

GITEA
PROBLEM
SOLVING
COOKBOOK
VOLUME 4

Compiled by:
The Georgia Industrial
Technology Education Association

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This book of Problem Solving Activities has been compiled by the Georgia Industrial Technology Education Association. Members of our professional organization have contributed ideas and activities that work in their classrooms and laboratories. We hope that these activities will be beneficial to you in your classroom or laboratory situation.

Please feel free to reproduce any portions of this booklet or the entire book to use in your classes or to share with other Technology Education professionals. GITEA is working to improve and enhance Technology Education in Georgia. We appreciate this opportunity to share our ideas with you.

For additional information or if you have ideas and activities that you would like to and are willing to share with us please send to:

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Special Thanks

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Through your help and support we will continue to be able to produce quality documents that will enhance the efforts of the classroom instructors. Your continued support is greatly appreciated.

The 1997-98 GITEA Executive Committee

TABLE OF CONTENTS

| | |
|------------------------------------|----|
| Business Card | 5 |
| Draw Bridge | 6 |
| Marble Maze | 7 |
| Ornament Display Package | 8 |
| Plate Display Package | 9 |
| Pringles Challenge | 10 |
| Raft Design | 11 |
| Recyclable Child's Toy | 12 |
| Sailing Vessel | 13 |
| Shoe Box House | 14 |
| Slow Coaster | 15 |
| Spaghetti Challenge | 16 |
| Technological Game | 17 |
| Technology Before I Was Born | 18 |

Business Card

Chip Fowler - O. P. Evans Middle School

OBJECTIVE

To design a business card that provides your contact information and represents your hobbies, interests, or job skills

MATERIALS(Per student)

1. 1 - 3" x 5" index card
2. Colored pencils

TOOLS

1. Ruler

LIMITATIONS

1. You may use only the materials listed above.
2. Your card should only have 5 colors (white excluded).

REQUIREMENTS

1. Business card should include the following information:
 - Name
 - Street Address
 - City, State & Zip Code
 - Home Phone Number
 - Graphics or pictures to represent your hobbies, interests, or job skills.
2. Business Card should be created on the unlined side of the card.

Draw Bridge

Scott Brown - Carrollton High School

OBJECTIVE

The Trojan Technological Corporation, a subsidiary of the Georgia Department of Waterway Transportation (GAWT) has just commissioned you to design and construct a new draw bridge over the Louie Brown Causeway. This causeway is a major rout for supertankers bringing oil into the new billion dollar oil refinery outside of Savannah, Georgia, as well as for shrimp boats bringing their catches to market. The bridge must open enough to allow either the supertanker or the shrimp boat to pass through. The first order of business the GAWT wants is for you to design and build a working model. You will be required to give a presentation and demonstration before the board of directors. After all models have been presented the 1.2 billion dollar contract will be awarded to one company.

MATERIALS (Team of 2 or 3 students)

- | | |
|-----------------|--------------------|
| 1. Craft sticks | 6. Gears |
| 2. String | 7. Thread spools |
| 3. Pulleys | 8. Clothes hangers |
| 4. Dowel rods | 9. Glue |
| 5. Hinges | |

LIMITATIONS

1. You may use only the materials listed above, however there is no limit to the amount that you can use.

| | | |
|-----------------------|----------------|----------------|
| 2. Limitations | Minimum | Maximum |
| Length | 4 1/2 feet | 5 feet |
| Width | 12 inches | 16 inches |
| Roadbed above surface | 5 inches | 9 inches |
| Overall Height | ----- | 2 feet |

REQUIREMENTS

1. The bridge must draw up completely to allow an object (either a supertanker or a shrimp boat) to pass through.
2. The bridge must be either hand cranked or electric motor driven. (No gasoline engines)
3. The bridge must be able to support a mass of 3 concrete blocks.
4. Sketches (Top, Front and Side view) must be submitted.

TESTING

1. Concrete blocks will be placed on the bridge.
2. Drawbridge will be demonstrated allowing for the tanker or shrimp boat to pass through.
3. Appearance and functionality will help to determine your grade.

Marble Maze

Chip Fowler - O. P. Evans Middle School

OBJECTIVE

Students will design and construct a maze that will allow a marble to travel from point A to point B in the longest time possible.

MATERIALS (Team of 2 or 3 students)

1. 1 - cardboard soda flat
2. 1 - marble
3. 3 - file folders
4. Glue
5. Masking tape

TOOLS

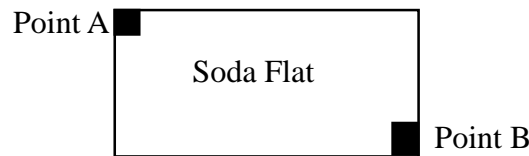
1. Scissors
2. Ruler

LIMITATIONS

1. You may use only the materials provided.

REQUIREMENTS

1. The marble must start in one corner (Point A) of the soda flat and end at the opposite corner (Point B).



2. The base of the maze (bottom of soda flat) must be placed in the horizontal position and may have no more that a 5 degree slant forward or backwards.

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

1. A stop watch will be needed to time travel of each marble.
2. Students will be allowed to place the marble at the starting position and release the marble.
3. Once the marble has begun its journey, no one may touch the marble or the maze.
4. If the marble get stuck in the maze, one team member may tap the starting corner of the maze once to dislodge the marble. Tapping the corner of the maze will result in a 5 second penalty,
5. The time that the marble is stuck will be deducted from the over all time.
6. Time will begin when the marble is released from point A and end when the marble reaches point B.
7. Each device will have three attempts and the best time will be recorded.
8. Appearance and construction will be considered in grading.

Ornament Display Package

Pam Brown - Central Middle School

OBJECTIVE

To design a package that will display a glass Christmas ornament. The package must be able to keep the ornament from breaking if it were to be knocked off of the shelf on which it is displayed. The shelf is located 6 feet above a concrete floor.

MATERIALS (Per Team of 2 students)

1. Masking tape
2. 2 - sheets of 8 1/2" x 11" card stock
3. 1 - sheet of overhead transparency film
4. 10 - low temperature glue sticks
5. 2 - sheets of white copy paper
6. 1 - 2 1/2" glass ornament

TOOLS

1. Scissors
2. Ruler
3. Pencil
4. X-actoknife
5. Glue gun
6. Cardboard Cutting Matt (only to be used for cutting on)

LIMITATIONS

1. The package must be constructed from only the materials listed.
2. Tools can not become a part of the solution.
3. Be sure to carefully inspect your ornament for cracks or breaks.

REQUIREMENTS

1. The package must allow the ornament to be viewed from at least 3 sides/faces. Each viewing window must be at least 2" tall and wide.
2. The package must be no larger than 4" in length, width, or height.
3. The package must be able to be opened and closed.

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

Test 1: Packages will be knocked from shelf placed at a height of 6 feet. Those that survive will then proceed to the next test.

Test 2: All ornament packages will be placed in a large box and shipped through the mail or courier system to another school or back to your own school.

Plate Display Package

Pam Brown - Central Middle School

OBJECTIVE

To design a package that can be used a shelf display for a glass plate. The package must be able to display a pattern printed on the plate. The package should also keep the plate from breaking if it were to fall off of the shelf on which it is displayed. The shelf is located 5 feet above a concrete floor.

MATERIALS(Per Team of 2 students)

1. Masking tape
2. 1 1/2 - sheets of poster board
3. 1 - sheet of overhead transparency film
4. 10 - low temperature glue sticks
5. 2 - sheets of colored copy paper
6. 1 - 6" glass plate

TOOLS

1. Scissors
2. Ruler
3. Pencil
4. X-acto knife
5. Glue gun
6. Cardboard Cutting Matt (only to be used for cutting on)

LIMITATIONS

1. The package must be constructed from only the materials listed.
2. Tools can not become a part of the solution.
3. Be sure to carefully inspect your plate for crack, chips or breaks.

REQUIREMENTS

1. The package must allow the plate to be viewed, displaying any pattern or design on the plate.
2. The package must be able to be opened and closed.
3. The display package should advertise:
The Technology Glass Company
2000 Technology Way
Atlanta, Georgia 30020
Visit our web site at: WWW.Technoglass.com

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

Test 1: Packages will be dropped vertically from a height of 5 feet. Those that survive will then proceed to the next test.

Test 2: All packages should be wrapped for shipping. Packages will be shipped individually through the mail or courier system to another school or back to your own school.

Creativity of packaging design will count towards your grade.

Pringles Challenge

John Davis & Steve Hill
Goshen Middle School - Goshen, New York

BACKGROUND INFORMATION

Once products are manufactured they must safely be transported to the consumer. The role of the Package Designer is to create an appropriate container for the item being shipped. They must carefully examine the product and the manner in which it will be shipped.

For example, a computer might be shipped in a large container packed in foam. The cost might be as high as \$25 per container. At the other extreme might be a Bic Pen requiring nothing more than a plastic wrapper costing a 10th of 1 cent.

OBJECTIVE

Students are to create a package design that will allow a Pringles chip to safely survive a trip through the US mail system.

MATERIALS (Per Individual or Team of 2 students)

- 1 - legal size envelope
- 1 - Pringles Chip
- 3 - 3" x 5" index cards
- 2 - 8 1/2" x 11" sheets of copy paper
- 4 craft sticks
- 2 - drinking straws
- 12 inches of masking tape

TOOLS

- Scissors
- Ruler

LIMITATIONS

- You may use only the materials provided.
- Your envelope must be treated as a normal piece of mail.

REQUIREMENTS

- Students should address the envelopes to the School Technology Lab (provide address) from the individual student or students.

INSTRUCTIONS

- Construct your Pringles package and prepare for testing.

TESTING

- Test 1: Impact Test - Place the envelope on a table or the floor. Hold a text book 12" above the envelope and drop the book onto the envelope. Investigate how well the idea worked. Survivors proceed.
- Test 2: Conveyor Belt Test - Place the envelope on the conveyer belt with 2 weighted boxes after it. Turn the hand crank slowly and observe the boxes fall on top of the envelope. Examine the idea. Survivors proceed. (See page for Conveyor Belt Diagram.)
- Test 3: Mail Test - Turn-in the envelope to your instructor to be mailed. Good luck.

Raft Design

Pam Brown - Central Middle School

OBJECTIVE

Students will design and construct a raft that can support the greatest amount of weight before sinking.

MATERIALS (Per Team of 2 or 3 students)

- | | |
|--|--------------------------|
| 1. 20 - craft sticks | 4. 4 - large paper clips |
| 2. 1 - 12" x 12" sheet of plastic wrap | 5. 2 feet of string |
| 3. 1 - 6" x 12" sheet of aluminum foil | 6. glue or hot glue |

TOOLS

- | | |
|-------------|--|
| 1. Scissors | 3. Glue gun (preferably low temp./cool melt) |
| 2. Ruler | 4. Wire cutters (access to if needed) |

LIMITATIONS

1. You may use only the materials provided.
2. Device can not be attached to bottom of the testing pool.
3. Device must be able to float.

| | | |
|-----------|----------------|----------------|
| 4. Sizes: | <u>Minimum</u> | <u>Maximum</u> |
| Length | 3" | 6" |
| Width | 3" | 6" |

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

1. Students should set up their device for testing one at a time in the pool.
2. Instructor will provide a large bucket or tub for testing.
3. Instructor will provide jumbo paper clips for weights.
4. Vessels should be weighed before testing.
5. Paper clips should be weighed after testing.
6. Efficiency of vessel can be determined by the following formula:

$$\frac{\text{Weight of supported Paper clips (grams)}}{\text{Weight of Vessel (grams)}} + \frac{\text{Weight of supported Paper clips (grams)}}{10(\text{grams})} = \text{Effic.}$$

Recyclable Child's Toy

Pam Brown - Central Middle School

OBJECTIVE

Students will design and construct a child's toy from recyclable items.

MATERIALS(Per Team of 2 or 3 students)

- | | |
|--------------------------|-----------------------|
| 1. Soda cans | 8. Aluminumfoil |
| 2. Card board | 9. Styrofoam |
| 3. Plastic bottles/jars | 10. Newspaper |
| 4. Paper | 11. Craft sticks |
| 5. Egg cartons or crates | 12. Paper towel tubes |
| 6. Cloth | 13. String or yarn |
| 7. Glue or Glue Sticks | |

TOOLS

- | | |
|-------------|--|
| 1. Scissors | 3. Glue gun (preferably low temp./cool melt) |
| 2. Ruler | |

LIMITATIONS

1. You may use only the materials provided.
2. Toy should be no larger than a 12 inch cube.
3. Toy should be safe for small children

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your toy.

GRADING

1. Toys will be examined for durability and safety.
2. Toys will be judged on creativity and construction.

Sailing Vessel

Pam Brown - Central Middle School

OBJECTIVE

Students will design and construct a sailing vessel that can travel 10 feet in the least amount of time, while taking on the least amount of water.

MATERIALS(Per Team of 2 or 3 students)

1. 1 - 3" x 6" piece of Balsa or Bass wood
2. 1 - 12" piece of 1/8" x 1/8" Balsa wood
3. 1 - 6" x 12" sheet of aluminum foil
4. 1 - 12" x 20" sheet of tissue paper
5. 1 - 12" x 12" sheet of plastic wrap
6. 5 large paper clips
7. 2 feet of string
8. 5 craft sticks
9. 6" Masking tape
10. Glue or hot glue

TOOLS

1. Scissors
2. Ruler
3. Glue gun (preferably low temp./cool melt)
4. Wire cutters (access to if needed)

LIMITATIONS

1. You may use only the materials provided.
2. Vessel can not be attached to bottom of the testing trough.
3. Vessel must be able to float.
4. Vessel can only be powered only by the wind produced by the fan.

| | | |
|-------------------------|----------------|----------------|
| 5. Sizes: | <u>Minimum</u> | <u>Maximum</u> |
| Length | 6" | 10" |
| Width (boat) | 2" | 3" |
| Width (sail) | 3" | 6" |
| Height (including sail) | -- | 12" |

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

1. Students should set up their device for testing at the starting line.
2. Instructor will provide testing trough and an electric fan to be placed at one end of the testing trough. (See page for Trough Diagram.)
3. Instructor will provide a stop watch for timing the duration of the voyage.
4. Students should be allowed to turn on the fan.
5. Time should begin when fan is started and end when the entire vessel has crossed the finish.

Shoe Box House

Cindy Valentine - Central Middle School

OBJECTIVE

Students will design and construct a shoe box house that will provide the greatest amount of insulation.

MATERIALS (Per Team of 2 or 3 students)

- | | |
|----------------------|------------------|
| 1. Shoe box with lid | 6. Aluminum foil |
| 2. Cardboard | 7. Styrofoam |
| 3. Wooden dowels | 8. Newspaper |
| 4. Plastic | 9. Craft sticks |
| 5. Glue | 10. Glue sticks |

TOOLS

- | | |
|-------------|--|
| 1. Scissors | 3. Glue gun (preferably low temp./cool melt) |
| 2. Ruler | |

LIMITATIONS

1. You may use only the materials provided.

REQUIREMENTS

1. House should be no larger than the shoe box. All insulation must fit within the shoe box.
2. House should contain at least 2 windows and 1 door.
3. The outside of the house should be decorated to resemble a real house.
4. House must include an inside container in which to place an ice cube. This container may be insulated.
5. Groups must provide a sketch of the house design.
6. Groups must provide a list of materials used in the construction of the house.
7. Groups must provide a description of how the house was built.
8. House must be easily openable and closable for checking the status of the ice cube during testing.

TESTING

1. The instructor will provide one ice cube for each house.
2. The time that the house receives the ice cube will be recorded.
3. Houses will be checked at hourly intervals and those with melted ice cubes will be eliminated. The group whose ice cube melts last is the winner.
4. No group member may touch or tamper with any house once the testing has begun.

Slow Coaster

Ron Barker - Georgia Department of Education

OBJECTIVE

Students will design and construct a device that will control the fall of a marble, allowing the marble to roll as slowly as possible.

MATERIALS (Team of 2 or 3 students)

1. 1 - 18" x 24" cardboard or poster board base
2. 24 - 3" x 5" index cards
3. 6 sheets of 8 1/2" x 11" copy paper
4. 24 strands of dry spaghetti
5. 1 - marble
6. 36 inches masking tape

TOOLS

1. Scissors
2. Ruler

LIMITATIONS

1. You may use only the materials provided.

REQUIREMENTS

1. The marble must start in one corner of the base and, change directions at least 3 time.
2. The marble must come to a resting point at any corner other than the one it started from.
3. There must be a triggering mechanism that can be released to start the marble. The triggering mechanism must be able to be reset for multiple tests.

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

1. A stop watch will be needed to time the fall of each marble.
2. Once the marble has begun its journey, no one may touch the marble.
3. Students will be allowed to place the marble at the starting position and release the starting mechanism.
4. Each device will have three attempts and each time will be recorded.
5. Time will begin when the marble is released from point A and end when the marble reaches point B.
6. Appearance and construction will be considered in grading.

Spaghetti Challenge

John Davis & Steve Hill
Goshen Middle School - Goshen, New York

OBJECTIVE

Students will construct a simple structure capable of allowing the spaghetti to extend from the table top as far as possible.

MATERIALS (Per Individual or Team of 2 students)

1. 20 - pieces of Spaghetti
2. 24 inches of masking tape

TOOLS

1. Scissors
2. Ruler

LIMITATIONS

1. You may use only the materials provided.

REQUIREMENTS

1. Structure may be attached to the desk.
2. Structure should allow the spaghetti to extend as far as possible from the table top. Only the amount beyond the table top will be counted in the distance extended.

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

1. The distance from the edge of the table to the non-supported end to the spaghetti will be measured.

Technological Game

Pam Brown - Central Middle School
Scott Brown - Carrollton High School

OBJECTIVE

Students will develop a game to teach children about a specific areas of technology. Choose one of the following areas:

1. Energy, Power & Transportation Technology
 - a. Automobile Industry
 - b. Flight
 - c. American or Russian Space Program
 - d. Water Transportation
 - e. Electricity
 - f. Electronics
 - g. Land Transportation
 - h. Types of Energy
2. Communications Technology
 - a. Computer Technologies
 - b. The Internet
 - c. Animation Technology
 - d. Radio or Television Broadcasting
 - e. Satellite Communication
 - f. Telephone
3. Bio-Related Technology
 - a. Meteorology Technology
 - b. Medical Technology
 - c. Agricultural Technology
 - d. Aquaponics
 - e. Hydroponics
 - f. Bionics
4. Production Technology
 - a. Engineering Technology
 - b. Manufacturing
 - c. Construction
 - d. Robotics
5. Inventors and Inventions

REQUIREMENTS (Teams of 2 or 3 students)

1. Your game may be in any form (trivia, board, card, etc.)
2. Your game must come in its own box. The box must be appropriately decorated including the following information: Name of Game, Name of Company, Logo, Appropriate Ages
3. Your game must include all necessary playing tools. Your group will be responsible for making all parts.
4. Your game must come with a complete set of typed rules/instructions.
5. Your game must be a learning tool that can be used in schools to teach about different areas of Technology.
6. Your game should be designed for one of the following age groups:
 - 8 - 11 year olds (3rd - 5th graders)
 - 11 - 14 year olds (6th - 8th graders)
 - 14 - 18 year olds (9th - 12th graders)

Technology Before I was Born

Scott Brown - Carrollton High School

OBJECTIVE

Students will develop a 4 to 8 minute presentation on a technological invention developed between 1900 and 1940.

REQUIREMENTS

1. The technological invention must have been invented between 1900 and 1940.
2. The technological invention must come from one of the 5 cluster areas of technology Education. These areas are: Communications, Manufacturing, Construction, Bio-related Technologies, and Energy, Power & Transportation.
3. The presentation must be between 4 and 8 minutes in length.
4. The presentation must be accompanied by a 1 page types summary (12 point type with 1" page margins), an outline, a bibliography and a cover page. Total of 4 pages.
5. Presentation must include at least 1 visual aid (video, poster, transparencies, or computer presentation). No more that 1 minute of video can be shown during the presentation.

GRADING

1. Students will be graded as follows:

| | |
|---|-----------|
| Typed summary, outline, bibliography and cover page | 20 points |
| Length of Presentation (There will be 1 point deducted for each minute over or under the required time) | 10 points |
| Visual Aid(s) (5 extra points will be awarded for additional appropriate visual aids developed and used) | 20 points |
| Presentation Delivery | 20 points |
| Presentation Content | 30 points |