Tension in Ropes with Pulleys

Pre-Lecture Questions

Problem Set #13(due next time)

Lecture Outline

1. Examples

Pre-Class Summary:

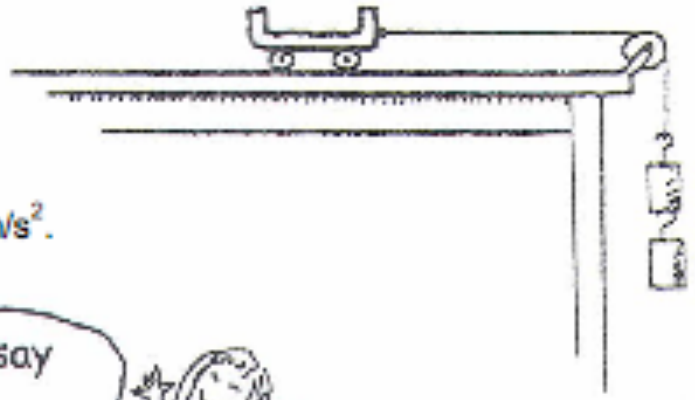
In summary, when solving a problem involving ropes and pulleys, you must be sure that the coordinate system is consistent:

- Choose a positive direction.
- All forces causing motion that way are now positive.
- Acceleration in that direction is also positive.

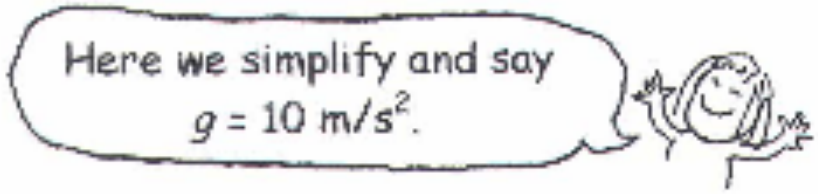
Objects tied together with a rope have the same acceleration and feel the same tension.

By applying the Second Law to each part of a larger system can provide help solve complex problems.

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

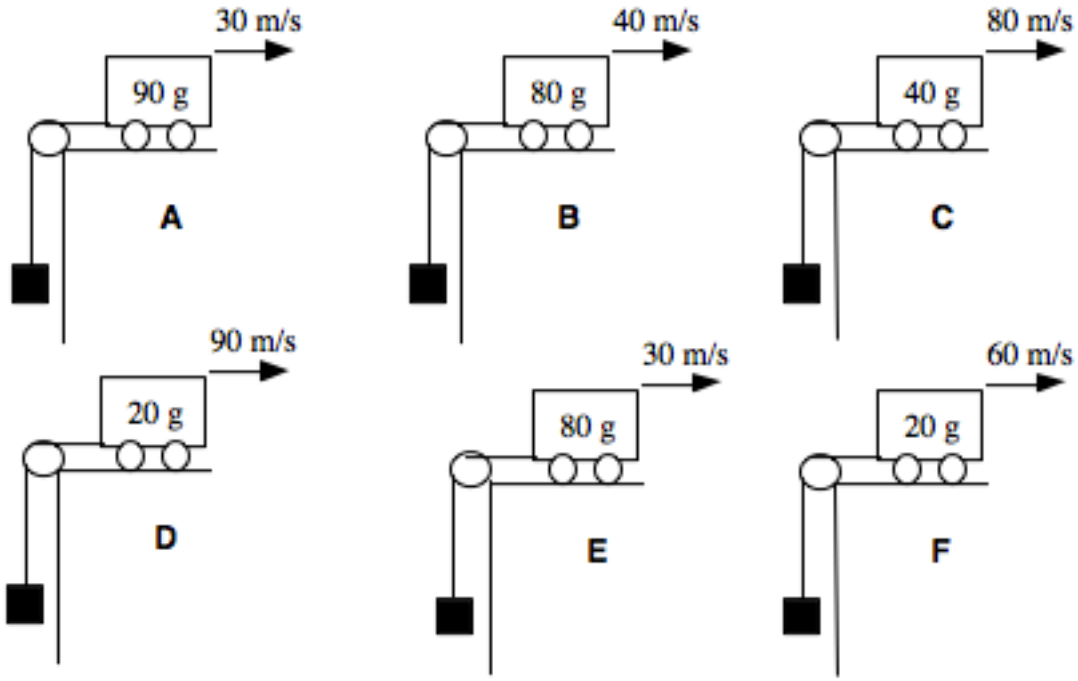


$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \frac{\quad}{\quad} = \underline{\qquad} \text{ m/s}^2.$$

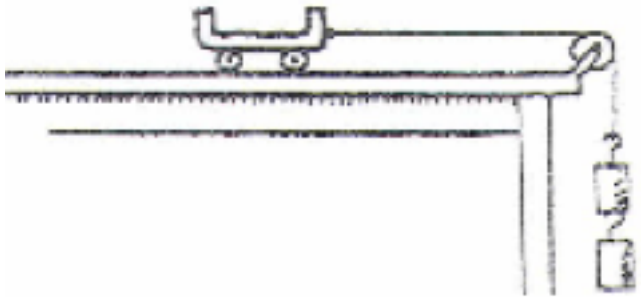


The six figures below show carts that are moving along horizontal surfaces at various speeds. The carts are the same size and shape but carry different loads, so their masses differ. All of the carts have a string attached, which passes over a pulley and is tied to a metal block that is hanging free. All of the metal blocks are identical. As the carts move to the right, they will pull the blocks up toward the horizontal surface, which is the top of the table.

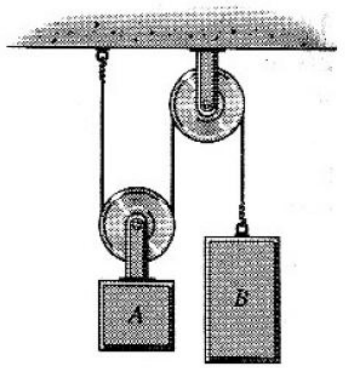
Rank these situations, from greatest to least, on the basis of the magnitude of the acceleration of the carts. That is, put first the situation where the cart has the greatest acceleration, and put last the situation where the cart has the smallest acceleration.



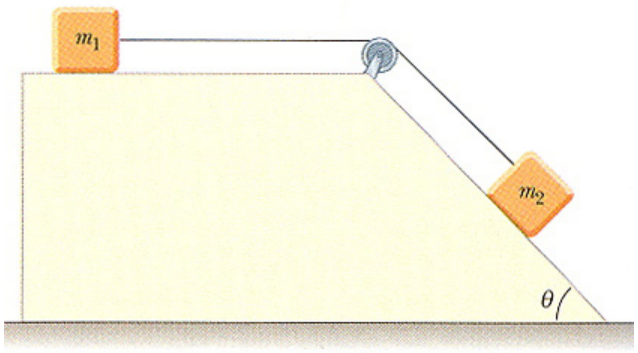
Example 1: The cart at the right has a mass of 1kg. The weights are 10N each. Find the acceleration of the cart.



Example 2: The system shown at the right is at rest. Find (a)the tension in the string and (b)the ratio of the two masses.



Example 3: A block of mass m_1 = 1.80kg and a block of mass m_2 = 6.30kg are connected by a massless string over a pulley. The fixed, wedge-shaped ramp makes an angle of θ = 30.0° as shown in the figure. The coefficient of kinetic friction is 0.360 for both blocks. Find (a)the acceleration of the blocks and (b)the tension in the string.



Lecture 13 - Summary

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