

Oobleck Investigation - FORCE VS FLOW STEM INVESTIGATION

Print-and-go
STEM lab where
students learn
about non-
newtonian fluids
through a hands-
on activity.

Oobleck Investigation: Force vs Flow — STEM Investigation

Purpose

Use a hands-on oobleck challenge to teach experimental design, variables and controls, data collection, graphing, and evidence-based explanations while exploring how non-Newtonian fluids behave differently under different forces.

Learning Objectives

- Plan and carry out a controlled investigation with clear independent, dependent, and controlled variables
- Observe and measure how oobleck responds to different amounts of force
- Collect repeated trials and identify patterns in behavior
- Graph and analyze results to compare force vs flow behavior
- Explain results using particle motion, force, and viscosity concepts

Safety

- Do not eat oobleck or put it near the mouth
- Avoid contact with eyes; wash hands after use
- Clean spills immediately (oobleck can be slippery)
- Dispose of oobleck in trash, **not down the sink**
- Wipe tables and floors thoroughly after the activity

Materials

- Cornstarch
- Water
- Mixing bowl or cup
- Spoon or stir stick
- Measuring cups/spoons
- Tray or plate (for testing)
- Timer or stopwatch
- Ruler (optional)
- Paper towels
- Data table + pencil

Background Science for the Teacher

Oobleck is a **non-Newtonian fluid**, meaning its viscosity (thickness) changes depending on the force applied. When force is applied quickly (punching, tapping, squeezing), the particles lock together and the mixture flows like a solid. When force is applied slowly (pouring, pressing gently), the mixture flows like a liquid. This behavior is called **shear**. Non-Newtonian fluids are due to how particles interact when



SCROLL
to take a look inside!

NO PREP

Teach With
Fergy



HOW THIS LAB WILL HELP YOU



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

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Background Science for the Teacher

Oobleck is a **non-Newtonian fluid**, meaning its viscosity (thickness) changes when force is applied to it. When force is applied quickly (punching, tapping, squeezing) and the mixture behaves like a solid. When force is applied slowly (pouring) the mixture flows like a liquid. This is called **shear thickening**. The unusual properties of non-Newtonian fluids are due to the way particles interact when stress is applied.

Oobleck Investigation: Force vs Flow — STEM Investigation

Driving Question

How does the type of force applied affect whether oobleck behaves like a solid or a liquid?

Hypothesis

Write a testable hypothesis predicting how oobleck will behave when a fast force is applied compared to a slow force.

Variables

Type	Describe for This Experiment
Independent Variable	
Dependent Variable	
Controlled Variables	

Experimental Design

1. Mix **2 parts cornstarch to 1 part water** to make oobleck.
2. Place a scoop of oobleck on the tray.
3. **Fast Force Test:** Tap, punch, or hit the oobleck quickly.
4. **Slow Force Test:** Press your finger in slowly or let it flow.
5. Observe and record whether it behaves like a solid or liquid.
6. Repeat **3 trials for each force type**.
7. Record data and identify patterns.

Coil Turns	Fast Force Result (Solid or Liquid?)	Slow Force Result (Solid or Liquid?)
1		
2		
3		
4		
5		

Summary Table

Force Type	Most Common Behavior Observed
Fast Force	
Slow Force	

★ 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

Oobleck Investigation: Force vs Flow — STEM Investigation

Purpose
Use a hands-on oobleck challenge to teach experimental design, variables, graphing, and evidence-based explanations while exploring how no differently under different forces.

- Learning Objectives**
- Plan and carry out a controlled investigation with clear independent variables
 - Observe and measure how oobleck responds to different forces
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 - Avoid contact with eyes (it can be slippery) when the sink after the activity

Rubric	Exceeds (4)	Meets (3)	Approaches (2)	Beginning (1)
Category				
Experimental Design	Variables clearly named; consistent testing; sufficient trials	Variables named; mostly consistent testing	Some variables unclear; inconsistent testing	No clear variables; few trials
Data Quality	All trials recorded; summary accurate	Most trials recorded; minor errors	Several omissions; summary incomplete	Data missing; summary unusable
Analysis Questions	Student clearly explains non-Newtonian behavior using particle motion and force; shows strong conceptual understanding.	Student explains behavior using basic ideas about force and movement.	Explanation is limited or partially incorrect.	Explanation is missing or shows misunderstanding.
Claim-Evidence-Reasoning (CER)	Clear, accurate claim; specific evidence from multiple trials; strong reasoning connects evidence to particle behavior and force.	Claim is present; evidence included; reasoning mostly correct.	Claim weak or unclear; limited evidence; reasoning incomplete.	No valid claim, evidence, or reasoning.
Collaboration & Safety	Excellent teamwork; clean, safe work area	Mostly cooperative; safe	Uneven participation; reminders needed	Unsafe or off-task behavior

Claim – Evidence – Reasoning
Use your data and observations to explain how force affects the behavior of oobleck.

CLAIM
Make a clear claim answering the driving question:
How does the type of force applied affect whether oobleck behaves like a solid or a liquid?

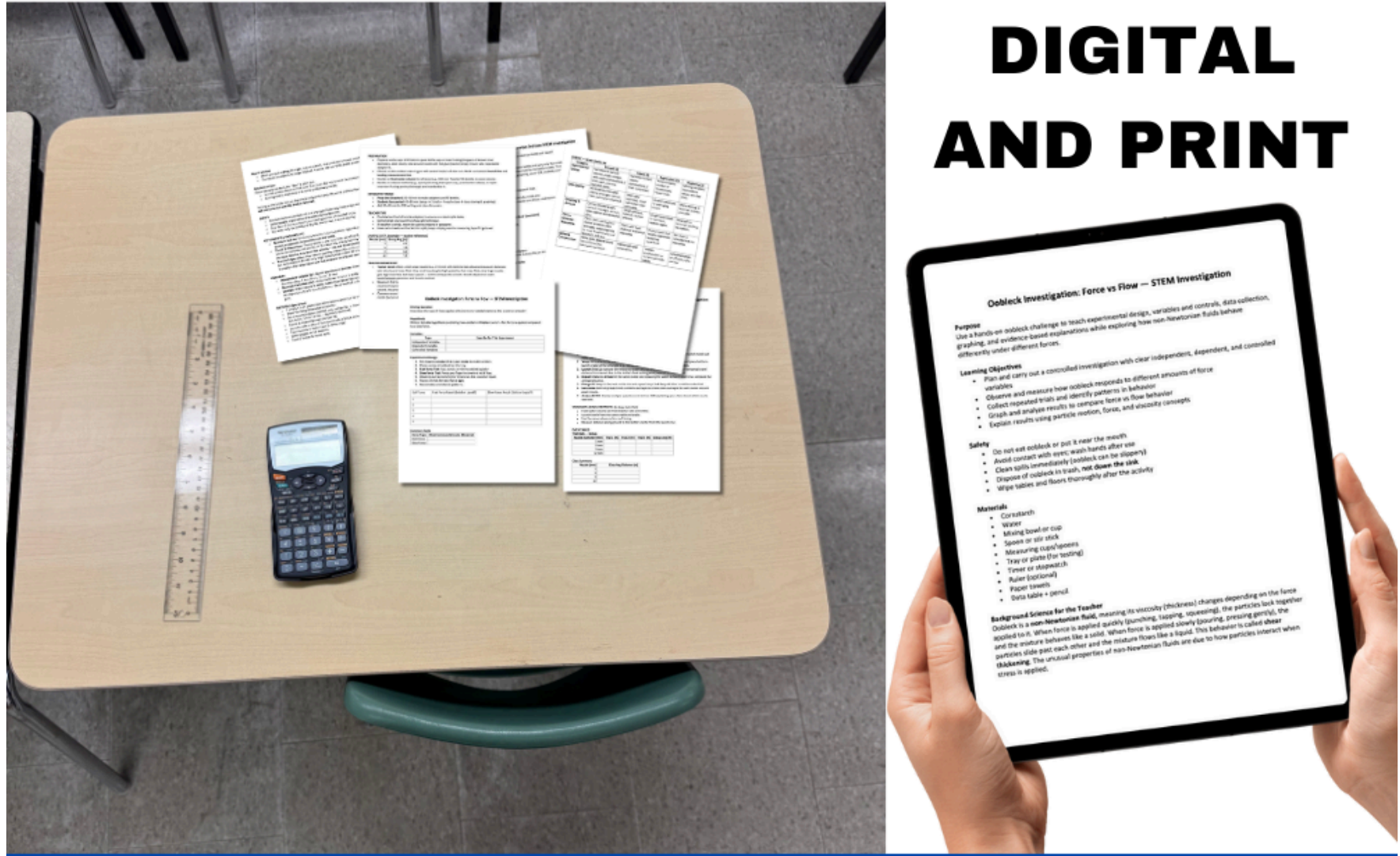
EVIDENCE
Use specific observations and/or data from your investigation. Include results from both fast and slow force tests.

REASONING
Explain why your evidence supports your claim. Use ideas about particle movement, force, and non-Newtonian fluids.

- Analysis Questions**
1. How did oobleck behave when fast force was applied?
 2. How did oobleck behave when slow force was applied?
 3. What pattern do you see between force type and oobleck behavior?
 4. Explain why oobleck behaves differently under different forces.
 5. Identify two controlled variables and explain why they matter.
 6. Identify two sources of error in this investigation.
 7. What is one improvement you would make for better data?

viscosity (thickness, tap is applied like a non-Newtonian fluid)

Skills Your Students Will Learn/Improve



GREAT FOR TEACHING THE SCIENTIFIC METHOD

- ✓ Carrying out Controlled Experiments
- ✓ Precise Measurement
- ✓ Design and Redesign
- ✓ Analysing Data
- ✓ Claim–Evidence–Reasoning
- ✓ Analyzing Results

Your Lab

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Background Science for the Teacher

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All steps are clearly outlined and easy to follow

Students collect data in organized charts

CER Analysis

Students analyze their data and draw conclusions

Claim – Evidence – Reasoning

Use your data and observations to explain how force affects the behavior of oobleck.

CLAIM

Make a clear claim answering the driving question:

How does the type of force applied affect whether oobleck behaves like a solid or a liquid?

EVIDENCE

Use specific observations and/or data from your investigation. Include results from both fast and slow force tests.

REASONING

Explain *why* your evidence supports your claim. Use ideas about particle movement, force, and non-Newtonian fluids.

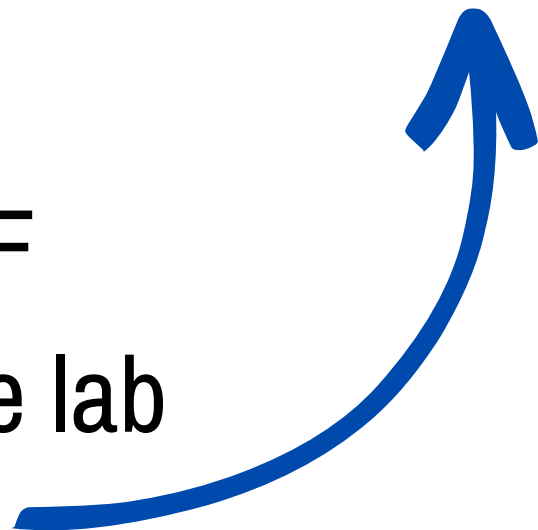
Analysis Questions

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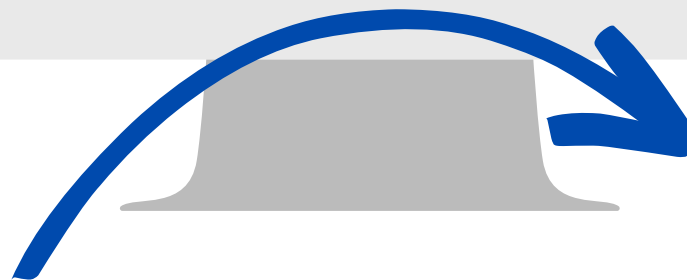
At School or at Home



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



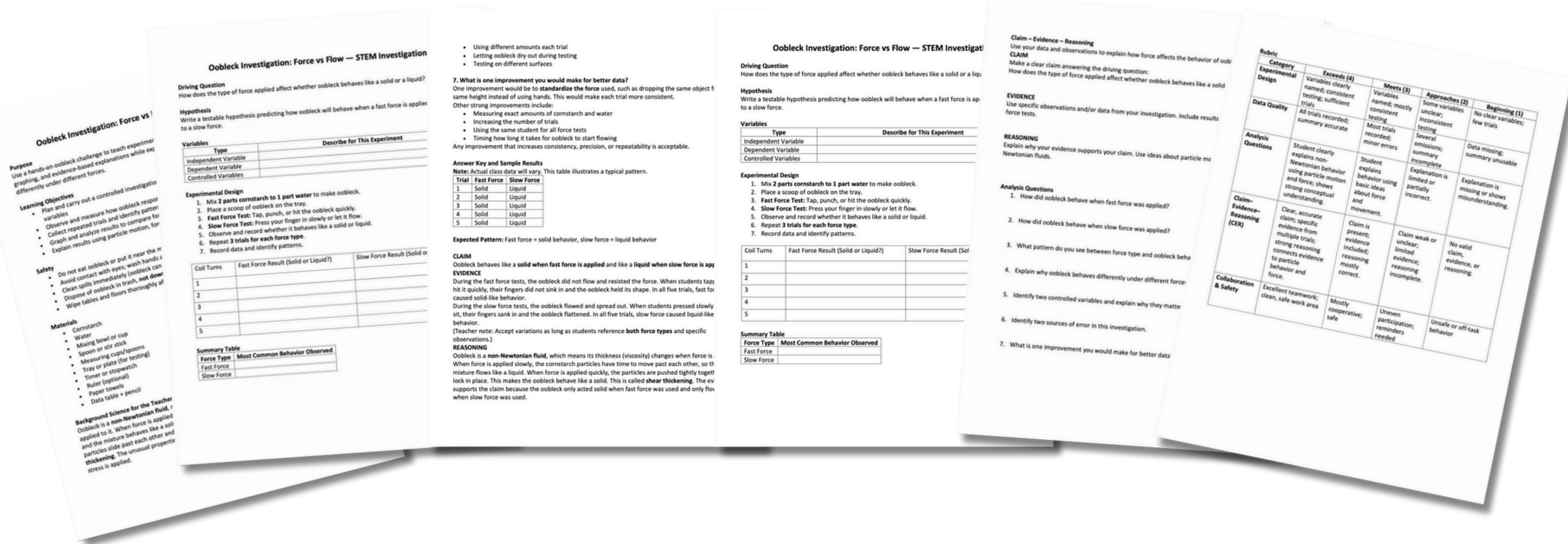
Reinforce key ideas



Teach data analysis and graphing



Formative or Summative Assessment



Download my Angle of Attack STEM Lab FREE
CLICK HERE

Paper Airplane Angle of Attack STEM Lab

Scientific Method • Variables • Data & Graphing

✓ Classroom-Ready

✓ Data tables + bar graph templates included



✓ 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 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.

- Use a standard 8.5x11 in. — identical for all planes
- Use a standard template (optional, one standard design for all teams)
- Use a protractor (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 my best 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



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learn more!**

As a special bonus, I want to send you a few resources that you can use in your classroom tomorrow. Completely free and geared towards what you teach!



Just  **and then choose what you teach!**

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