

STEM Workshop: Physics

Lesson 7: Buildings and Architectural Design

Brought to you by the University of Maryland Balloon
Payload Program!

What is a Force?

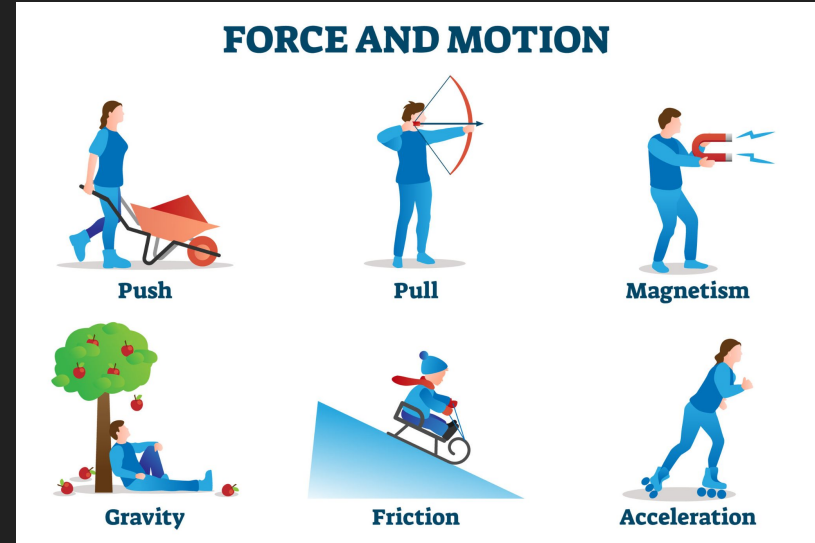
The push or pull on an object which causes it to change its speed.

Types of forces

- Gravity
- The wind
- Your muscles

How do you find force?

Force = Mass x Acceleration



What about forces on things that aren't moving?

Isaac Newton vs. Forces

Newton's 3rd Law: Every force has an equal and opposite force!

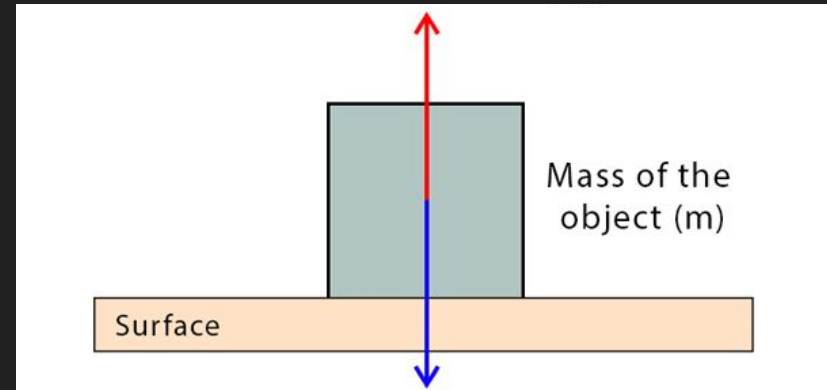


Even when you're not moving, there's still force!

So what about forces that don't cause motion?

They are being resisted by the opposite force!

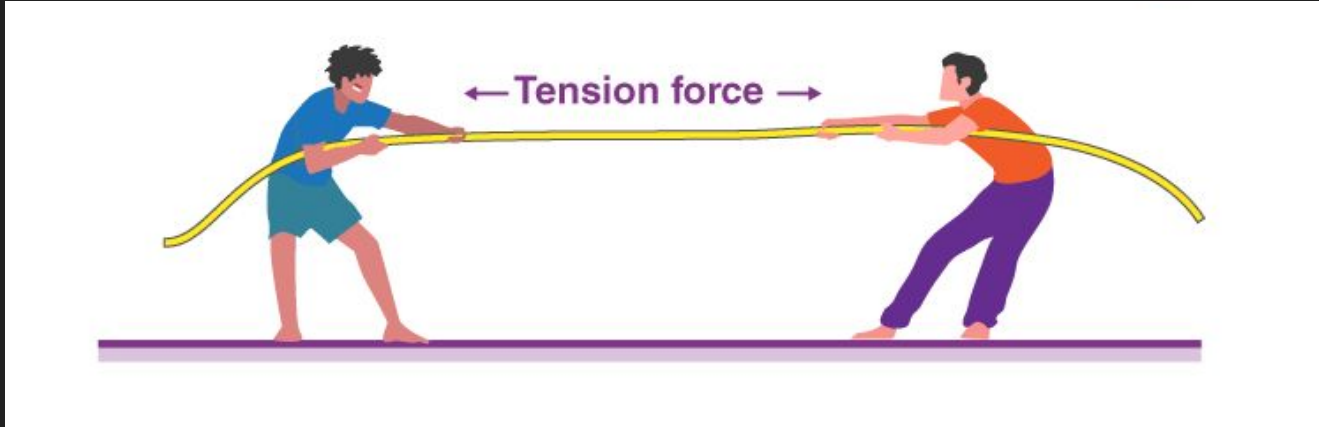
Forces **only** move things when the opposite force is unequal



Tension

A type of force that's trying to **pull things apart**

- Tension can cause stretching or breaking



Compression

A type of force that's trying to **push things together**.

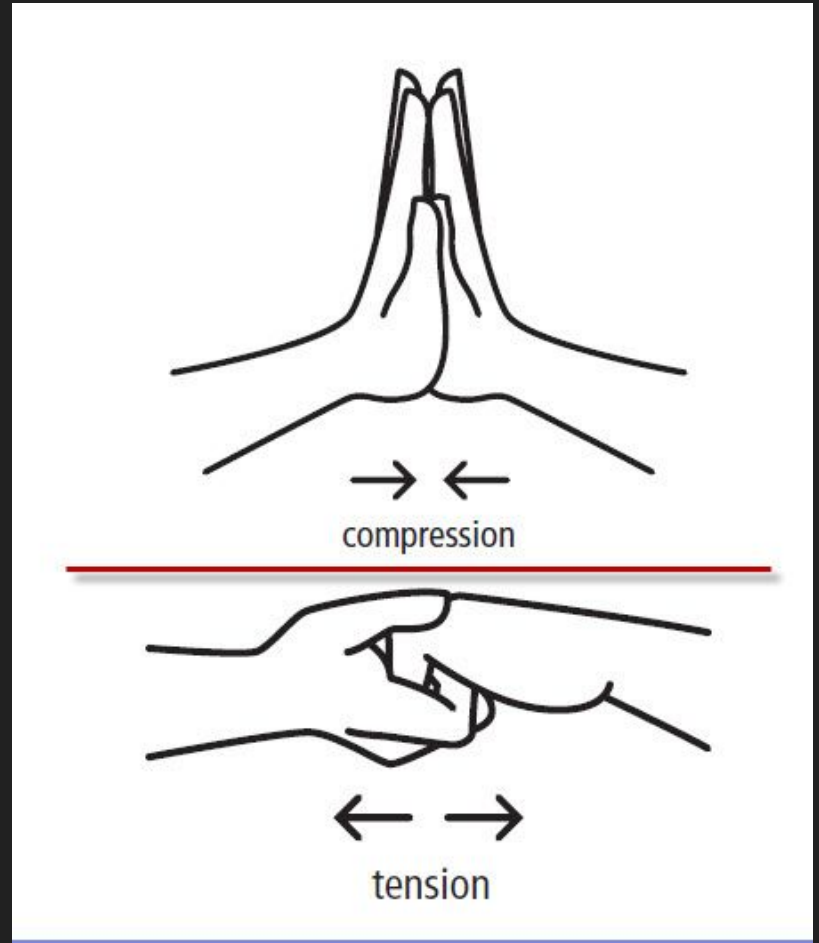
- Think of squishing something between your hands, you're compressing it!



Combinations of Forces

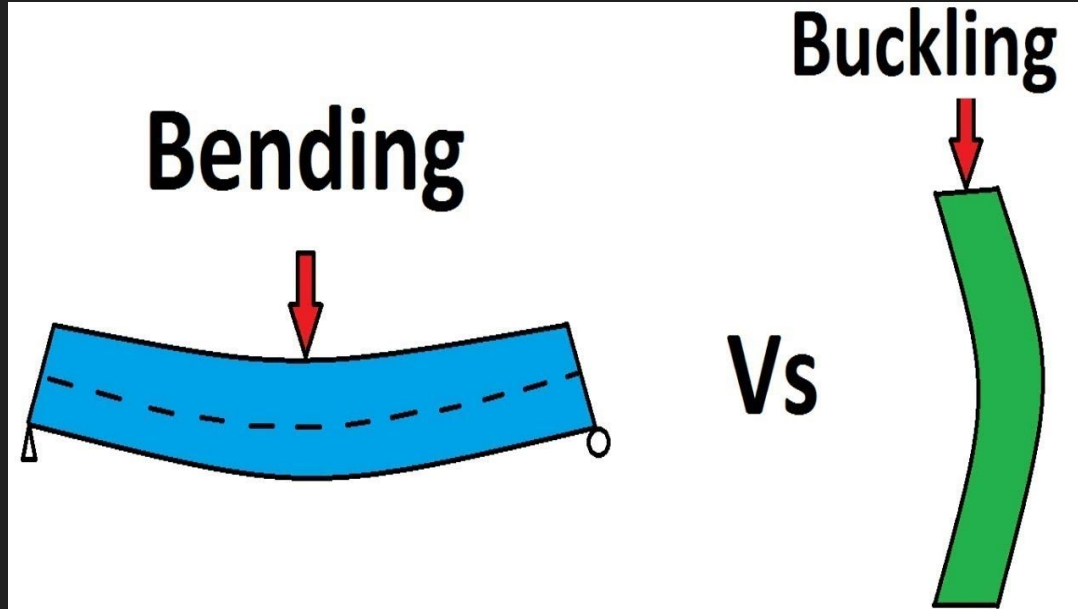
Multiple types of forces can happen at the same time!

What happens when you do that, though?



Bending & Buckling

Let's do some spaghetti experiments...



Internal Forces

Think about how some forces may act on an object:

If I put one apple in a paper bag, will it rip?

What about 50 apples? 100?

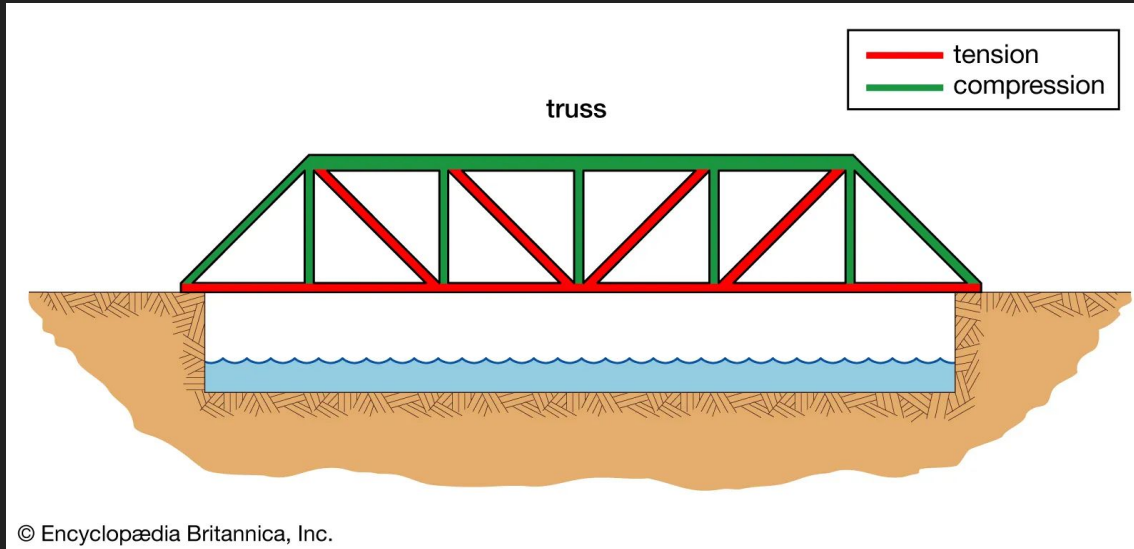


At some point, the weight of the apples will rip the bag

Trusses

A skeleton-like structure composed of short straight pieces.

Think of a bridge!

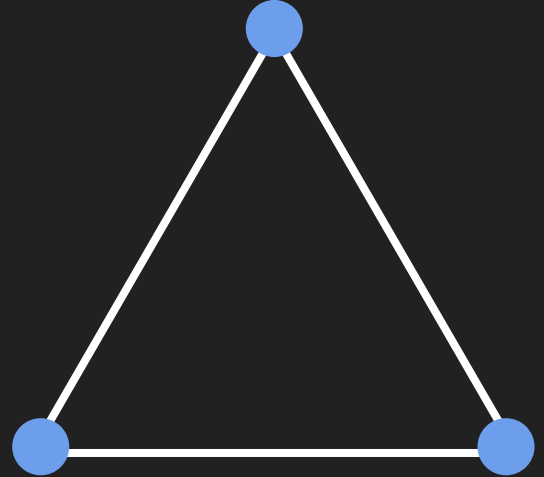
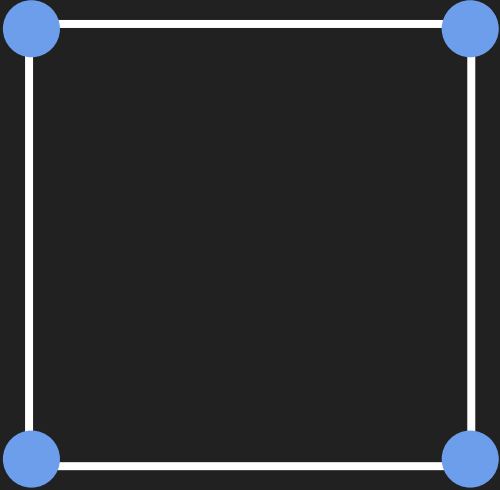


What do we notice about most trusses?



How strong are different shapes?

Let's test out a few:



Building Stability

Which of these is more likely to fall over?
(Hint: They are almost the same height)



One more thing: Frequencies

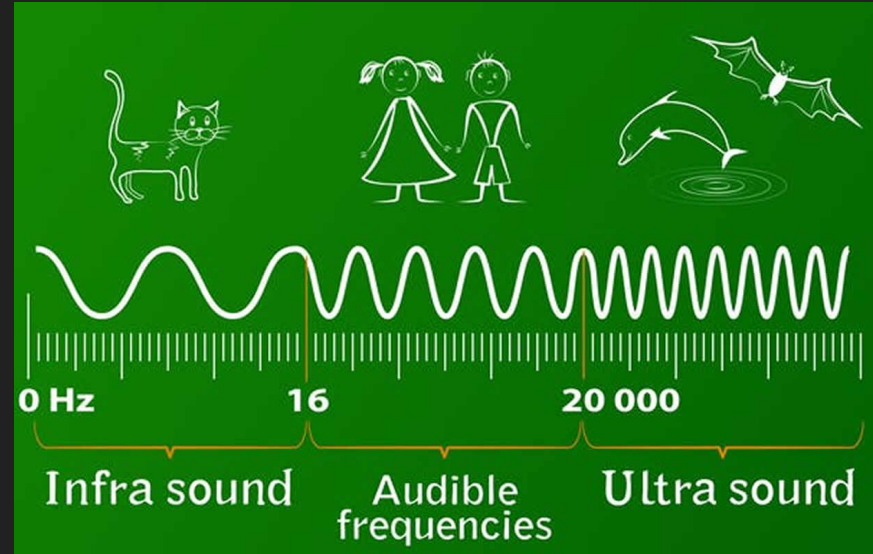
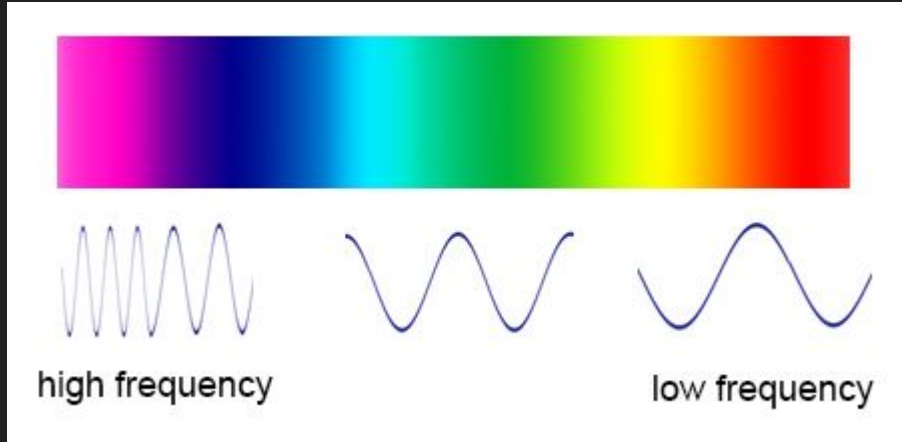
What is a **frequency**?

What is a **resonant frequency**?

How does frequency mess with things?



More Examples of Frequencies



What happens if a building has a bad Resonant Frequency?

The wind can mess things up!

Everything has a resonant frequency...



Here's a building swaying in the wind:





Workshop

Split into groups of 3-4

You'll get some marshmallows and some spaghetti

Try and make a tower as tall as possible

Think about trusses!

