ISP209 Spring 2002 **Homework 1** Name:_____
Due: Thurs., Jan. 17, 2:40 pm, in Rm 118PA. SN:_____

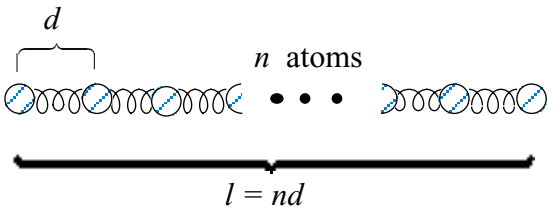
Homework Problems

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

falling from a tree. __**G**__
orbiting of planets. _____
exploding of a firecracker. _____
fusion of Deuterium in the sun. _____
ebbing of the tide. _____
burning of a candle. _____
heating a TV dinner in a microwave oven. _____
cycling of ATP & ADP in the body. _____
air-conditioning a room. _____
firing of a gun. _____
recording on an audio tape. _____
pressurizing a balloon. _____
dissolving sugar in water. _____
coloring of paints. _____
melting of an ice cube. _____
ringing of a bell. _____
breathing the air. _____
smelling a flower. _____
flying a jet plane. ____and____
freezing of ice cream. _____
decay of the isotope Carbon-14 ____
fertilizing an egg. _____

2. What is the common name for the electromagnetic forces generated by an object when it is stretched from its ends? _____. In addition to the ends of the object, where else are these forces active? _____.

3. What is the name of the electromagnetic forces generated by an object in response to squeezing? _____. In addition to the ends of the object, where else are these forces active? _____.



4. As shown above, the atoms along one edge of a bar, $l = 10.00$ cm long , are spaced $d = 7.130\times10^{-9}$ cm apart. Use the relationship, $\boxed{l = nd}$, between the length l, and spacing, d, between the atoms, to determine how many atoms, n, are located along the edge of the bar. (use scientific notation with 4 significant digits in calculations, 3 in the expressed answers, and show your work below).

The number of atoms along the length is _____.

Use the relationship again to answer the next few questions. (4 significant digits when available in the calculations, 3 in the expressed answers; and show your work).

When stretched along its length by, $S = 1.00 \times 10^{-2}$ cm, for a new total length, $L = l + S$, what is the new atomic spacing, D, along the object?

The new spacing along the length, D = _____.

Along one edge of the stretched object, how many atoms lie in the region extending beyond the old length?

The number beyond the old length, n_b = _____.

Along one edge of the stretched object, how many atoms are within the old length?

The number within the old length, n_w = _____.

Answer the questions above again, considering the number of atoms within the volume, and not just along one edge, if it has a width and height of 1cm each.

The number of atoms in the bar is _____.
The new spacing along bar's length is _____.
The number beyond the old bar length is _____.
The number within the old bar length is _____.

5. In an atom with a diameter, 1×10^{-10} m, what fraction of the volume is occupied by the nucleus with a diameter 1×10^{-14} m? ($V = \frac{4}{3}\pi r^3$, for a sphere, where r = diameter/2.)

The nucleus occupies (fraction) _____ of the volume.

6. What happens to an object that is elastically (see text for the definition) distorted when the distorting forces are removed? An object will _____ when the forces elastically distorting it are removed.

7. Which of the following solids <u>in normal use</u> **do not** behave elastically?

beach sand, a guitar string, a drum stick, a concrete walkway,
the wing of an airplane, an igloo, ice cream, an accordion,
a banana, a feather pillow, a tooth pick, an eyelash.

List 5 other solid objects that **do** behave elastically in normal use.

_____ _____ _____ _____ _____

8. True or false: when balanced forces act on my body I don't feel them.
9. True or false: no internal forces act on the atoms in an undistorted object.
10. How does a neutral object obtain a positive charge? _____ _____
11. Maxwell determined that light combined the effects of these two (previously thought to be very different) forces: _____ and _____.
12. (Don't answer this question without first reading the discussion of the Michelson and Morley experiment in section B of Chapter 1) If I compare the speed of light measured while running toward its source to a measurement standing at rest, does the measured speed change?

The speed of light (*does* or *does not*) change.

On the Earth, does the measured speed of a car depend on the speed of the observer?

The speed of a car (*does* or *does not*) change.

Who developed the single theory that can explain both phenomena? _____

13. What are the two conditions that must be met by a new theory of nature before it is accepted and replaces an existing theory?

1.
2.

14. What occurs in a battery to move electrons from one pole of the battery to the other? See section C of Chap. 1, for a discussion of batteries.

_____ reactions move electrons from the + pole to the – pole.

15. From information given in Lecture 1, how many oxygen atoms are contained within a molecule of oxygen gas? _____.
16. Compare the chemical formulae for water and oxygen molecules, and describe what must happen to oxygen molecules when hydrogen gas (H_2) is burned to form water molecules (see text)? _____.