Name: _____ Date: _____

Young's Modulus Practice Problems Answer Key

1. **A patient's leg was put into traction, stretching the femur from a length of 0.46 m to 0.461 m. The femur has a diameter of 3.05 cm. With the knowledge that bone has a Young's modulus of ~ 1.6 × 10^{10} in tension, what force was used to stretch the femur?**

   F*= *Y* ($\Delta L/L_0$)*A

   ***Y*= 1.6 x 10^{10} Pa = 16000000000 Pa (given)**

   L_0 = 0.46m (given)

   ΔL = 0.001 m (obtained from .461 m - .46 m – the given amount of "stretch")

   ***A* = πr^2 = 3.14 $(1.525)^2$ = 7.30 cm^2 = 0.00073 m^2 (obtained from given diameter of 3.05 cm)**

   Now, using the equation above:

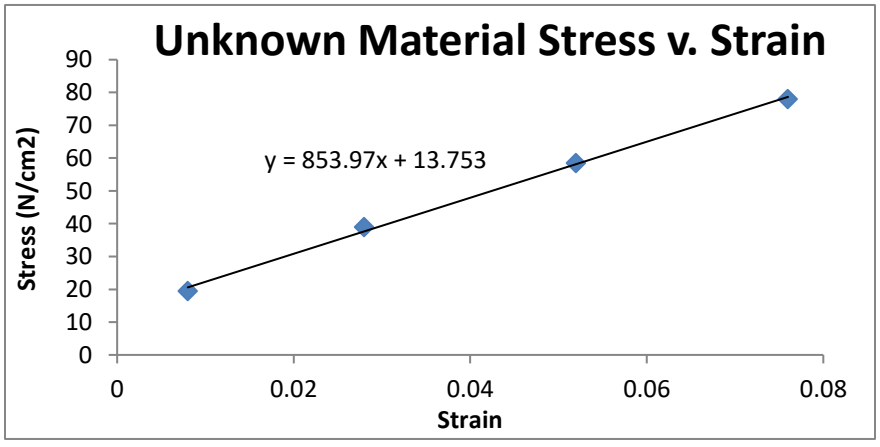
   ***F* = 16000000000 x (.001/0.46) x 0.00073**

   ***F* = 25,391.30 N**

2. **Using the following information on stress and strain, plot a graph in Excel to determine the Young's modulus for an unknown material. The radius of the material is 4 cm.**

   Cross-sectional area = *A*= πr^2 = 50.24 cm^2

Initial Length (cm)	Final Length (cm)	Change in Length – ΔL (cm)	Strain ($\Delta L/L_0$)	Mass (g)	Force (N)	Stress (N/cm^2)
25	25.2	0.2	0.008	100	980	19.50637
25	25.7	0.7	0.028	200	1960	39.01274
25	26.3	1.3	0.052	300	2940	58.51911
25	26.9	1.9	0.076	400	3920	78.02548



Young's modulus = 8.54 x 10^6 Pa