## Score

## Instructions:

- 1. Do all of your work on this sheet.
- 2. Show all of your steps in problems for full credit.
- 3. **Be clear and neat** in your work. Any illegible work, or scribbling in the margins, will not be graded.
- 4. Place your answers in a box.
- 5. If you need more space, you may use the back of the page and write **On back** in the problem space.
- 1. **Multiple Guess (3 pts)** Find the answer which best fits the question and write it in the space provided.
- a. Which is not a consequence of Einstein's postulates?
  - a) Moving clocks tick slower than stationary ones.
  - b) Simultaneous events in one inertial system may not be simultaneous in another system.
  - c) Stationary lengths are smaller than moving lengths.
  - d) None of these.
- b. A spaceship moves towards you at 1/3c, where c is the speed of light. The spaceship emits a beam of light in your direction. As measured in your frame of reference, the speed of the light emitted by the spaceship is:
  - a) 4/3c. b) c. c) 2/3c. d) 1/3c.
- c. You have two polarizing filters lined up so they block all the light. You can increase the light that gets through by a) placing a third filter in front of the first.
  - b) placing a third filter after the second.
  - c) placing a third filter in between the two.
  - d) a third filter won't transmit more light.

## 2. Definition/Principle (5 pts)

- a. What is an inertial reference frame?
- b. What is Huygen's Principle?
- c. What is the energy equivalent of a 0.75 g mass?

**Bonus:** In *Planet of the Apes* (original movie), the crew left Earth in July 1972. After six months, it was May 2673 back on Earth. How fast were they moving?

## 3. Problems (12 pts)

a. A thin film of an anti-reflective coating (n = 1.30) coats a thin lens (n = 1.69). What is the minimum thickness of the film if 530 nm wavelength light is not reflected??

b. Unpolarized light with intensity 3.6 W/m² strikes a piece of polarizing material with transmission axis at 30° to the horizontal. The emerging light comes into contact with polarizing material with a vertical polarization. What is light intensity that is transmitted through these materials?

- c. A UFO streaks across the sky at a speed of 0.60c relative to the Earth. A person on the Earth determines that the UFO is 240 m long in the direction of its motion.
  - i. What length do they measure for the UFO when it lands?
- ii. The UFO took a 30 year trip (Earth time) to pick up an alien. How much time passed on the UFO clock?

d. An observer sees two ships traveling towards each other at 0.75*c*. How fast does the captain of the ship on the left think the other ship is moving?

