Forces
-A force is a push or a pull

-The SI unit of force is the ____________. It has units of N = ________.

-Draw 2 forces acting on the block below:

Newton 2
-Newton's 2nd Law states that force equals mass times acceleration, or, F=ma

-The SI unit of force is ________________.

-The SI unit of mass is ________________.

-The SI unit of acceleration is ____________.

On Earth, the value of acceleration due to gravity is ___________ m/s²

A natural form of Newton 2 is the formula for weight: Weight = (mass)(acc. due to gravity), or, W=mg

Example -Use Newton 2 to calculate your mass

\[ F=ma \quad \quad 1 \text{ lb} = 4.45 \text{ N} \]
\[ W=mg \]

1) Convert your weight in lb to N
2) Solve $W=mg$ for $m$

$$m = \frac{W}{g}$$

3) Plug in the values and solve

My mass is ________kg. This value is the same regardless of what planet you're on!

Example - Use Newton 2 to calculate your weight on Mars

\[
W = mg \\
m = \frac{W}{g_M}
\]

My weight is __________N. This value would change if you traveled to the moon!

2) Convert your weight in N to lb
Stress

-Stress is a measure of force divided by the cross-sectional area that the force acts on.
-Stress = Force/Area
-The Greek letter sigma (σ) is used to represent stress

-The SI unit of force is ________________.

-The SI unit of Area is ________________.

-The SI unit of stress is ______ = Pascals (Pa)

Example - Find the stress acting in the cylinder

\[ \text{stress} = \frac{\text{Force}}{\text{Area}} \]
\[ \sigma = \frac{F}{A} \]

\[ F = \underline{\underline{\ldots}} \]

\[ A = \underline{\underline{\ldots}} \]

\[ \sigma = \frac{F}{A} = \underline{\underline{\ldots}} \]
Strain

- Strain is a measure how much a material elongates under an applied force.
- Strain = (L_f - L_i)/L_i
- The Greek letter sigma (ε) is used to represent strain

- The SI unit of length is _______________.
- The SI unit of strain is _______________.

**Example** - Find the strain in the block

\[ \text{strain} = \frac{(L_f - L_i)}{L_i} \]
\[ \varepsilon = \frac{(L_f - L_i)}{L_i} \]

\[ L_i = \text{__________}. \]
\[ L_f = \text{__________}. \]
\[ \varepsilon = \text{__________}. \]
Stress vs. Strain Curves and Young's Modulus

- For nearly all materials, we can measure stress and strain in the same sample and plot the results.
- If we calculate the slope of the line of the plot of stress vs. strain, we can find an important material parameter called _______ ________.
- Young’s Modulus is a measure of material stiffness
Example - Identify the stiffest material.

How do you know this material is the stiffest?