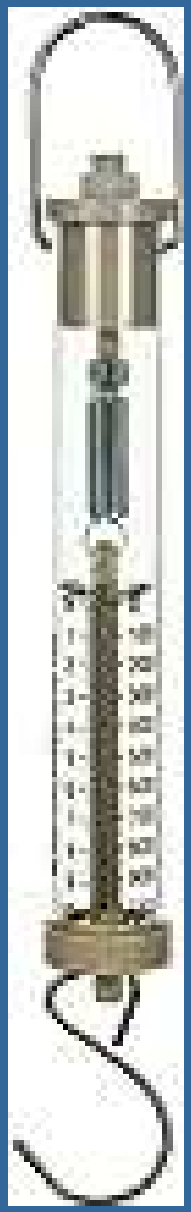
Chapter 4-1 Notes

Force

Force

- Force is a push or pull exerted on some object.
- Forces cause changes in velocity.
- The SI unit for force is the Newton.
- 1 Newton = 1 kg m/s^2

Spring Scale – Measures Force



Which tool will measure force directly?

- Oscilloscope
- Electronic balance
- Spring scale
- Triple beam balance

Which tool will measure force directly?

- Oscilloscope
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- Spring scale
- Triple beam balance

2 types of forces

- Contact Force – physical contact between objects
- Field Force – no physical contact between objects. Examples: electricity, magnets, and gravity

Field Forces

- Van De Graff Video


Coulomb's Law

Late at night, and without permission, Reuben would often enter the nursery and conduct experiments in static electricity.

Static Electricity Mini Lab

Magnetic Resonance Imaging (MRI)

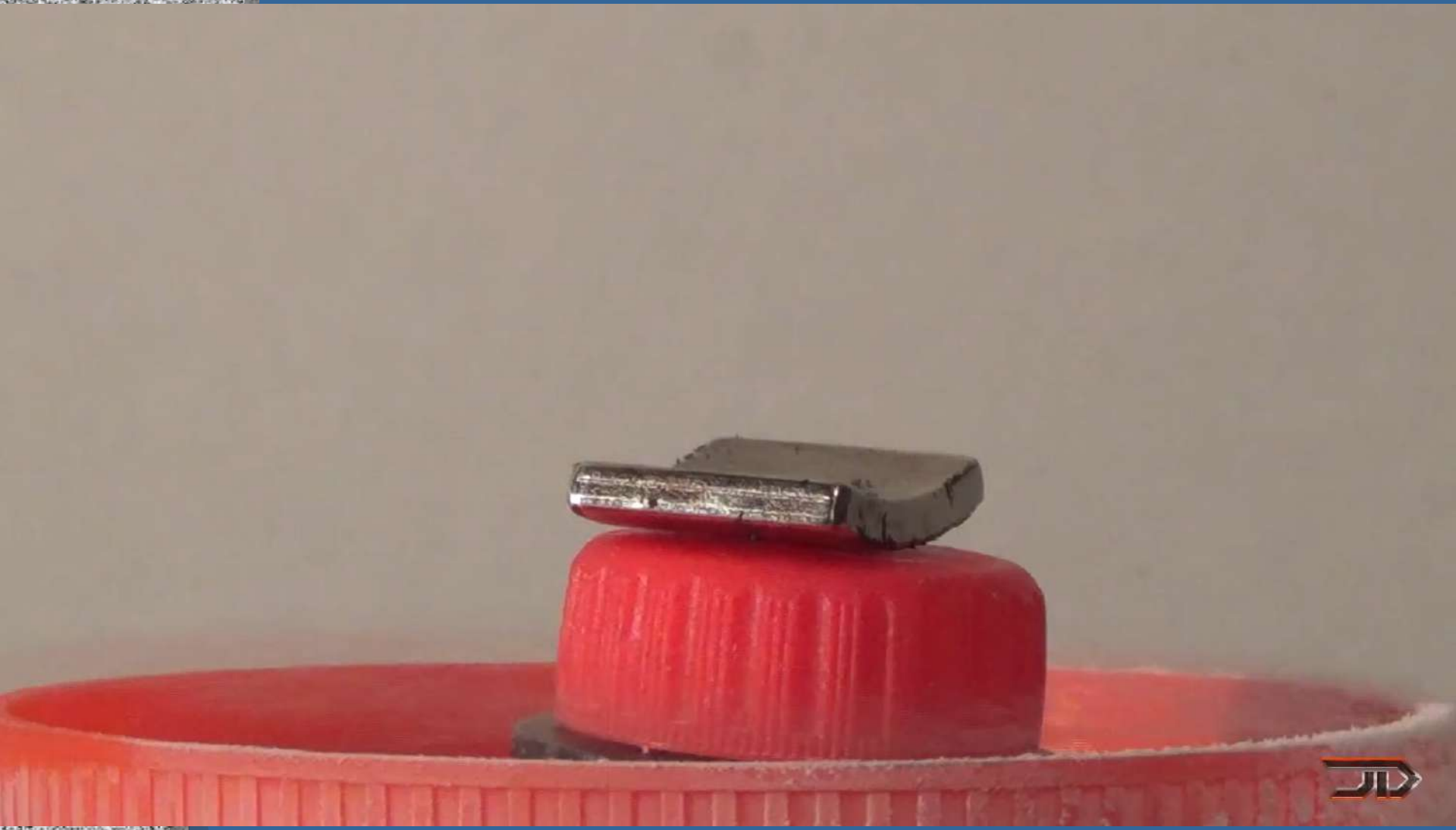
Loadstone & 1st Compass

Types of Magnets
Ceramic, Steel, Hematite

Neodymium Magnets – Mini,

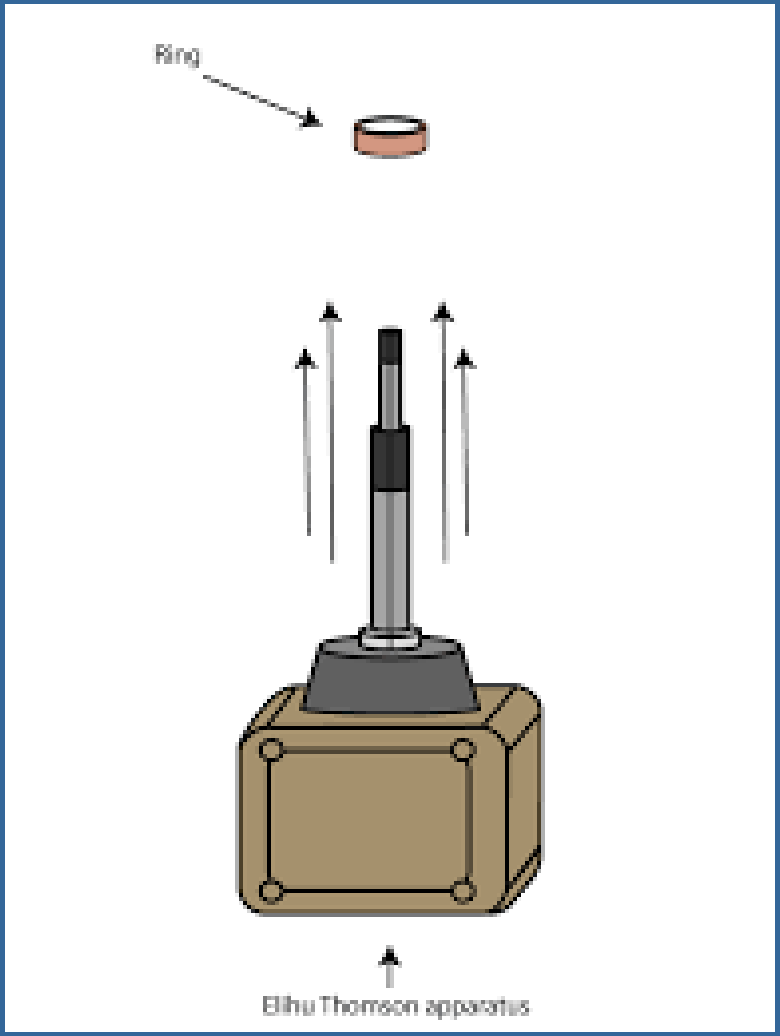

@physicsfun

Magnetic Levitation



Magnetic Forces

- Launcher



Iron Filings, Ferrofluid, and Ferroslime,

Magnetic toys & Magic tricks

Balanced Force

When each force is equal, then it's a balanced force.

For example, if the force of gravity and the normal force are equal, then the object will not move up or down.

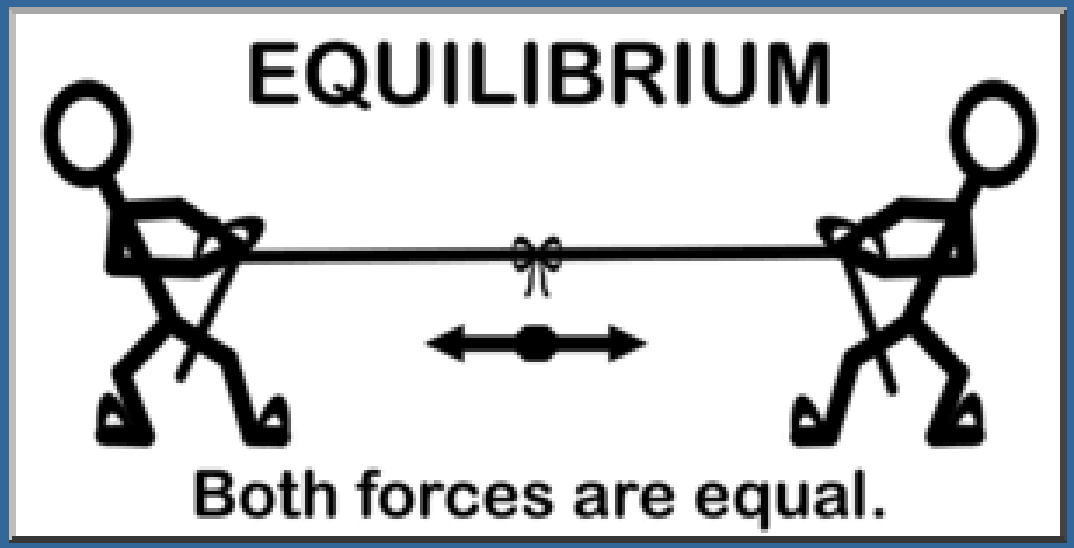
Unbalanced Force

When the forces are not equal, they are unbalanced. Imagine a washing machine with a load of towels all to one side. It jumps around and moves. Imagine a car with wheels out of balance. You feel the shake in your steering wheel.


Furry Tails
AMAZING
BALANCING TURTLES

Equilibrium

- Objects that are either at rest or moving with a constant velocity are in equilibrium (balanced)
- He pulls at 10 N and he pulls at 10 N. Net force = 0 N




TEMPLE

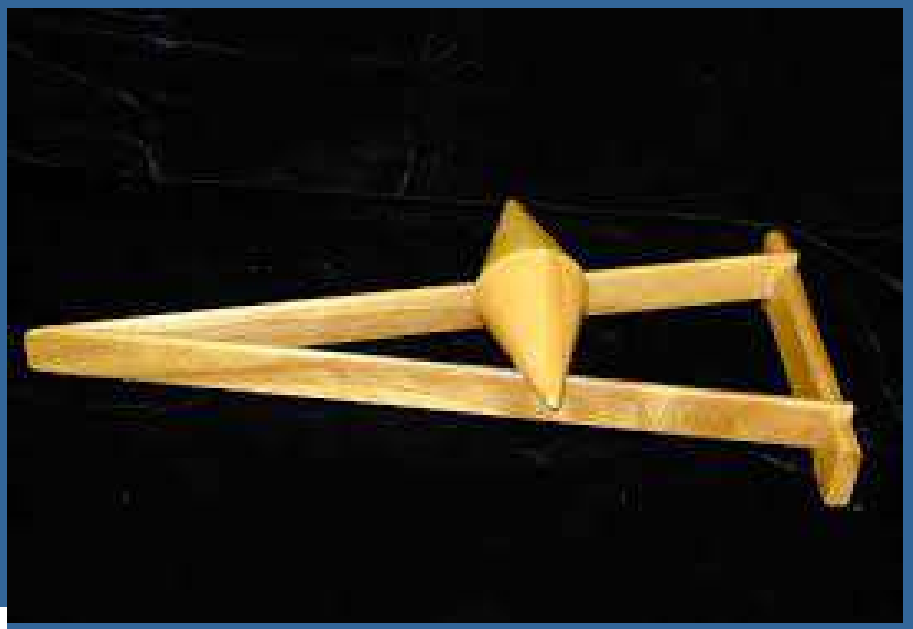

RT

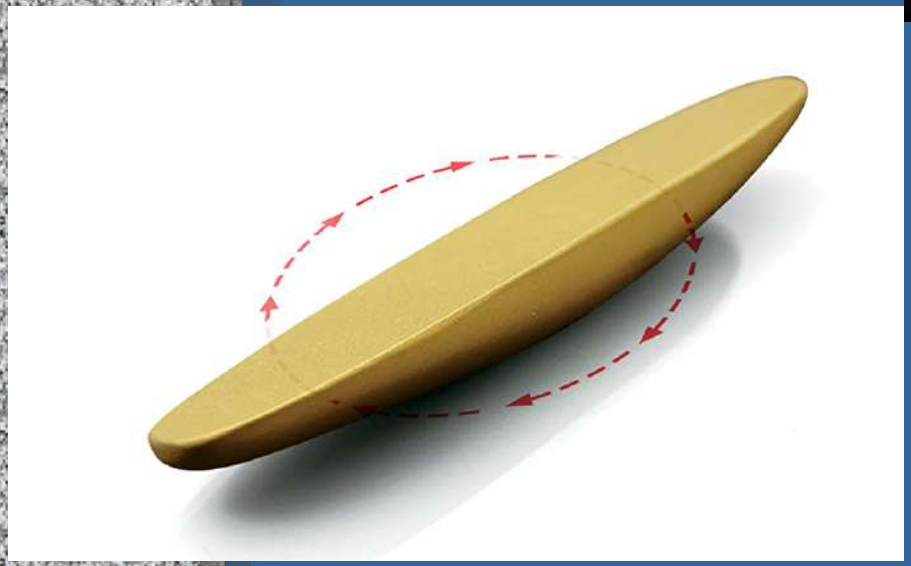
Balanced


WelcomeTo


BALANCING
NAILS

Unbalanced Force



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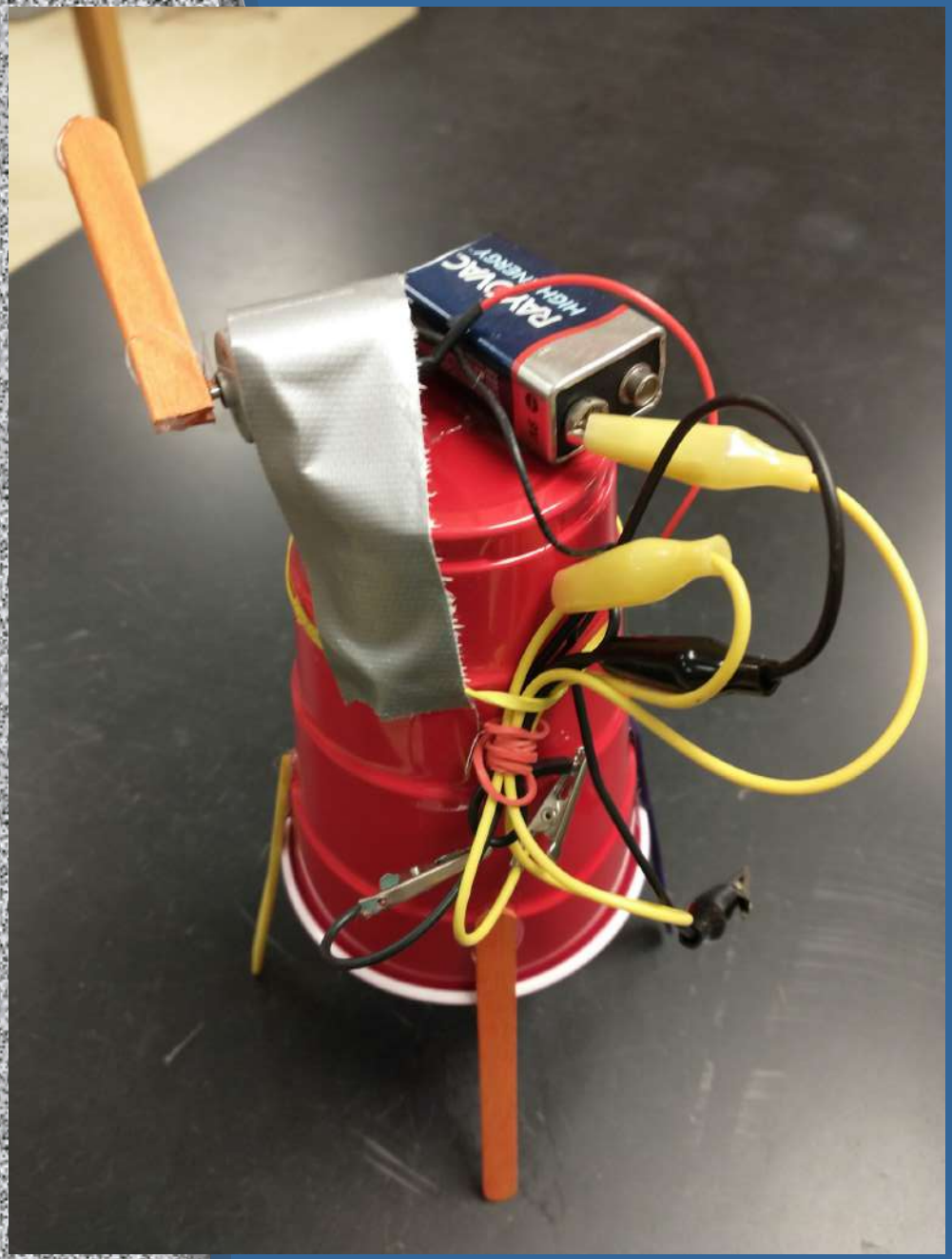
HDD



Jitterbug

- It's an unbalanced force.
- Too unbalanced and it falls over.

Weight and Friction

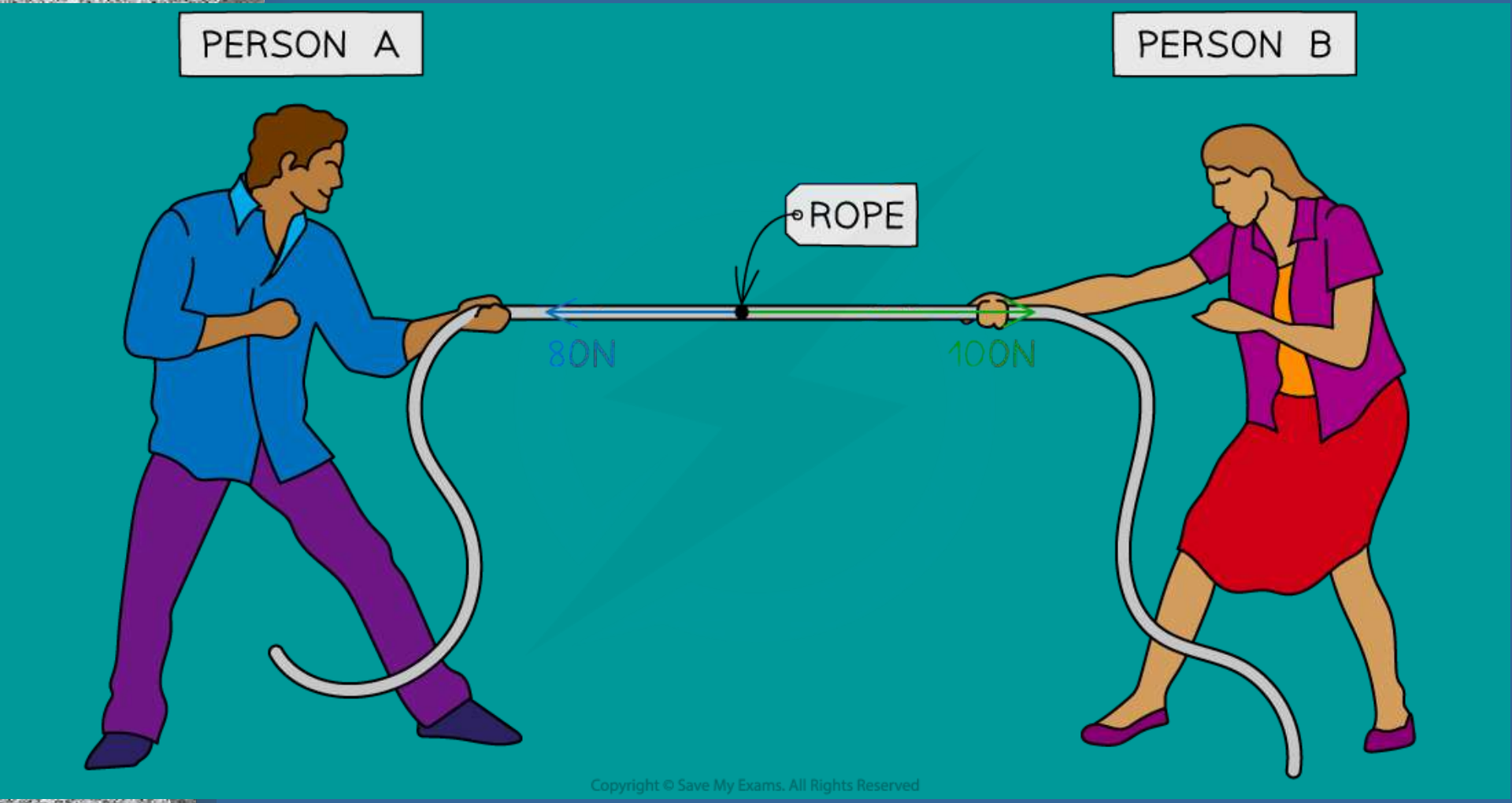
Weight

- Weight is the force of gravity acting on an object.
- Weight = Fg
- Fg = mass x gravity

Force Diagrams

- A free-body diagram used to analyze forces affecting the motion.
- Find x and y components and then use Pythagorean theorem to find the result.

Balanced or Unbalanced?

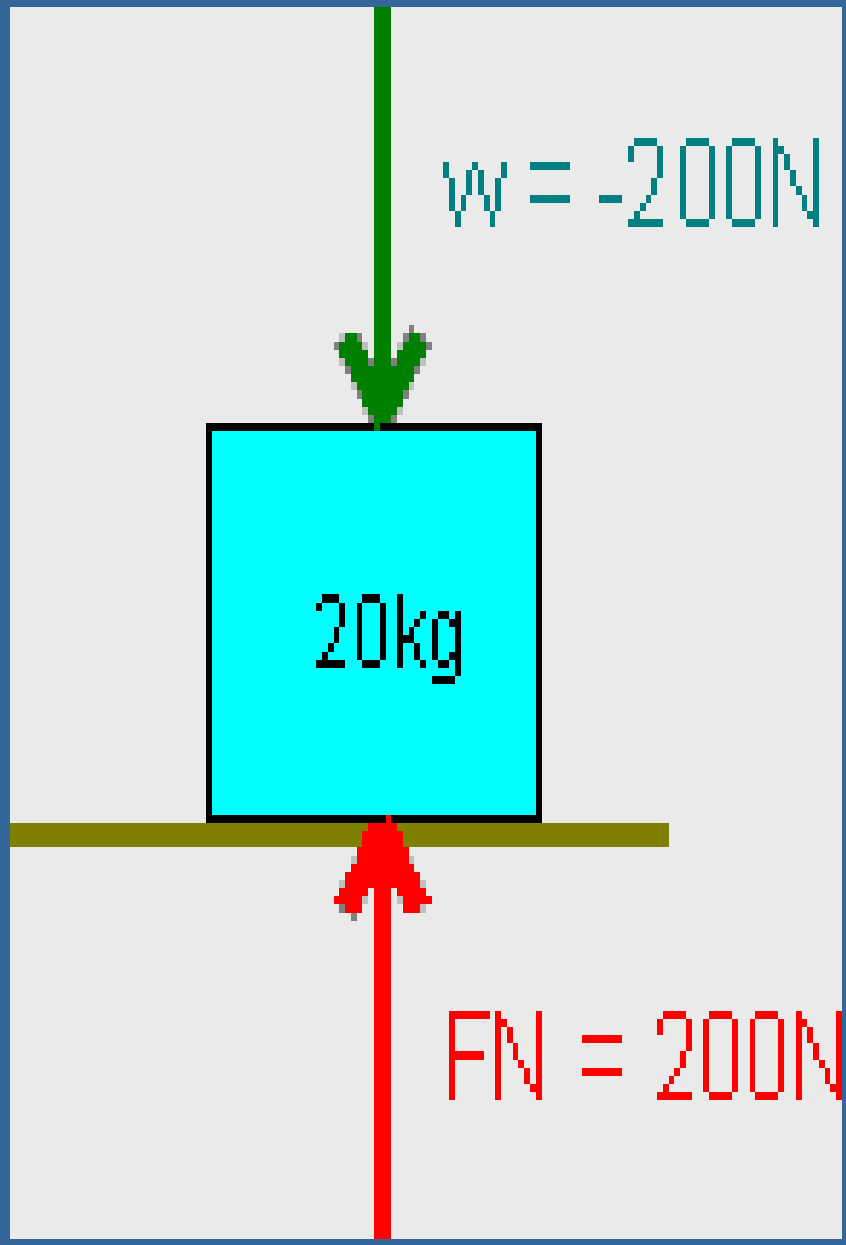


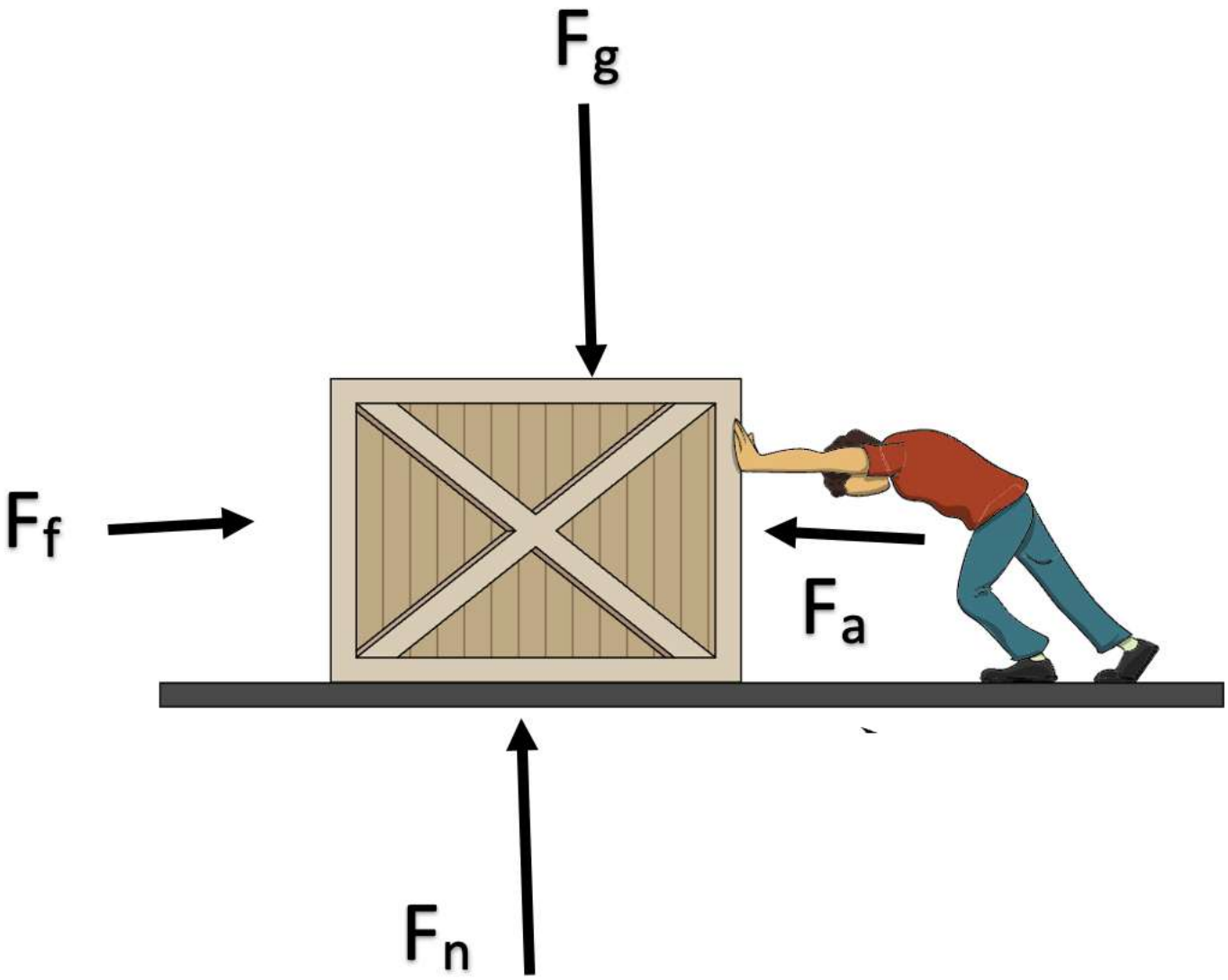
Truck = 50 mph left
Ball Launched = 50 mph right

Normal Force

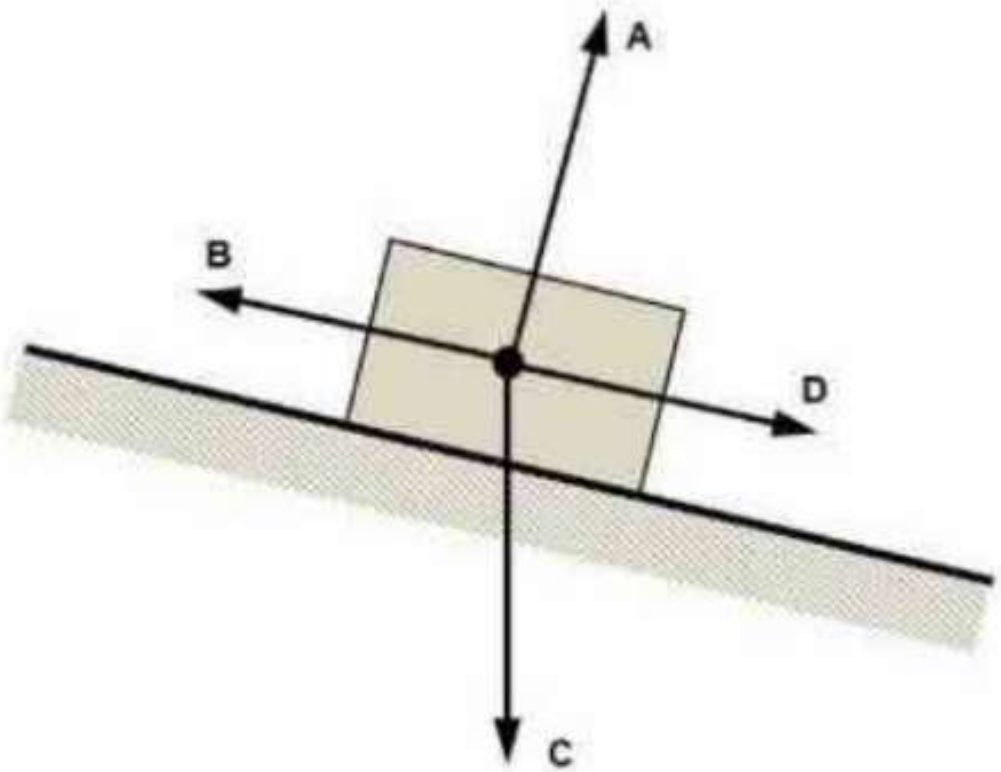
- Normal Force is a force exerted by one object on another in a direction perpendicular to the surface of contact.

- The normal force is always perpendicular to the surface but is not always opposite the force of gravity.



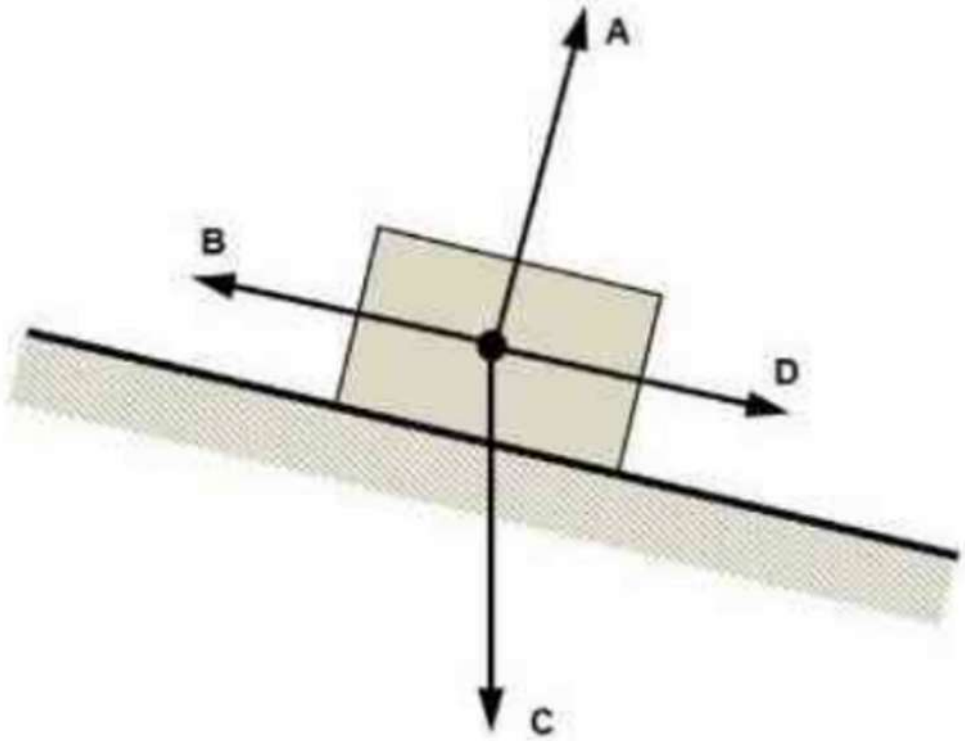

F_g
F_f
F_a
F_n

Identify the Normal Force in the diagram.



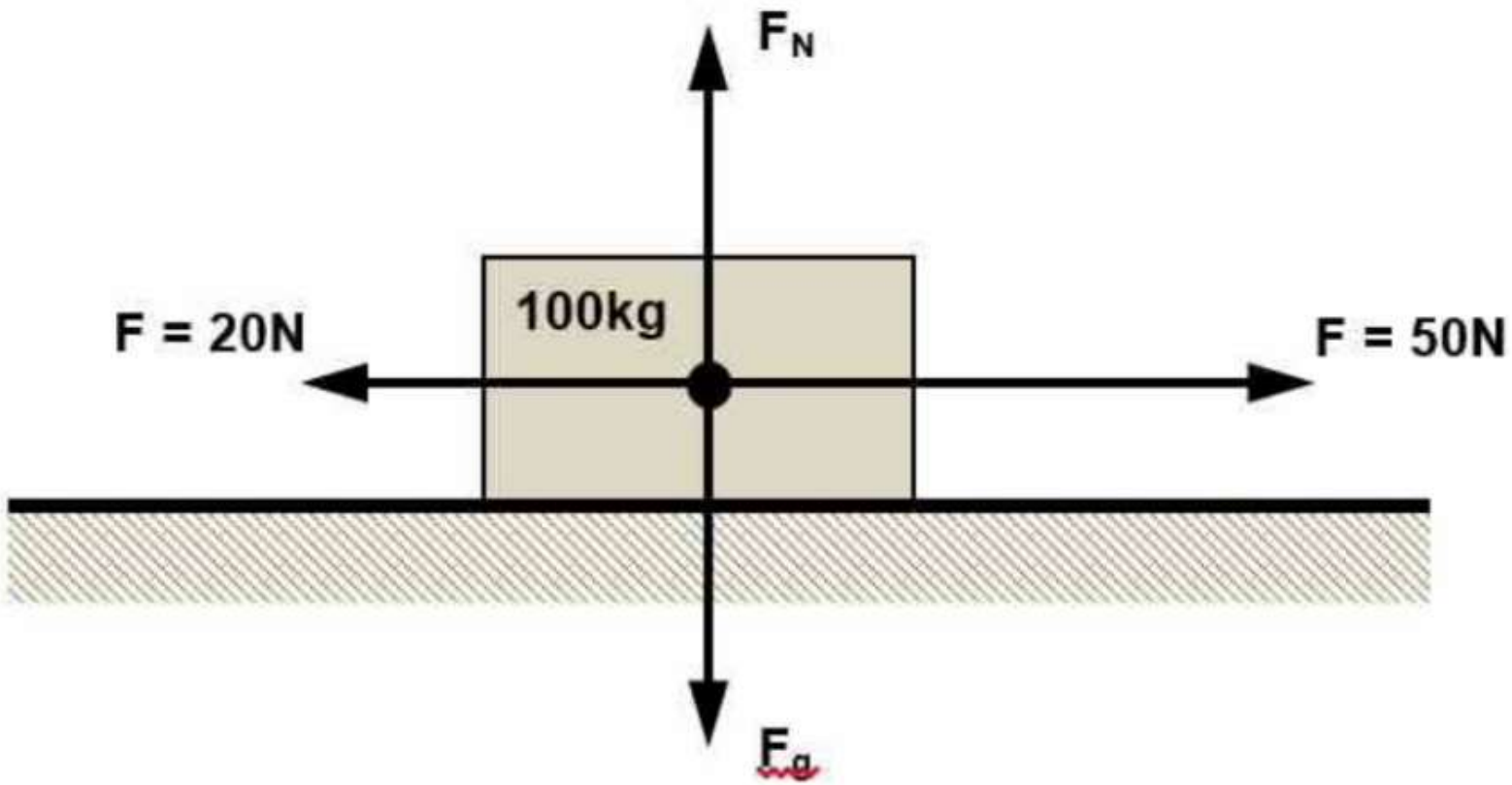
- C
- A
- B
- D

Identify the Normal Force in the diagram.



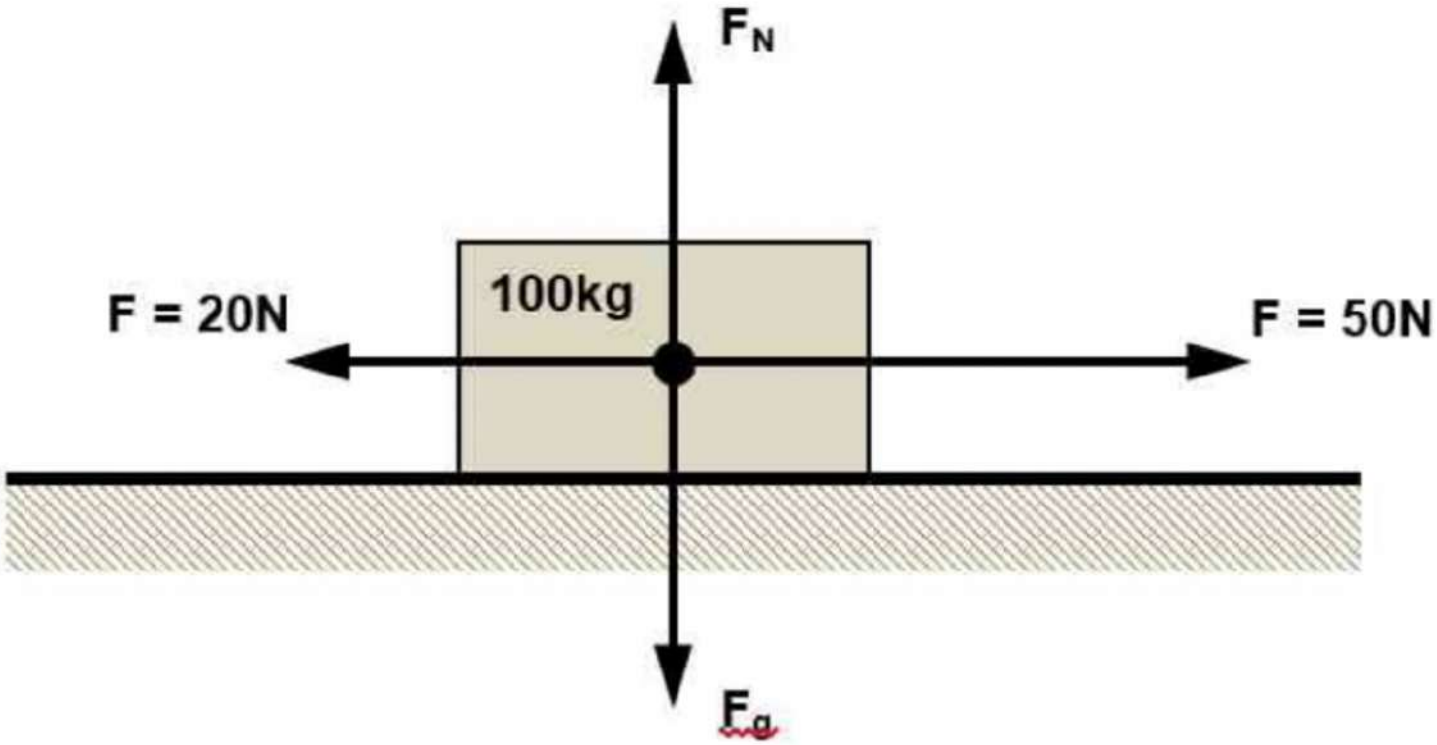
- ○ C
- ● A
- ○ B
- ○ D

What is the net force acting on the box in this image?



- 20 N to the left
- 70 N to the left
- 50 N to the right
- 30 N to the right

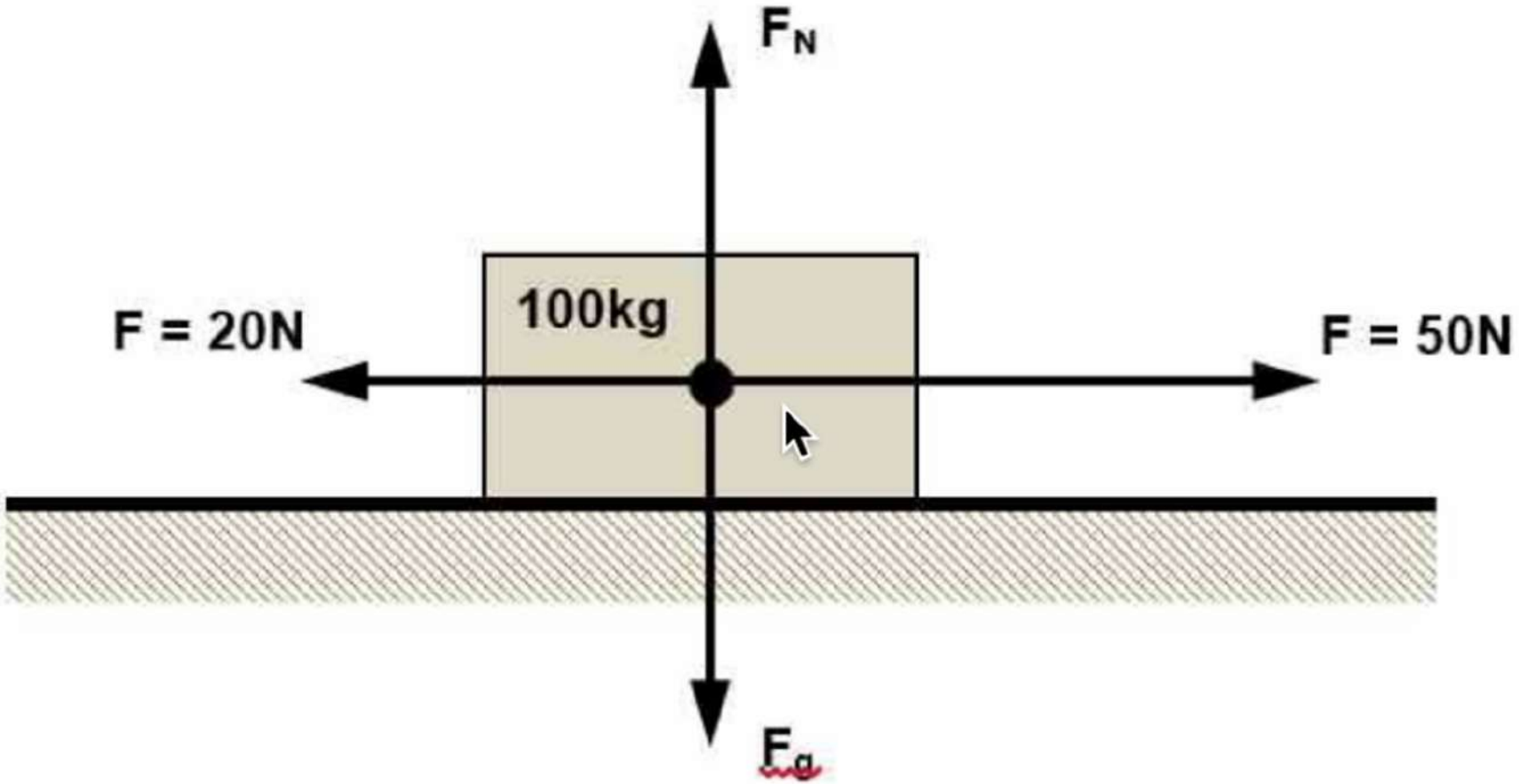
What is the net force acting on the box in this image?



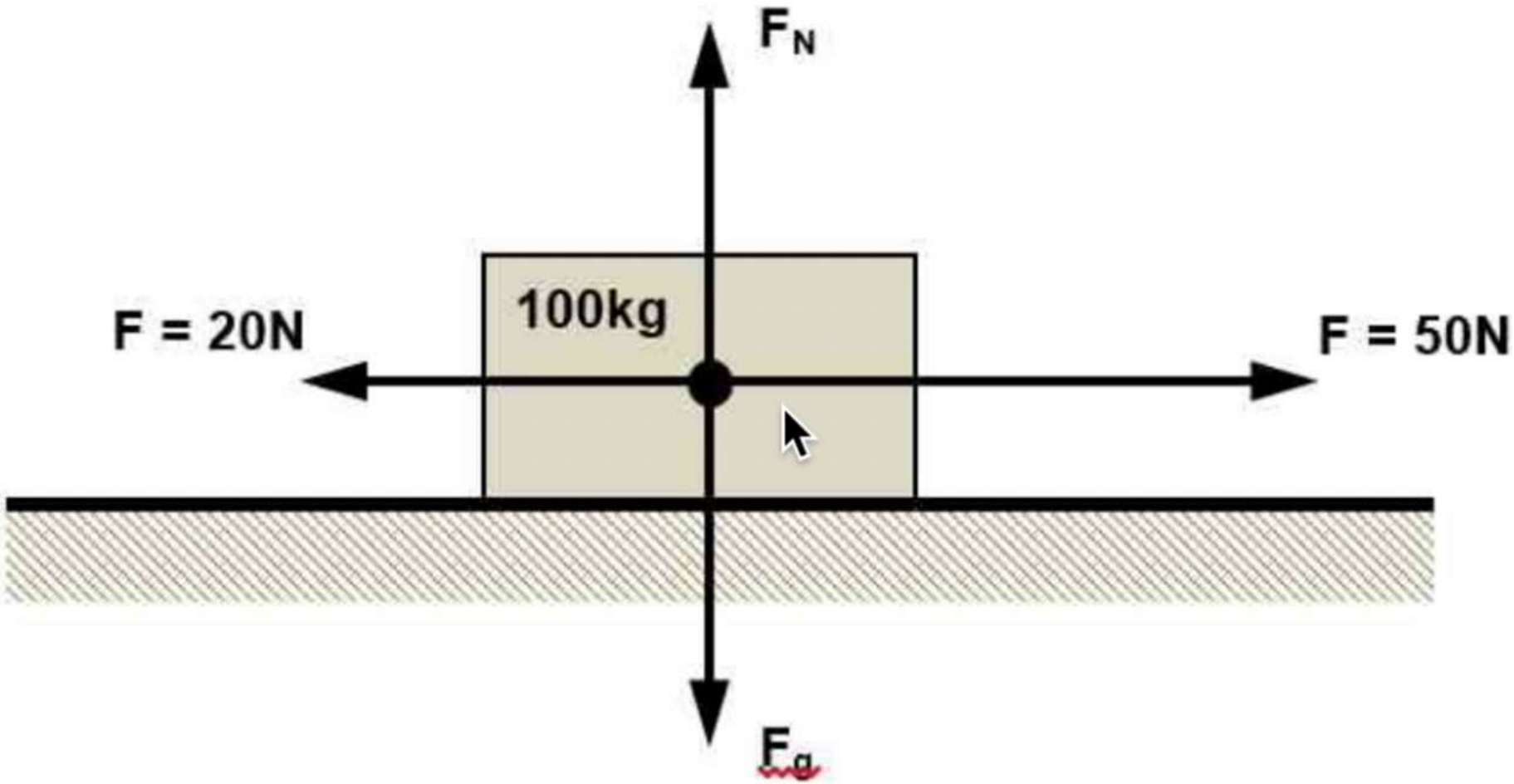
- ○ 20 N to the left
- ○ 70 N to the left
- ○ 50 N to the right
- ● 30 N to the right

50 - 20 = 30

What is the normal force acting on the box in this image?



What is the normal force acting on the box in this image?



Normal Force = Force of Gravity

Force of Gravity = Mass * Gravity

= 100 * 9.8 = 980 N

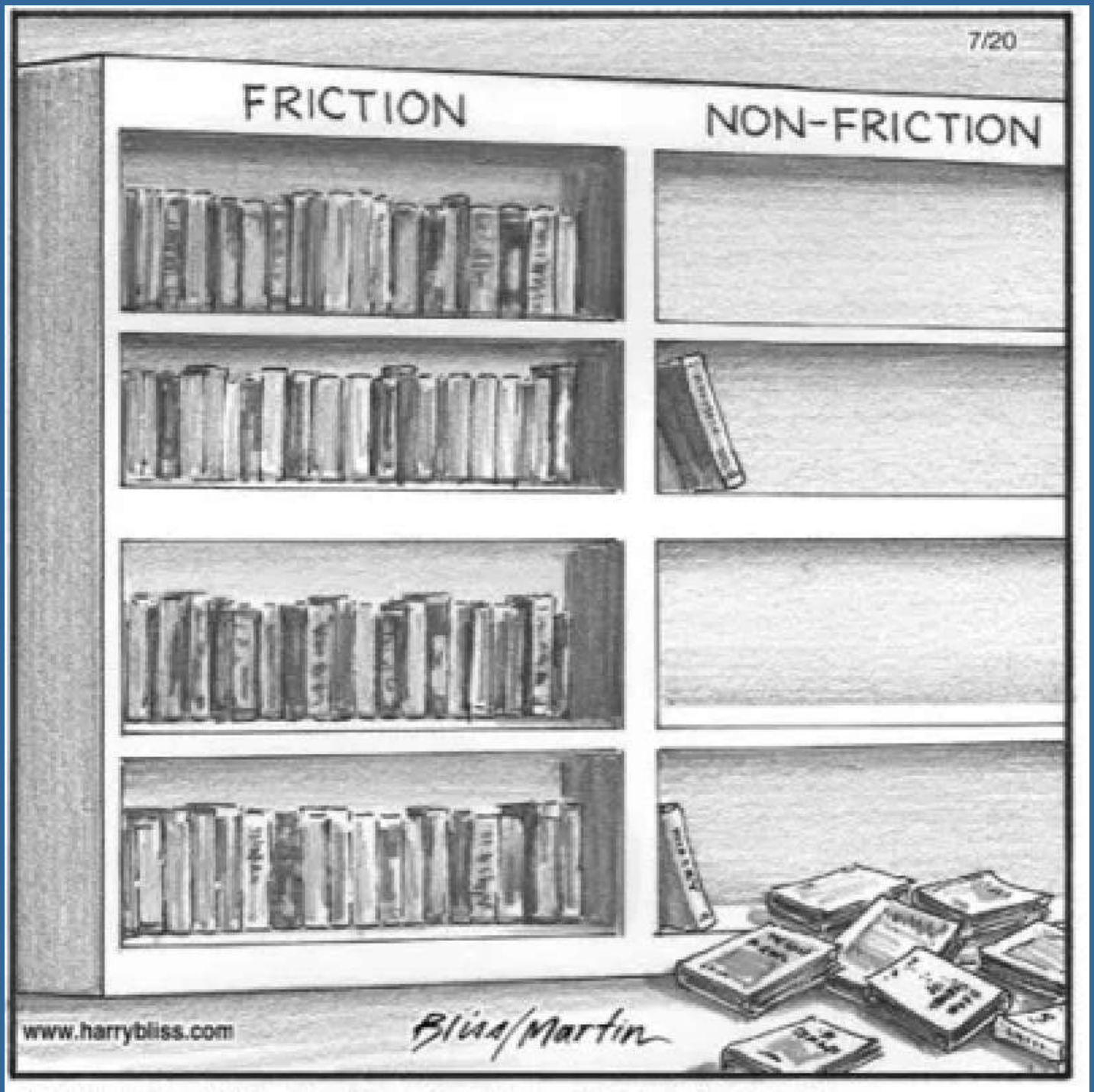
- The net force is the sum of all the forces acting on an object.
- A simple problem occurs when all forces act directly along the x and y axis. You would use Pythagorean theorem.
- $C^2=A^2 + B^2$

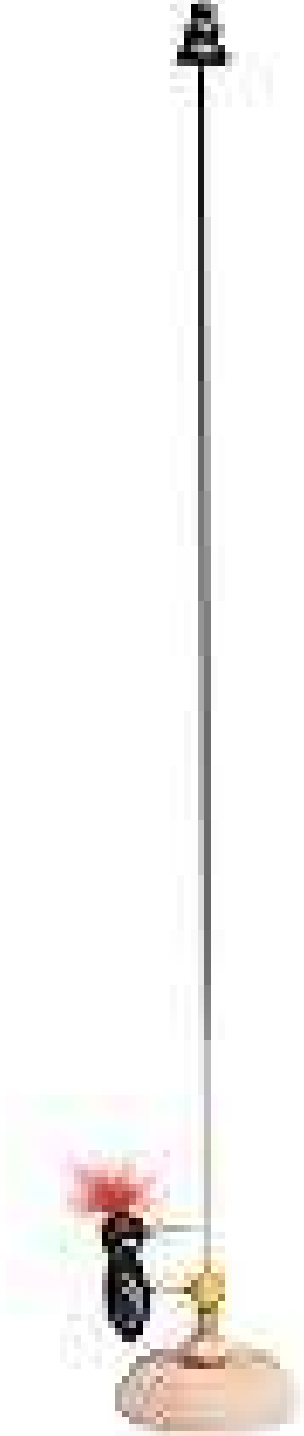
Air Resistance

- Whenever an object moves through a fluid, like air or water, the fluid has resistance to the motion.
- This is called **air resistance** or **drag**.
- Friction in/of the air

Friction

- Friction opposes the applied force.
- Two types of friction: Static (F_s) – not moving
- Kinetic (F_k) - moving

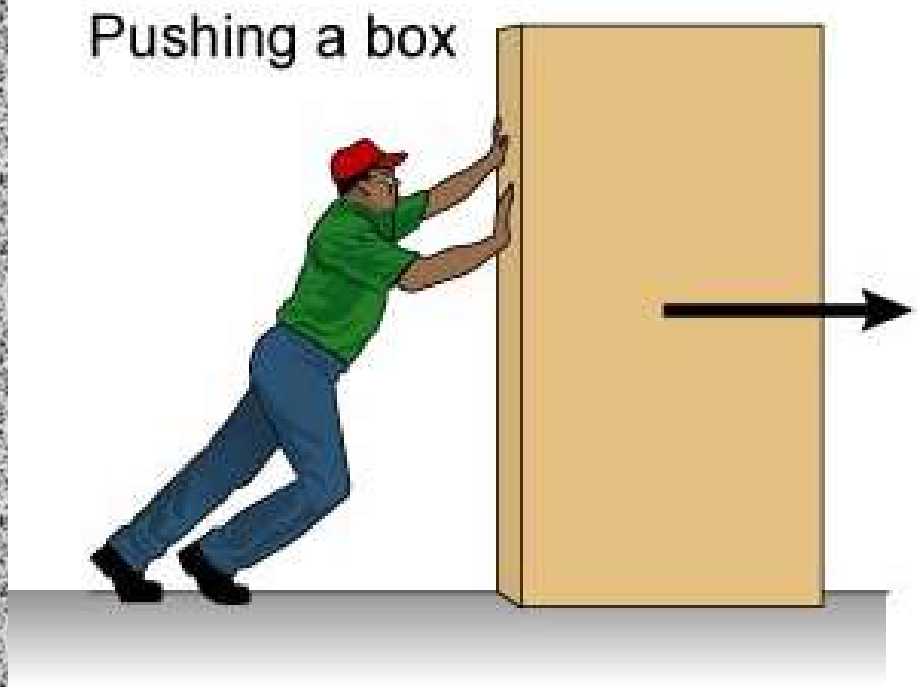

7/20
FRICTION
NON-FRICTION
www.harrybliss.com
Bliss/Martin

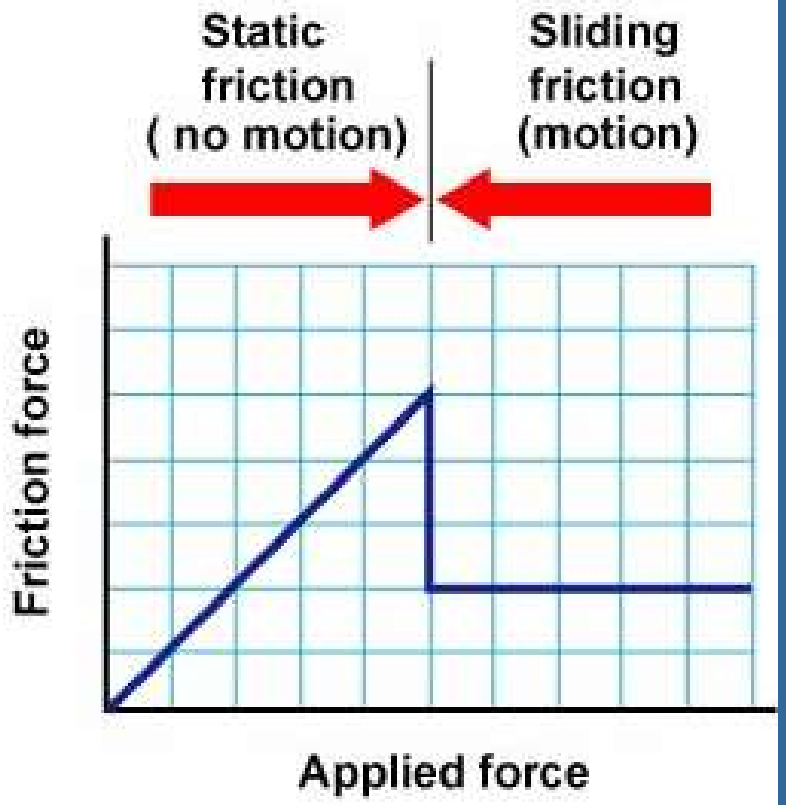


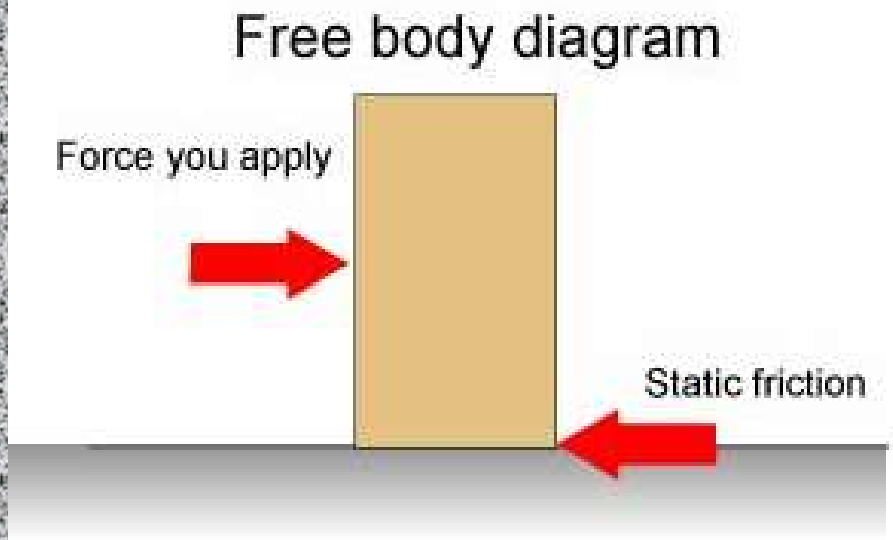

Heat
Heat

- The kinetic friction is always **less** than or equal to the static friction.
- Think about pushing a car that is sitting still or pushing a car that is already moving.

Friction Forces







Coefficients of Friction

- Friction depends on the **surfaces** in contact.
- Surfaces in contact - called the **coefficient of friction**.
- Coefficient of friction is represented by the symbol **μ** and pronounces **mu**.

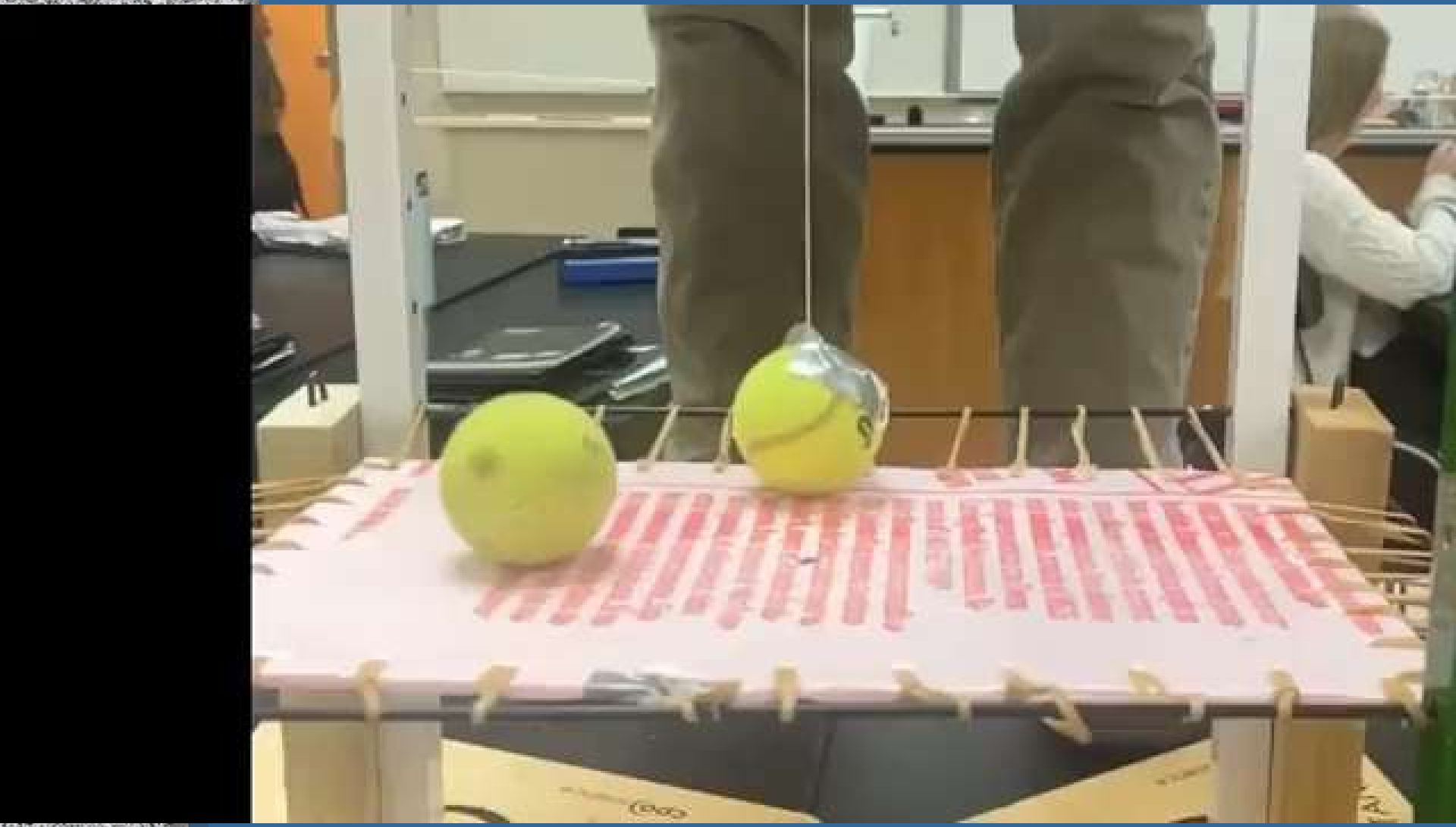
Materials	μ_s	μ_k
Wood on wood	0.5	0.3
Waxed ski on snow	0.1	0.05
Ice on ice	0.1	0.03
Rubber on concrete (dry)	1.0	0.8
Rubber on concrete (wet)	0.7	0.5
Glass on glass	0.94	0.4
Steel on aluminum	0.61	0.47
Steel on steel (dry)	0.7	0.6
Steel on steel (lubricated)	0.12	0.07
Teflon on steel	0.04	0.04
Teflon on Teflon	0.04	0.04
Synovial joints (in humans)	0.01	0.01


NEWS

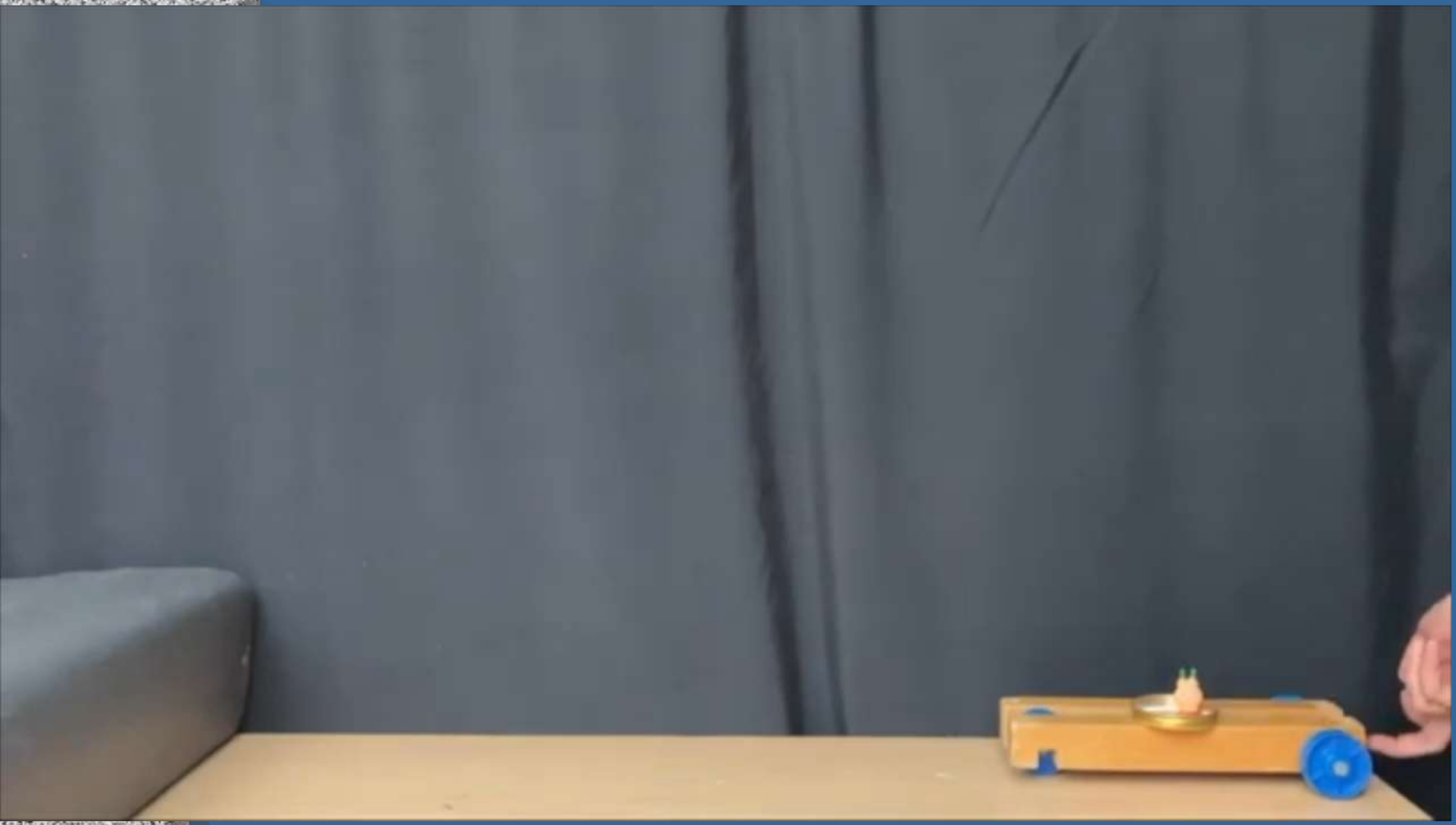
Chapter 4-2 Notes

Newton's First Law

- Newton's First Law – An object at rest remains at rest and an object in motion stays in motion (inertia) unless acted on by an outside force (friction, gravity, applied force).




Physics.
Respect 😳⚛️👨‍💼




PowerDirector


Newtons 1st Law of Motion


DO NOT
BLOCK
MØDA

Inertia

- The tendency of an object not to accelerate is called **inertia**.
- Inertia depends on the amount of mass.
- Train stopping versus a car stopping

Why we wear seatbelts!


8MPH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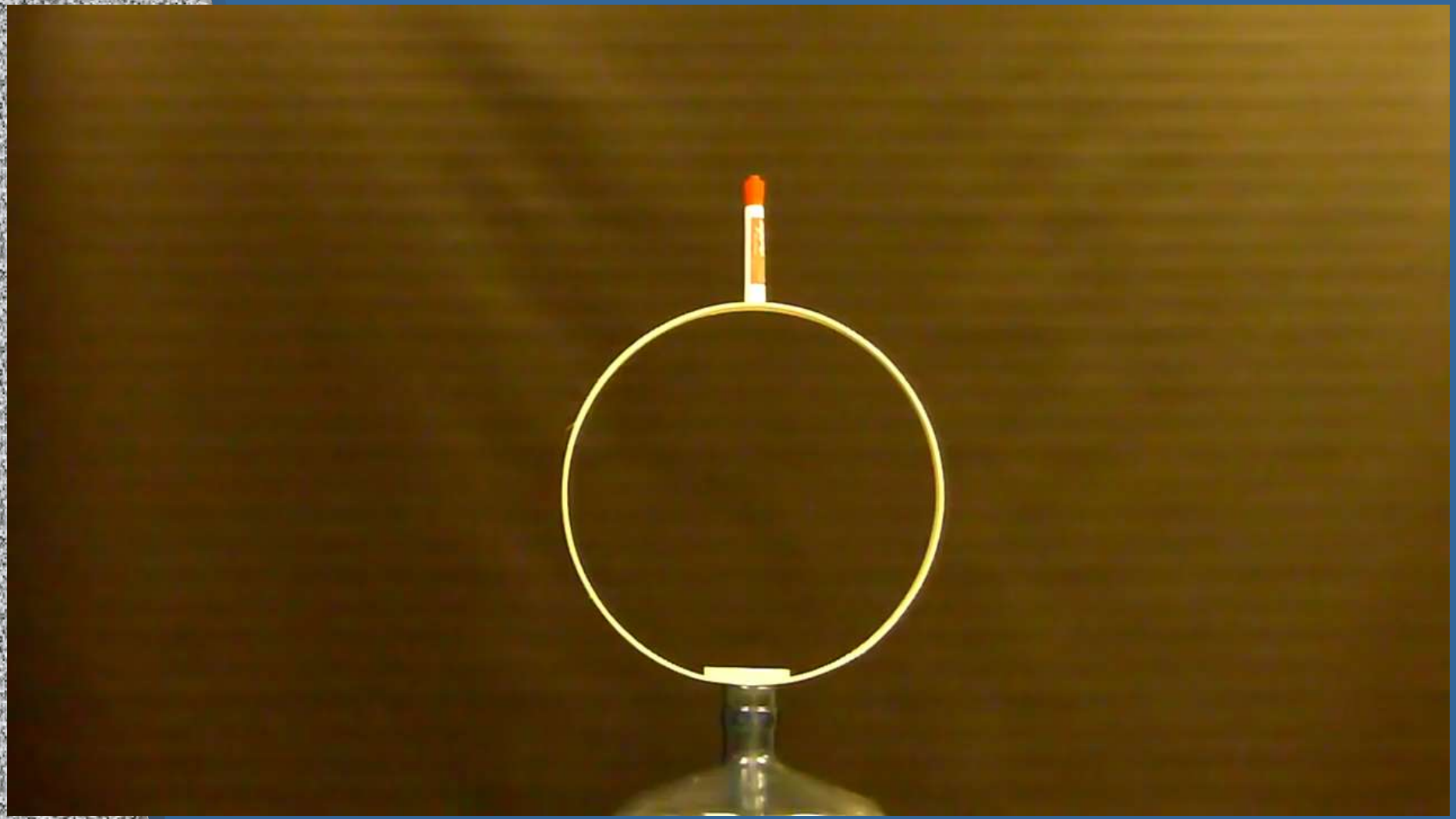
Inertia Tablecloth Demo



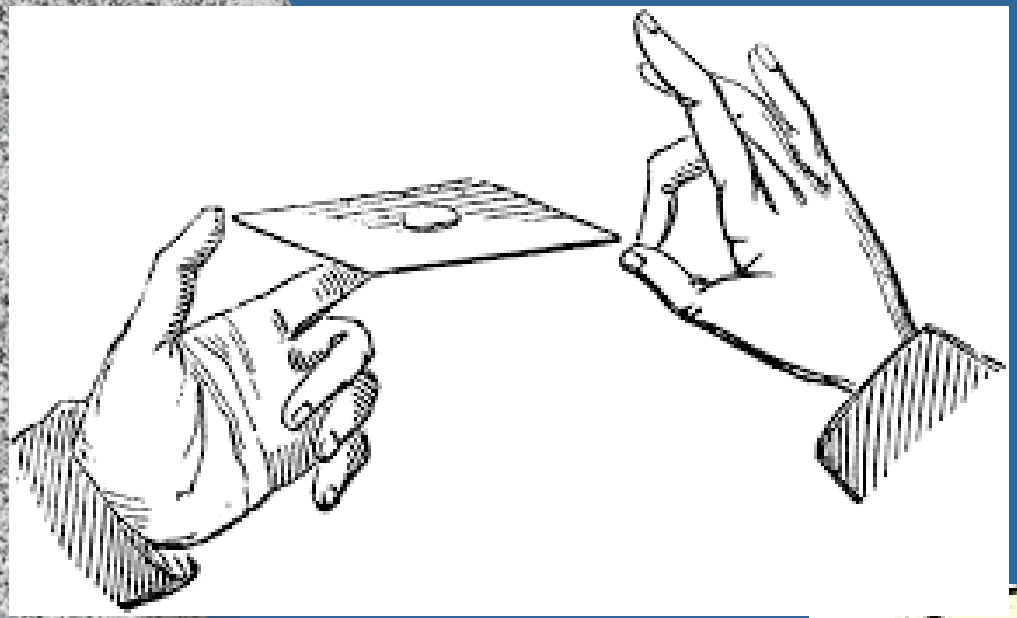
Woosh Bottle Demo

Inertia Beads

Chinese Hammer Toy

Flip Ball

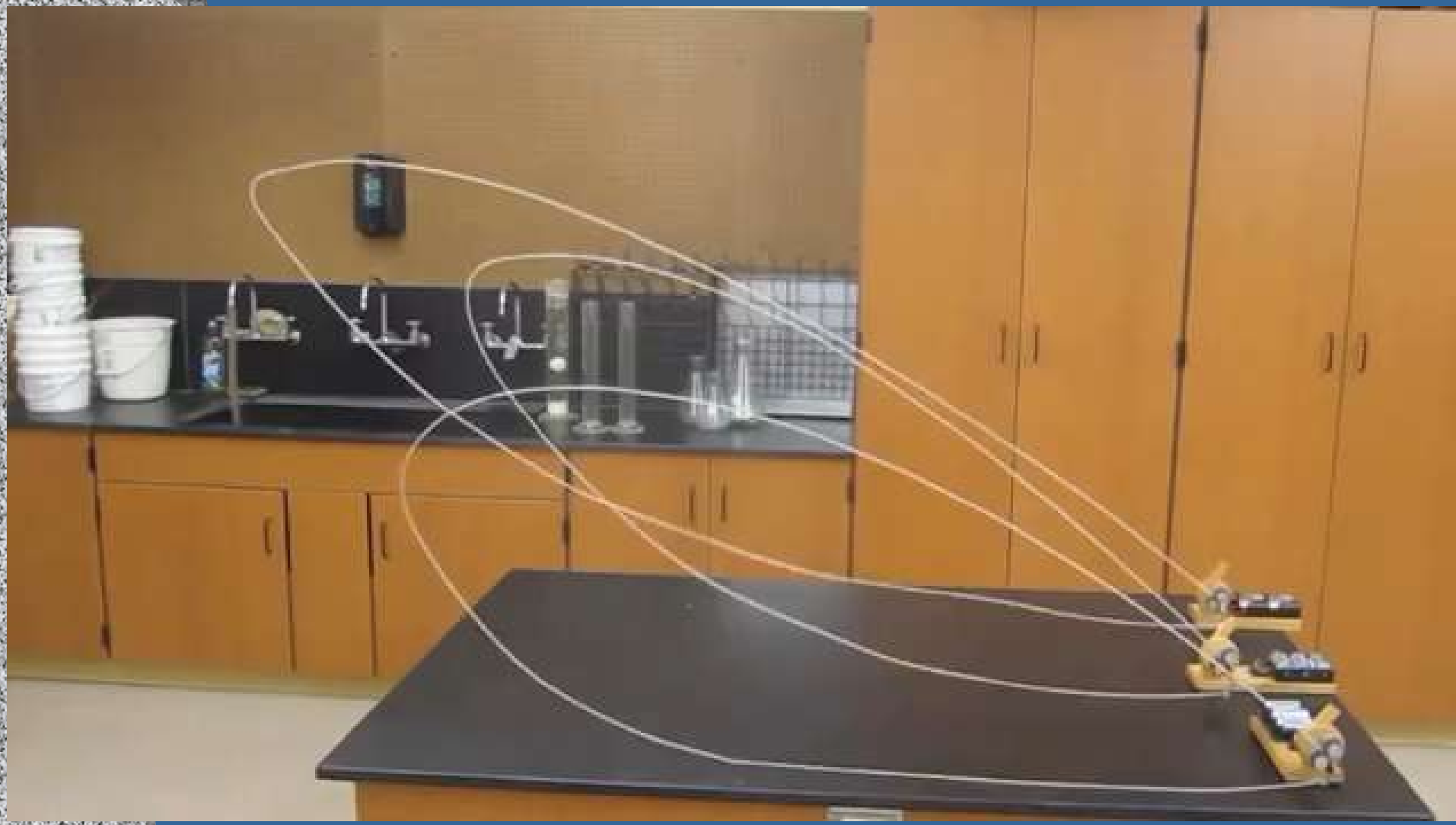
Penny Flip

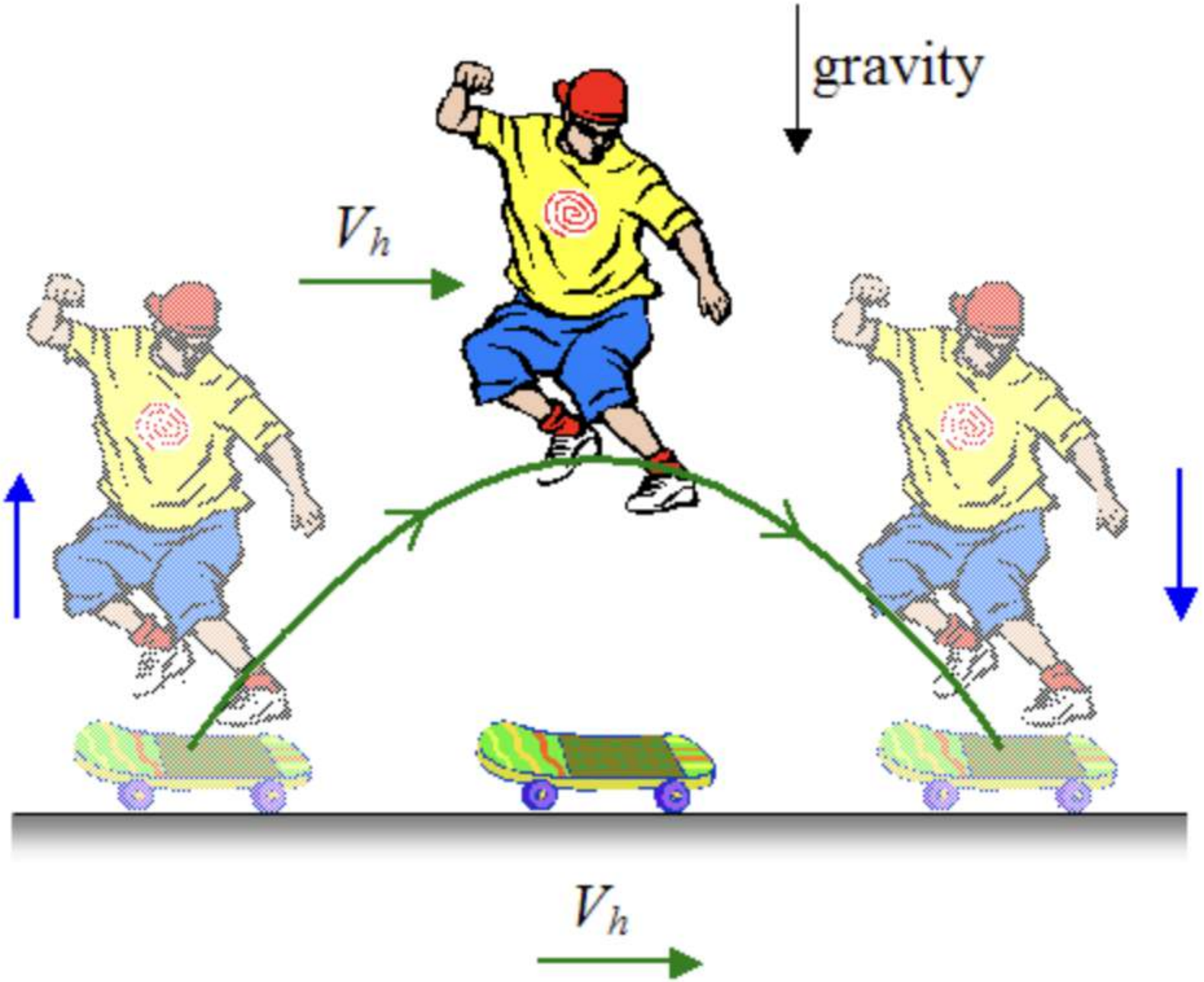


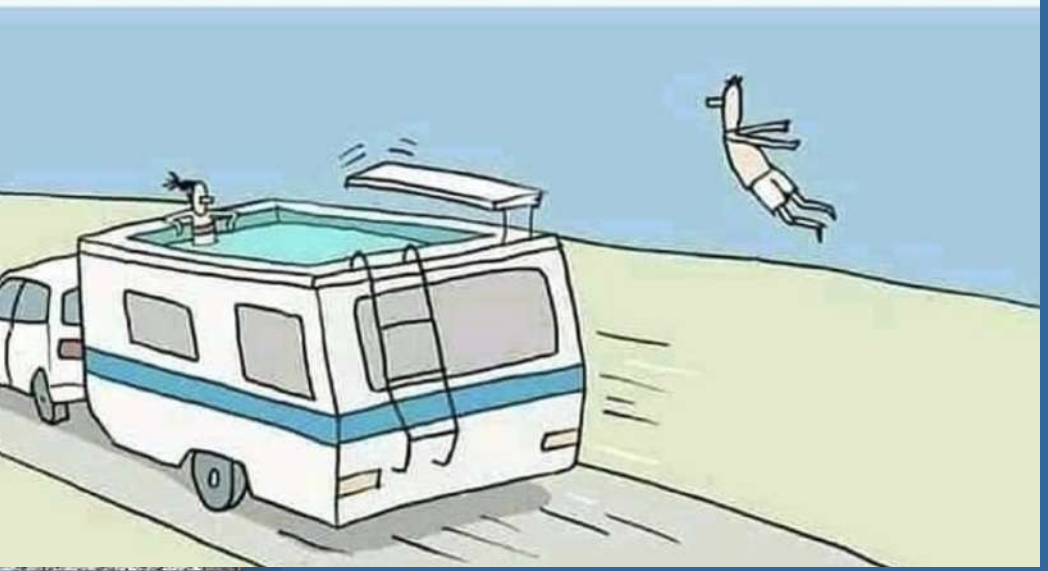
Jacob's Ladder

Metal Slinky Drop

Plastic Slinky Tricks




gravity
V_h
V_h



Would this really happen? Assume no wind.

Chapter 4-3

Newton's 2nd and 3rd Laws

Newton's 2nd Law

- Force = Mass x Acceleration
- F=ma

More Force = More Acceleration

- 8 cylinder Corvette versus a 4 cylinder Miata

More mass = Less acceleration

Train accelerates much slower than a car due to mass

A 200 kg object is pushed forward with a net force of 40 N. Calculate the acceleration of the object.

- ○ 0.2 m/s^2
- ○ 5 m/s^2
- ○ 0.2 m/s
- ○ 5 m/s

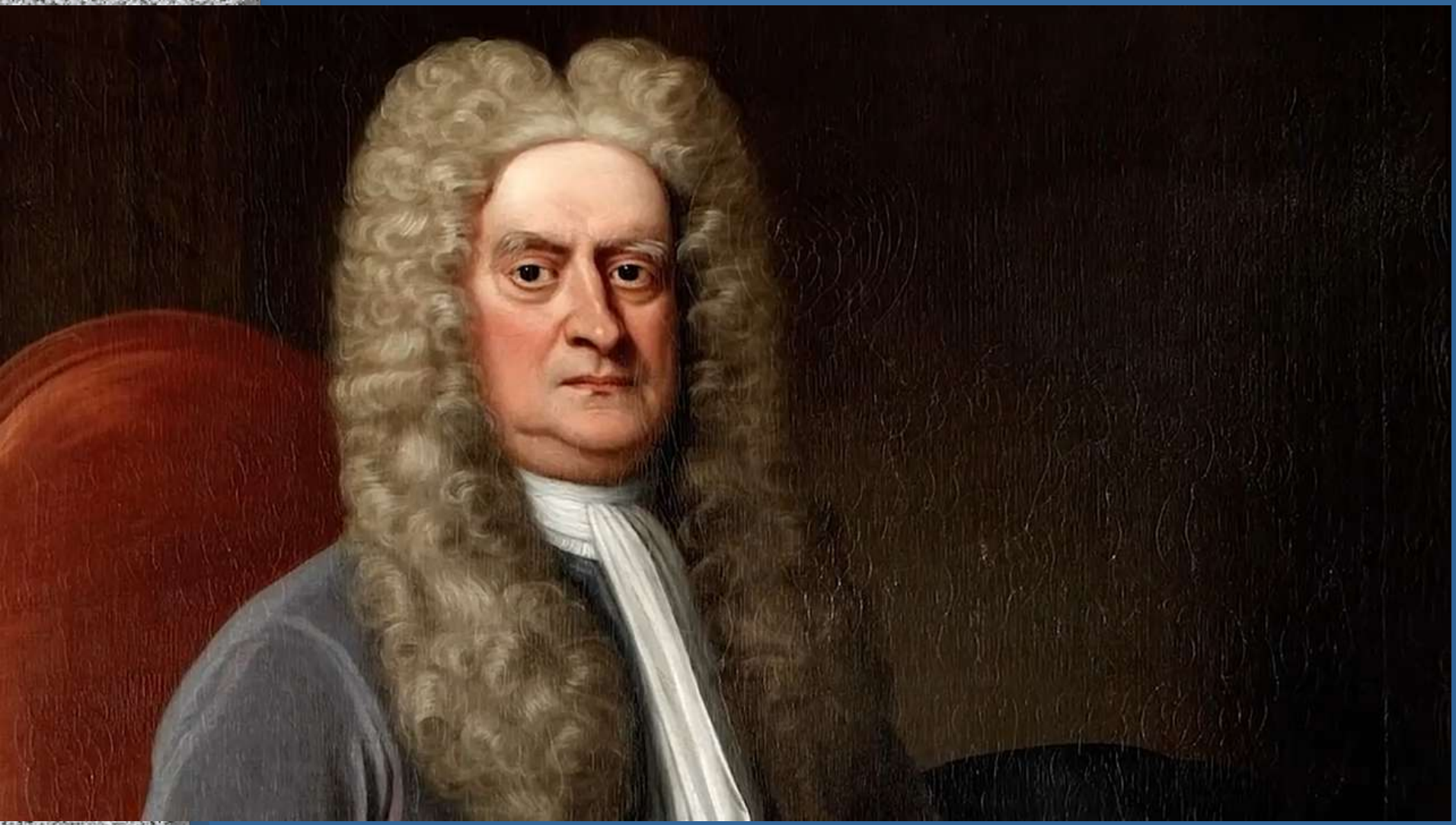
A 200 kg object is pushed forward with a net force of 40 N. Calculate the acceleration of the object.

- 0.2 m/s^2
- 5 m/s^2
- 0.2 m/s
- 5 m/s

Force = mass * acceleration

40 = 200 * acceleration

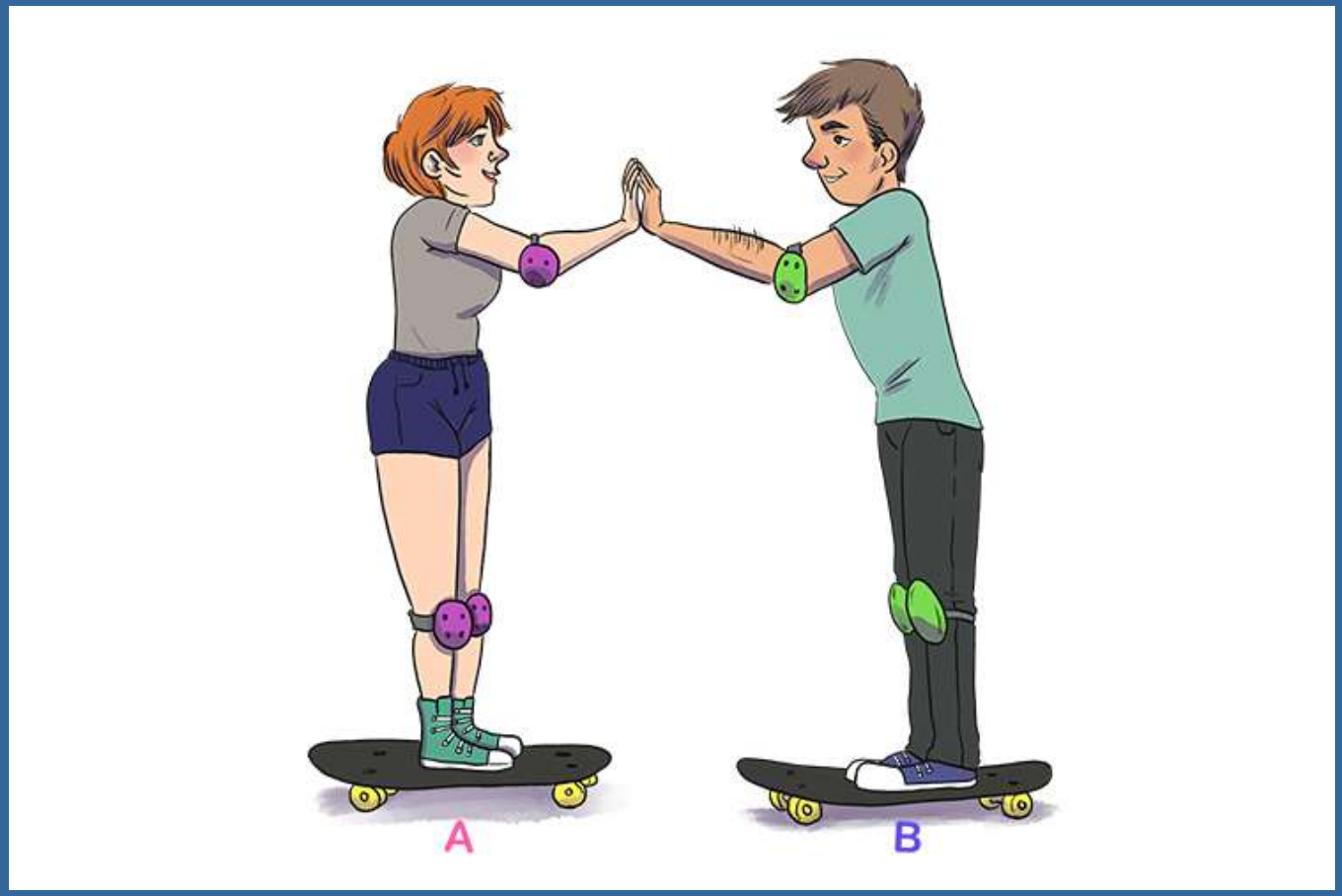
acceleration = 40/200 = .2 m/s^2



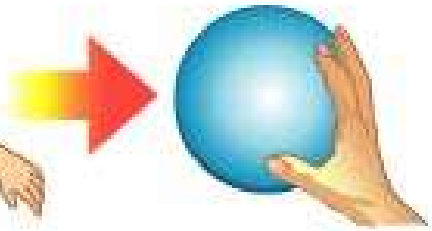
F=MA Demo

- Nerf Gun

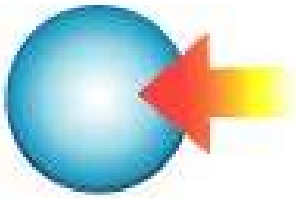
Frictionless Boards



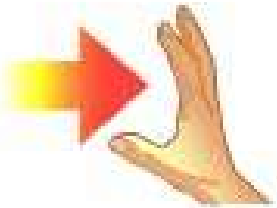
Newton's Third Law of Motion



When you throw a ball you create action and reaction forces.



Action force on ball



Reaction force on you

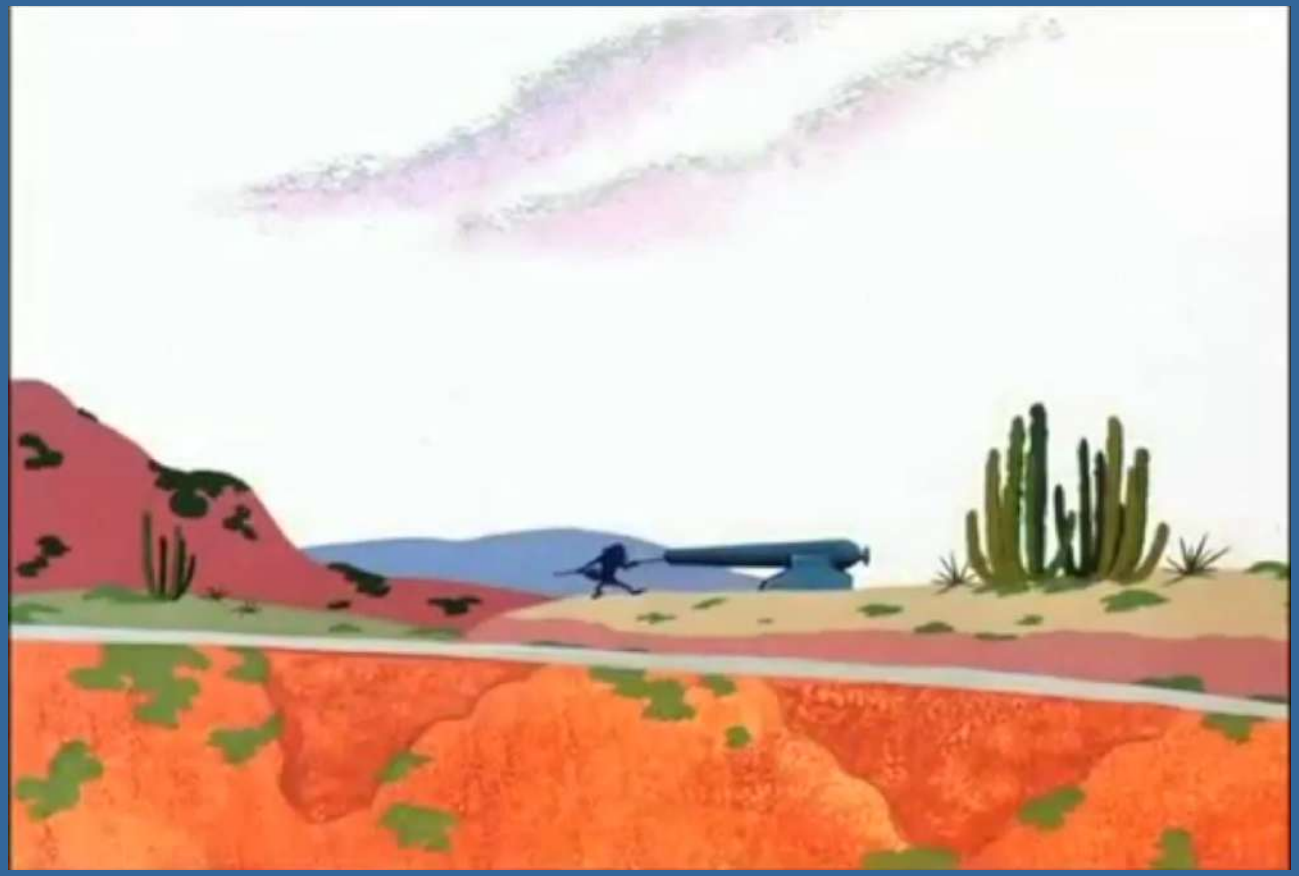
For every action force, there is a reaction force equal in strength and opposite in direction.

Newton's 3rd Law

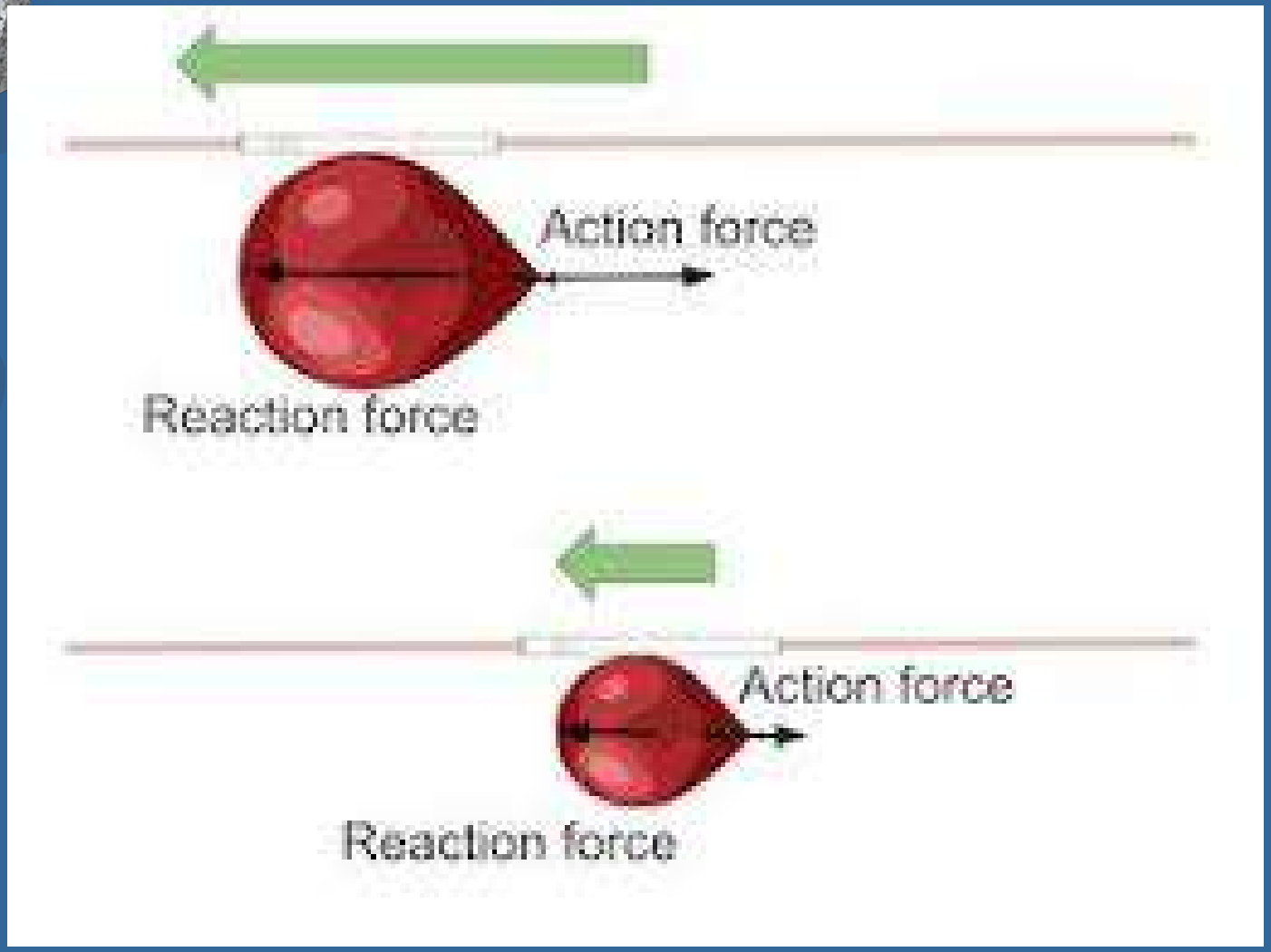
- Every action has an equal and opposite reaction.
- Forces always exist in pairs.


Flipping Physics

Is this possible?



Bottle and Alcohol



Balloons