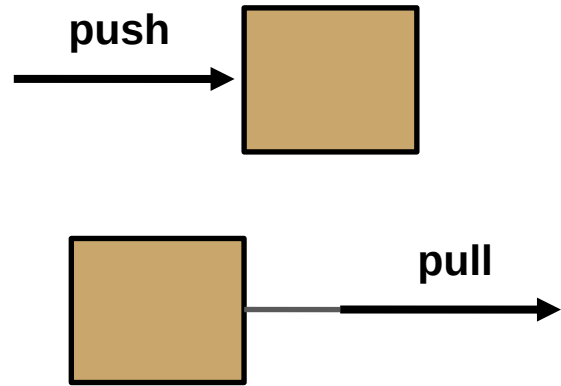


Essential Question

What pushes and pulls act on everyday objects?

What Is a Force?

- A push or a pull
- Has size and direction
- Measured in newtons (N)



1 N $\approx$ the weight of a small apple

Contact vs. Long-Range

- Contact: objects must touch
- Long-range: act across a gap
- Gravity works without touching

Contact

normal, friction, tension,
applied, air resistance, buoyant

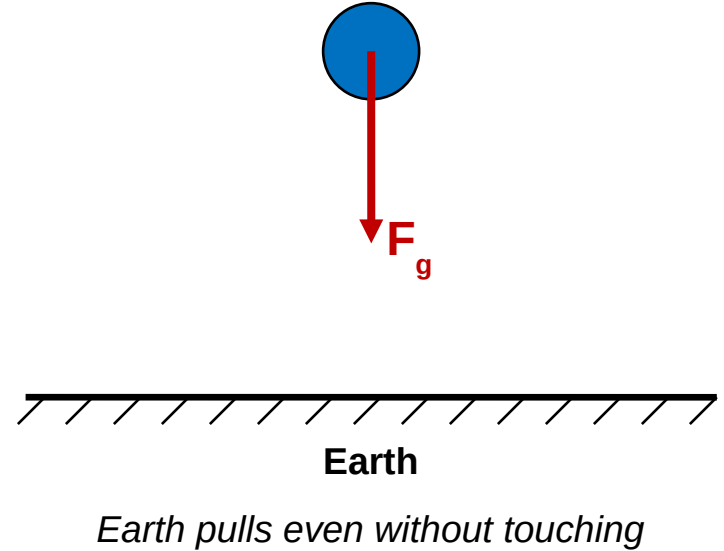
Long-Range

gravity, magnetic, electric

long-range forces don't need touching

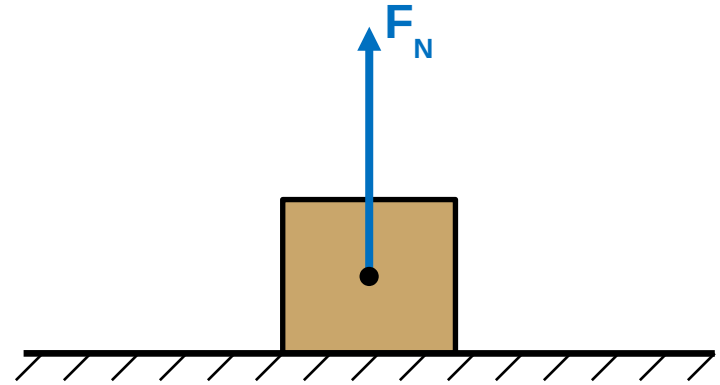
Gravitational Force

- Earth pulls objects toward it
- Also called weight
- Symbol: F_g



Normal Force

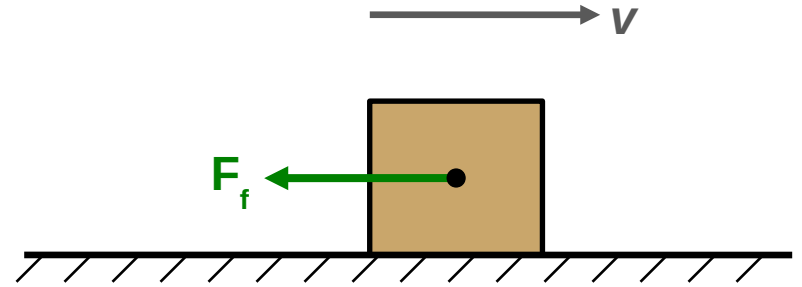
- A surface pushes on an object
- Perpendicular to the surface
- Symbol: F_N



normal means perpendicular

Friction

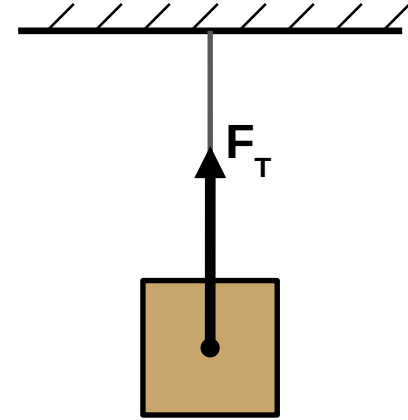
- Opposes sliding
- Parallel to the surface
- Symbol: F_f



friction points opposite the sliding

Tension

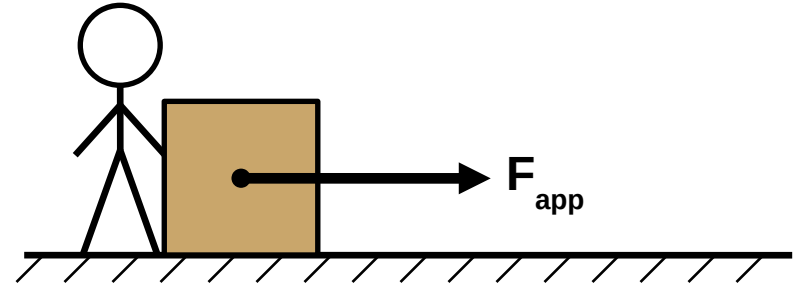
- A pull through a rope or cable
- Always pulls, never pushes
- Symbol: F_T



the rope pulls up on the block

Applied Force

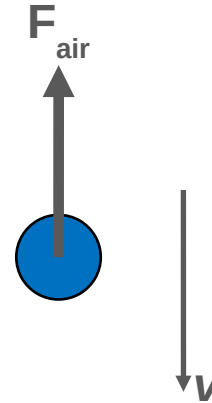
- A push or pull you apply
- A contact force
- Symbol: F_{app}



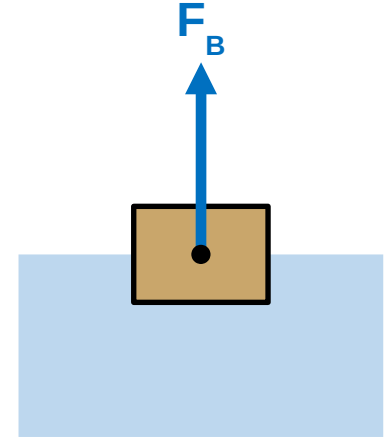
the hand pushes the box

Air Resistance and Buoyancy

- Air resistance opposes motion through air
- Buoyant force: a fluid pushes up
- Both are contact forces



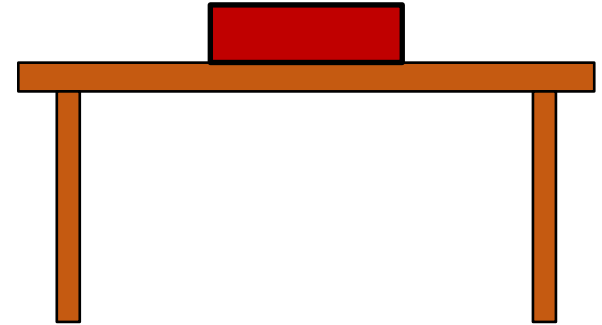
falling ball



floating block

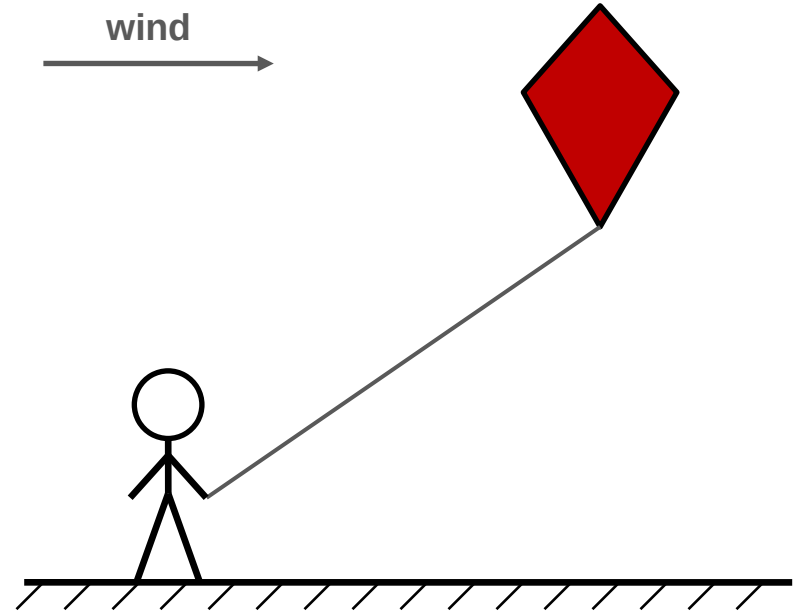
Example: Book on a Desk

A book rests on a desk. Name each force acting on the book, what exerts it, and its direction.



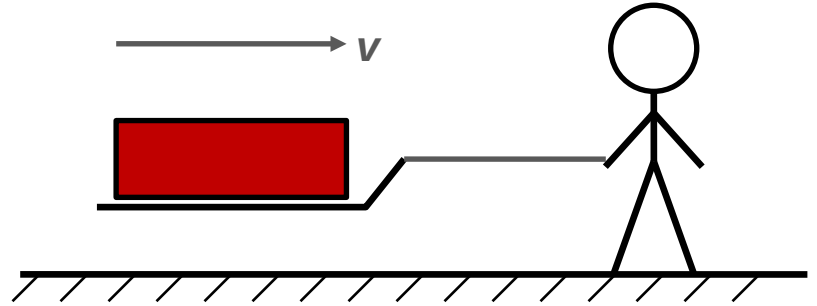
Example: Flying a Kite

A kite flies on a string on a windy day.
List the forces on the kite. Is each one
a contact force or a long-range force?



Example: Pulling a Sled

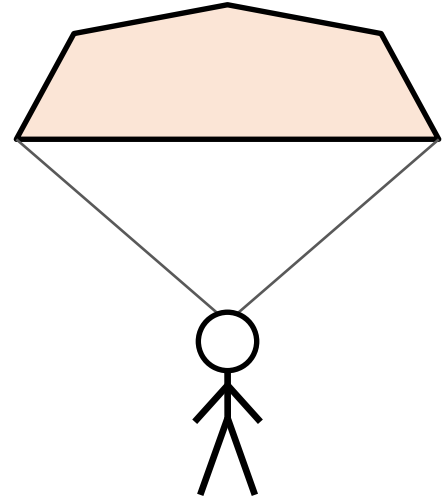
A child pulls a sled across flat snow with a horizontal rope. Name the four forces on the sled and the direction of each.



Example: Name That Force

Name the main force described in each case:

- (a) a parachute slowing a skydiver
- (b) a cable holding up an elevator
- (c) water holding up a boat



Big Ideas

- Force: a push or pull, measured in newtons (N)
- Contact forces need touching; long-range forces don't
- Contact: F_N , F_f , F_T , F_{app} , air, buoyant
- Long-range: gravity, F_g