Physics Exploration Homework Supplement P110-13.pdf

Equilibrium and Tension Forces

Go to the Physics Exploration Center. Enter through the resource room 311/312 Thaw Hall. Before you start the exploration, answer the following questions.

(1) The two Figures below show situations in which identical masses *m* are hanging from massless taut strings. In Figure (1), two equal masses *m* are hanging from a string via a pulley at the two ends. In Figure (2), mass m is hanging from a taut string whose other end is attached to the wall. Let T1be the tension in string 1, and tension T2 the tension in string 2. Which of the following statements is true?

Figure 1

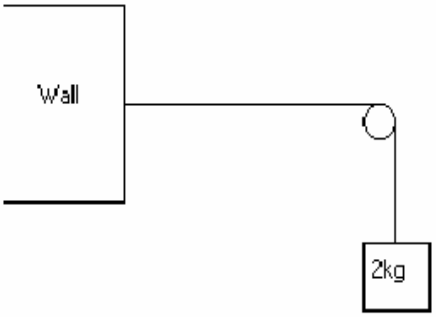

Figure 2

(a) T1 > T2
(b) T2 > T1
(c) T1 = T2
(d) The magnitude of tension in the string in Figure 1 can be either greater or smaller than that in the string in Figure 2 depending upon the actual value of the mass *m* (for example whether it is 0.5 kg or 1 kg etc.).
(e) not enough information given

(2) Justify your answer in question (1) using the appropriate laws of physics.

(3) Two 1 *kg* masses hang from a massless taut string such that mass A is closer and mass B is farther from the ground. Mass A which is lower is clamped to a stand. When the clamp is removed

(a) Mass A goes down and mass B goes up.

(b) Mass A goes up and mass B goes down.

(c) Mass A and B remain stationary.

(d) Mass A may go up or down depending on how much longer the rope is towards mass A than towards mass B.

(e) None of the above.

(4) A student remarks: "The situation in question (3) is not an equilibrium situation. Equilibrium means that both masses are exactly at the same vertical level." Another student remarks: "The situation in question (3) is an equilibrium situation because the net force on each of the masses is zero." Which student do you agree with and why? Draw a free body diagram for each block to verify your answer.

Now perform the following activities:

(a') Measure the magnitude of tension force in the string using a force-meter for the setup in Figures (1) and (2)?

(b') Can you show using a free body diagram and Newton's second law that your measurement makes sense? Does your observation match your predictions in question (1)? If not, reconcile the discrepancies.

(c') Using the setup described in question (3) [set-up number 3], lower one of the masses by using your hand. Then, let go of this lowered mass from rest. Do you observe any acceleration? Justify your observation using Newton's second law. If your observation is not consistent with your answer in question (3), reconcile the discrepancies.