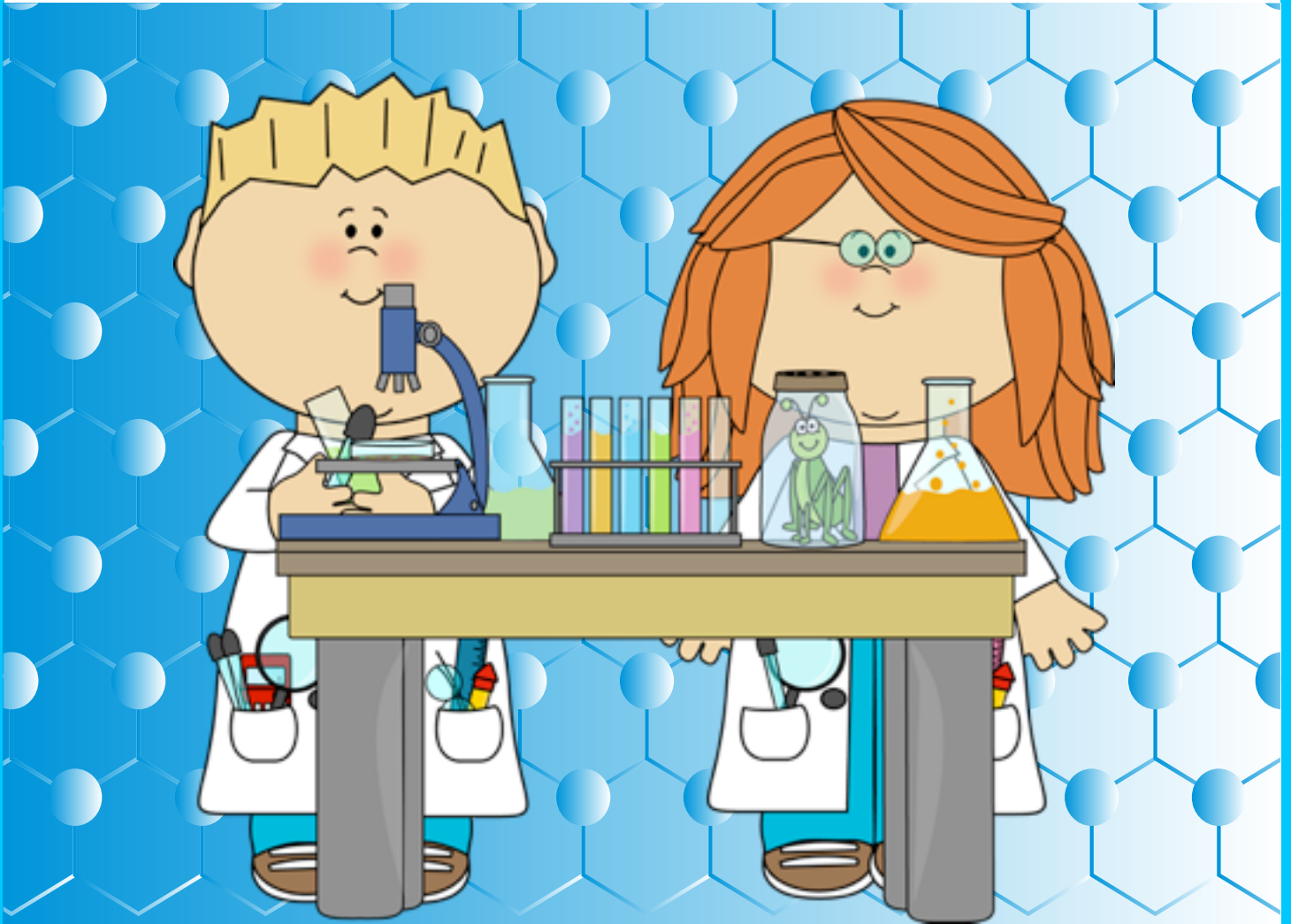


50 STEM LABS

SCIENCE EXPERIMENTS FOR KIDS



SCIENCE * TECHNOLOGY * ENGINEERING * MATHEMATICS

50 HANDS-ON PROJECT IDEAS FOR KIDS

SUPPORTS ENGINEERING & DESIGN PROCESS

PROMOTES CRITICAL THINKING & PROBLEM-SOLVING SKILLS



CREATED & DESIGNED BY ANDREW FRINKLE

IN THIS VOLUME

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WHAT ARE STEM AND STEAM?

STEM is an acronym for Science, Technology, Engineering, and Mathematics. All of the labs within this volume promote learning within these four fields. You might also find the acronym **STEAM** being used. STEAM is the addition of Art to the other four STEM fields.

Learn more about STEM & STEAM and this book series at www.50STEMLabs.com.

WHAT IS STEM AND STEAM?

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HOW TO USE THIS BOOK

GENERAL SUGGESTIONS:

This book contains 50 different STEM lab activities. You will find a strong emphasis on designing a project, testing it, measuring the results, and reflecting upon what worked and did not work, which might lead to a redesign and retesting process. Technology can easily be incorporated by recording and documenting the process and creating reports and projects about the topic(s) afterward. Presentation and sharing of results is key to cooperative learning. Journals and log books should be kept as a record of the learning process.

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. These are not recipes to follow to make a project or activity. These projects require critical thinking and problem solving skills.

There is no intended order to these projects, nor is it expected that you will do each project. It is highly recommended that you pick the ones you find to be most interesting or appropriate for each learning group, which might have to be slightly modified, depending on the learning and experience levels you are working with.

You will find some similar projects within this volume and in the additional volumes of the 50 STEM Labs Series. Attempting similar projects helps students build on previous learning experiences while making them adjust to new expectations and rules or materials in the new project. Many instructors have great success with thematic units or quarterly units on bridges, towers, or other sets of related projects.

Another key part of this series is the idea that learning science should not break the bank. Most projects are done with common and inexpensive school supplies, office supplies, or household objects. Students can even scavenge and recycle supplies for some projects.

Since this is an educational volume, graded assignment suggestions are provided, although your exact scoring will vary too much to provide an easy grading rubric.



MISSION LISTINGS

01

10 SECONDS AND COUNTING

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

02

3-2-1 LAUNCH

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

03

ALL RAMPED UP

You and your team have been selected to design a ramp for a matchbox car to jump as far as possible with.

04

ALL TANGLED UP

You and your team have been selected to tie the best knots to hold as much weight as possible.

05

BRIDGE TO NOWHERE

You and your team have been selected to build a paper bridge that can hold as much weight as possible.

06

BRIDGING THE RIVER STICKS

You and your team have been selected to build the longest toothpick bridge possible from a limited amount of supplies.

07

CAN CRUSHER

You and your team have been selected to make the strongest load-bearing structure possible from only tin foil.

08

COME FLY WITH ME

You and your team have been selected to design and build a kite from plastic straws and other household materials.

09

CRASH TEST DUMMIES

You and your team have been selected to design a stunt car that can protect passengers to the end of a track.

10

DAISY CHAINS

You and your team have been selected to make a chain from strips of paper that can hold as much weight as possible.

MISSION LISTINGS

11

DEAD LIFT

You and your team have been selected to make the strongest load-bearing structure possible from only plastic straws and tape.

12

DOWN THE CHUTE

You and your team have been selected to design a delivery device that can take marbles 5 foot across the room and drop them into an open and empty soda bottle.

13

EGG SURVIVOR 1 - HIGH FALLS

You and your team have been selected to make sure a very precious cargo (a raw egg) survives a fall of at least 10 feet. Surviving eggs will then compete for increasing heights.

14

EGG SURVIVOR 2 - SMALL WINS

You and your team have been selected to make a new EPD (egg protection device). This one must be as small as possible and must still survive a 10 foot fall!

15

EGG SURVIVOR 3 - ROLLING EGGS

You and your team have been selected to make a new EPD (egg protection device). This one must be a rolling vehicle that can protect an egg as it goes down an obstacle course.

16

EGG SURVIVOR 4 - LOG FLUME

You and your team have been selected to make a new EPD (egg protection device). This one must be a sailboat that can protect an egg as it goes down a water-filled track.

17

EGG SURVIVOR 5 - MARS LANDER

You and your team have been selected to make a new EPD (egg protection device). This one must be a small container that protects a falling egg with the use of balloons.

18

FIRE AWAY!

You and your team have been selected to make a rubber band dart thrower that throws a dart as far as possible!

19

FOILTY TOWERS

You and your team have been selected to make the tallest tower possible from a 3-foot length of foil and nothing else.

20

GET IT RUNNING

You and your team have been selected to make a car that runs on rubber band power!

MISSION LISTINGS

21

HANG TEN

You and your team have been selected to make a paper device that can stay in the air for the longest time possible.

22

HIGH CLIPS

You and your team have been selected to make the tallest tower possible from paper clips.

23

H.M.S. SPEEDBOAT

You and your team have been selected to design the fastest wind-powered land boat possible.

24

HOUSE OF CARDS

You and your team have been selected to make a the tallest tower possible from 6 index note cards, and nothing else.

25

HUFF AND PUFF YOUR HOUSE DOWN

You and your team have been selected to make a house out of plastic straws and other basic building materials that can withstand a wrecking ball's impending attack.

26

LANDING STRIP

You and your team have been selected to make a pair of paper airplanes that can land as accurately as possible on targets placed at different distances.

27

LAY IT ALL ON THE LINE

You and your team have been selected to make a rocket ship that races down a hanging line.

28

LEANING TOWERS

You and your team have been selected to make a the tallest tower possible from 3 pieces of paper and a foot of tape.

29

MARBLE MADNESS

You and your team have been selected to make the longest, trickiest course in which to deliver a marble to its final destination. The longer and trickier the better.

30

MARSHMALLOWS AWAY

You and your team have been selected to make a device to throw mini marshmallows as far as possible.

MISSION LISTINGS

31

MERRY-GO-ROUND

You and your team have been selected to make a balloon-powered merry-go-round.

32

OFF TO THE RACES

You and your team have been selected to design a race car that will race down a teacher-designed track as fast as possible.

33

ON A STRONG NOTE

You and your team have been selected to make the strongest load-bearing structure possible from only notecards.

34

PIPE DREAMS

You and your team have been selected to make the strongest load-bearing structure possible from only pipe cleaners.

35

PLASTIC BRIDGES

You and your team have been selected to make the longest bridge possible from just tape and plastic straws.

36

RICKETY OLD BRIDGE

You and your team have been selected to make a rope bridge from string and note cards.

37

RUBBER MATCH

You and your team have been selected to make the strongest chain possible from a handful of rubber bands.

38

STRONG AS ALUMINUM

You and your team have been selected to make the strongest chain possible from a small amount of tin foil.

39

TAKE THE HIGH ROAD

You and your team have been selected to design a racetrack that takes at least 10 seconds for a toy car to complete.

40

TAKE TO THE WIND

You and your team have been selected to make a working windmill that turns gears and makes an action occur as a result of the windmill and gears turning.

MISSION LISTINGS

41

TIN HIGHWAY

You and your team have been selected to make the strongest bridge possible from tin foil.

42

TO THE MOON AND BACK

You and your team have been selected to make a paper device that can fly the greatest distance in a straight line from a launch point.

43

TOOTHPICK TOWERS

You and your team have been selected to make a tower from only glue and toothpicks that is at least 3 feet tall.

44

TUBE FRAME TOWERS

You and your team have been selected to make as tall of a tower as possible using only a dozen plastic straws and minimal tape.

45

WE CAN FLY ANYTHING!

You and your team have been selected to make a flying device that can fly the greatest distance in a straight line from a launch point. You don't get to choose the material you use!

46

WEAKEST LINK

You and your team have been selected to make the strongest chain possible from paper clips.

47

WHAT FLOATS YOUR BOAT 1

You and your team have been selected to design a clay boat that can hold the most weight without sinking.

48

WHAT FLOATS YOUR BOAT 2

You and your team have been selected to design a foil boat that can hold the most weight without sinking.

49

WHAT FLOATS YOUR BOAT 3

You and your team have been selected to design a wooden boat that can hold the most weight without sinking.

50

WHIRLY BIRDS

You and your team have been selected to make a homemade helicopter that can take off from a stationary position.

50 STEM LABS

SCIENCE EXPERIMENTS FOR KIDS

EACH OF THE 50 PROJECTS CONTAINS:

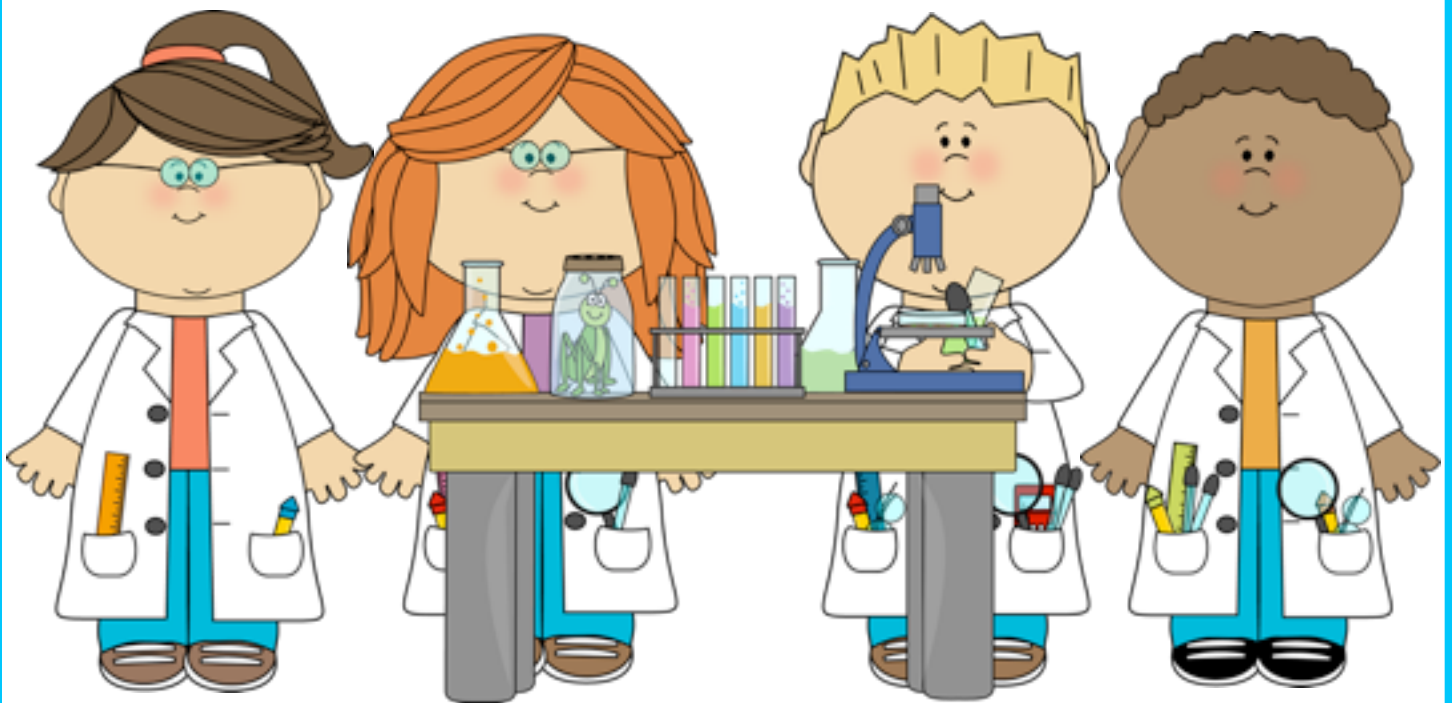
MISSION TITLE WITH TOPIC TAGS

MISSION GOALS

MISSION GUIDELINES & EXPECTATIONS

SUGGESTED MATERIALS

GRADING SUGGESTIONS & FOLLOW-UP ASSIGNMENTS



01

10 SECONDS AND COUNTING

* BALLOONS * FLIGHT * HEIGHT * MOTION * MEASUREMENT *

MISSION BRIEFING:

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

MISSION SUPPLIES:

- String
- Tape
- Glue
- Balloons
- Notecards
- Plastic straws
- Tape measure

MISSION GUIDELINES:

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.*

MISSION DEBRIEFING:

- Scoring based on results compared to other teams
- Blueprints & design diagrams for your project
- A reflection on your experiences with this project
- A follow-up project about propulsion, jets, and rocket engines



* DISTANCE * PING PONG BALLS * RUBBER BANDS * THROWERS *

MISSION BRIEFING:

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

MISSION SUPPLIES:

- Paper
- Glue
- Tape
- Rubber bands
- Paper clips
- Pencils
- Ping pong balls
- Tape measure

MISSION GUIDELINES:

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.
- *TEACHERS OPTION: Attempt to measure the launch angle of each ping pong ball fired by using a protractor or lines drawn at 10 to 15 degree increments on a wall or board.*

MISSION DEBRIEFING:

- Scoring based on results compared to other teams
- Blueprints & design diagrams for your project
- A reflection on your experiences with this project
- A follow-up project about siege engines, catapults, or trajectories



* CARS * DISTANCE * TRACKS *

MISSION BRIEFING:

You and your team have been selected to design a ramp for a matchbox car to jump as far as possible with.

MISSION SUPPLIES:

REQUIRED MATERIALS:

- Matchbox/toy cars
- Tape measure

Scavenged supplies might include things such as:

- Tape
- Straws
- Paper clips
- Notecards
- Cardboard tubes/boxes
- Paper
- Card stock

MISSION GUIDELINES:

1. You will design a car ramp from scavenged supplies. All supplies must be approved.
2. Your finished ramp must accommodate a car provided by your teacher, allowing the car to roll down and jump off the track.
3. It should be no more than 24 inches high, no longer than 24 inches, and no wider than 6 inches.
4. You will work with one or two partners. Teams may be of no more than 3 people.
5. Success will be measured by how far your car jumps after exiting your ramp. The car will be let go, not pushed.
6. Your teacher will determine the number of trials you receive. If more than 1 trial is done, an average score or formula may be used.

MISSION DEBRIEFING:

- Scoring based on results compared to other teams
- Blueprints & design diagrams for your project
- A reflection on your experiences with this project
- A follow-up project about cars, ramps, or physics



* CHAINS * MATERIALS STRENGTH * STRING * WEIGHT *

MISSION BRIEFING:

You and your team have been selected to tie the best knots to hold as much weight as possible.

MISSION SUPPLIES:

- Rulers
- Scissors
- String
- Bucket
- Weights, such as coins, flat washers, graduated weights, water, etc...

MISSION GUIDELINES:

1. You will design and tie a knot that will tie a string to a pole on one end and to a bucket on the other.
2. Your knot must be something that you and your partner can both demonstrate. One of you will tie the knot to the pole, and the other will tie the knot to the bucket.
3. You will work with one partner. Teams may not be of more than 2 people.
4. You must only use a single string of a length set by your teacher for your project. You will be given several short practice lengths, though, so you can perfect your knots.
5. Once the knots are tied, the pole will be set across two desks or tables, and the bucket will be suspended from the string. Weight will be added to the bucket until the string snaps. The breaking weight will be recorded.

MISSION DEBRIEFING:

- Scoring based on results compared to other teams
- Blueprints & design diagrams for your project
- A reflection on your experiences with this project
- A follow-up project about how string, rope, or fishing line are made and/or used



* BRIDGES * MATERIALS STRENGTH * PAPER * WEIGHT *

MISSION BRIEFING:

You and your team have been selected to build a paper bridge that can hold as much weight as possible.

MISSION SUPPLIES:

- Paper (copy paper is suggested)
- Glue
- Trays to hold weights
- Weights, such as coins, flat washers, graduated weights, etc...

MISSION GUIDELINES:

1. You will research bridges and get ideas for a concept for your bridge design.
2. Your bridge must be 36 inches long, between 2 and 6 inches wide, and 2 to 12 inches tall. If you are outside these measurements by more than 1/2 inch, you will be penalized.
3. You will work with a single partner. Teams may not be of more than 2 people.
4. You must only use paper and glue for your project. The amount of paper allowed may be predetermined.
5. The bridge must have a place in the center of it where a tray can be attached to hold weight. Projects that hold more weight score better.

MISSION DEBRIEFING:

- Scoring based on results compared to other teams
- Blueprints & design diagrams for your project
- A reflection on your experiences with this project
- A follow-up project about bridges, construction techniques, or how paper is made



RESOURCE PAGES

GRAPHS, PLANNING PAGES, & REPORT PAGES

REUSABLE FORMS AND PAGES:

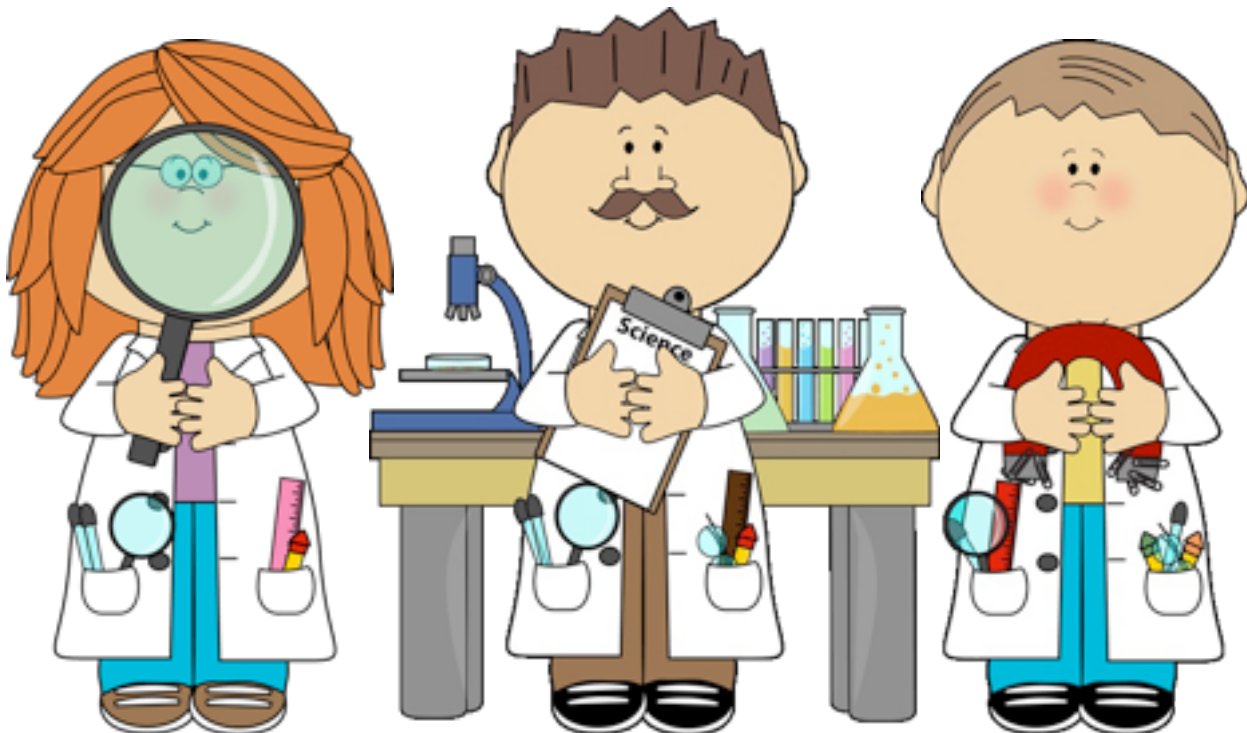
BLUEPRINTS

DATA COLLECTION

GRAPHING

REFLECTION

SCIENCE JOURNALS



PLANNING SHEET

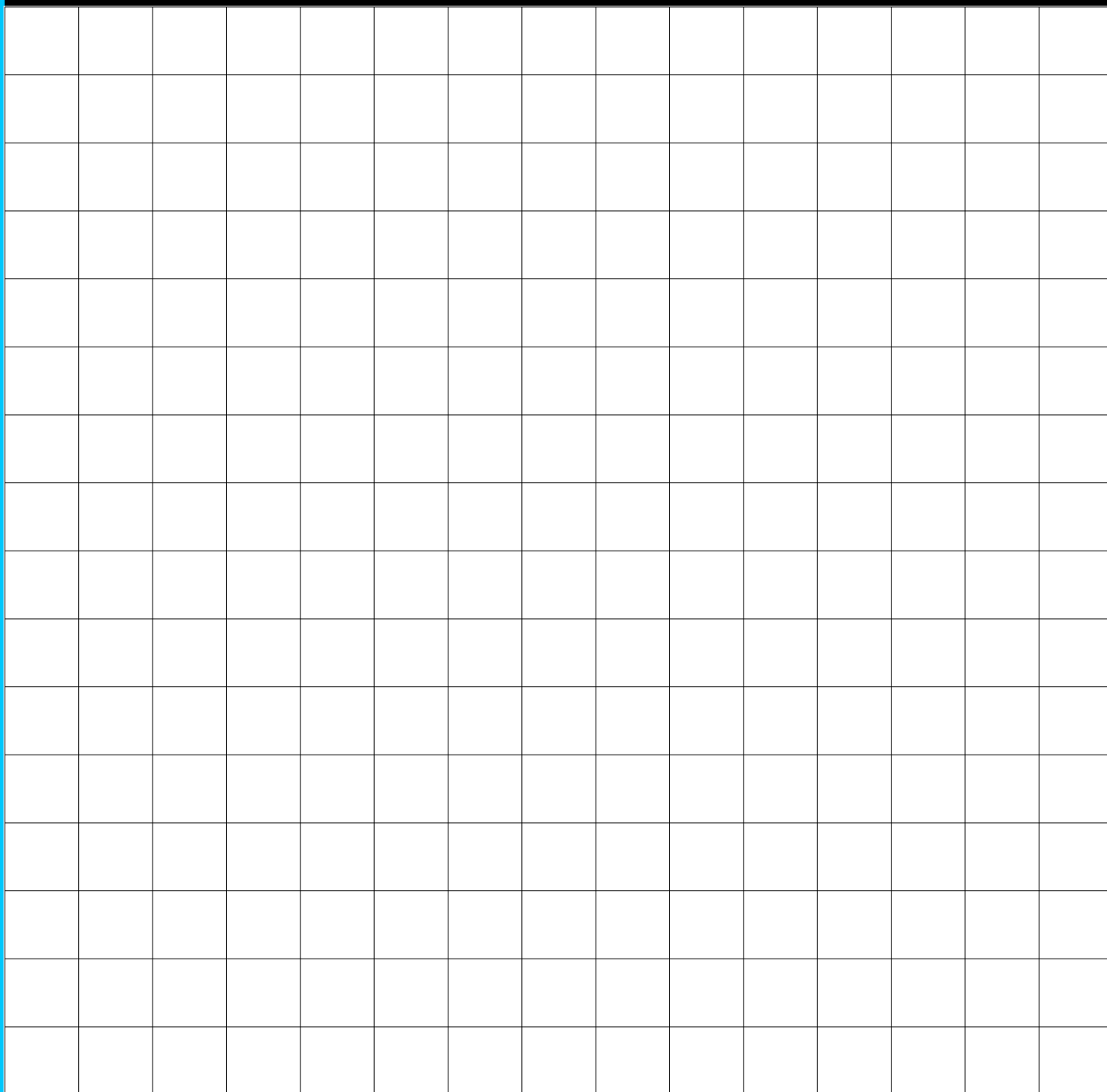
NAME:

PLANNING AREA

BLUEPRINT SHEET

NAME:

DESIGN AREA



DATA SHEET

NAME:

DATA RECORD AREA

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DATA SHEET

NAME:

DATA RECORD AREA

OBSERVATIONS SHEET

NAME:

DRAWING & WRITING AREA

GRAPHING SHEET

SINGLE TRIAL DATA SHEET

DATA GRAPH

LEGEND

Blank area for writing a legend.

GRAPHING SHEET

MULTIPLE TRIAL DATA SHEET

TEST 1

TEST 2

TEST 3

ABOUT THE AUTHOR

ANDREW FRINKLE



ABOUT THE AUTHOR:

Andrew Frinkle is an award-nominated teacher and writer with experience in America and overseas, as well as years of developing educational materials for big name educational sites like Have Fun Teaching. He has taught PreK all the way up to adult classes, and has focused on ESOL/EFL techniques and STEM Education.

With two young children at home now, he's been developing more and more teaching strategies and books aimed at helping young learners, as well as games and activity books for primary grades.

Andrew Frinkle is the founder & owner of MediaStream Press LLC. He also writes fantasy and science fiction novels under the pen name Velerion Damarke and writes/illustrates children's fiction as Andrew Frinkle. Additionally, he is working on educational music albums.

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- www.common-core-assessments.com
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50 STEM LABS

SCIENCE EXPERIMENTS FOR KIDS

WHAT'S NEW?

GET THOSE SAME 50 GREAT LABS, WITH UPDATES LIKE:

- SUGGESTED MATERIALS LISTS FOR EACH PROJECT!
- IMPROVED WORDING AND DIRECTIONS!
- MORE TEACHERS' OPTIONS SUGGESTIONS!
- GRADED ASSIGNMENTS SUGGESTIONS INSTEAD OF SIMPLE RUBRICS!
- REPRODUCIBLE JOURNALING AND DATA COLLECTION PAGES!
- NEW ARTWORK AND GRAPHICS!
- NEW LAYOUTS AND DESIGNS THROUGHOUT!
- NOW IN FULL COLOR!

