Chapter-38

1. A car of mass 2 000 kg moving with a speed of 20.0 m/s collides and locks together with a 1 500-kg car at rest at a stop sign. Show that momentum is conserved in a reference frame moving at 10.0 m/s in the direction of the moving car.

 In the rest frame,

 

 Since 

 

 In the moving frame, these velocities are all reduced by +10.0 m/s.

 

 Our initial momentum is then

 

 and our final momentum has the same value:



1. A spacecraft with a proper length of 300 m passes by an observer on the Earth. According to this observer, it takes 0.750 μs for the spacecraft to pass a fixed point. Determine the speed of the spacecraft as measured by the Earth-based observer.

 The spaceship is measured by the Earth observer to be length-contracted to

  or 

 Also, the contracted length is related to the time required to pass overhead by

  or 

 Equating these two expressions gives 

 or 

 Using the given values *Lp* = 300 m and , this becomes

 

 giving 

1. Calculate the momentum of an electron moving with a speed of (a) 0.010 0*c*, (b) 0.500*c*, and (c) 0.900*c.*

 (a)  for an electron moving at 0.010 0*c*,

 

 Thus, 

 

 (b) Following the same steps as used in part (a), we find at 0.500*c*,
*γ* = 1.15 and

 

 (c) At 0.900*c*, *γ* = 2.29 and

 