Ramps 1

Ramps

Ramps 2

Question:

Can a ball ever push downward on a table with a force greater than the ball's weight?

Ramps 3

Observations About Ramps

- Lifting an object straight up is often difficult
- Pushing the object up a ramp is usually easier
- The ease depends on the ramp's steepness
- Shallow ramps require only gentle pushes
- You seem to get something for nothing
- How does distance figure into the picture?

Ramps 4

Type of Force

- Support force
  - Prevents something from penetrating surface
  - Points directly away from that surface

Ramps 5

Physics Concept

- Net Force
  - The sum of all forces on an object.
  - Determines object's acceleration.

Ramps 6

Newton's Third Law

For every force that one object exerts on a second object, there is an equal but oppositely directed force that the second object exerts on the first object.

Ramps 7

Experiment:

If you push on a friend who is moving away from you, how will the force you exert on your friend compare to the force your friend exerts on you?

1. You push harder
2. Your friend pushes harder
3. The forces are equal in magnitude

Ramps 8

Forces Present Part 1:

1. On ball due to gravity (its weight)
2. On ball due to support from table
3. On table due to support from ball

All three forces have the same magnitude for the stationary ball

Ramps 9

Forces Present Part 2:

1. On ball due to gravity (its weight)
2. On ball due to support from table
3. On table due to support from ball

Pair

Ramps 10

Forces Present Part 3:

1. On earth due to gravity from the ball
2. On ball due to gravity from the earth

Pair

3. On ball due to support from table
4. On table due to support from ball

Pair

- Since the ball doesn't accelerate, 2 and 3 must cancel perfectly

Ramps 11

Question:

Can a ball ever push downward on a table with a force greater than the ball's weight?

Ramps 12

Two Crucial Notes:

- While the forces two objects exert on one another must be equal and opposite, the net force on each object can be anything.
- Each force within an equal-but-opposite pair is exerted on a different object, so they don't cancel directly.

Ramps 13

Physical Quantities

- Energy
  - A conserved quantity
  - The capacity to do work
- Work
  - The mechanical means of transferring energy
  - work = force · distance
    (where force and distance in same direction)

Ramps 14

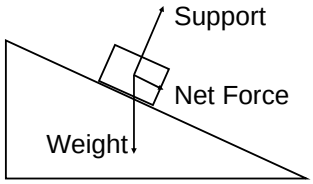
Work Lifting a Ball, Part 1

- Going straight up:
  - Force is large
  - Distance is small

work = force · distance

Ramps 15

Forces on a Ramp



Ramps 16

Work Lifting a Ball, Part 2

- Going up ramp:
  - Force is small
  - Distance is large

work = force · distance

Ramps 17

Work Lifting a Ball, Part 3

- Going straight up:

  work = force · distance
- Going up ramp:

  work = force · distance
- The work is the same, either way!

Ramps 18

Physics Concept

- Mechanical Advantage
  - Doing the same amount of work
  - Redistributing force and distance

Summary about Ramps

- Ramp partially supports object's weight
- Ramp exchanges force for distance
- Overall work done is unchanged