Name (print) ------------------------------ ---------- Section:-----------

Instructor Signature -------------------------- -------------

After you have completed each part of this lab, ask one of the instructors to check it and then sign above. Your assignment will not be accepted without the signature of an instructor.

Problem 3.S41: Measure Youngs modulus of a wire

3.S41. Measure and graph the strain versus stress curve for a long metal wire by hanging weights from the end of the wire and carefully measuring the stretch as a function of the hanging weight. Using your measurements, and any other measurements that you might need, determine what the Young's modulus is for the material in the wire. At some point, you will add sufficient weight to the wire that it will reach its *yield point.* You will observe a sudden large increase in the length of the wire. Record the force needed to reach the yield point of the wire.

The Young's modulus, Y is defined as the stress divided by the strain. The stress is the force per unit area pulling on the material, and the strain is its fractional change in length. If a force F pulls on a wire of cross-sectional area A and length L, then the length will increase by ΔL. The Young's modulus is

$$Y = \frac{(F/a)}{(\Delta L/l)}.$$

Add mass in small increments until you observe a sudden large stretching. Plot your data as you go along on a neat, labeled graph on a separate page, showing strain vs. stress.

Mass (kg)	Scale Reading (mm)	Stretch (mm)	Strain (N/m^2)	Stress	Stress/Strain

Problem 3.S42: Observations of a spring-mass oscillator

3.S42. (a) Using a spring and a number of known masses, measure the spring constant k of the spring. (b) Place two springs end-to-end and measure the effective spring constant. How does it compare to the individual spring constants? (c) Return to your single spring. Measure the period of oscillation of the mass-spring system for several different masses. Plot your results of period versus mass. (d) For one fixed mass, measure the period of your mass-spring system for several different values of amplitude.

Mass (kg)	Force (N)	Total Length (mm)	Stretch (mm)	Spring Constant

Mass (kg)	Amplitude (mm)	Period (s)

2