ISP209 Fall 2003 **Homework 1** Name:_____
Due: Tues., Sept. 9, 10:20 am, in Rm 1410 BPS. SN:_____

1. What is the shape of an ideal spring? coil spring
2. What is the spring-like object that cannot be considered an ideal spring? slinky
3. What must act on an ideal spring to stretch it? forces How many? 2. What does a stretched ideal spring generate that acts on other objects? forces How many? 2
4. Can an object generate and be acted on by the same force? NO
5. Contact forces are generated where two objects touch each other.
6. Without an object to act on, can a force be generated? NO
7. a) Gravity acts on what property of matter? Mass The force of gravity acting on an object is called the object's weight
   b) Which of the answers above can change on another planet? weight
8. When you throw a ball you *give* it a force. (T or F) Do you give it forces? (Y or N)
9. How does a neutral object obtain a positive charge? By removing electrons
10. 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. . **G**
exploding of a firecracker. . **E**
fusion of protons and neutrons in the sun. . **SN**
ebbing of the tide. . **G**
burning of a candle. . **E**
heating a TV dinner in a microwave oven. . **E**
air-conditioning a room. . **E**
firing of a gun. . **E**
pressurizing a balloon. . **E**
dissolving sugar in water. . **E**
coloring of paints. . **E**
melting of an ice cube. . **E**
ringing of a bell. . **E**
breathing the air. . **E**
fertilizing an egg. . **E**
freezing of ice cream. . **E**
emission of solar neutrinos . **WN**

11. By what amount does the mass of the neutron exceed the mass of the proton and compare the mass difference to the electron mass? (see section E) Use scientific notation, 3 sig. digits, and show work !

$$m_n - m_p = \left(1.675\times10^{-27} - 1.673\times10^{-27}\right)\text{ kg} = 0.002\times10^{-27}\text{ kg}$$
$$= 2\times10^{-30}\text{ kg} \quad > \quad m_e = 0.9\times10^{-30}\text{ kg}$$

Neutron-proton mass difference: 2×10^{-30} kg, is (> or <) the electron mass.

12. Maxwell determined that light combined the effects of these two (previously thought to be very different) forces: electricity and magnetism.
13. What occurs in a battery to move electrons from one pole of the battery to the other? See section D of Chap. 1, for a discussion of batteries.

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

14. (Reread discussion of Michelson and Morley experiment in section F of Chapter 1)
i)Two cars each traveling at 60 mph are headed toward each other. If I'm in one car, what do I measure for the speed of other car as it speeds past me?
a) 120 mph b) 90 mph c) 60 mph d) 0 mph e) none of the previous
ii) Light traveling with speed, $c = 3\times10^8$ m / s, passes me when I'm in a car moving at 60 mph toward it. I measure speed of the light as
a) c + 60 mph b) c + 30 mph c) c d) 0 mph e) none of the previous
iii) Who developed a single theory that can explain both phenomena? A. Einstein

15. 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. predict those peculiar phenomena incorrectly described by the old theory
2. must show *why* the old theory, despite its flaw, gave apparently correct predictions in every other situation

16. Two atoms have formed a molecule. What value of force acts on each two atom? zero

17. Two atoms have formed a molecule. If the atoms are pulled apart slightly, which way will they move when released? toward each other If the atoms are pushed together slightly, which way will they move when released? away from each other

18. When the forces distorting an elastic object are removed, to what shape does it return? natural or normal shape

19. Which of the following solids in normal use **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.
fork floor cell phone window hammer

20. what is the specific name of the elastic force that acts on my hands when a) I stretch a bungie cord, tension , and b) when I compress a rock? compression

21. I attach a long thread to a wall and pull on the other end to stretch it. Where along the thread are the atoms furthest apart?
a) the wall end b) the center c) the hand end d) nowhere e) none of the previous

22. I stretch a 100 cm long string of atoms by 1 cm. The string contains 1.2×10^9 atoms. How many atoms lie in the region beyond the old length?(show work)

$$\text{(stretched) } d = \frac{l}{n} = \frac{101\text{ cm}}{1.2\times10^9} = 8.4\times10^{-7}\text{ cm}$$

$$\text{(1 cm length) } n = \frac{l}{d} = \frac{1\text{ cm}}{8.4\times10^{-7}\text{ cm}} = \underline{1.2\times10^7}$$