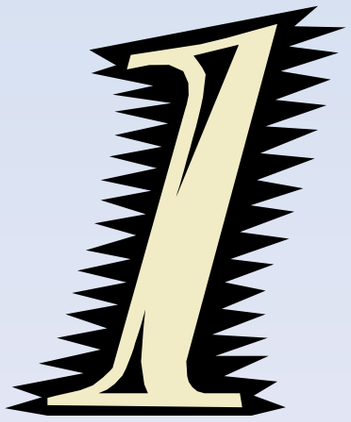
Bell Work--draw a sketch of yourself AND the forces acting upon you when standing still.

Concept Check

- As you stand at rest on a floor, does the floor exert an upward force on your feet? If so, what exactly is this force?

Newton's First Law



An object at rest tends to stay at rest

and

an object in motion tends to stay in motion

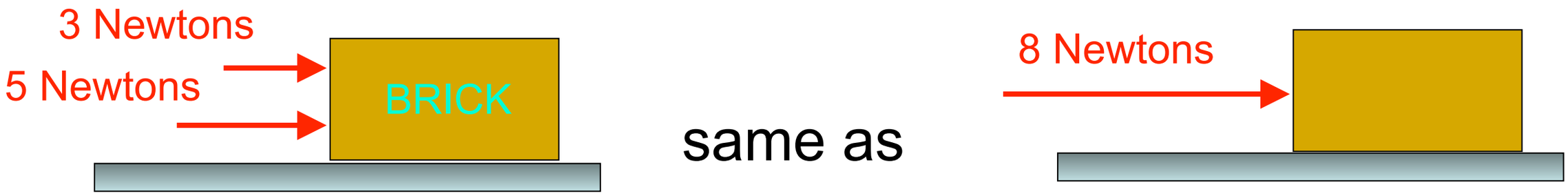
unless

acted upon by an unbalanced force.

Net Force

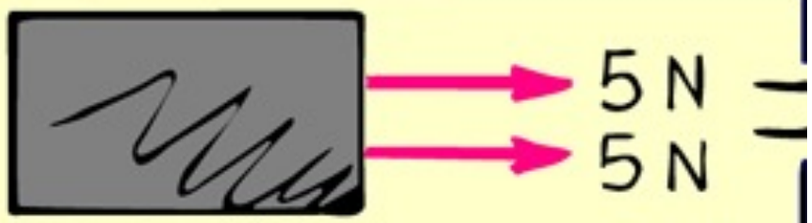
When several forces act on an object, the forces add together.

Sum of forces called net force or total force.

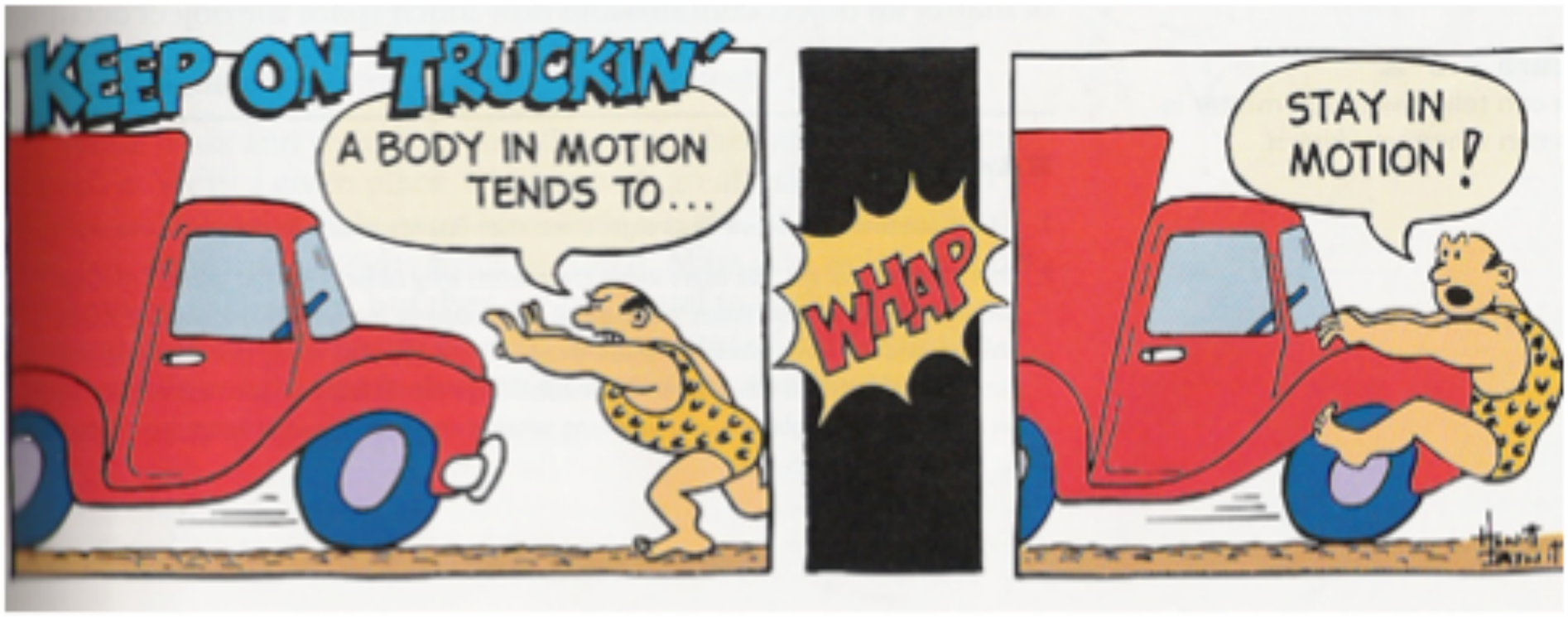


A Newton is a measure of force (about 100 grams in Earth's gravitational field--about the weight of an apple).

Check Yourself

Applied forces	Net force ?
	
	
	


STAYING PUT
A BODY AT REST TENDS TO
!
... STAY AT REST!


KEEP ON TRUCKIN'
A BODY IN MOTION TENDS TO...
WHAP
STAY IN MOTION!

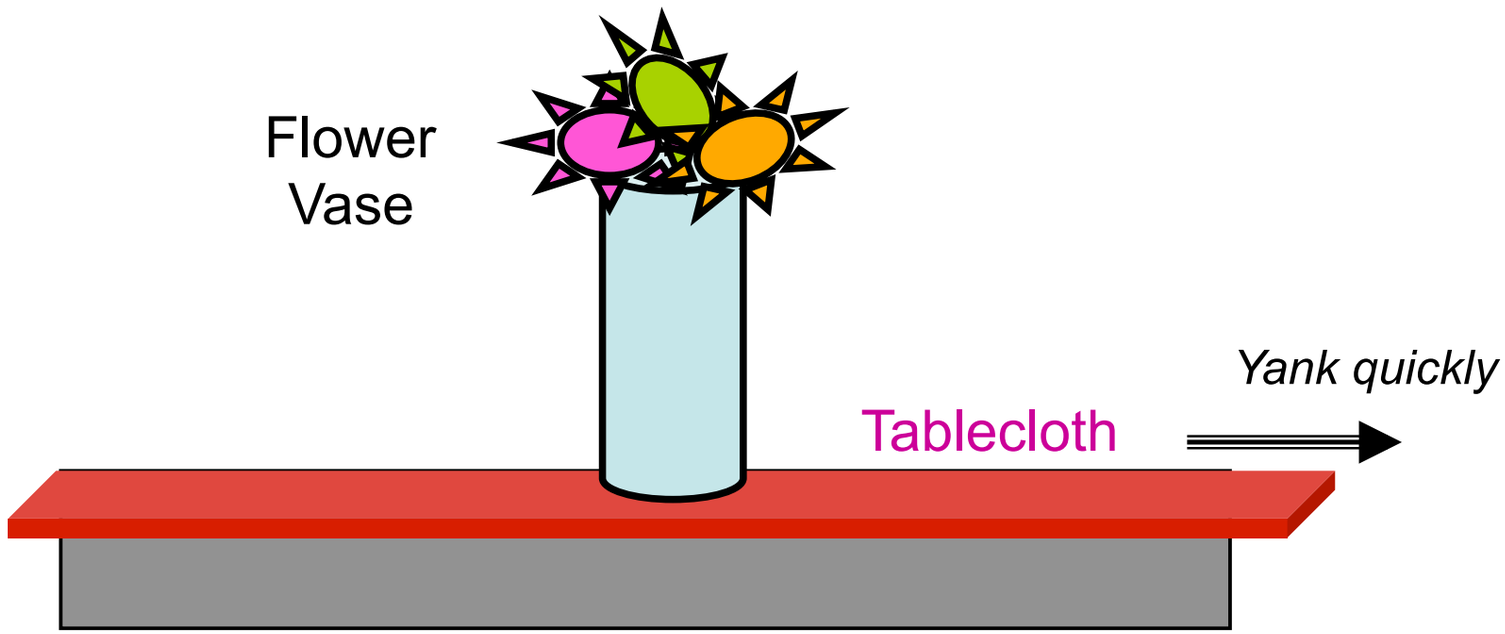
Newton's First Law is also called the *Law of Inertia*

Inertia is the resistance of an object to a change in its state of motion or rest.

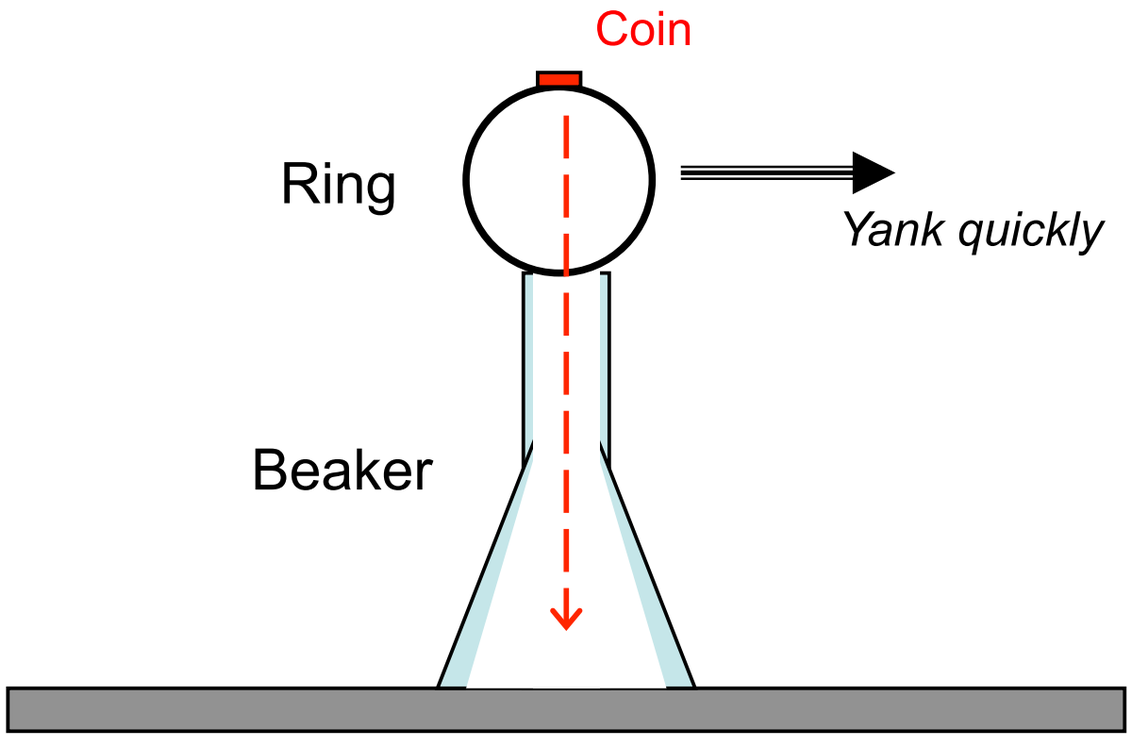
An object's mass is a measure of the object's inertia. The more mass an object has, the more inertia it has (and the harder it is to change its motion).

Examples of Inertia

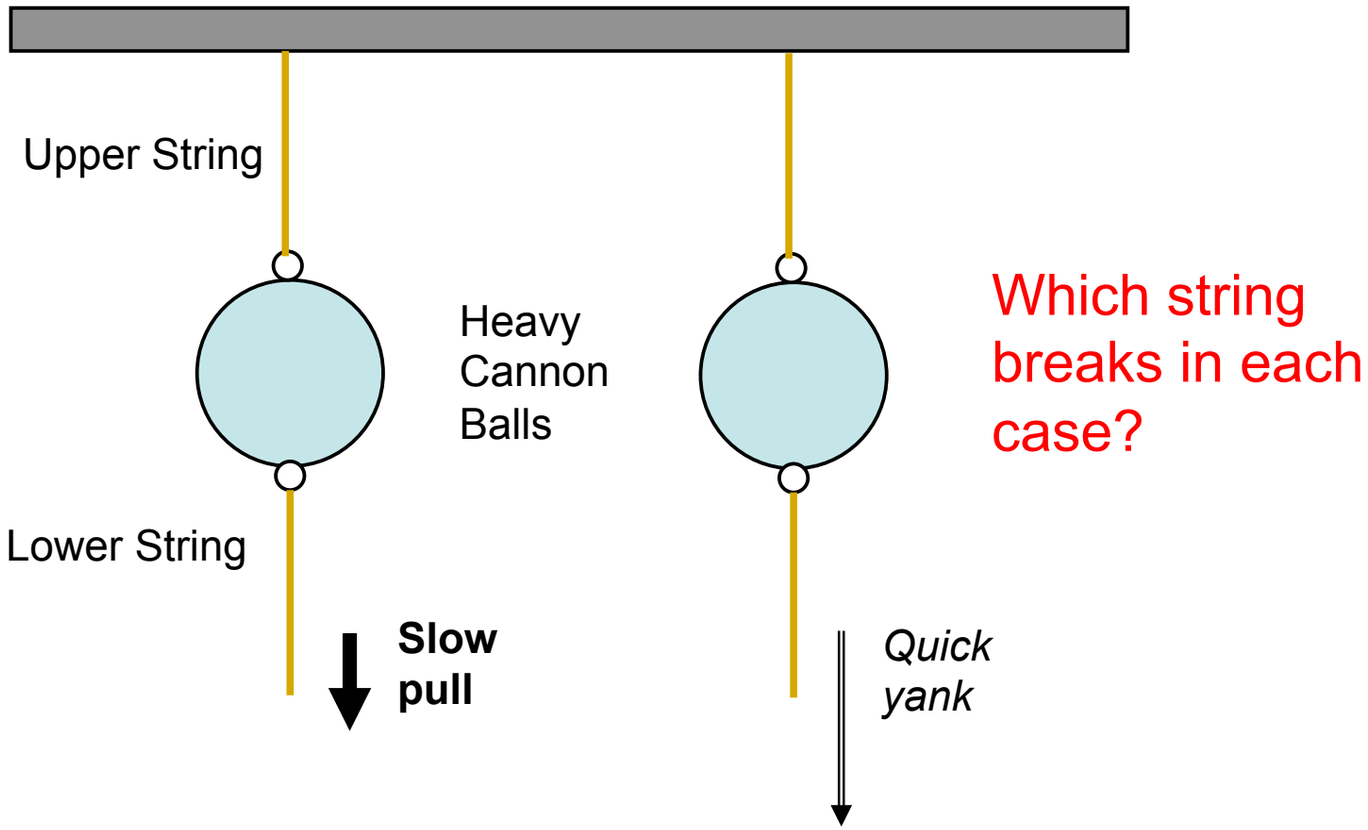
Demo: Tablecloth Pull



Demo: Ring Yank

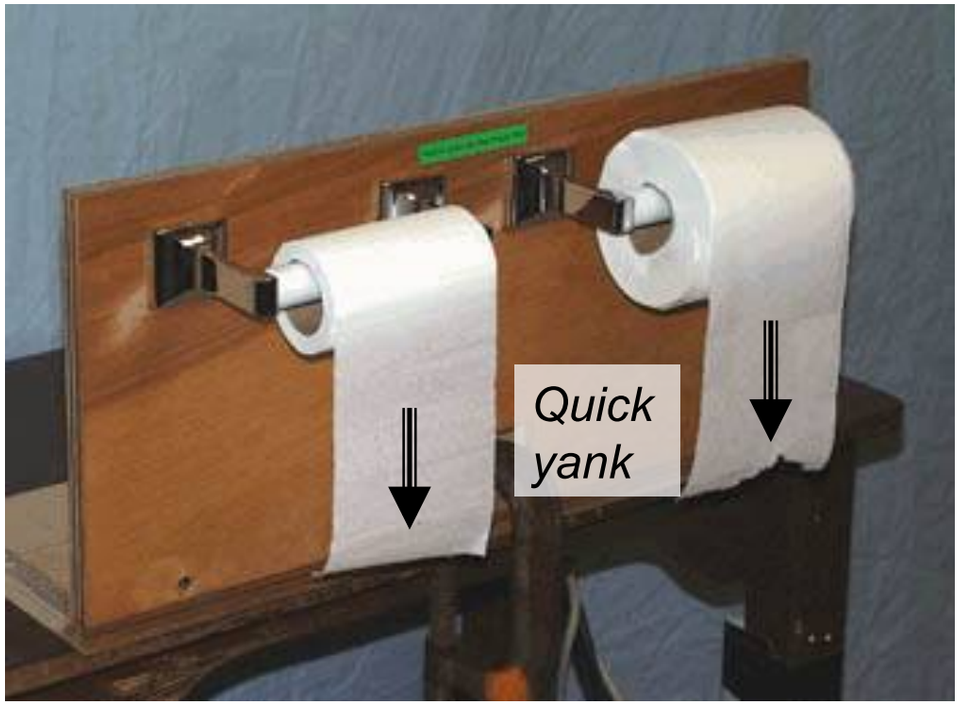


Demo: Inertia Balls



Which string breaks in each case?

Demo: Paper Pull



What happens in each case?

Which roll has more inertia?

Concept Check

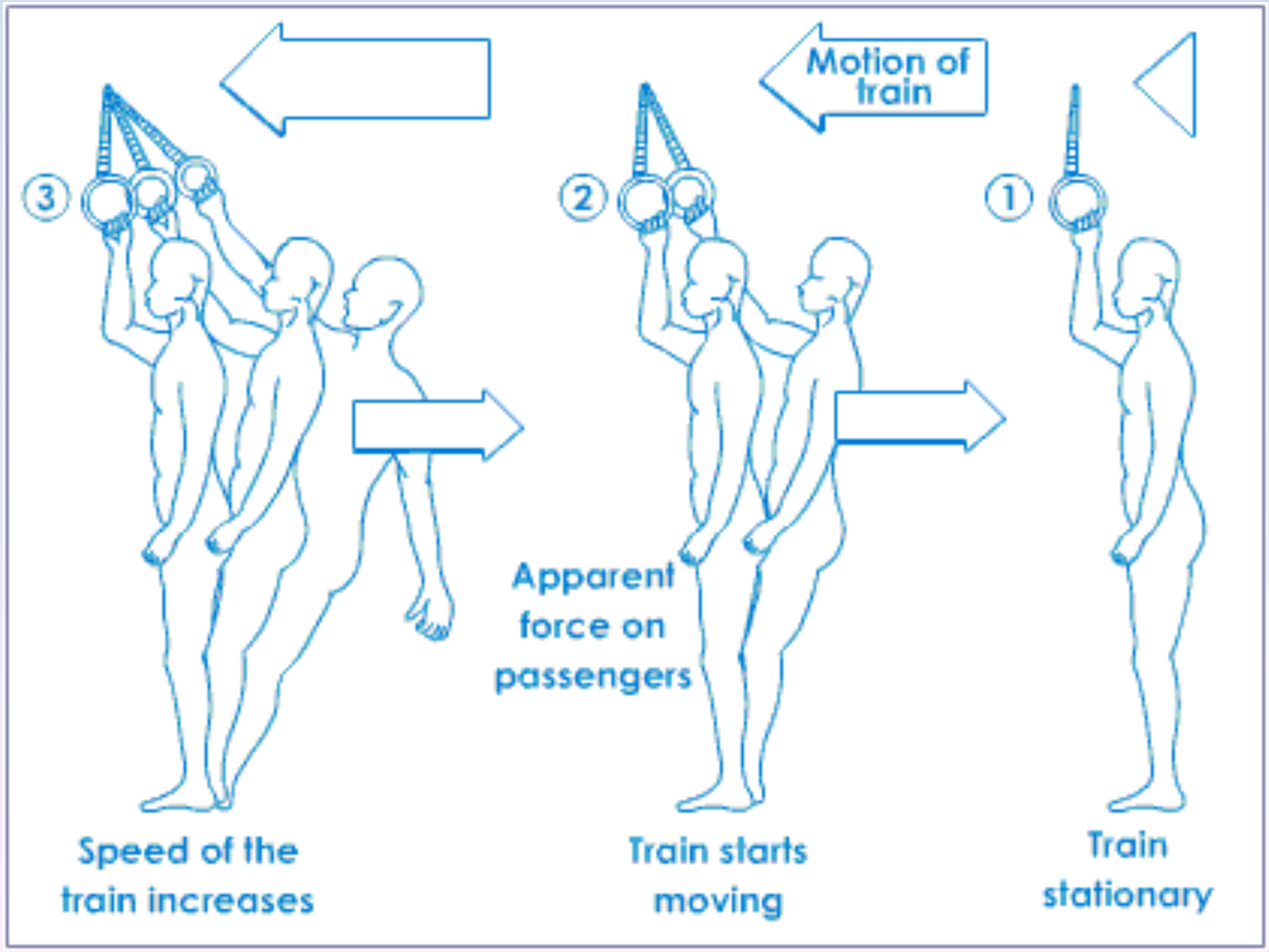
- How does the law of inertia account for removing dirt from your shoes by stamping on the porch before entering a house or removing dust from a coat by shaking it?

Concept Check

If an elephant were chasing you, its enormous mass would be very threatening.

But if you zigzagged, the elephant's mass would be to your advantage.

Why?

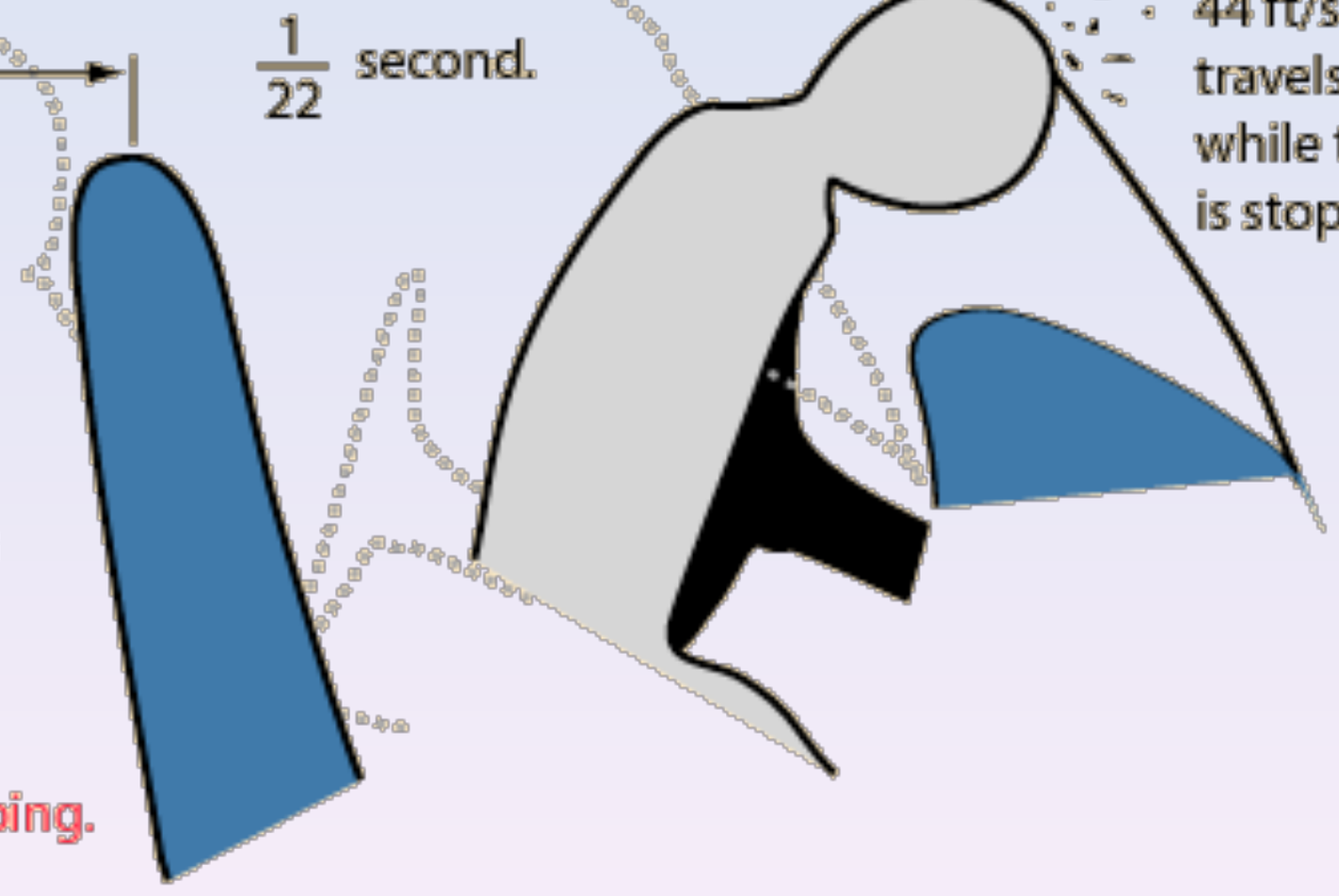

Motion of train
3
2
1
Apparent force on passengers
Speed of the train increases
Train starts moving
Train stationary

No Seatbelt!

How far will the driver fly forward while the car is stopping?

Time to stop car $\frac{1}{22}$ second.

Stopping distance of car 1 ft



Driver flies forward at 44 ft/s and travels 2 ft while the car is stopping.

If car is originally traveling at 44 ft/s and has constant deceleration, the average speed is 22 ft/s while stopping.

From example car crash scenario with car stopping in one foot distance from a speed of 30 mi/hr.

INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

Newton's First Law

Hypothesis:

When the impact speed of a collision increases, it will also increase the distance the dummy is thrown for the trolley.

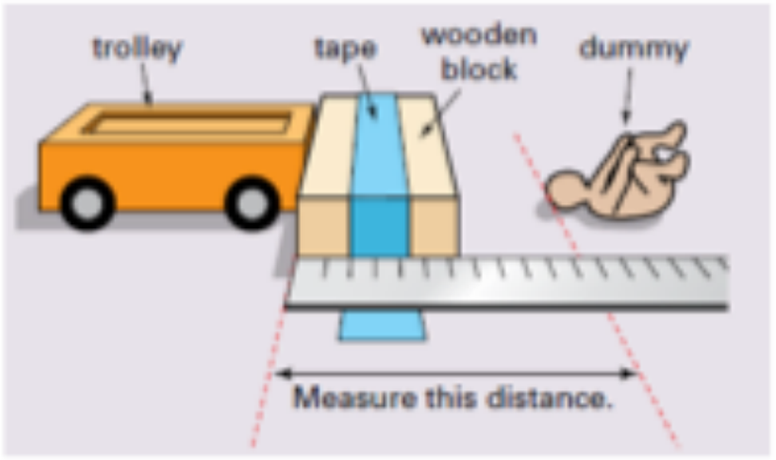
Task:

Design an experiment that will test the hypothesis above. You will have access to the equipment listed below. You will need to:

1. Draw a diagram showing how you will set up your experiment
2. Explain how you will design a fair experiment (variables controlled)
3. Decide which measurements you would like to take
4. Draw up a table to collect your results

Equipment:

- Ramp
- Trolley
- Block
- Dummy
- Ruler
- Tape
- Stopwatch



1. Sketch of design:

2. To make a fair experiment I will...

3. I will measure...

4. Results:

5. I proved the hypothesis correct/incorrect because...

Hypothesis:

When the impact speed of a collision increases, it will also increase the distance the dummy is thrown for the trolley.

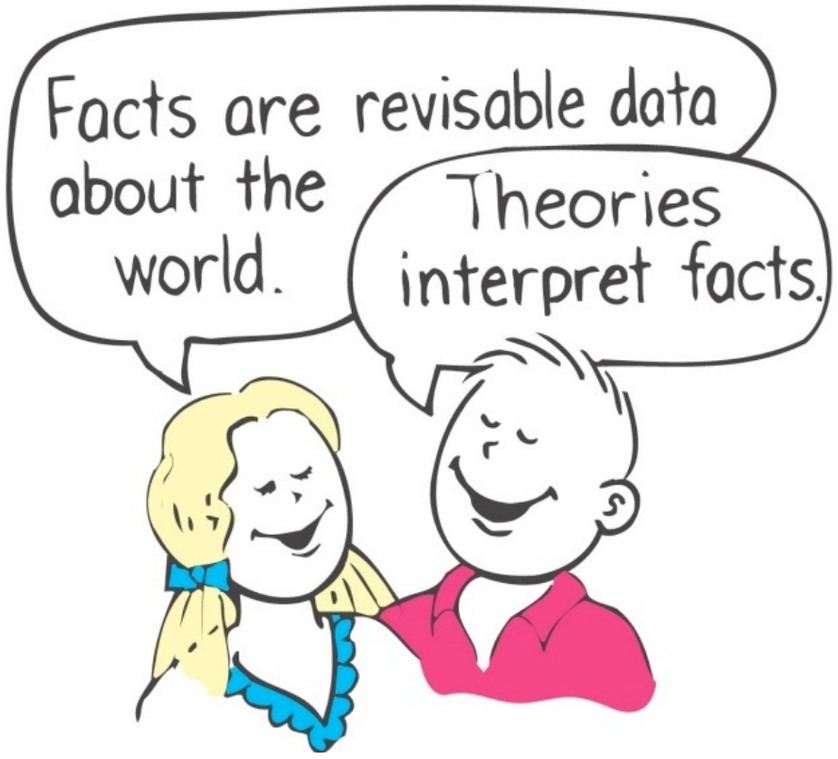
Scientific Methods —Common Steps

1. Recognize a question, a puzzle, or an unexplained fact.
2. Make a hypothesis (educated guess) to resolve the puzzle.
3. Predict consequences of the hypothesis.
4. Perform experiments or make calculations to test the predictions.
5. Formulate the simplest general rule that organizes the three main steps.

The Scientific Attitude

- **Fact** is a close agreement by competent observers who make a series of observations about the same phenomenon.

- A scientific **hypothesis** is an educated guess that is only presumed to be factual until supported by experiment.



The Scientific Attitude
CHECK YOUR NEIGHBOR

Which of these is a scientific **hypothesis**?

A. The Moon is made of green cheese.
B. Atomic nuclei are the smallest particles in nature.
C. A magnet will pick up a copper penny.
D. Cosmic rays cannot penetrate your brain.

The Scientific Attitude
CHECK YOUR NEIGHBOR

Which of these is a scientific **hypothesis**?

A. **The Moon is made of green cheese.**
B. **Atomic nuclei are the smallest particles in nature.**
C. **A magnet will pick up a copper penny.**
D. **Cosmic rays cannot penetrate your brain.**

Explanation:

All are scientific hypotheses!
All have opportunities for scientific investigation, so they pass the test of being a scientific hypothesis.

The Scientific Attitude
CHECK YOUR NEIGHBOR

Which of these is *not* a scientific **hypothesis**?

A. Protons carry an electric charge.
B. Undetectable particles are some of nature's secrets.
C. Charged particles bend when in a magnetic field.

The Scientific Attitude
CHECK YOUR NEIGHBOR

Which of these is *not* a scientific **hypothesis**?

A. Protons carry an electric charge.
B. **Undetectable particles are some of nature's secrets.**
C. Charged particles bend when in a magnetic field.

Explanation:

Choices A and C can be proved or disproved by experiments.

Choice B cannot be investigated with experiments, so it is *not* a scientific hypothesis.

The Scientific Attitude

Law or principle

- A hypothesis that has been tested repeatedly and has not been contradicted

Theory

- A synthesis of a large body of information that encompasses well-tested and verified hypotheses about certain aspects of the natural world

The Scientific Attitude
CHECK YOUR NEIGHBOR

Which of these often changes over time with further study?

A. Facts.

B. Theories.

C. Both of the above.

D. Neither of the above.

The Scientific Attitude
CHECK YOUR NEIGHBOR

Which of these often changes over time with further study?

A. Facts.
B. Theories.
C. **Both of the above.**
D. Neither of the above.

Explanation:
Both can change. As we learn new information, we refine our ideas; likewise in science.

The Scientific Attitude
CHECK YOUR NEIGHBOR

A person who says, “that’s only a theory” likely doesn’t know that a scientific theory is a

A. guess.

B. number of facts.

C. hypothesis of sorts.

D. vast synthesis of well-tested hypotheses and facts.