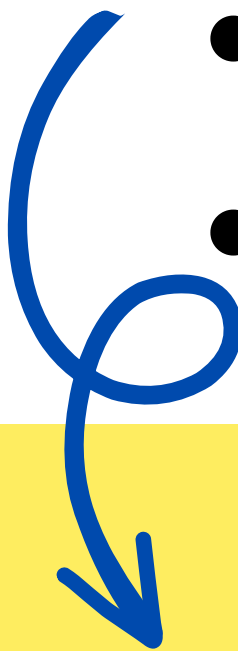


Complete Newton's 2nd Law Bundle

- **Lesson**
- **Worksheets**
- **Activities**
- **Assessment**



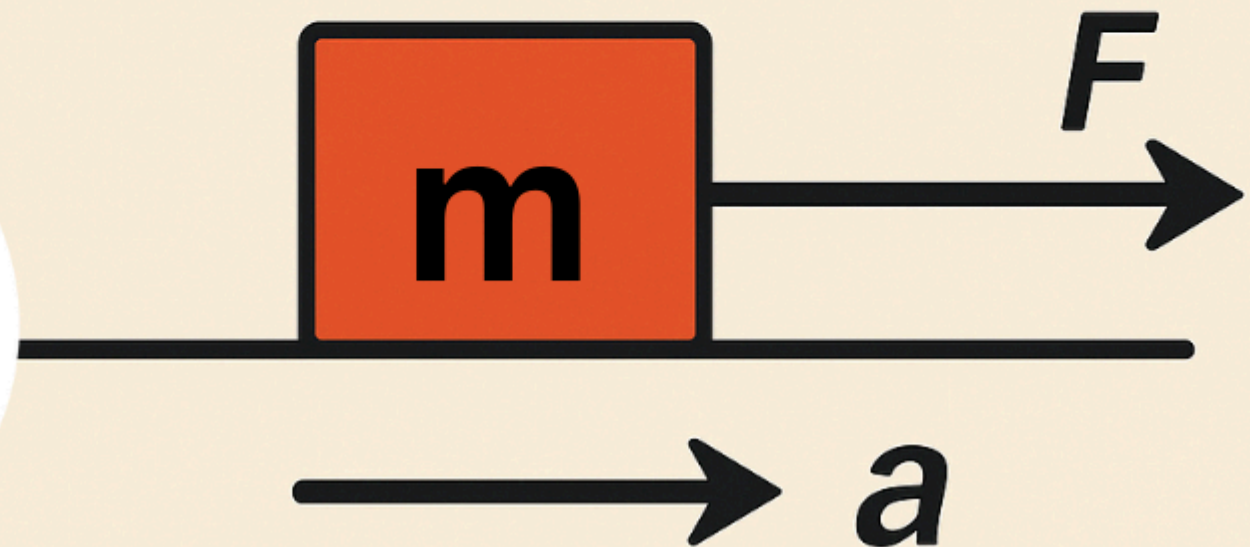
SCROLL
to take a look inside!

Newton's 2nd Law of Motion: Lesson, Worksheet, & Activities Bundle

- Grade 6-8+
- Interactive Lesson

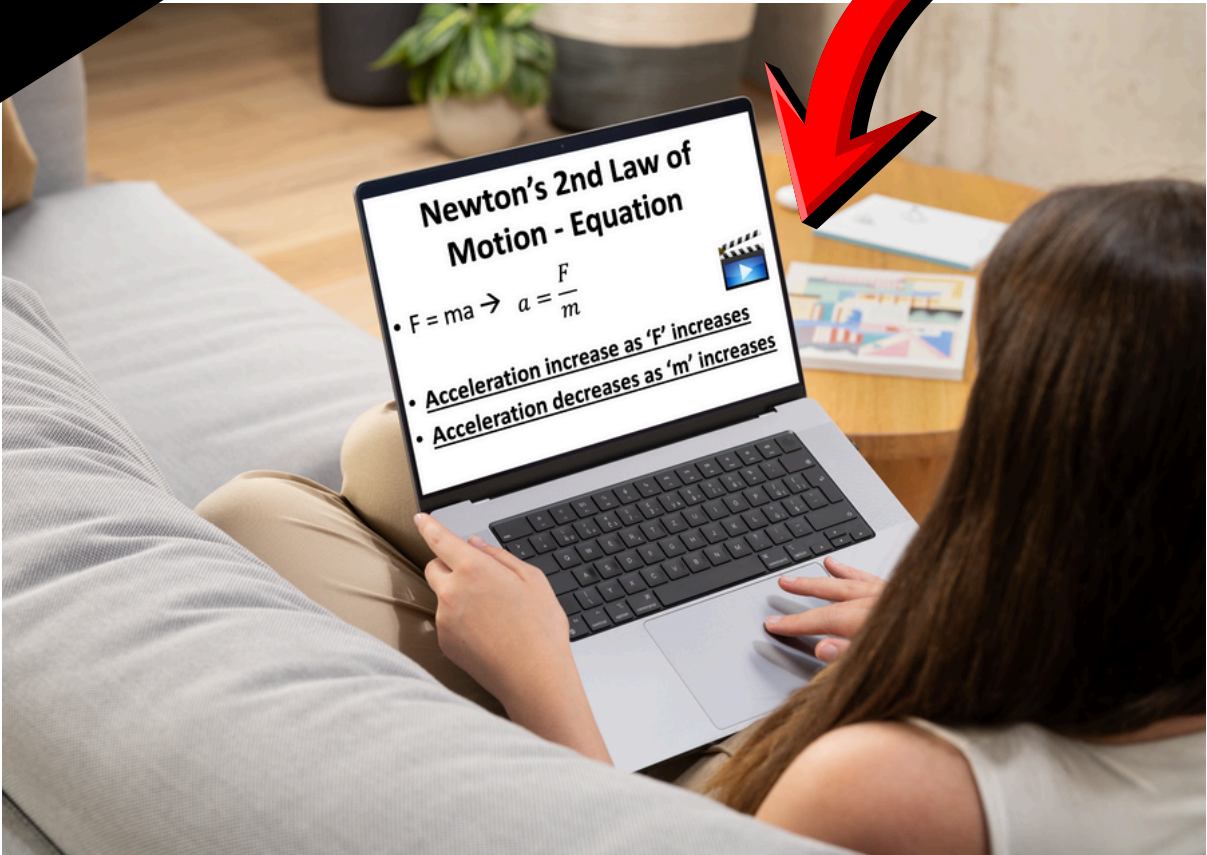
- Worksheets
- Activities
- Assessments

$$F = ma$$



1 Fully Editable & Engaging Lesson and Worksheets

Videos embedded directly in your lesson



6-Part Worksheet with Answer Key

Newton's Second Law of Motion — Worksheet

Name: _____

What is Newton's Second Law of Motion?
What does it tell us about how force, mass, and acceleration are related?

Part 1 — Vocabulary (Match the term to the definition)
A. Force
B. Mass
C. Acceleration
D. Newton's Second Law

1. ___ How
2. ___ The r
3. ___ A pus
4. ___ The a

Part 2 — True or False
Write T for true and F for false.

1. ___ More force = more acceleration.
2. ___ A heavier object needs *more* force to accelerate, not less.
3. ___ The equation for Newton's Second Law.
4. ___ Less mass = more acceleration with the same force.
5. ___ Direct relationship: double force → double acceleration.
6. ___ Acceleration requires force.
7. ___ Acceleration includes speeding up, slowing down, & changing direction.
8. ___ Mass affects acceleration.
9. ___ If mass goes up and force stays the same, acceleration decreases.
10. ___ Newton's Second Law tells *how* motion changes.

Part 3 — Short Answer

1. **F = m × a**
Acceleration depends on force and mass. More force → more acceleration. More mass → less acceleration.

2. **The empty cart accelerates more because it has less mass, the same force causes greater acceleration.**

3. **Acceleration increases because more force means the object speeds up faster if mass stays the same.**

Part 4 — Application

1. $a = \frac{F}{m} = \frac{10N}{2kg} = 5\text{ m/s}^2$

The ball accelerates at 5 m/s².

2. **Box A accelerates more because it has less mass, the same force causes greater acceleration.**

3. **Acceleration increased**
The car accelerated faster because force increased.

Part 5 — Challenge
Acceleration increases. With more force and the same mass, the rocket speeds up faster because a = F ÷ m. Since there is no air resistance in space, a constant, minimal thrust will provide a constant acceleration which will continually increase its speed.

Part 6 — Multiple Choice
1-C, 2-C, 3-C, 4-C, 5-C, 6-A, 7-B, 8-B, 9-B, 10-A

Newton's Second Law of Motion — Worksheet KEY

What is Newton's Second Law of Motion?
Force = mass × acceleration.
This law explains how force changes motion—an object accelerates more when more force is applied and accelerates less if it has more mass.

Part 1 — Vocabulary
1-C 2-D 3-A 4-B

Part 2 — True or False

1. **T** — More force = more acceleration.
2. **F** — A heavier object needs *more* force to accelerate, not less.
3. **T** — The equation for Newton's Second Law.
4. **T** — Less mass = more acceleration with the same force.
5. **T** — Direct relationship: double force → double acceleration.
6. **F** — Acceleration requires force.
7. **T** — Acceleration includes speeding up, slowing down, & changing direction.
8. **F** — Mass affects acceleration.
9. **T** — If mass goes up and force stays the same, acceleration decreases.
10. **T** — Newton's Second Law tells *how* motion changes.

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Newton's Laws of Motion

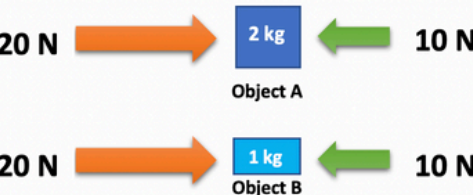
Change in Mass:

If a net force acts on two objects, each will change their motion.

Newton's Laws of Motion

Change in Mass:

If a net force (unbalanced force) acts on two objects, each will change their motion.



Since Object B has less mass than A, its speed will change more due to the unbalanced force.

Newton's Laws of Motion — Student Lesson Outline

Newton's Laws of Motion

1. The Law of Inertia: If the net force acting on an object is zero, that object maintains its state of rest or constant velocity.

2. An object accelerates in the direction of the net force. The acceleration is directly proportional to the net force and inversely proportional to the object's mass.

3. _____

Newton's First Law of Motion

- a.k.a. The Law of Inertia: Things want to keep doing what they are doing
 - Stationary objects don't want to move
 - Moving objects don't want to stop moving

Newton's First Law of Motion

This law has several important implications.

- For an object to change velocity (including changing from v = 0), the F_{net} must be greater than zero
- Objects at rest remain at rest unless acted upon by an external F_{net} greater than zero

Application

- An example occurs when a car slows down quickly; the people in the car tend to continue moving forward, possibly crashing their heads into the windshield if they are not wearing a seatbelt
- The seatbelt prevents them from shooting forward through the windshield
- An airbag acts in a similar fashion to stop the person from hitting their head on the dashboard or steering wheel during a front-end collision

Check Your Understanding

You exert a force of 45 N (up) on your backpack, causing it to move upward with a constant velocity. Determine the force of gravity on the pack.

Explanation

The FBD of the pack (right) shows that two forces act on the pack: the applied force (F_{app}) that you exert and the force of gravity (F_g) that Earth exerts. Since the pack is moving at a constant velocity, the net force must, by the law of inertia, be zero. So the upward and downward forces have the same magnitude, and F_g = 45 N [down].

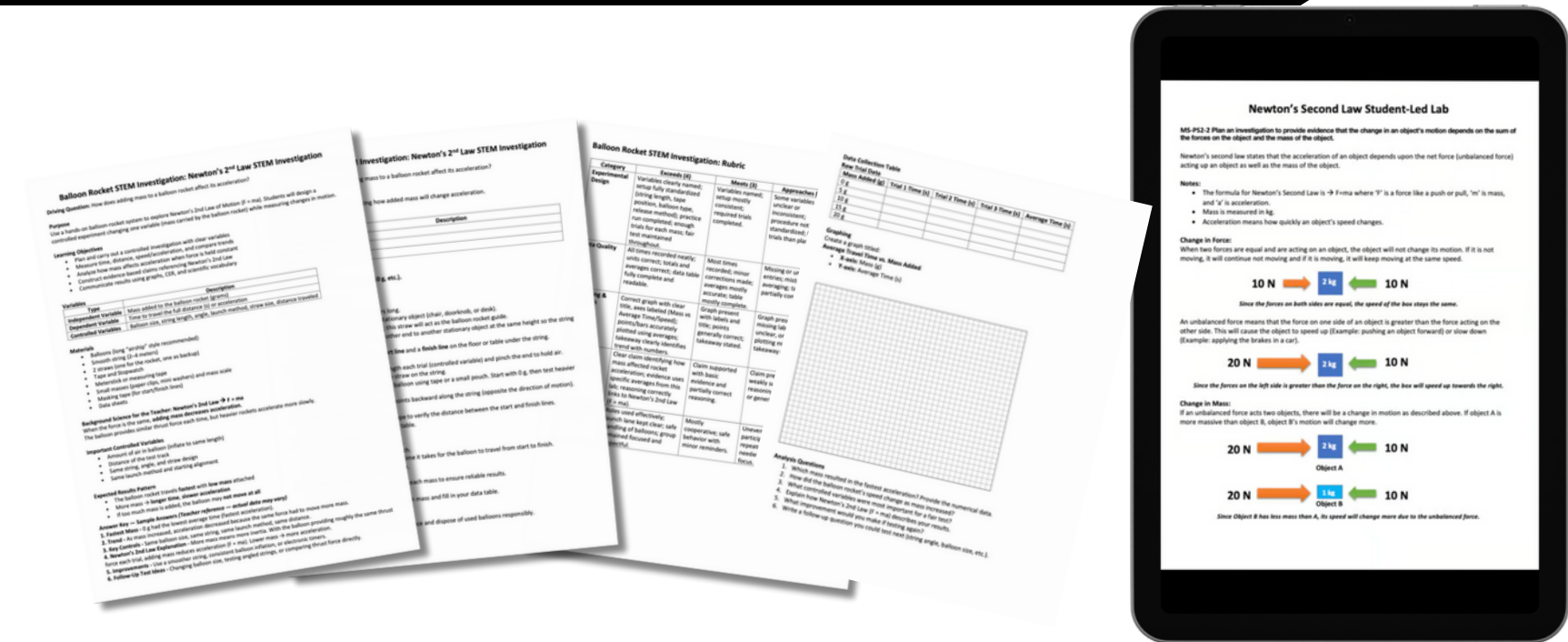
Check Your Understanding

The traction system below stabilizes a broken tibia (bottom leg bone). What is the force of the tibia on the pulley? Neglect friction. Hint: A traction system is meant to create a F_{net} = 0 so that the leg doesn't move.

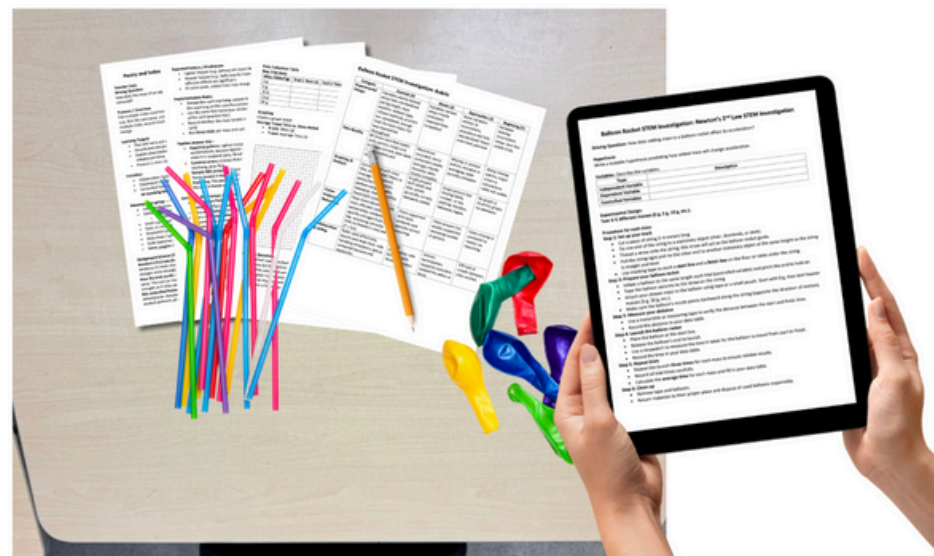
Student Notes

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TO-GO INVESTIGATION**



Newton 2nd Law of Motion
STEM Investigation



Newton's 2nd Law of
Motion Worksheet Bundle



Newton's 2nd Law Case

Study - Sports Car v Truck



Newton's Second Law
Student-Led Lab

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Newton's 2nd Law of Motion Middle School Lesson & Worksheet

Grade 6-8

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Newton's Second Law Student-Led Lab

MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Newton's second law states that the acceleration of an object depends upon the net force (unbalanced force) acting upon an object as well as the mass of the object.

Notes:

- The formula for Newton's Second Law is $F = ma$ where 'F' is a force like a push or pull, 'm' is mass, and 'a' is acceleration.
- Mass is measured in kg.
- Acceleration means how quickly an object's speed changes.

Change in Force:
When two forces are equal and are acting on an object, the object will not change its motion. If it is not moving, it will continue not moving and if it is moving, it will keep moving at the same speed.

10 N → 2 kg ← 10 N
Since the forces on both sides are equal, the speed of the box stays the same.

An unbalanced force means that the force on one side of an object is greater than the force acting on the other side. This will cause the object to speed up (Example: pushing an object forward) or slow down (Example: applying the brakes in a car).

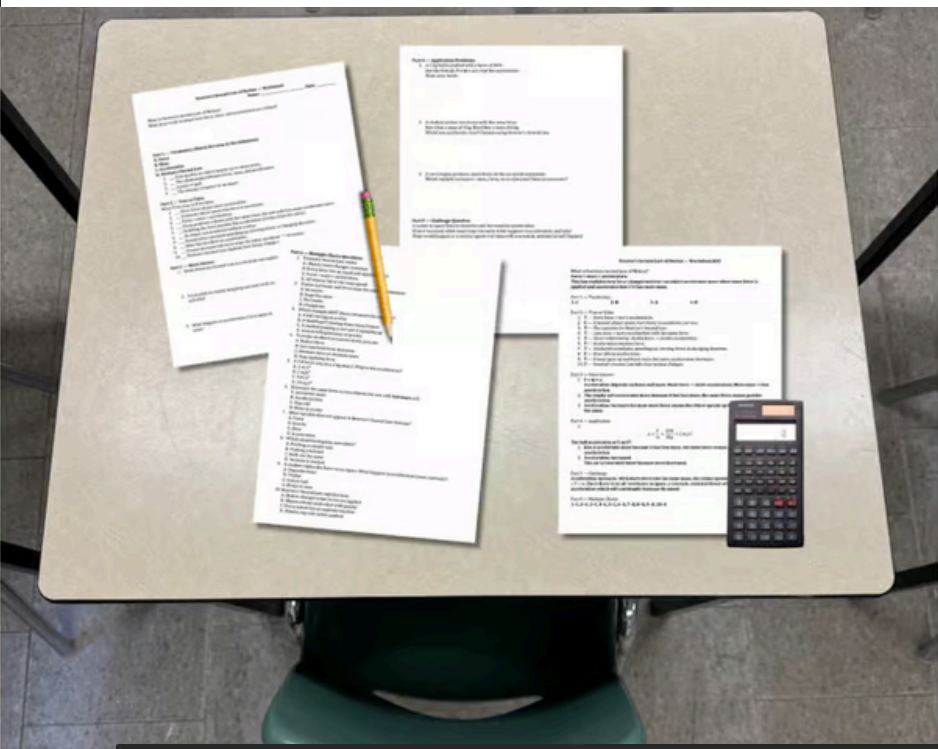
20 N → 2 kg ← 10 N
Since the forces on the left side is greater than the force on the right, the box will speed up towards the right.

Change in Mass:
If an unbalanced force acts two objects, there will be a change in motion as described above. If object A is more massive than object B, object B's motion will change more.

20 N → 2 kg ← 10 N
Object A

20 N → 1 kg ← 10 N
Object B

Since Object B has less mass than A, its speed will change more due to the unbalanced force.



Newton's Laws of Motion

Change in Mass:

Newton's Laws of Motion

Change in Mass:

If a net force (unbalanced force) acts on two objects, each will change their motion.

20 N → 2 kg ← 10 N
Object A

20 N → 1 kg ← 10 N
Object B

Since Object B has less mass than A, its speed will change more due to the unbalanced force.

Reading & Questions

Case Study - Understanding Newton's 2nd Law - Sports Car vs. Pickup Truck

Payton was walking home from school on a warm, windy afternoon. They stopped at the intersection where cars often stacked up at the long straight. As they waited, they noticed there was a shiny red sports car with a low, sleek frame and a tall blue pickup truck and metal tools. The contrast between the two vehicles made Payton laugh.

"Which truck will speed off faster?" she asked. Jake didn't hesitate. "The sports car. No question, it'll be faster."

"But the truck is bigger," she said. "It has more mass. It should be slower."

"The sports car is lighter," Jake said. "It has less mass. It should be faster."

They both started at the same time and experienced a force.

4. Greater mass resists acceleration, so the truck required more quickly and therefore accelerated more slowly.

5. The sports car accelerated more because of its lower mass acceleration depends on both force and mass.

Answer Key

NEWTON 2ND LAW OF MOTION STEM INVESTIGATION

Balloon Rocket STEM Investigation: Newton's 2nd Law STEM Investigation

Driving Question: How does adding mass to a balloon rocket affect its acceleration?

Purpose: Use a hands-on balloon rocket system to explore Newton's 2nd Law of Motion ($F = ma$). Students will design a controlled experiment changing one variable (mass carried by the balloon rocket) while measuring changes in motion.

Learning Objectives:

- Plan and carry out a controlled investigation with clear variables.
- Measure time, distance, speed/acceleration, and compare trends.
- Analyze how mass affects acceleration when force is held constant.
- Construct evidence-based claims referencing Newton's 2nd Law.
- Communicate results using graphs, CUB, and scientific vocabulary.

Variables:

Type	Description
Independent Variable	Mass added to the balloon rocket (grams)
Dependent Variable	Time to travel the full distance (s) or acceleration
Controlled Variables	Balloon size, string length, angle, launch method, straw size, distance traveled

Materials:

- Balloons (long "striking" style recommended)
- Smooth string (2-4 meters)
- 2 straw tubes for the rocket, one as a backstop
- Tape and Stopwatch
- Measuring tape
- Small masses (paper clips, mini washers) and mass scale
- Marking tape (for start/finish lines)
- Data sheets

Background Science for the Teacher: Newton's 2nd Law - $F = ma$

When the force is the same, adding mass decreases acceleration. The balloon rocket travels faster with less mass attached.

Important Controlled Variables:

- Amount of air in balloon (inflate to same length)
- Distance of the test track
- Same string, angle, and straw design
- Same launch method and starting alignment

Expected Results Pattern:

- The balloon rocket travels faster with less mass attached.
- More mass → longer time, slower acceleration
- If too much mass is added, the balloon may not move at all.

Student Activity:

1. Inflate the balloon and attach it to the straw. Hold the straw in place.

2. Release the balloon and observe the motion.

3. Record the time it takes to travel the distance.

4. Repeat the experiment with different masses.

5. Compare the results and draw a conclusion.

Newton's Second Law Student-Led Lab

NGSS MS-PS2-2

Students design and carry-out an experiment to test Newton's Second Law of Motion

NGSS MS-PS2-2

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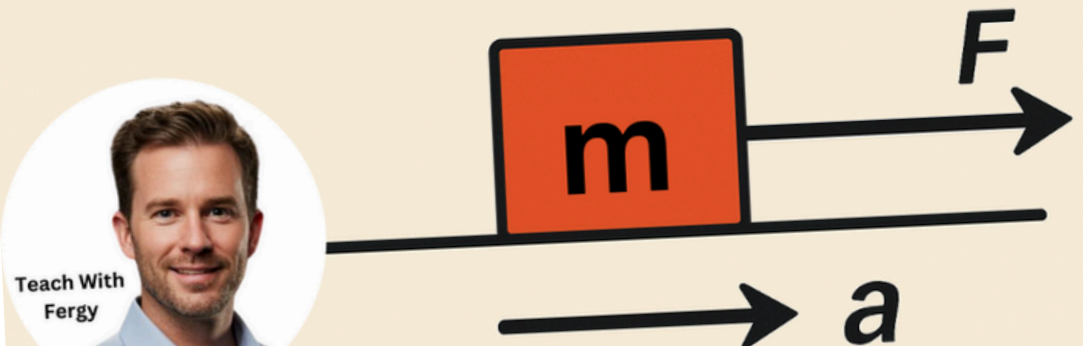
BY THE END OF THIS BUNDLE, STUDENTS WILL UNDERSTAND

- Forces & Net Force
- Definition of a force as a push or pull
- Net, Balanced, and Unbalanced forces
- Unbalanced forces cause changes in an object's motion
- Newton's 2nd Law Equation: $F = ma$
- How to calculate force, mass, and acceleration
- Using Simulations to Explore Newton's 2nd Law
- Observing how force and an objects mass affects its motion
- Application & Problem Solving

Newton's 2nd Law of Motion: Lesson, Worksheet, & Activities Bundle

- Teaching Timeline
- Grade 6-8+
- Lessons
- Worksheets
- Activities
- Assessments

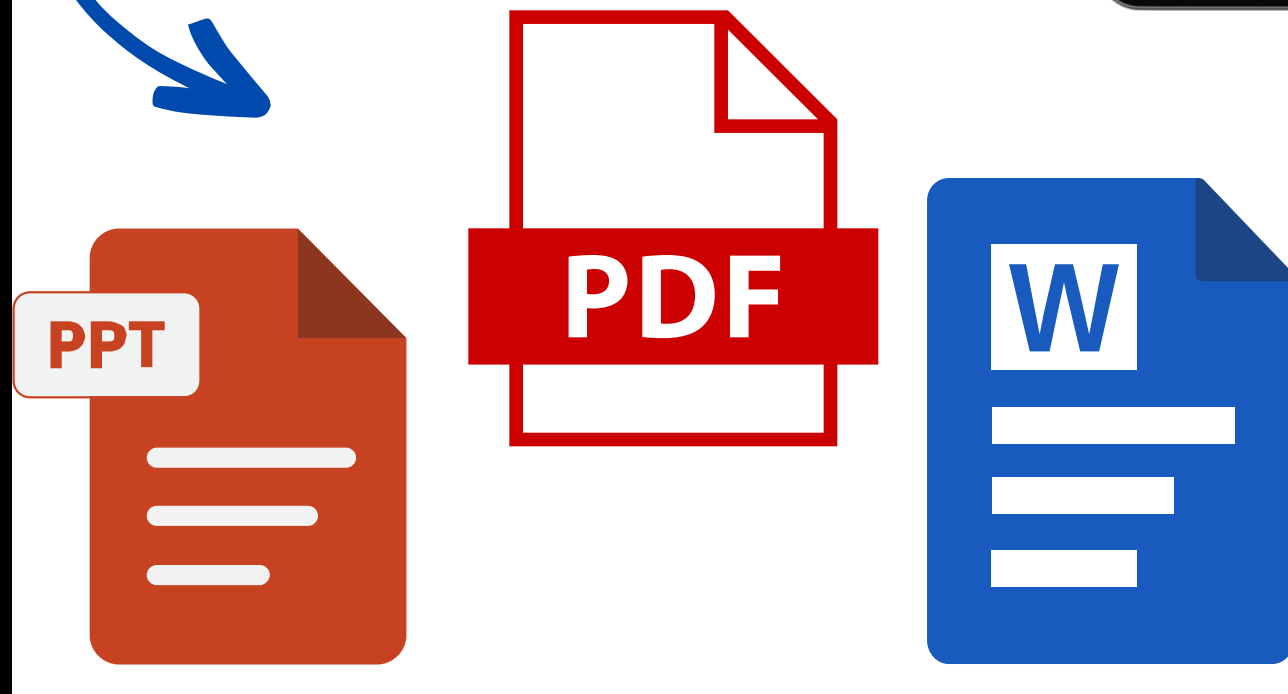
$F = ma$



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