Special Relativity Worksheet #2

1. A woman stands on a moving railroad car. She slips and her ice cream cone flies straight up into the air. Neglecting air resistance, will it land on her, behind her, or in front of her?

2. If you were on a space ship traveling at 0.5c away from a star, at what speed would the starlight pass you?

3. Does time dilation imply that time actually passes more slowly from the point of view of the people in moving reference frames? Explain.

4. A young woman astronaut has just arrived home from a space voyage. She rushes to an old, gray-haired man and in the ensuing conversation she refers to him as her son! How might this be possible?

5. If you were traveling at 0.5c away from the earth would you notice a change in your heartbeat? Would your height, mass, or waistline change? How would observers on earth describe your height, mass, and waistline?

6. Do mass increase, time dilation, and length contraction occur at normal speeds (~100 mph)? Explain.

7. Explain the statement, "The sun is losing mass" according to special relativity?

8. A farm boy studying physics believes he can get a 12-m-long pole into a 10-m-long barn if he runs fast enough (carrying the pole of course). Can he do it? Explain. How does your answer deal with the fact that when he is running the barn looks even shorter to him?

Problems:

1. An astronaut travels at 0.93c. As one hour passes for her how much time passes for an observer on earth?

2. A spaceship passes you at 0.95c. You note its length to be 80.0 m. How long is it when at rest?

3. At what speed will a 2.0 kg object have a mass of 6.0 kg?

4. Ideally, how much energy could be obtained from a 0.500 kg golf ball?