3rd International Physics Olympiad
1969, Brno, Czechoslovakia

Problem 1. Figure 1 shows a mechanical system consisting of three carts A, B and C of masses $m_1 = 0.3$ kg, $m_2 = 0.2$ kg and $m_3 = 1.5$ kg respectively. Carts B and A are connected by a light taut inelastic string which passes over a light smooth pulley attaches to the cart C as shown. For this problem, all resistive and frictional forces may be ignored as may the moments of inertia of the pulley and of the wheels of all three carts. Take the acceleration due to gravity g to be 9.81 m s^{-2}.

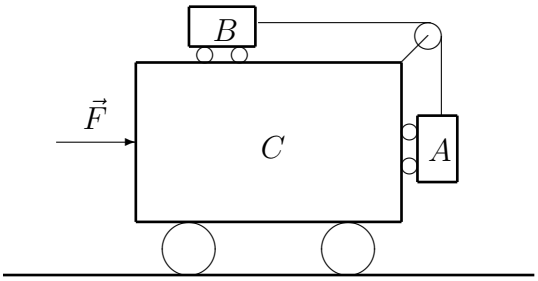

Figure 1:

1. A horizontal force $\vec{F}$ is now applied to cart C as shown. The size of $\vec{F}$ is such that carts A and B remain at rest relative to cart C.
   a) Find the tension in the string connecting carts A and B.
   b) Determine the magnitude of $\vec{F}$.
2. Later cart C is held stationary, while carts A and B are released from rest.
   a) Determine the accelerations of carts A and B.
   b) Calculate also the tension in the string.