Applying Newton's Laws

Pre-Class Questions

Problem Set (due next time)
Ch 5 - 12, 13, 27, 28

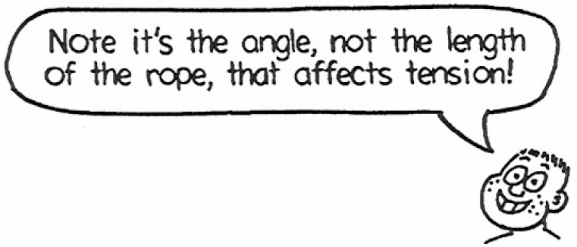
Lecture Outline

1. Tension in Strings
2. Choosing Coordinate Systems
3. Dealing With Ropes and Pulleys

Example 1: A fisherman reels up a 1.20kg fish using 20.0N (4lb) test line. Find the maximum acceleration of the fish if the line is vertical.

CONCEPTUAL Physics PRACTICE PAGE

The heavy ball is supported in each case by two strands of rope. The tension in each strand is shown by the vectors. Use the parallelogram rule to find the resultant of each vector pair.



Is your resultant vector the same for each case?

_____

How do you think the resultant vector compares to the weight of the ball?

_____

Hewitt Drew it!

Example 2: A 100g toy car rolls down a 25° incline. (a)Draw the free-body diagram. (b)Using coordinates along and perpendicular to the incline apply the Second Law. (c)Find the acceleration of the car.

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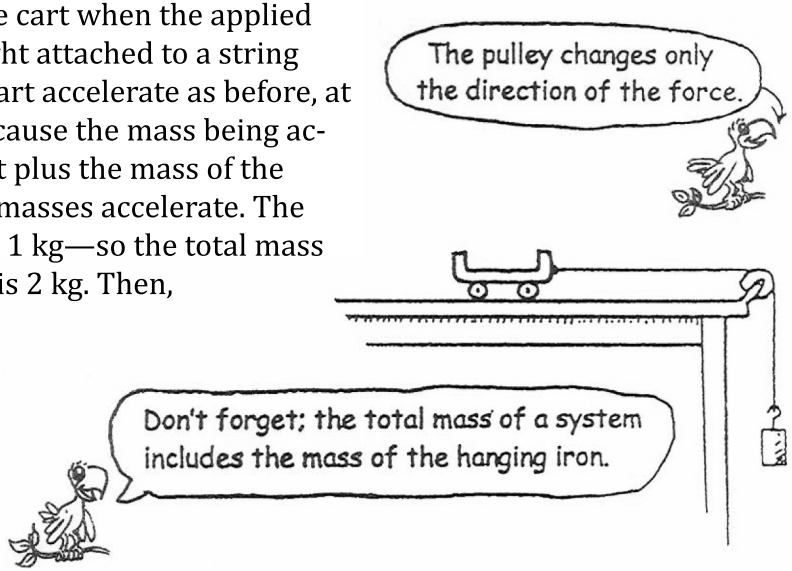
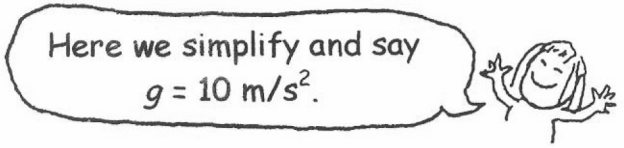
Consider the acceleration of the cart when the applied force is due to a 10-N iron weight attached to a string draped over a pulley. Will the cart accelerate as before, at 10 m/s2? The answer is no, because the mass being accelerated is the mass of the cart plus the mass of the piece of iron that pulls it. Both masses accelerate. The mass of the 10-N iron weight is 1 kg—so the total mass being accelerated (cart + iron) is 2 kg. Then,

$$a = \frac{F}{m} = \frac{10\,\text{N}}{2\,\text{kg}} = 5\,\text{m/s}^2.$$

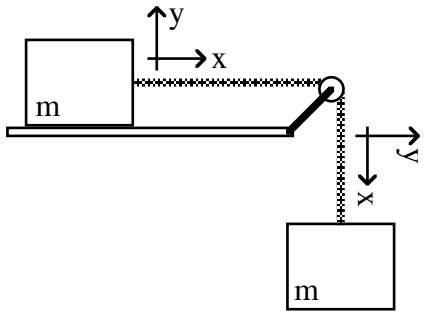


Find the acceleration of the 1-kg cart when two identical 10-N weights are attached to the string.

$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \frac{\quad}{\quad} = \underline{\qquad}\ \text{m/s}^2.$$



Example 3: Two 0.500kg masses are connected by a string as shown at the right. The hanging mass pulls the second mass along a smooth horizontal surface. Find the acceleration of the system and the tension in the string.



Lecture 11- Summary

Tension in strings

When possible, choose coordinates such that:

- the acceleration vector points along one axis.
- most of the forces are aligned with an axis.

Ropes and pulleys require special care with coordinate choices.