

IS YEAST ALIVE? STEM INVESTIGATION

Print-and-go STEM lab where students learn about Yeast and determine whether it is alive.

Is Yeast Alive? STEM Investigation - Evidence of Biological Activity
Driving Question
Do the results provide evidence that yeast is alive, and how do sugar availability and temperature affect its biological activity?

Investigation Conditions		
Condition	Name	Setup
A	Warm + Sugar + Yeast	100 mL warm water, 5 g sugar, 2 g yeast
B	Warm + No Sugar + Yeast	100 mL warm water, 0 g sugar, 2 g yeast
C	Warm + Sugar + No Yeast	100 mL warm water, 5 g sugar, 0 g yeast
D	Cold + Sugar + Yeast	100 mL cold water, 5 g sugar, 2 g yeast

Hypothesis
Write a testable hypothesis predicting which condition will produce the greatest change in balloon circumference. Explain your prediction using yeast energy needs and environmental conditions.

Variables	
Type	Describe for This Experiment
Independent Variable	
Dependent Variable	
Controlled Variables	

Before You Begin
1. Why is Condition C an important control?

2. Why must all bottles and balloons be as similar as possible?

3. Why is balloon circumference considered an indirect measurement of gas production?



NO PREP

SCROLL
to take a look inside!



HOW THIS LAB WILL HELP YOU



- Print-and-go setup
- Clear Testing Procedure
- Teaches Scientific Method
- Low-cost & common materials

Is Yeast Alive? STEM Investigation - Evidence of Biological Activity

Purpose

Use a hands-on investigation to teach characteristics of living things, respiration, fermentation, experimental controls, data collection, and compare yeast under different conditions and measure balloon inflation. They then use their results to evaluate whether

Learning Objectives

- Design and carry out a controlled investigation using multiple
- Explain why yeast is classified as a living, single-celled fungus
- Describe how yeast obtains and uses energy from sugar
- Connect carbon dioxide production to respiration and alcohol
- Measure change in balloon circumference as an indirect indicator
- Collect and analyze repeated measurements over time
- Calculate and compare average gas-production indicator rate
- Create and interpret a multi-line graph
- Use controls to rule out alternative explanations
- Construct a CER explaining whether the results provide evidence

Safety

- Do not taste or drink any mixture used in the investigation
- Wear safety goggles while mixing solutions and attaching
- Avoid breathing yeast dust. Add dry yeast gently and keep
- Wash hands before and after the investigation.
- Clean spills immediately because sugar solutions can make
- Check for latex allergies before using latex balloons. Use
- Do not tightly seal gas-producing mixtures inside rigid containers

Materials

Required

- Four identical 250-500 mL plastic bottles or flasks per class
- Four identical balloons
- Active dry or instant yeast from the same package
- Granulated sugar
- Warm water maintained near 37 degrees C
- Cold water maintained near 10 degrees C
- Graduated cylinder or measuring cup
- Digital balance or standardized measuring spoons
- Flexible measuring tape or string and ruler
- Thermometer and Timer
- Labels and permanent marker
- Funnels, trays, and paper towels

Optional

Water baths, gas syringes or water-displacement equipment, safety aprons, and extra setups for replicate trials.

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Hypothesis

Write a testable hypothesis predicting which condition will produce the greatest change in balloon circumference. Explain your prediction using yeast energy needs and environmental conditions.

Variables

Type	Describe for This Experiment
Independent Variable	
Dependent Variable	
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Before You Begin

1. Why is Condition C an important control?
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3. Why is balloon circumference considered an indirect measurement of gas production?

What Will Your Students Learn?

NO PREP

Full investigation breakdown

Tables and Graphs

Answer Key Included

Is Yeast Alive? STEM Investigation - Evidence of Biological Activity

Purpose
Use a hands-on investigation to teach characteristics of living things, cellular energy use, yeast metabolism, respiration, fermentation, experimental controls, data collection, calculations, and graphing. Students compare yeast under different conditions and measure balloon inflation as an indirect indicator of carbon dioxide production. They then use their results to evaluate whether yeast shows evidence of being alive.

Learning Objectives

- Design and carry out a controlled investigation.
- Explain why yeast is classified as a living organism.
- Describe how yeast obtains and uses energy.
- Connect carbon dioxide production to respiration and fermentation.
- Measure change in balloon circumference to measure gas production.
- Collect and analyze repeated measurements.
- Calculate and compare average gas production rates.
- Create and interpret a multi-line graph.
- Use controls to rule out alternative explanations.
- Construct a CER explaining whether the results support the hypothesis.

Safety

- Do not taste or drink any mixture used.
- Wear safety goggles while mixing solutions.
- Avoid breathing yeast dust. Add dry yeast to water carefully.
- Wash hands before and after the investigation.
- Clean spills immediately because sugar can attract insects.
- Check for latex allergies before using balloons.
- Do not tightly seal gas-producing mixtures in flexible gas collectors.

Materials Required

- Four identical 250-500 mL plastic bottles.
- Four identical balloons.
- Active dry or instant yeast from the same source.
- Granulated sugar.
- Warm water maintained near 37°C.
- Cold water maintained near 10°C.
- Graduated cylinder or measuring cup.
- Digital balance or standardized measuring scale.
- Flexible measuring tape or string.
- Thermometer and Timer.
- Labels and permanent marker.
- Funnels, trays, and paper towels.

Optional
Water baths, gas syringes or water safety aprons, and extra setups for repeated trials.

Is Yeast Alive? STEM Investigation - Evidence of Biological Activity

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Write a testable hypothesis predicting which condition will produce the greatest change in balloon circumference. Explain your prediction using yeast energy needs and environmental conditions.

Variables

Type	Describe for This Experiment
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Before You Begin

- Why is Condition C an important control?
- Why must all bottles and balloons be as similar as possible?
- Why is balloon circumference considered an indirect measurement of gas production?

Experimental Design

- Put on safety goggles and organize all materials on a tray.
- Label four identical bottles A, B, C, and D.
- Pre-stretch each balloon the same number of times.
- Add 100 mL of warm water to bottles A, B, and C. Add 100 mL of cold water to bottle D.
- Add 5 g of sugar to bottles A, C, and D. Do not add sugar to bottle B.
- Swirl each sugar-containing bottle for the same amount of time.
- Add 2 g of yeast to bottles A, B, and C. Do not add yeast to bottle D.
- Immediately attach one balloon securely to each bottle and start the timer.
- Place bottles A, B, and C in the warm-water bath and bottle D in the cold-water bath.
- Observe each bottle for bubbling, foam, and balloon inflation.
- At 0, 5, 10, 15, and 20 minutes, measure balloon circumference at the widest inflated point.
- Record the change from the initial measurement. If there is no measurable inflation, record 0 cm.
- Measure carefully without squeezing the balloon.
- Record water-bath temperatures and other observations.
- Stop the trial if a balloon becomes highly inflated or appears likely to burst.
- Do not taste or drink any mixture used in the investigation.

Temperature Record

Water Bath	Starting Temperature (degrees C)	Ending Temperature (degrees C)
Warm		
Cold		

Qualitative Observations
Record bubbling, foam, smell without directly inhaling, balloon appearance, leaks, or other changes.

Observations

Sample Calculations

Condition	Calculation	Average Indicator Rate
A	13.0 cm / 20 min	0.65 cm/min
B	2.0 cm / 20 min	0.10 cm/min
C	0 cm / 20 min	0 cm/min
D	5.0 cm / 20 min	0.25 cm/min

Interpretation: Condition A had the highest rate of balloon inflation. Condition D produced gas more slowly in the cold. Condition B produced only a small amount without added sugar, and Condition C produced no measurable gas without yeast. Because the measurement is circumference, the rates compare balloon inflation rather than direct carbon dioxide volume.

Graphing Sample
Students should create a multi-line graph comparing change in balloon circumference over time for all four conditions.

Title: Yeast Gas Production Under Different Conditions

X-axis: Time (minutes)

Y-axis: Change in Balloon Circumference (cm)

Legend: One clearly identified line for each condition. Because each treatment is measured repeatedly in time order, students should connect the sequential measurements for each condition with a line rather than use lines of best fit.

Yeast Gas Production Under Different Conditions

- ✓ Why yeast is classified as a living organism
- ✓ How yeast cells obtain usable energy from sugar
- How respiration and fermentation can produce carbon dioxide
- ✓ Why gas production is evidence of metabolic activity
- ✓ How sugar availability affects yeast activity
- How temperature affects the rate of enzyme-controlled reactions
- ✓ How a no-yeast treatment functions as an experimental control
- ✓ How to measure balloon inflation consistently over time
- ✓ How to calculate and compare average gas-production indicator rates
- ✓ How to create and interpret a multi-line graph
- Why balloon circumference is a proxy rather than a direct gas-volume measurement
- ✓ How to use Claim–Evidence–Reasoning (CER) to evaluate scientific evidence



Teacher Guide: setup, safety, pacing, and background science.



Student Packet: clear, step-by-step setup and timing instructions with blank data tables.



Graphing pages templates and marking rubric.



Complete answer key with example data tables.

What you get inside

Rubric				
Category	4 – Exceeds Expectations	3 – Meets Expectations	2 – Approaches Expectations	
Understanding of the Challenge	Clearly explains hydroponics, plant needs, and sustainability	Understands basic challenge	Partial understanding	
Hypothesis	Testable prediction with clear scientific reasoning	Testable prediction stated	Weak or vague prediction	
Engineering Design	Thoughtful, functional design clearly addresses plant needs and water efficiency	Functional hydroponic design	Design has significant weaknesses	
Variables & Controls	Correctly identifies IV, DVs, and multiple controls	Variables mostly correct	Some incorrect/missing	
Procedure	Follows procedure accurately and consistently	Minor errors	Inconsistent procedure	
Data Collection	Complete, accurate measurements at all intervals	Mostly complete	Several missing/inconsistent measurements	
Plant Observations	Detailed, relevant observations throughout	Appropriate observations recorded	Limited observations	
Graphing	Accurate line graph with title, scales, labels, units, and correctly plotted data	Graph complete with minor errors	Graph has major errors	
Data Analysis	Clearly identifies and explains growth and water-use patterns	Identifies major patterns	Limited analysis	Analysis missing/incorrect
Scientific Understanding	Accurately connects results to plant needs and hydroponic principles	Basic scientific explanation	Partially correct explanation	Incorrect/no explanation
Sustainability	Thoughtfully evaluates water efficiency and sustainability, including trade-offs	Explains basic sustainability connection	Limited connection	No meaningful connection
Claim (CER)	Clear claim directly evaluates system performance	Claim answers question	Claim unclear	Missing claim
Evidence (CER)	Uses specific plant-growth and water-use data	Uses relevant data	Evidence vague/incomplete	No evidence
Reasoning (CER)	Clearly connects evidence to hydroponics, plant needs, and water efficiency	Basic scientific connection	Weak connection	No reasoning
Design Improvements	Proposes realistic improvement supported by evidence	Appropriate improvement proposed	Vague improvement	No improvement
Collaboration & Safety	Consistently engaged, cooperative, and safe	Appropriate participation	Frequent reminders	Off-task/unsafe

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Before You Begin

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3. Why is balloon circumference considered an indirect measurement?

Data Table

Change in Balloon Circumference

Record the change from the starting circumference in centimetres. Record 0 cm when there is no measurable inflation.

Time (min)	A: Warm + Sugar + Yeast (cm)	B: Warm + No Sugar + Yeast (cm)	C: Warm + Sugar + No Yeast (cm)	D: Cold + Sugar + Yeast (cm)
0	0	0	0	0
5				
10				
15				
20				

Calculations

Average Gas-Production Indicator Rate = Final Change in Balloon Circumference / Trial Time

Condition	Calculation	Average Indicator Rate (cm/min)
A		
B		
C		
D		

Graphing Task

Yeast Gas Production Under Different Conditions

X-axis: Time (minutes)

Y-axis: Change in Balloon Circumference (cm)

Graph Type: Multi-line graph

Plot one clearly identified line for each condition. Connect the sequential points for each treatment and include a legend. Then write one sentence describing the overall pattern.

Skills Your Students Will Learn/Improve

WHAT YOU GET

- ✓ Teacher Guide: setup, safety, pacing, and background science.
- ✓ Student Packet: clear, step-by-step setup and timing instructions with blank data tables.
- ✓ Graphing pages templates and marking rubric.
- ✓ Complete answer key with example data.

The collage displays several pages from the 'Is Yeast Alive? STEM Investigation - Evidence of Biological Activity' kit. Visible elements include: a 'Background Science' section explaining yeast metabolism; a 'Safety' section with handling instructions; a 'Materials' list; a 'Scientific Interpretation' section; a 'Driving Question' and 'Hypothesis' section; a 'Variables' table; a 'Data Collection' table; a 'Graphing' section with a line graph showing 'Change in Balloon Circumference (cm)' over time for four conditions (A, B, C, D); a 'Rubric' for student work; and a 'Marking Rubric' for the investigation.

✓ Carrying out Controlled Experiments

✓ Precise Measurement

✓ Design and Redesign

✓ Graphing Data

✓ Claim–Evidence–Reasoning

✓ Analyzing Results

Your Lab

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All steps are clearly outlined and easy to follow

Students collect data in organized charts

Graphing

Students analyze their data and draw conclusions

Data Table - Solar Desalination Water Production

Time (hours)	Cumulative Freshwater Collected (mL)	Water Produced During Interval (mL)	Observations
0		0	
1			
2			
3			
4			
5			

Calculations

Starting Saltwater Volume: _____ mL

Total Freshwater Produced: _____ mL

Total Exposure Time: _____ hours

Graphing Task

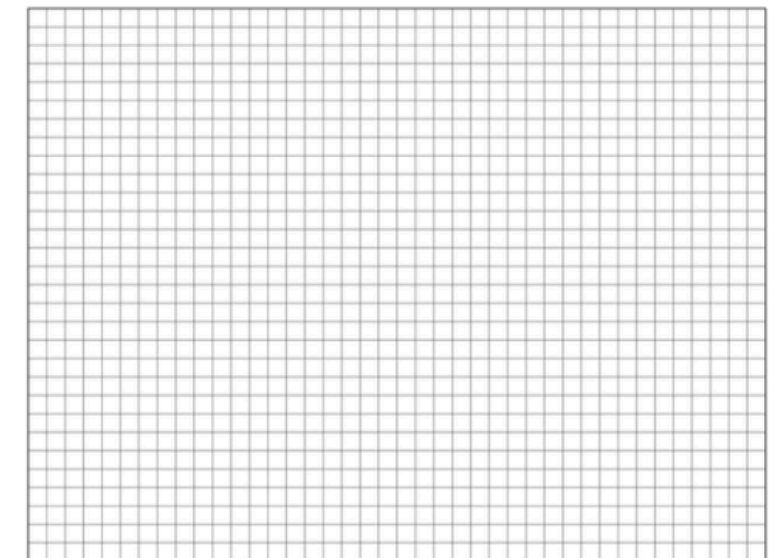
Freshwater Production in a Solar Desalination Device

X-axis: Time (hours)

Y-axis: Cumulative Freshwater Collected (mL)

Graph Type: Line graph

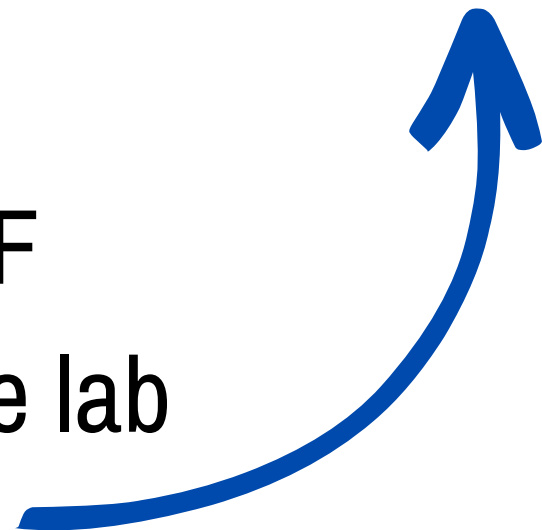
Create a line graph showing how the cumulative volume of collected freshwater changed throughout the investigation. Then write one sentence describing the overall pattern shown by your graph.



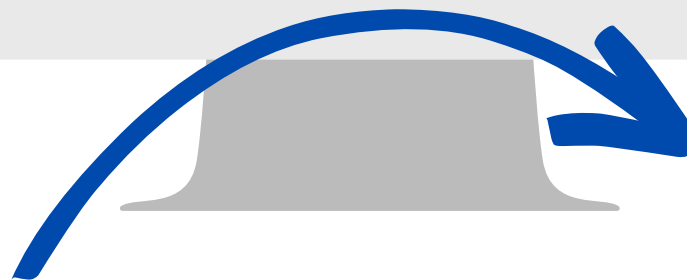
At School or at Home



Word and PDF
versions of the lab



Fully digital and editable - can be
done in class or through distance
education/homeschool



Ways to Use this Resource

★ **Introduce the Scientific Method**

★ **Hands-on introductions to new science concepts**

★ **Teach data analysis and graphing**



★ **End-of-unit applications that connect learning to real-world problems**

★ **CER writing practice**

★ **Small-group collaborative learning opportunity**

★ **Differentiated learning opportunities**

Classroom Fit Guarantee

I want you to feel confident when you purchase from Teach With Fergy. If a resource is not the right fit for your students, simply contact me and I'll provide double your purchase amount in store credit toward another resource in my store.

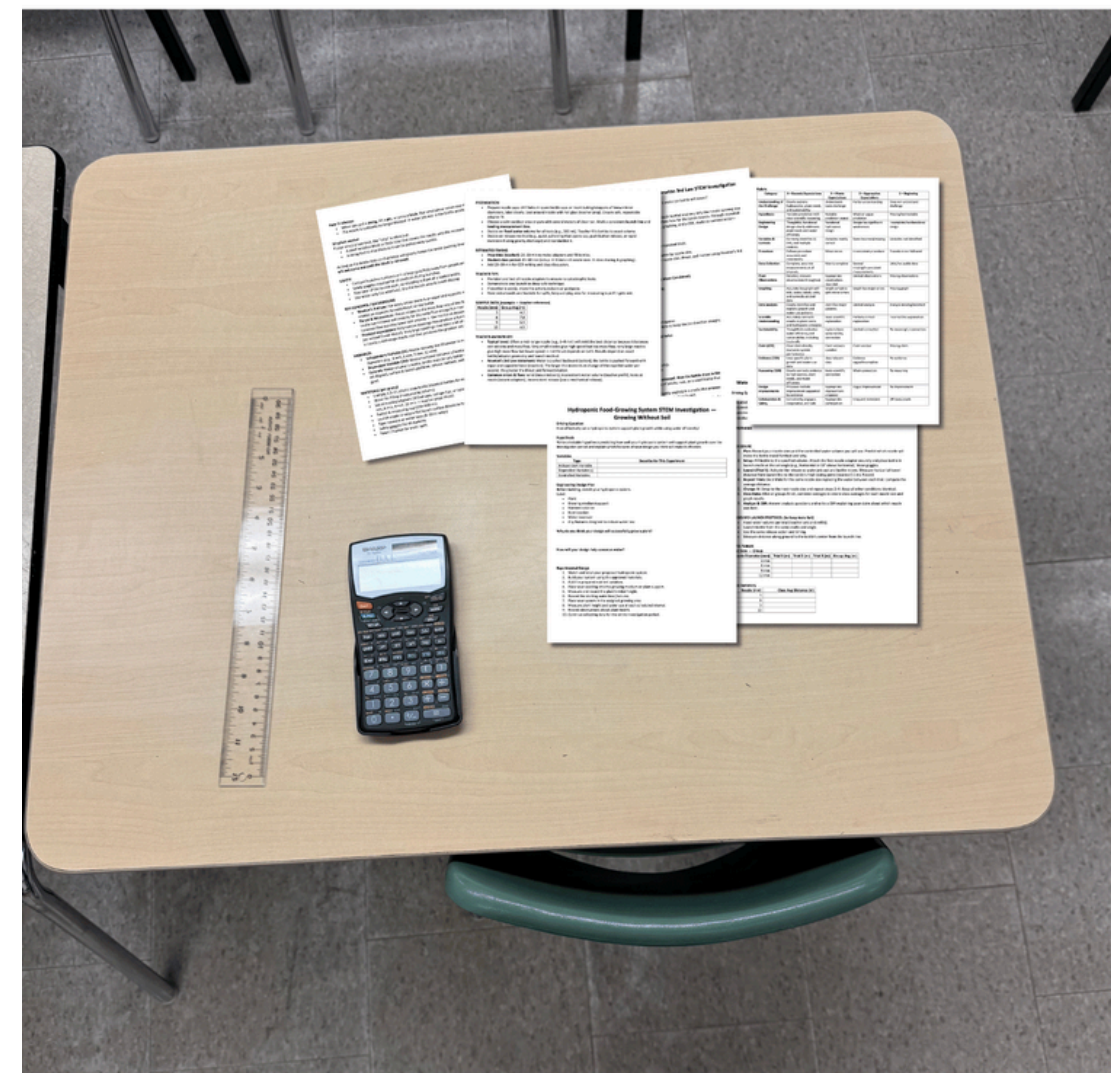


Your Activity

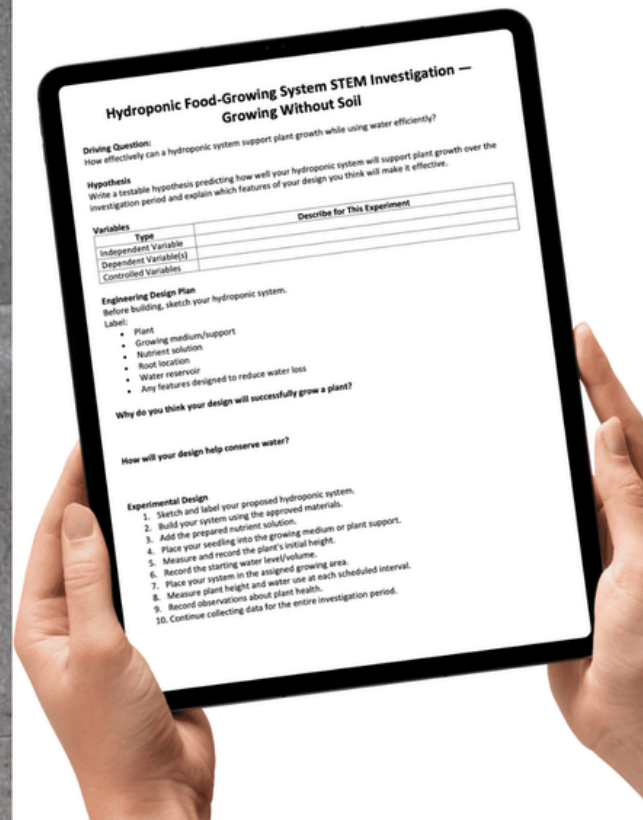
- Is a fun and interactive way to reinforce concepts and study
- **DIGITAL and PRINT** ready
- **FULLY EDITABLE**
- Complete Answer Key



FULLY EDITABLE AND READY-TO-GO INVESTIGATION



DIGITAL AND PRINT



GREAT FOR TEACHING THE SCIENTIFIC METHOD

Download my Angle of Attack STEM Lab FREE
CLICK HERE

✓ Teacher guide with setup, safety, background science, pacing

✓ Step-by-step procedure for testing

✓ Analysis questions with model answers and Rubric



Paper Airplane Angle of Attack STEM Lab

Scientific Method • Variables • Data & Graphing

✓ Classroom-Ready

✓ Data tables + bar graph templates included



Paper Airplane: Angle of Attack STEM Investigation: Scientific Method Activity

Teachers Reference:

Angle of Attack Explained - <https://youtu.be/D1J1oUP-aKA?si=vsnb9a72PajoWnZs>



Purpose

Use a high-engagement paper-airplane challenge to teach experimental design, variables and controls, proportional reasoning, data analysis, and communication of results.

Learning Objectives

- Plan and carry out a controlled investigation with clear independent, dependent, and controlled variables.
- Collect sufficient data (replicates) and compare results across angle conditions.
- Graph distance data to analyze trends and construct evidence-based claims.
- Explain the physical principles (lift, drag, stall) that affect flight distance.

only airplanes; no paper clips or sharp nose cones.
a clear launch lane; stand behind the throw line; throw parallel to the floor.
ing area clear; retrieve planes only after all throws in a round are complete.

- 8.5×11 in) — identical for all planes
- and template (optional, one standard design for all teams)
- factor (or angle guides) to set release angle relative to horizontal
- Tape for a throw line and distance marks; measuring tape or meter tape
- Data sheets (included), clipboards, pencils

Background Science for the Teacher

Lift vs Angle of Attack (AoA): Lift generally increases with AoA up to a point. Beyond a critical AoA, airflow separates (stall), causing lift to drop and drag to rise, shortening distance.

Drag and Energy: Higher AoA increases frontal area and induced drag; too much drag slows the plane quickly. Moderate AoA balances adequate lift with manageable drag for a longer glide.

Consistency: A single plane design, constant throw force/height, and a clear angle-setting method are key to fair comparisons.

Expected Results Pattern

- Distances typically peak at a moderate AoA (around 10°–15° for a simple dart design).
- Very low AoA (0°–5°) may dive or fail to generate a strong glide; very high AoA (20°+) often stalls or climbs then falls rapidly.
- As throw technique becomes consistent, variation decreases and the distance curve vs angle becomes clearer.

Implementation Notes

- Use one standard airplane design per class for consistency (provide a template or model).
- Assign roles: Thrower, Angle Setter/Checker, Measurer, Recorder. Rotate roles between angles.
- Mark the throw line and measure angle at release using a protractor or an angle card taped to the forearm or launcher guide.

Answer Key and Sample Results

Note: Actual class data will vary. The sample below models typical trends and acceptable analysis quality.

Sample Summary Data

Angle (°)	Average Distance (m)
0	7.8
5	10.6
10	12.9
15	12.1
20	8.9

Interpretation

- Greatest average distance at 10° (=12.9 m) with a close second at 15° (=12.1 m).
- Very low angle (0°) underperformed (dives/low lift). Very high angle (20°) lost distance (near-stall and higher drag).
- The trend supports a moderate-angle optimum due to balance of lift and drag.

Model Responses to Analysis Questions

- Best angle: 10° with an average of ~12.9 m (our class graph shows a peak around 10–15°).
- Consistency: Results were reasonably consistent after the practice round; using the same thrower and angle card reduced variation.
- Controls that mattered most: Plane design and paper type, release height and throw force, indoor/no-draft room, and measuring to first contact.
- Follow-up: Test nose mass with paper clips at the best angle. Hypothesis: Adding a small nose mass (1–2 clips) will increase distance by improving stability without greatly increasing drag.

STEM INVESTIGATION BUNDLE

Build a high-engagement, low-prep STEM program.

- This Bundle includes all my STEM investigations—each one built around true engineering design, fair testing, repeated trials, data tables, graphing, and CER writing.
- STEM develops crucial skills like critical thinking and creativity and prepares students for a changing world and future opportunities.

“Tell me and I forget. Teach me and I remember. Involve me and I learn.”
—Benjamin Franklin

STEM Investigation Growing Bundle

Scientific Method • Variables • Data & Graphing

✓ Classroom-Ready

✓ A Variety of Science Topics Included



Thanks
**for your interest
in this resource!**

I am a real person and if
you have any questions,
suggestions, or concerns,
please reach out.



devon@teachwithfergy.com

TWF

Teach With Fergy

*Let's
Connect!*

