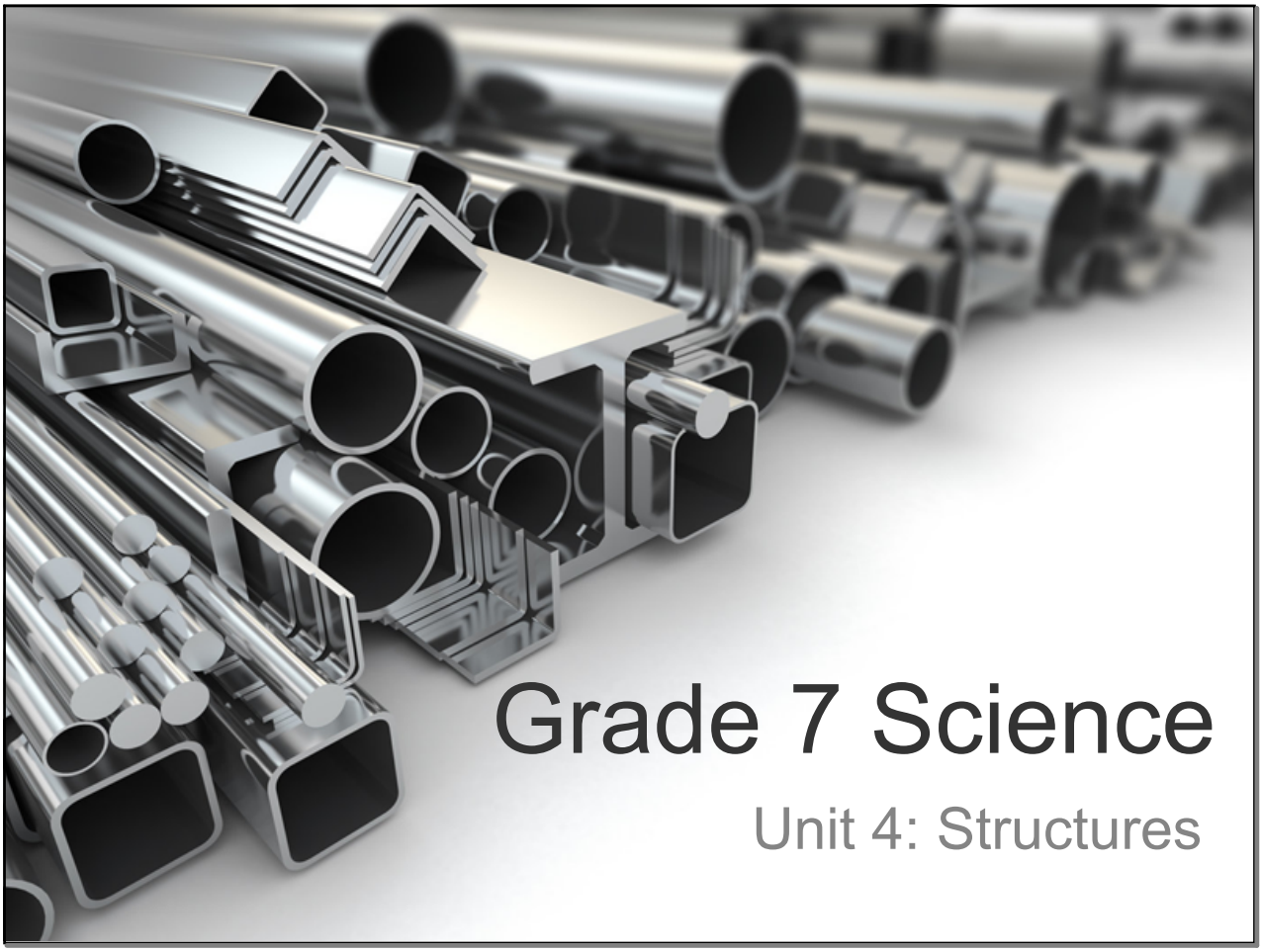


Grade 7 Science

Unit 4: Structures

Forces

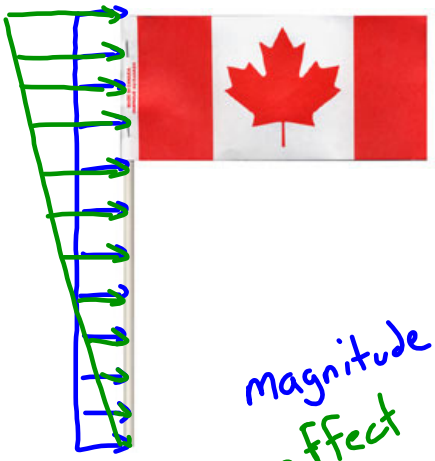
Why is it important that we, as a human race, study forces?

- We need to understand failure, and learn how to prevent it.
- If one part of a structure breaks, due to a force, the whole thing may fail.
- Small forces can cause a lot of damage if not prepared for.

How can a small force cause big time damage? (nail example)

Amplified Forces

When a small force is "amplified" it can affect large structures as well. Take a look at the flag pole.



What would be the affect of wind on this flag pole?
- move
- bend
- sway

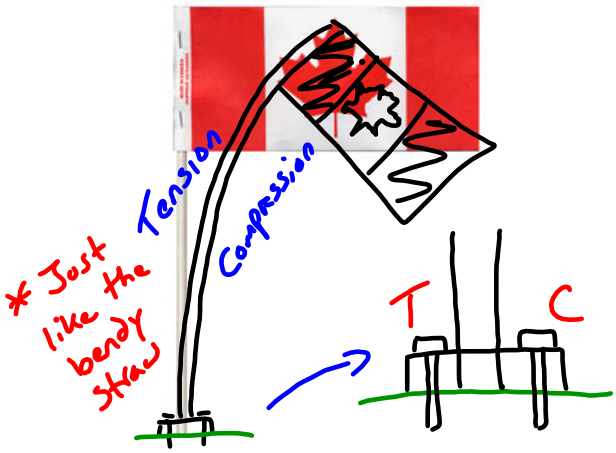
Where would the wind "hit" the pole?
- all over one side

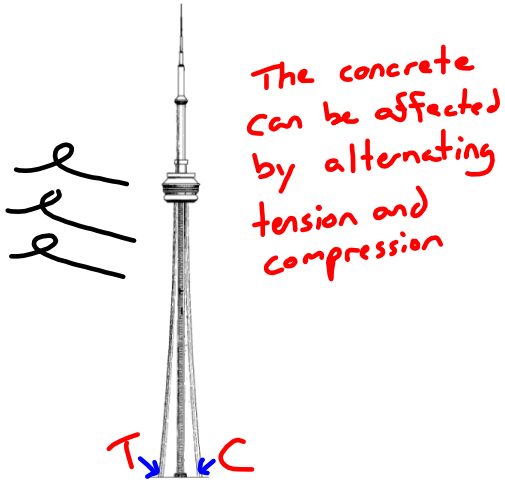
What would affect the pole more, a force at the top, or a force at the bottom?
TOP

Let's see what this would look like...

I need a volunteer.

Amplified Forces





When we compare this to a building, we can see how forces on the side of the building may affect the stability of the foundation.

Types of Failure

There are four types of forces, and each type causes its own failure mode:

Tension	When a material is pulled from either end it will elongate, and eventually it will "**snap**," meaning the material breaks into two pieces.
Compression	When a material is pushed together from opposite sides there are two possible outcomes. 1) The material can bend, or "**buckle**" under the force. 2) The material will shift, or "**shear**," where different parts move in different directions.
Torsion	Twisting the ends of a material in opposite directions will eventually cause the material to shift passed itself, meaning the failure method is similar to a compression failure, in this case it is known as "**twist**."
Shear	Pushing different parts of material in different directions results in a failure known as "**shear**."

Shear Failure

So, what does it look like when compression causes a shear failure?