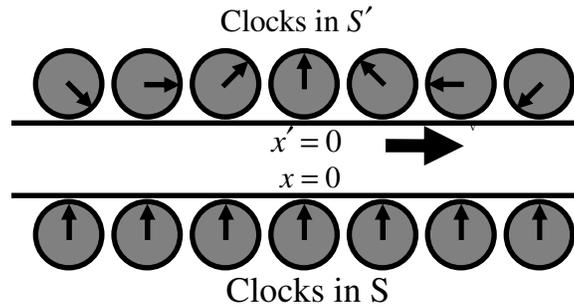


LUMS School of Science and Engineering
PHY201 Modern Physics – Assignment # 1

1. a) In measuring the length of a metre stick, how does the requirement of simultaneity enter?
b) What is the equivalent requirement in the measurement of time?
2. A spaceship moving away from earth at $0.5c$ fires two missiles at speed $0.6c$ as measured in its rest frame. One missile is aimed away from earth and the other is towards it. What will be the speed of the missiles as measured on earth.
3. Two identical clocks are set to the same time. One remains on earth while the other is in an aircraft that travels at 1000km/h around the world. Will the the two clocks read the same or a different time? [Actually this experiment has been done with extremely accurate atomic clocks, and the time difference has been measured.]
4. How fast must a car approach a red light so that it is Doppler shifted and appears green?
5. Clocks placed at equal distances in frame S are synchronized to read the same value of time by sending a light pulse from the origin of S . The clocks in frame S' are similarly synchronized. To an observer in S , will the clocks in S' be synchronized? What about the observer in S' ?



6. The identical twins Speedo and Goslo join a migration from the Earth to Planet X, 20.0 ly away in a reference frame in which both planets are at rest. The twins, of the same age, depart at the same moment on different spacecraft. Speedo's spacecraft travels steadily at $0.950c$ and Goslo's at $0.750c$. (a) Calculate the age difference between the twins after Goslo's spacecraft lands on Planet X. (b) Which twin is older?

7. A moving rod is observed to have a length of $l=2.00\text{m}$ and to be oriented at an angle of $\theta=30.0^\circ$ with respect to the direction of motion as shown. The rod has a speed of $0.995c$. (a) What is the proper length of the rod? (b) What is the orientation angle in the proper frame?

