ISP209 Spring 2002 **Homework 3** Name: _____
Due: Thurs., Jan. 31, 2:40 pm, in Rm 118PA. ID:_____

Homework Problems

1. Which force, electromagnetic(E), gravitational(G), weak nuclear(WN) or strong nuclear(SN), is primarily responsible for the following: (all correct for credit)

fusion of Deuterium and Tritium. ____ pumping water from a well. _____
smoking a cigarette. _____ beta decay of Tritium to Helium-3. _____
bleaching a shirt. _____ sawing wood. _____
cutting a piece of paper. _____ toasting a muffin. _____
cooking a chicken. _____ defrosting in a microwave. _____
crushing a nut. _____ growing of hair. _____

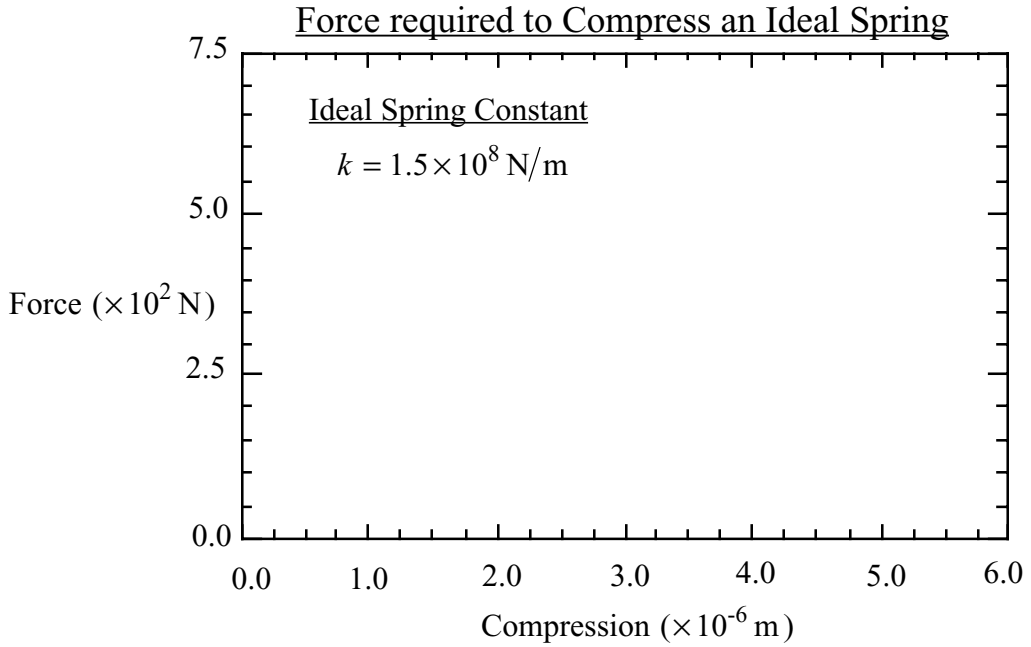
2. True or False (all correct for credit)

T F Two force vectors are "equal" only if the magnitude and direction are the same.
T F Two force vectors can "balance" if the magnitude and direction are the same.
T F Two force vectors cannot "balance" and be "equal" at the same time.
T F Two force vectors with "equal" magnitudes can point in opposite directions.
T F Two force vectors cannot stretch an object if they are "equal".

3. Convert the pressure 1×10^5 N/m^2 to a pressure in lb/in^2 (1 in = 2.54 cm). ____ lb/in^2

4. What are the units of a spring constant? _____

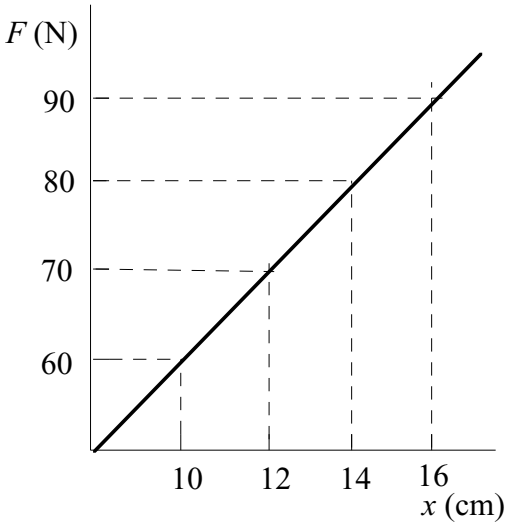
5. On the graph below, plot the applied force vs. compression of a spring, spring constant $k = 1.5\times10^8$ N/m, from zero to 5×10^{-6} m, increasing in 10 steps of 0.5×10^{-6} m. The plot should look similar to text *Fig. 3.5* .



6. A long spring obeys Hooke's law and can be stretched 10 cm by a force of 20 N.
   a) Plot of force vs. stretch of this spring has what slope (w/units)? _____
   b) Force applied is 50 N. How far does the spring stretch (w/ units)? _____

Show work for all questions. **Attach extra sheets if necessary.**

Plotted on the right, is data for a spring following Hooke's law only after an initial force, F_0, is applied; $F = kx + F_0$. (Note: the zero of each scale is not shown.)



Graph for problems 7–8

7. What is the spring constant, k (slope of the line), in the region shown? _____

8. Use k, and one point, F and x, on the graph to find F_0, force applied to the spring when it begins to stretch; F_0 = _____. (assume spring is linear down to $x = 0$).

(show work here)

9. In lbs, what force is equal to 1 N? _____lb

10. A force of 21 N, stretches a spring by 7 cm. What is its spring constant? _____ N/cm.

11. What force (maximum) do you apply to dental floss in use (in lb. & N)? Do not guess, use logic! For example, tell me how many five pound bags of sugar can you can lift with a piece of dental floss. What will the dental floss do to your hand if you tried to lift 20 bags of sugar? maximum force on dental floss = _____ lb,. and _____ N

12. An additional 10 N of force increases the stretch of a spring from 5 cm to 7 cm.
a)What is the spring constant (w/ units) of this spring? _____
b) What additional force (w/ units) stretches this spring another 3 cm? _____

(show work here)

13. A rod has a spring constant $k = 2\times10^7$ N/m (note units). How far will it compress (in mm!) under a force of 2×10^3 N? _____ mm

(show work here)

14. The density of lead is 11 g/cm^3 (1 cm^3 has an 11 g mass). What is the mass (in kg) of 1 m^3 of lead? (convert density to kg/m^3; 1 m^3 is a cube, 100 cm on a side; 1g = 10^{-3} kg.

(show work here) m = _____ kg.

15. A cubic centimeter of water has a 1 gram mass, i.e., the density is 1g/cm^3. What is the mass of one cubic meter of water? (convert density to kg/m^3).

(show work here) m = _____ kg.