GEORGIA MIDDLE SCHOOL Instructional Resources

CAREER, TECHNICAL, & AGRICULTURAL EDUCATION

ENGINEERING & TECHNOLOGY

COURSE: Technological Systems

UNIT 2: Crash Car Derby

INTRODUCTION

Annotation:

This unit will provide students the opportunity to design, construct and test a wheeled transportation vehicle that can withstand a head-on collision with a concert wall while protecting the passenger during the collision. Students will use the engineering design process as they develop their vehicle.

Grade(s):

	6th
	7th
X	8th

Time:

3 to 45-minute class periods for information and testing
10 to 14 days outside of class to complete the project

Author:

Pam Brown

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 appropriately. 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. Many students (both with and without disabilities) who struggle with reading may benefit from the use of text reading software or other technological aids to provide access to printed materials. Many of these are available at little or no cost on the internet.

FOCUS STANDARDS

GPS Focus Standards:

ENGR-TS-2 The students will develop an understanding of how the design process is used to develop a technological system.

a) Identify the steps of the design process

d) Construct and work with a variety of systems, including Engineering, Electronics, Manufacturing, and Energy

ENGR-TS-3 The students will develop an understanding of how humans interact with systems.

c) Constructing technological systems

d) Design technological systems

ENGR-TS-7 Students will develop leadership skills and work ethics.

a) Demonstrate work ethics within the classroom and lab environment

GPS Academic Standards:

M8A1. Students will use algebra to represent, analyze, and solve problems.

UNDERSTANDING & GOALS

Enduring Understandings:

The engineering design process is critical in the development of solution for various engineering problems.

Essential Questions:

- What are some ways to protect a passenger in a head on collision?
- What is the formula for velocity?
- How are times and distances relative to velocity?

Knowledge from this Unit:

- Solving algebraic equations
- Application of the Engineering Design Process to a real world problem
- Creating a system to solve a real world problem

Skills from this Unit:

- Solving algebraic equations
- Application of the Engineering Design Process to a real world problem
- Construction of a system to solve a real world problem

ASSESSMENTS

Assessment Method Type:

_____ Pre-test
_____ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
__ Unit test
_____ Group project
x Individual project
x Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
__ Self-check rubrics
x __ Self-check during writing/planning process
__ 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
_____ Subjective assessment/Informal observations
__ Essay tests
__ Observe students working with partners
__ Observe students role playing
_____ Peer-assessment
__ Peer editing and 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
_____ Post-test

Assessment(s) Title:

Crash Car Derby – Design Process

Crash Car Derby – Material List & Sketches

Crash Car Derby – Impact Testing

Crash Car Derby – Velocity Worksheet

Crash Car Derby – Rubric

Assessment(s) Description/Directions:

Crash Car Derby – Design Process: Students will use the Engineering Design Process in the development of their vehicles. They should document the step of the design process as they develop their vehicle. Steps should include: Identification of the Problem, Brainstorming, Designing of a Solution, Testing the Ideas, Evaluating the Ideas, and Building the Solution.

Crash Car Derby – Material List & Sketches: Students will complete a sketch of the front, top and side views of their finished vehicle. They will also provide a complete materials list of items used in the construction of the vehicle.

Crash Car Derby Vehicle Impact Testing: All vehicles will be tested on the designated day. The testing apparatus can be created as the instructor desires. The device I use consists of approximately 8 to 10 feet of surgical hose/rubber tubing that can be purchased at Home Depot or Lowe's. The tubing is tied to the base of 2 lab stations that are about 8 feet from a concrete black wall. This created a large sling shot on the floor. The tubing is pulled back from the initial point to create tension on the tubing and the vehicles are then fired into the wall by releasing the tubing. As the tubing is pulled further from the initial point the tension on the tubing increases, therefore, firing the cars at a greater velocity. Each car is tested at level 1 of impact – those that survive this impact are then tested at level 2. Survivors of level 2 move on to level 3 and process continues to level 6. Note: See the PowerPoint Crash Car Impact Testing Mechanism for additional information and a visual of the testing. *Feel free to design your own mechanism for testing this is only one way to accomplish this task.*

Crash Car Derby – Velocity Worksheet: Students will calculate the velocity of their vehicle at the point of impact with the concrete wall from each level that their vehicle is tested. Students will use the formula Velocity = Distance/Time. Two students will be gathering the time data using stopwatches. Both times will be recorded and an average time will be calculated based on the 2 times (this allows for human error in starting and stopping the timing process). The distances from the wall are already step by the initial placement of the vehicle launcher (i.e. Sling shot device).

Crash Car Derby – Rubric: After testing, students will complete their rubric.

Attachments for Assessment(s):

Crash Car Derby – Design Brief

Crash Car Derby – Design Process

Crash Car Derby – Material List & Sketches

Crash Car Derby – Velocity Worksheet

Crash Car Derby – Rubric

PowerPoint - Crash Car Impact Testing Mechanism

PowerPoint – Examples of Crash Cars

LESSON PLANS

• INTRODUCTION

1. Identify the Standards. Standards should be posted in the classroom for each lesson.

ENGR-TS-2 The students will develop an understanding of how the design process is used to develop a technological system.

a) Identify the steps of the design process

d) Construct and work with a variety of systems, including Engineering, Electronics, Manufacturing, and Energy

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c) Constructing technological systems

d) Design technological systems

ENGR-TS-7 Students will develop leadership skills and work ethics.

a) Demonstrate work ethics within the classroom and lab environment

2. Review Essential Questions.

- What are some ways to protect a passenger in a head on collision?
- What is the formula for velocity?
- How are times and distances relative to velocity?

3. Identify and review the unit vocabulary.

Brainstorming

Engineering Design Process

Velocity

• LESSON 1: CRASH IMPACT TESTING FOR VEHICLES (1 DAY)

1. Watch the YouTube Video Crash test: 2008 Smart Car for Two

   • http://www.youtube.com/watch?v=mz-s1sIoLhU – The video will last just over 6 minutes.

   • Use the video to demonstrate the crash test safety testing that actual vehicles go through. Discuss the information gained from the video.

2. Watch the video Engineering Process

   •http://www.education.rec.ri.cmu.edu/roboticscurriculum/vex_online/lessons/engineering_design/eng_process/process.html – The video will last about 3 minutes.

• Use the video to demonstrate the crash Engineering Design Process. Discuss the steps of the Engineering Design Process.

3. Assignment – Crash Car Derby

   • Review the **Crash Car Derby Design Brief** with the students. Go over all the limitations and specifications for the activity. Show example of vehicles that have been constructed in the past. Look for positive and negatives to these designs. (If you do not have example vehicle use the **PowerPoint Examples of Crash Cars**).

4. Allow students 10 to 14 days to complete their crash cars outside of class.

• LESSON 2: CRASH IMPACT TESTIGN AND VELOCITY CALCULATIONS (2 DAYS)

1. Inspect Cars for compliance with the following design criteria:
   Roll Test
   Length
   Width
   Height

2. Provide eggs (passengers) to students. Note: Do not allow students to bring eggs to school. The instructor should provide raw eggs and zip lock bags to students.

3. Begin Level 1 Impact Testing
   a. Have a student to record impact test results
   b. Have 2 students with stopwatches to time the vehicles impact
   c. Have a student to record the impact times for each vehicle

4. Continue with Impact Testing

5. Have each student find the average time for their car at each level. Use the average time and the know distance to calculate the vehicle velocity at each level. Use the formula Velocity = Distance/Time.

Attachments for Learning Experiences:

Crash Car Derby – Design Brief
Crash Car Derby – Design Process
Crash Car Derby – Material List & Sketches
Crash Car Derby – Velocity Worksheet
Crash Car Derby – Rubric
PowerPoint - Crash Car Impact Testing Mechanism
PowerPoint – Examples of Crash Cars

UNIT RESOURCES

Web Resources:

http://www.youtube.com/watch?v=mz-s1sIoLhU – The video will last just over 6 minutes.

Materials & Equipment:

- Materials & Equipment:
- Stopwatches
- Rubber Tubing (Surgical Tubing)
- Eggs
- Zip Lock Bags
- Example Vehicles or Vehicle Images

What 21st Century Technology was used in this unit?

X	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	x	Video
	Animation Software		Wiki		Electronic Game or Puzzle Maker
	Email		Website		