Wednesday Reading Assessment: Unit 5, Forces

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1 Memory Bank

- Stress versus strain relationship: $stress = Y \times strain$

- Stress (pressure) is defined like: $stress = F/A$, where F is applied force, and A is cross-sectional area.

- Strain (fractional change in length) is defined like: $\Delta L/L_0$, where L_0 is the original length of a system, and ΔL is the change in length.

- Putting it all together: $F/A = Y(\Delta L/L_0)$

Material	Young's modulus (tension–compression)Y (10^9 N/m^2)	Shear modulus S (10^9 N/m^2)	Bulk modulus B (10^9 N/m^2)
Aluminum	70	25	75
Bone – tension	16	80	8
Bone – compression	9		
Brass	90	35	75
Brick	15		
Concrete	20		
Glass	70	20	30
Silk	6		
Spider thread	3		
Steel	210	80	130

Figure 1: (Left) A table of Young's moduli, shear moduli, and bulk moduli. (Right) A diagram of stress and strain on a rod of cross-sectional area A and original length L_0.

2 Chapter 5 - Stress and Strain

1. Steel suspension cables are used to carry gondolas at ski resorts. Find the Young's Modulus of steel in Figure 1. Consider a suspension cable that (unstretched) has a length of 2 km. Calculate the ΔL in the steel cable, assuming that the cable has a diameter of 6 cm and the tension is 4.0×10^6 N.

2. What would the ΔL be if the original length was 3 km? (*Hint: you can redo the problem with this new number, or just use scaling.*