

Please answer at least 3 of the following 4 problems. Written answers (no typing necessary) are due at the end of the class period. If you like, you may work in groups of 2 people.

1. One of the most important (and least appreciated) functions of a city government is the creation and enforcement of a building code. Without a standard code, people would be at the mercy of possibly unscrupulous construction contractors who might cut corners in terms of safety to reduce costs.

An example of this code is regulations on where and how holes can be bored in the joists that hold up the floors of a house. Figure 1 shows examples of safe, and unsafe holes drilled into two joists. Why are these holes are comparatively safe or dangerous?

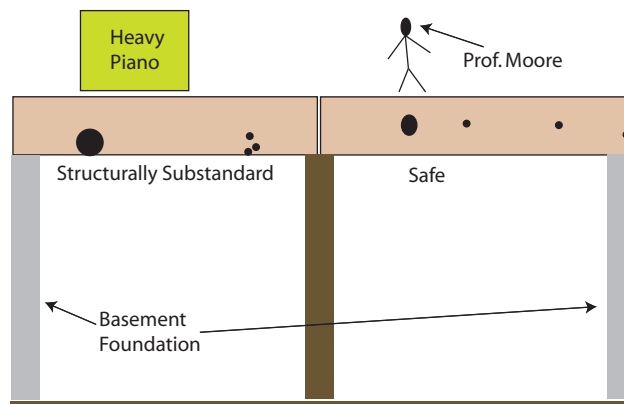


Figure 1: This not-to-scale model of a house shows safe and unsafe examples of holes that can be bored in floor joists.

2. One of your friends, who is majoring in sculpture at WSU, wants to make a sculpture that swings back and forth with a tunable frequency, essentially a grandfather clock that keeps variable time. After hearing about the work you've done lately in this class, he asks you for your help in designing the sculpture.

The specific question he has is how to design a clock pendulum which has variable oscillation time, ie, a person can make the clock cycle every 2 seconds, 3 seconds, 10 seconds, etc. To make your advice useful, provide a detailed description of how the clock should be configured if it is to give a clock cycle time of "T" seconds.

3. If you put 6 pennies in a closed film container and the drop the contained in water, how will you know when the film container reaches its equilibrium position?

If you want to add pennies to see how the equilibrium state of the canister changes, what variable or coordinate will you use to describe the equilibrium? (Be sure to explain why your choice is a good one!)

What forces create this equilibrium? How do you know that these forces are the ones creating the equilibrium (ie what experimental test could you perform to show that they're the relevant ones)?

If you dropped the film container in corn oil rather than water, how would the equilibrium position compare to that of the film container in water?

4. One day last year in Physics 221 I brought in a pair of running shorts (size large) and suspended them from a horizontal bar. I attached a mass hanger to the bottom of the shorts and measured the extension of the waistband as the suspended mass changed. The results of that measurement are shown in figure 2.

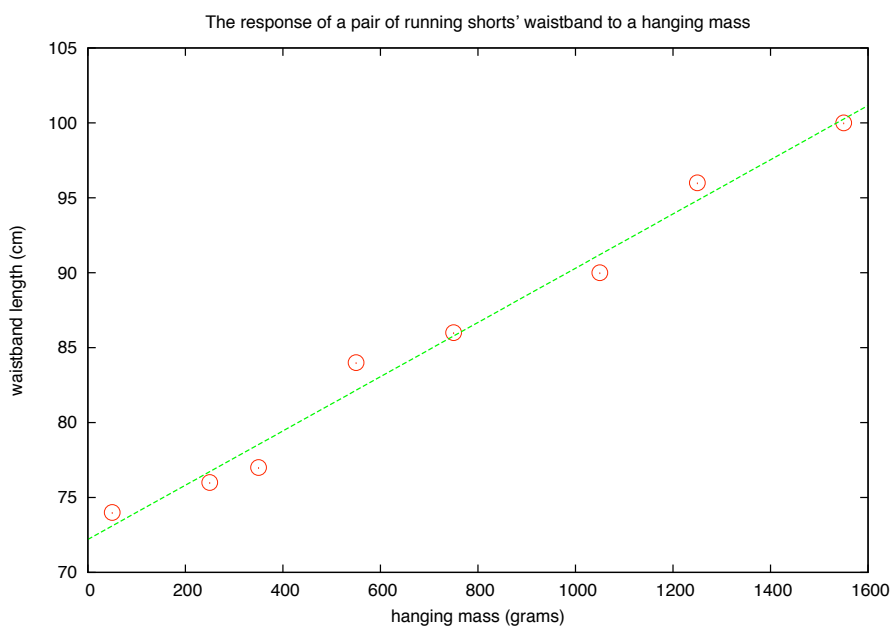


Figure 2: You may have made a similar figure while investigating springs. The “spring” being analyzed is actually the waistband of a pair of running shorts which is quite Hookean at small extensions.

The line of best-fit included in this figure is,

$$w = am + b$$

where,

$$w = \text{the waistband length (cm)}$$

$$a = 0.0181 \text{ cm/gram}$$

$$m = \text{the hanging mass, (grams)}$$

$$b = 72.24 \text{ cm}$$

If you were to perform the same experiment with a pair of shorts, size small, how would the graph change?

Why is it hard to put on clothes that are too small? Be specific in terms of your understanding of elasticity.