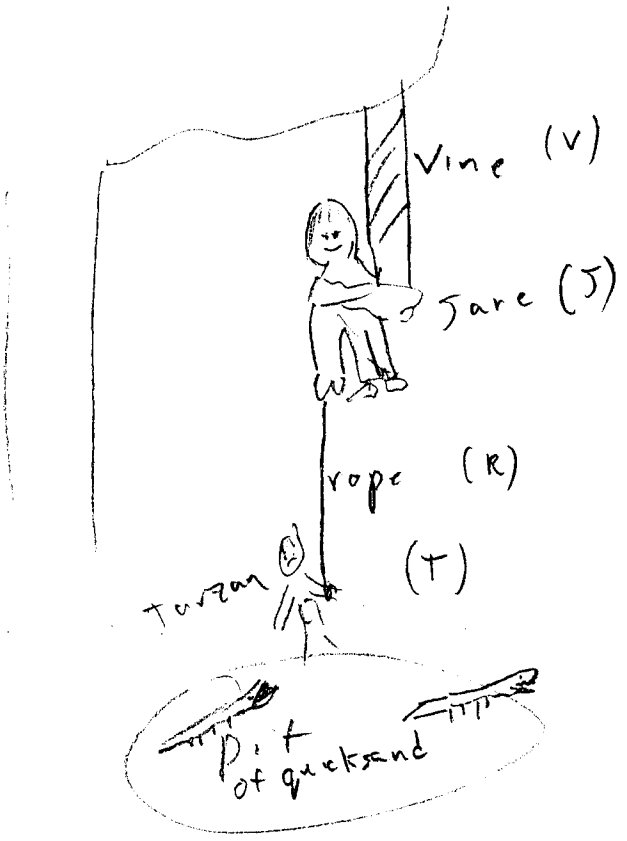
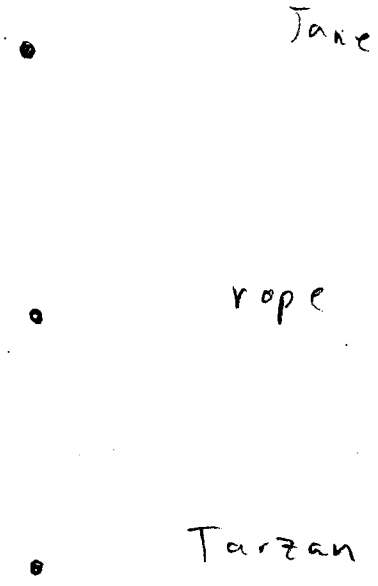
Name_____

1. Jane clings to a vine hanging from a tree with one hand. With her other hand she clings to a rope. On the other end of the rope dangles Tarzan, mere centimeters from a crocodile-filled pit of quicksand (10 points).



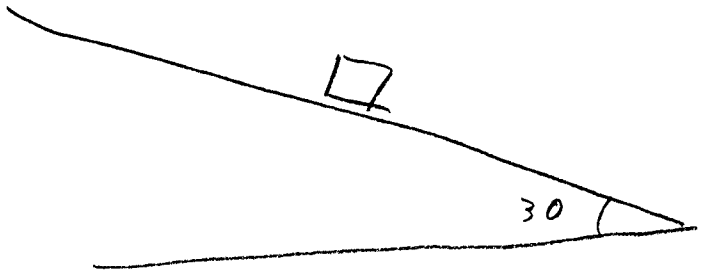


Draw the force diagrams for Jane, the rope, and Tarzan.

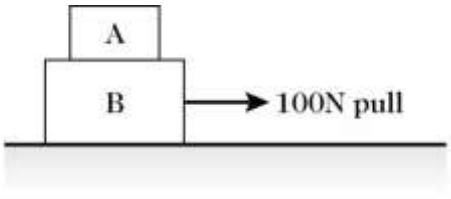
1) All forces should be labeled as weights (W), normal forces (N), frictional forces (f), or tension forces (T).
2) Use the subscript notation to indicate the object being affected by and causing the force. For example W_{GE} might be the weight of a giraffe caused by the earth. Use the following subscripts: V=vine, J=Jane, R=rope, T=Trazan, E=Earth.
3) Label any action reaction pairs that are in the diagrams by drawing an X through the arrows representing the forces. If there is more than one pair, the second pair should be labeled XX, the third labeled XXX, etc.

2. A karate master strikes a board with her hand and the board shatters. What was greater: the force of her hand on the board, the force of the board on her hand, or neither. Explain your answer using Newton's Laws (3 points).

3. A block slides down a slope that makes and angle of 30 degrees with the horizontal. If the coefficient of kinetic friction between the block and the block is 0.3, what is the acceleration of the block as it slides?



3) Two blocks, A and B, are being pulled to the right with **constant velocity** along a horizontal surface by a horizontal 100 N pull from a rope, as shown in the figure. Box A has a mass of 10 kg and box B has a mass of 20 kg. Do not assume friction is negligible between the various surfaces (although it might be zero in some situations).



a) According to Newton's first law, what is the net force on block A? What about block B? Think carefully! This is the key to the whole problem! (1 point).

b) Draw free body diagrams for boxes A and B in the space provided below. Label all forces with subscripts. Note any action-reaction pairs with slashes. **Check that your diagrams are consistent with your answer to part A**! (2 points)

c) What is the magnitude of the force of friction of the surface acting on box B? **Check that your answer is consistent with your answer to part A**! (1 point)

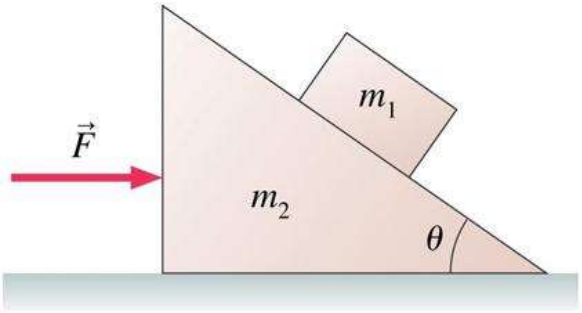
A

d) What is the magnitude of the force of friction of box B acting on box A? **Check that your answer is consistent with your answer to part A**! (1 point)

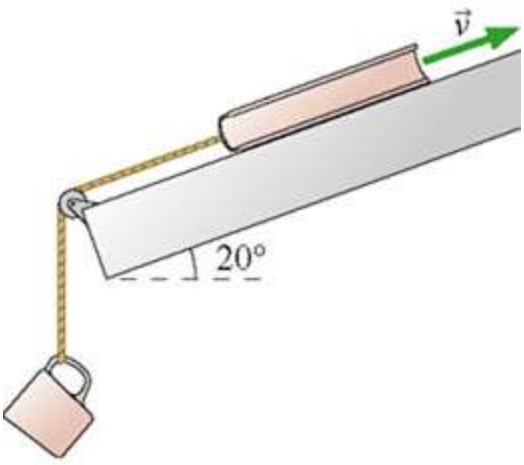
e) What is the coefficient of kinetic friction between the surface and block B? (2 points).

B

5. Find an expression for the magnitude of the horizontal force F in the figure below for which m_1 does not slip either up or down along the wedge. All surfaces are frictionless. Your answer may contain the constants m_1, m_2, θ, and g, although it does not necessarily need to include all of these constants.



6. The 1.0 kg physics book in figure is connected by a string to a 500 g coffee cup. The book is given a push up the slope and released with a speed of 3.0 m/s. The coefficients of friction are $\mu_s = 0.50$ and $\mu_k = 0.20$.

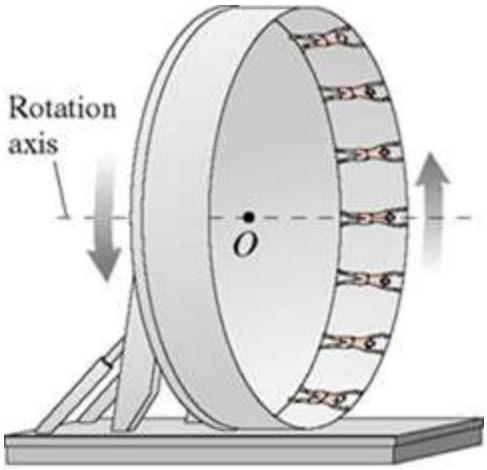


a) How far does the book slide?

This problem is continued on the next page

b) At the highest point, does the book stick to the slope, or does it slide back down? Explain your reasoning.

7. In an amusement park ride called The Roundup, passengers stand inside a 16-m diameter ring. After the ring has acquired sufficient speed, it tilts into a vertical plane as shown in the figure. Suppose the ring rotates once every 4.5 s.



a) If a rider's mass is 55 kg, with how much force does the ring push on her i) at the top of the ride and ii) at the bottom?

b) What is the longest rotation period of the wheel that will prevent the riders from falling off at the top?