NAME _____ DATE _____ PERIOD _____

Score ____ / ____

Identifying Variables: Forces in Motion

CHANGE ONE · MEASURE ONE · CONTROL THE REST

WHY THIS MATTERS Knowing how variables interact helps you predict how everyday objects—like a kicked soccer ball or a sliding backpack—will move when different forces push or pull them.

DIRECTIONS Read the experiment details below carefully. Identify the independent variable, dependent variable, three controlled variables, and write a scientific hypothesis.

Experiment Title: The Sliding Book Force Experiment

Research Question: How does the amount of unbalanced force applied to a textbook affect the distance it slides across a classroom desk?

VARIABLES

INDEPENDENT — WHAT IS CHANGED

DEPENDENT — WHAT IS MEASURED

CONTROLLED — WHAT STAYS THE SAME

HYPOTHESIS

Write an if/then hypothesis connecting your independent and dependent variables.

FAIR TEST TIP

To keep this test fair, make sure you release the book from the exact same starting line on the desk for every trial.

Identifying Variables — Facilitator Guide

GRADES 6-8 · SCIENCE · SCIENCE LAB

A guided worksheet where students identify the independent, dependent, and controlled variables in a sliding textbook force experiment and write a formal hypothesis.

QUICK START

***WHY THIS MATTERS** · Learning target: Identify the independent, dependent, and controlled variables in a sliding book force experiment and write a testable hypothesis using an If/Then structure.*

TIME	GROUPING	MATERIALS
15-20 min	Pairs or individual work	Identifying Variables: Forces in Motion worksheet

KEY VOCABULARY independent variable · dependent variable · controlled variable · unbalanced force · hypothesis

GUIDING QUESTIONS

What is the one factor we are intentionally changing to see how it affects the textbook's movement?

Why must we keep the same textbook and desk surface for every single trial?

How does the sliding distance of the book show us the effect of the unbalanced force?

Prerequisite knowledge: Students should have a basic understanding of balanced vs. unbalanced forces and know that friction is a force that opposes motion.

FACILITATION SEQUENCE

1 LAUNCH · 5 MIN

Observe a quick demonstration of a textbook being pushed with different forces across a desk, then read the research question.

Watch for: Students connecting the visual push of the book to the concept of 'unbalanced force' and 'sliding distance'.

Teaching tip: A useful prompt here is: "What did you notice change when I pushed the book harder?"
Teaching tip: A useful prompt here is: "How can we measure the result of that push?"

ANSWER KEY & HOW TO APPROACH

FOR THE TEACHER

Expected answers for this worksheet, with guidance on evaluating student responses.

ITEM	EXPECTED ANSWER	HOW TO APPROACH / ACCEPT
Three-column sort	One independent, one dependent, several named controls for the given experiment	If students place more than one variable in the Independent column, the experiment (or their reading of it) is confounded — that is the teachable moment.
Operationalisation (9-12)	Units, range, and levels for the IV; unit and measurement method for the DV; a concrete hold-constant method per control	The replication test: could another scientist run this exact design from the definitions alone?

LIKELY STUDENT RESPONSES, MISCONCEPTIONS, AND HELPFUL TEACHER MOVES

Anticipate these — and the response that moves thinking forward.

STUDENTS MAY…	WHAT THAT MIGHT MEAN…	A HELPFUL NEXT MOVE…
Identify 'the push' as the independent variable and 'the slide' as the dependent variable without specifying what is measured or changed.	They understand the general cause and effect but are not thinking about measurable scientific variables.	Ask: 'How would we actually measure or describe "the push" and "the slide" in a data table?'
List 'friction' or 'gravity' as the independent variable because they know they are forces.	They are focusing on force vocabulary rather than what the experimenter is actively manipulating.	Remind them that the experimenter changes the force applied; friction and gravity are kept constant by using the same desk and book.

EQUITY, SEL, AND TRAUMA-INFORMED PROMPTS

EQUITY

Perspective invitations you can offer students — a second context, a missing voice, a different lived reality.

Invite students to consider how different desk surfaces in the classroom (e.g., smooth plastic vs. textured wood) might alter the friction force, validating diverse observations of their immediate environment.

SEL

The emotional and interpersonal demands of this task — confidence, disagreement, frustration points, collaboration.

Support students who feel anxious about writing a 'wrong' hypothesis by emphasizing that a hypothesis is a testable prediction, not a guaranteed fact.

TRAUMA-INFORMED

Participation safety and predictability — a private response option, lower-stakes sharing, predictable structure.

Allow students to write and submit their variable identifications individually or share with a single partner before any whole-class sharing to reduce academic performance anxiety.

UDL, DIFFERENTIATION, AND LANGUAGE SUPPORTS

IF STUDENTS NEED MORE SUPPORT

Scaffolds for the same core thinking: oral rehearsal first, sketch or sort before writing, a worked example, chunked steps.

Provide a physical textbook and desk for students to physically push and observe before writing down the variables.

Provide a sentence starter for the hypothesis: 'If the force is increased, then...'

IF STUDENTS ARE READY FOR MORE

Extensions that add complexity, not busywork: compare two approaches, justify a choice, transfer to a new context.

Ask students to predict how the dependent variable (distance) would change if they conducted the exact same experiment on a carpeted floor instead of a smooth desk, identifying which variable changed.

LANGUAGE SUPPORTS

Name the language function (explain, compare, argue, justify) with sentence frames and oral rehearsal.

Name the language function: Explain. Provide sentence frames for explaining controls: 'We must keep the [control variable] the same because if we changed it, it would...'