

Forces

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Force

- ▶ A force is a push or pull on an object
- ▶ Abbreviated as F
- ▶ Measured in Newtons (N)
 - $1\text{ N} = 1\text{ kg} \cdot \text{m}/\text{s}^2$
 - Force is a vector
 - Vectors have *Magnitude & Direction*

Types of Forces

- ▶ **Contact Forces**
 - Acts on an object only by touching it.
- ▶ **Action-at-a-Distance Forces**
 - Field Forces
 - Act on an object without touching it.

All forces have an “agent” – an immediate, specific, identifiable cause of the force! When the cause goes away, the force stops.

Contact Force Examples

- ▶ Force =
- ▶ Normal Force (or support force) =
- ▶ Applied Force (AKA Thrust) =
- ▶ Friction (contact) =
- ▶ Air Resistance =
- ▶ Tension (rope) =
- ▶ Spring (rope) =

At-A-Distance Force Examples

- ▶ Gravity (Gravitational Force) =
- ▶ Electrical Force =
- ▶ Magnetism (Magnetic Force) =

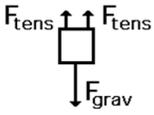
Drawing Forces

- ▶ Remember that forces are a vector and they have magnitude and direction.
- ▶ A book is at rest on a tabletop. Diagram the forces acting on the book.



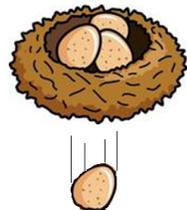
Drawing Forces

- A girl is suspended motionless from the ceiling by two ropes. Diagram this.

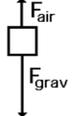
Drawing Forces

- An egg is free-falling from a nest in a tree. Neglect air resistance.



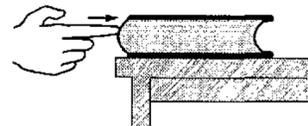
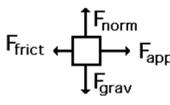

Drawing Forces

- A squirrel is jumping (no wing flaps) from a high tree branch to a lower tree branch at constant velocity. Consider air resistance.

Drawing Forces

- A rightward force is applied to a book in order to move it across a desk with a rightward acceleration. Consider frictional forces & neglect air resistance.

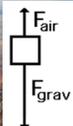
Drawing Forces

- A student rests a backpack upon her shoulder. The pack is suspended motionless by one strap from one shoulder.



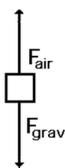

Drawing Forces

- A skydiver is descending and accelerating due to gravity (he has not opened his parachute). Consider air resistance.

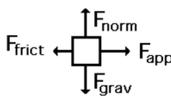
Drawing Forces

- A skydiver is descending with a constant velocity (after parachute is open). Consider air resistance.

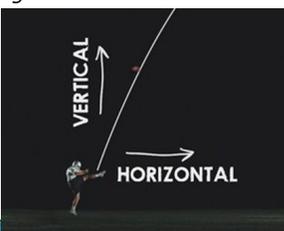
Drawing Forces

- A force is applied to the right to drag a sled across loosely packed snow with a rightward acceleration. Ignore air resistance.

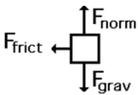
Drawing Forces

- A football is moving upwards towards its peak after having been kicked by the punter. Ignore air resistance.

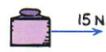
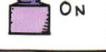



Drawing Forces

- A car is coasting to the right and slowing down. (Driver is not using brakes).

Net Force

APPLIED FORCES	NET FORCE
	
	
	

- Net Force** - The combination (or sum) of all forces that act on an object.
- An overall net force results in **acceleration**.
- Changes in force cause changes in motion.

Free Body Diagrams

- A drawing that identifies all the forces acting on an object. **OBJECT IS DRAWN AS A BOX**
 - Used to predict the motion of objects
- Draw all forces as vectors.
- Start at the center of the object you are focusing on.
- Label each force - remember that forces are vectors, and arrows should be drawn to appropriate length.

