**Light & Special Relativity Problems 1**

1. Describe an experiment that you could perform in a reference frame to determine whether the frame was non-inertial.
2. A spacecraft is travelling at 0.99c past the Earth. An astronaut inside the craft records a time of 1 hour for a certain event to occur. How long would a stationary observer on Earth record for this event? (7.09 h)
3. A missile travelling at 9/10 the speed of light has a rest length of 10 m and travels parallel to the ground at a height of 100 m. Calculate the length of the moving missile as measured by a stationary observer directly under the flight path of the missile. (4.36 m)
4. An electron with a rest mass of 9.11 x 10-31 kg is travelling at 0.999c. Determine the relativistic mass of the electron. (2.04 x 10-29 kg)
5. A radioactive isotope loses 5 x 102 J of energy. Calculate its resultant loss of mass. (5.6 x 10-15 kg)
6. The radius of our galaxy is 3 x 1020 m, or about 3 x 104 light years.  
   1. Can a person, in principle, travel from the centre to the edge of our galaxy in a normal lifetime? Explain using either time dilation or length contraction arguments.
   2. Determine the constant velocity that would be needed to make the journey in 30 years (proper time). (299999850 m/s or 0.9999995c)
7. A new EFT (extremely fast train) is travelling along the tracks at 0.999999c relative to the Earth’s surface. A passenger decides to try to reach the speed of light by running toward the front of the train. Will the passenger be successful? Analyse this situation from the point of view of Special Relativity.