

50 STEM Labs

SCIENCE, TECHNOLOGY, ENGINEERING, & MATHEMATICS



***50 hands-on, fun science experiments for kids!**

***Each comes with rules and grading rubrics!**

***Supports learning in STEM fields!**

***Great for school or home!**

***Use them over and over again!**

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CONTENTS: WHAT IS THIS BOOK ABOUT?

STEM is an acronym for Science, Technology, Engineering, and Mathematics. Recent shifts in education have favored these subjects, primarily because we have a shortage of workforce in these particular areas, which is really quite sad for a number of reasons. These can be some of the most interesting things to study in school, provided they are taught in a fun, interesting, and hands-on fashion. They also lead to some of the best-paying technical jobs, too!

All of the labs within promote these 4 fields. You will find a strong emphasis on designing a project, testing it, measuring the results, and reflecting upon what worked and did not work. The projects are also labeled at the bottom with a series of categorical tags, so you can find similar projects to work on, allowing students to build upon prior knowledge gained in doing these projects! Of course, you can do them in any order you wish, but it can be fun to do a set of similar projects.

Since this is an educational volume, developed in my years teaching science in public schools, grading rubrics for each assignment are provided. There are some general suggestions and guidelines for each project, but it has deliberately been left without too much detail to allow the projects to be adapted to your classroom’s individual needs.

CONTENTS: COPYRIGHT INFORMATION

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Alphabetical Mission Listing - Page 1

1. 10 Seconds and Counting... (**Balloons, Fliers, Height**)
2. 3-2-1 Launch! (**Distance, Ping Pong Balls, Rubber Bands, Throwers**)
3. All Ramped Up (**Cars, Distance, Tracks**)
4. All Tangled Up (**Chains, Materials Strength, String, Weight**)
5. Bridge to Nowhere (**Bridges, Materials Strength, Paper, Weight**)
6. Bridging the River Sticks (**Bridges, Materials Strength, Toothpicks, Weight**)
7. Can Crusher (**Dead Lift, Foil, Materials Strength, Weight**)
8. Come Fly With Me (**Fliers, Plastic Straws, Time**)
9. Crash Test Dummies (**Cars, Crashes, Tracks**)
10. Daisy Chains (**Chains, Materials Strength, Paper, Weight**)
11. Dead Lift (**Dead Lift, Materials Strength, Plastic Straws, Weight**)
12. Down the Chute (**Accuracy, Marbles, Tracks**)
13. Egg Survivor I - High Falls (**Crashes, Eggs, Height, Scavengers**)
14. Egg Survivor II - Smallest Winner (**Crashes, Eggs, Height, Scavengers**)
15. Egg Survivor III - Rolling Eggs (**Cars, Crashes, Eggs, Scavengers, Tracks**)
16. Egg Survivor IV - Log Flume (**Boats, Crashes, Eggs, Scavengers, Tracks, Wind, Water**)
17. Egg Survivor V - Mars Lander (**Balloons, Crashes, Eggs**)
18. Fire Away! (**Distance, Rubber Bands, Throwers**)
19. Foilty Towers (**Foil, Height, Towers**)
20. Get it Running (**Cars, Distance, Rubber Bands**)
21. Hang Ten! (**Airplanes, Fliers, Paper, Time**)
22. High Clips (**Height, Paper Clips, Towers**)
23. H.M.S. Speedboat (**Boats, Cars, Scavengers, Speed, Wind**)
24. House of Cards (**Height, Notecards, Towers**)
25. Huff and Puff Your House Down (**Crashes, Materials Strength, Notecards, Plastic Straws**)

CONTENTS:

Alphabetical Mission Listing - Page 2

26. Landing Strip (**Accuracy, Airplanes, Fliers, Paper**)
27. Lay it All on the Line (**Balloons, Distance, Fliers, String**)
28. Leaning Towers (**Height, Paper, Towers**)
29. Marble Madness (**Marbles, Scavengers, Time, Tracks**)
30. Marshmallows Away (**Distance, Marshmallows, Paper Clips, Throwers**)
31. Merry-Go-Round (**Balloons, Scavengers**)
32. Off to the Races (**Cars, Speed, Tracks**)
33. On a Strong Note (**Dead Lift, Materials Strength, Notecards, Weight**)
34. Pipe Dreams (**Dead Lift, Materials Strength, Pipe Cleaners, Weight**)
35. Plastic Bridges (**Bridges, Length, Plastic Straws**)
36. Rickety Old Bridge (**Bridges, Cars, Length, Materials Strength, String, Weight**)
37. Rubber Match (**Chains, Materials Strength, Rubber Bands, Weight**)
38. Strong as Aluminum (**Chains, Foil, Materials Strength, Weight**)
39. Take the High Road (**Cars, Scavengers, Time, Tracks**)
40. Take to the Winds (**Scavengers, Wind**)
41. Tin Highway (**Bridges, Foil, Materials Strength, Weight**)
42. To the Moon and Back (**Airplanes, Distance, Fliers, Paper**)
43. Toothpick Towers (**Height, Toothpicks, Towers**)
44. Tube Frame Towers (**Height, Plastic Straws, Towers**)
45. We Can Fly Anything! (**Airplanes, Distance, Fliers, Paper**)
46. Weakest Link (**Chains, Materials Strength, Paper Clips, Weight**)
47. What Floats Your Boat I (**Boats, Buoyancy, Clay, Water**)
48. What Floats Your Boat II (**Boats, Buoyancy, Foil, Water**)
49. What Floats Your Boat III (**Boats, Buoyancy, Toothpicks, Water**)
50. Whirly Birds (**Fliers, Height, Rubber Bands**)

CONTENTS:

Mission Categories Listing

- Accuracy
- Airplanes
- Balloons
- Boats
- Bridges
- Buoyancy
- Cars
- Chains
- Clay
- Crashes
- Dead Lift
- Distance
- Eggs
- Fliers
- Foil
- Height
- Length
- Marbles
- Marshmallows
- Materials Strength
- Notecards
- Paper

- Paper Clips
- Ping Pong Balls
- Pipe Cleaners
- Plastic Straws
- Rubber Bands
- Scavengers
- Speed
- String
- Throwers
- Time
- Toothpicks
- Towers
- Tracks
- Water
- Weight
- Wind



CONTENTS:

Categorical Mission Listing - Page 1

Accuracy

1. Down the Chute
2. Landing Strip

Airplanes

1. Hang Ten
2. Landing Strip
3. To the Moon and Back
4. We Can Fly Anything

Balloons

1. 10 Seconds and Counting...
2. Egg Survivor V
3. Lay it All on the Line
4. Merry-Go-Round

Boats

1. Egg Survivor IV
2. H.M.S. Speedboat
3. What Floats Your Boat I
4. What Floats Your Boat II
5. What Floats Your Boat III

Bridges

1. Bridge to Nowhere
2. Bridging the River Sticks
3. Plastic Bridges
4. Rickety Old Bridge
5. Tin Highway

Buoyancy

1. What Floats Your Boat I
2. What Floats Your Boat II
3. What Floats Your Boat III

Cars

1. All Ramped Up
2. Crash Test Dummies
3. Egg Survivor III
4. Get it Running
5. H.M.S. Speedboat
6. Off to the Races
7. Rickety Old Bridge
8. Take the High Road

Chains

1. All Tangled Up
2. Daisy Chains
3. Rubber Match
4. Strong as Aluminum
5. Weakest Link

Clay

1. What Floats Your Boat I

Crashes

1. Crash Test Dummies
2. Egg Survivor I
3. Egg Survivor II
4. Egg Survivor III
5. Egg Survivor IV
6. Egg Survivor V
7. Huff and Puff Your House Down

Dead Lift

1. Can Crusher
2. Dead Lift
3. On a Strong Note
4. Pipe Dreams

CONTENTS:

Categorical Mission Listing - Page 2

Distance

1. 3-2-1 Launch!
2. All Ramped Up
3. Fire Away!
4. Get it Running
5. Lay it All on the Line
6. Marshmallows Away
7. To the Moon and Back
8. We Can Fly Anything

Eggs

1. Egg Survivor I
2. Egg Survivor II
3. Egg Survivor III
4. Egg Survivor IV
5. Egg Survivor V

Fliers

1. 10 Seconds and Counting...
2. Come Fly With Me
3. Hang Ten
4. Landing Strip
5. Lay it All on the Line
6. To the Moon and Back
7. We Can Fly Anything
8. Whirly Birds

Foil

1. Can Crusher
2. Foilty Towers
3. Strong as Aluminum
4. Tin Highway
5. What Floats Your Boat II

Height

1. 10 Seconds and Counting...
2. Foilty Towers
3. High Clips
4. House of Cards
5. Leaning Towers
6. Toothpick Towers
7. Tube Frame Towers
8. Whirly Birds

Length

1. Plastic Bridges
2. Rickety Old Bridge

Marbles

1. Down the Chute
2. Marble Madness

Marshmallows

1. Marshmallows Away

Materials Strength

1. All Tangled Up
2. Bridge to Nowhere
3. Bridging the River Sticks
4. Can Crusher
5. Daisy Chains
6. Dead Lift
7. Huff and Puff Your House Down
8. On a Strong Note
9. Pipe Dreams
10. Rubber Match
11. Rickety Old Bridge
12. Strong as Aluminum
13. Tin Highway
14. Weakest Link

Notecards

1. House of Cards
2. Huff and Puff Your House Down
3. On a Strong Note

CONTENTS:

Categorical Mission Listing - Page 3

Paper

1. Bridge to Nowhere
2. Daisy Chains
3. Hang Ten
4. Landing Strip
5. Leaning Towers
6. To the Moon and Back
7. We Can Fly Anything

Paper Clips

1. High Clips
2. Marshmallows Away
3. Weakest Link

Ping Pong Balls

1. 3-2-1 Launch!

Pipe Cleaners

1. Pipe Dreams

Plastic Straws

1. Come Fly With Me
2. Dead Lift
3. Huff and Puff Your House Down
4. Plastic Bridges
5. Tube Frame Towers

Rubber Bands

1. 3-2-1 Launch
2. Fire Away!
3. Get it Running
4. Rubber Match
5. Whirly Birds

Scavengers

1. Egg Survivor I
2. Egg Survivor II
3. Egg Survivor III
4. Egg Survivor IV
5. H.M.S. Speedboat
6. Marble Madness
7. Merry-Go-Round
8. Take the High Road
9. Take to the Winds

Speed

1. H.M.S. Speedboat
2. Off to the Races

String

1. All Tangled Up
2. Lay it All on the Line
3. Rickety Old Bridge

Throwers

1. 3-2-1 Launch!
2. Fire Away!
3. Marshmallows Away

Time

1. Come Fly With Me
2. Hang Ten
3. Marble Madness
4. Take the High Road

Toothpicks

1. Bridging the River Sticks
2. Toothpick Towers
3. What Floats Your Boat III

Towers

1. Foily Towers
2. High Clips
3. House of Cards
4. Leaning Towers
5. Toothpick Towers
6. Tube Frame Towers

CONTENTS:

Categorical Mission Listing - Page 4

Tracks

1. All Ramped Up
2. Crash Test Dummies
3. Down the Chute
4. Egg Survivor III
5. Egg Survivor IV
6. Marble Madness
7. Off to the Races
8. Take the High Road

Water

1. Egg Survivor IV
2. What Floats Your Boat I
3. What Floats Your Boat II
4. What Floats Your Boat III

Weight

1. All Tangled Up
2. Bridge to Nowhere
3. Bridging the River Sticks
4. Can Crusher
5. Daisy Chains
6. Dead Lift
7. On a Strong Note
8. Pipe Dreams
9. Rubber Match
10. Rickety Old Bridge
11. Strong as Aluminum
12. Tin Highway
13. Weakest Link

Wind

1. Egg Survivor IV
2. H.M.S. Speedboat
3. Take to the Winds



CONTENTS:

50 STEM LABS

Each of the **50 STEM LABS** has the following:

- A snappy **Title**
- A **Brief Description** of the task to be completed
- General **Mission Rules**, suggestions, limitations, and requirements of the task
- **Grading Rubrics** for a Quiz and a Test Grade
- A small **note space** for any changes or adaptations required
- **Category Tags** at the bottom to help you find similar projects



MISSION: 10 Seconds and Counting...

BRIEF:

You and your team have been selected to make rocket ship that can take off vertically and go as high as possible.

MISSION RULES:

1. You will design a rocket ship that is balloon-powered and attached to a string. The rocket ship must slide up along the string and go as high as possible,
2. Your rocket ship must be built from a single balloon, a straw, tape or glue, and notecards.
3. You will work with a single partner. Teams may not be of more than 2 people.
4. The straw will be used to slide along the line that is strung vertically from floor to ceiling. Both ends will be secured during tests. Inflated balloons will be attached to the rocket ship. Letting air from the balloons should propel the project as high as possible.

• *TEACHERS OPTION: Have a thin rod for the plastic straw to start on, allowing the device to fly freely after clearing the launch pad. Heights must still be measured, perhaps visually against marks on an exterior wall.*



QUIZ GRADE:

Research and design on jets, rockets, and propulsion.

- A paragraph on jets, engines, and propulsion 25%
- A concept idea for your rocket sketched and explained 50%
- Conclusions and reflections based on your results 25%

TEST GRADE:

Your completed design and the results of the test.

- Project Completed = 50%
- 50% of your grade depends on how high your project travels.
- *NOTE: The best project gets an automatic 100%.*

NOTES:

CATEGORIES:

Balloons, Fliers, Height

MISSION: 3-2-1 Launch

BRIEF:

You and your team have been selected to make a device to throw a ping pong ball.

MISSION RULES:

1. You will design a throwing device.
2. Your device must be no longer than 18 inches, no taller than 18 inches, and no wider than 12 inches when assembled and stationed at the throwing line.
3. You will work with two or three partners. Teams may not be of more than 4 people.
4. You must only use paper, glue, tape, rubber bands, paperclips, pencils, or other approved office supplies for your project.
5. The device must have some cup or place to put the ping pong ball. The device will then be manipulated and the attempt measured.



QUIZ GRADE:

Create a blueprint design for your ideas

- Sketch 25%
- Sketch is labeled 25%
- Explanation of strategies 25%
- Conclusions and reflections based on your results 25%

TEST GRADE:

Your completed design and the results of the test.

- Project Completed = 50%
- 50% of your grade depends on how far your project throws compared to the other group's projects. The projects that do best will get more points.
- *NOTE: There is a -5% penalty for every 1/2 inch your project is out of the size specifications.*

NOTES:

CATEGORIES:

Distance, Ping Pong Balls, Rubber Bands, Throwers

MISSION:

Andrew Frinkle

BRIEF:

A quick look at the author of this book.

ABOUT THE AUTHOR:

1. Over 10 years of experience in the teaching field with a specialization in math and science education in elementary and middle schools.
2. Award Nominated for teacher of the year.
3. Winner of the Karen Pelz Writing Award for short fiction.

PICTURE:



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NOTES:

Author of over 20 books in nonfiction and fiction genres.

CATEGORIES:

Hands-On, Labs, Math, Measurement, Physics, Science, STEM

50 STEM Labs

SCIENCE, TECHNOLOGY, ENGINEERING, & MATHEMATICS

WHAT IS STEM?

STEM is an acronym for Science, Technology, Engineering, & Mathematics. It is in these areas that many American students are lacking, and recent initiatives in education are pushing the focus of students' academics back into these core technical fields to make them better prepared to find careers in high paying technical fields.

The goal of this book is to present these fields, which can seem uninteresting if taught wrong, in a fun and inventive way. Students are engaged with problem solving and critical thinking in exciting, hands-on, and competitive tasks. Math and measurement add to the tasks, making for educational activities that hit all core areas of the STEM philosophy.