foundations:** Learners achieve state academic standards at or above grade level.
- **CTAE-FS-4 Problem Solving and Critical Thinking:** Learners define and solve problems, and use problem-solving and improvement methods and tools.
- **ENGR-FET4:** Students will apply mathematics to the solution of a technological problem.
- **ENGR-STEM3:** Students will design technological problem solutions using scientific investigation, analysis and interpretation of data, innovation, invention, and fabrication while considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.
- **ENGR-STEM5:** Students will select and demonstrate techniques, skills, tools, and understanding related to energy and power, bio-related, communication, transportation, manufacturing, and construction technologies.

GPS Academic Standards:

SCSh3. Students will identify and investigate problems scientifically.
SCSh6. Students will communicate scientific investigations and information clearly.

MM3P3. Students will communicate mathematically.
MM3P4. Students will make connections among mathematical ideas and to other disciplines.

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings:

- Students will observe the scientific principal of air density.
- Students will understand how mathematics is applied in the development of a product.

Essential Questions:

- Why is it important to estimate materials before building a product?
- How do hot-air balloons work?

Knowledge from this Unit:

- Students will be able to define key Vocabulary: Analyze, Area, Ascent, Density, Descent, Design, Estimation, Flight, Gore, Hypothesis, Pressure, Surface area, Template
- Students will use mathematical formulas for finding area.
- Students will observe principals of density, ascent, and descent

Skills from this Unit:

- Students will build a model hot-air balloon by correctly following written directions.

ASSESSMENT(S)

Assessment Method Type: Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

- x Pre-test
- ____ Objective assessment - multiple-choice, true- false, etc.
  - __ Quizzes/Tests
  - __ Unit test
- x Group project
- ____ Individual project
- X Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
  - __ Self-check rubrics
  - __ Self-check during writing/planning process
  - _x_ Journal reflections on concepts, personal experiences and impact on one's life
  - __ Reflect on evaluations of work from teachers, business partners, and competition judges
  - __ Academic prompts
  - __ Practice quizzes/tests
- X Subjective assessment/Informal observations
  - __ Essay tests
  - _x_ Observe students working with partners
  - __ Observe students role playing
- ____ Peer-assessment
  - __ Peer editing & commentary of products/projects/presentations using rubrics
  - __ Peer editing and/or critiquing
- ____ Dialogue and Discussion
  - __ Student/teacher conferences
  - __ Partner and small group discussions
  - __ Whole group discussions
  - __ Interaction with/feedback from community members/speakers and business partners
- ____ Constructed Responses
  - __ Chart good reading/writing/listening/speaking habits
  - __ Application of skills to real-life situations/scenarios
- x Post-test

Other Assessments:

Performance: Successful construction of hot-air balloon.

Journal Entries

Assessment(s) Title:

Basic Area Mathematical Assessment

Surface Area Data Sheet

Flight Analysis Data Sheet

Student designed vocabulary quiz

Assessment(s) Description/Directions:

Attachments for Assessment(s):

Basic Area Mathematical Assessment

Surface Area Data Sheet

Flight Analysis Data Sheet

Student designed vocabulary quiz

LEARNING EXPERIENCES

Sequence of Instruction

1. **Identify the Standards. Standards should be posted in the classroom for each lesson.**
2. **Review Essential Questions.**
3. **Identify and review the unit vocabulary.**
4. **Pre-test on knowledge of finding area.**
5. **Teach area if necessary.**
6. **Have students find area of irregular shapes.**
7. **Provide students with vocabulary worksheet.**
8. **Review vocabulary, re-teach science concepts as needed.**
9. **Provide students with Working with Surface Area Student instructions and Hot-air balloon gore templates and have them find area of gore. (Record on data sheet)**
10. **Have students find area of entire hot-air balloon, remind students to consider overlap.**
11. **Provide students with instructions and materials for building hot-air balloon.**
12. **Complete flight data sheet and test hot-air balloons. (Best results occur if tested outside in cooler temperatures.)**
13. **Ongoing journal entries recorded in Engineering design notebook or teacher made journal.**
14. **Final Assessment Activity, vocabulary test and finding mathematical area problems.**

Attachments for Learning Experiences:

Journal sheets, data sheets, and analysis sheets are provided.

Notes & Reflections:

Use the Pitsco Hot-Air Balloon Teacher's Guide or create data sheets and hot-air balloon GORE template.

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title: Build and Test Hot-air balloon

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Description: Students working in pairs will follow written directions to build hot-air balloon.

Directions: **see attached resource**

Differentiated Instruction: Students design their own hot-air balloon, determine surface area and construct balloon according to own design.

Attachments for Culminating Performance Task:

Gore Template and Instructions

Area Data Sheet

Flight Data Sheet

UNIT RESOURCES

Web Resources:

Attachment(s): Supplemental files not listed in assessment, learning experiences, and performance task.

Materials & Equipment:

Tissue Paper, stick glue, scissors, tape

Hot air balloon Tester (Pitsco), hair dryer, or base of hot-air popcorn popper.

What 21st Century Technology was used in this unit:

☐ Slide Show Software	☐ Graphing Software	☐ Audio File(s)
☐ Interactive Whiteboard	☐ Calculator	☐ Graphic Organizer
☐ Student Response System	☐ Desktop Publishing	☐ Image File(s)
☐ Web Design Software	☐ Blog	☐ Video
☐ Animation Software	☐ Wiki	☐ Electronic Game or Puzzle Maker
☐ Email	☐ Website	