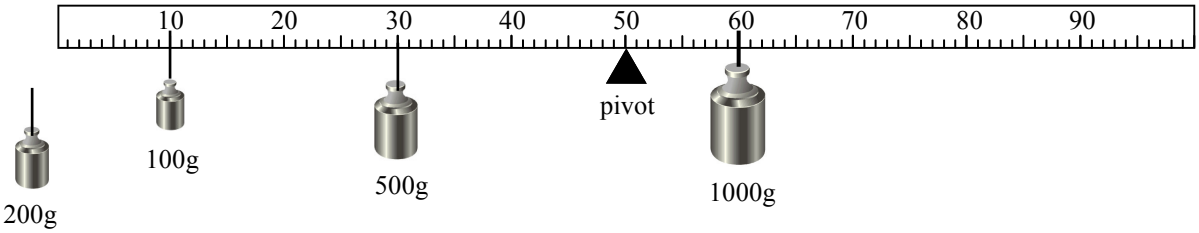
B-Day: Due Fri., Nov 5
A-Day: Due Mon., Nov 8

2010-11 PreAP Forces 6

Lots of asterisks! I'm not going over them in class.

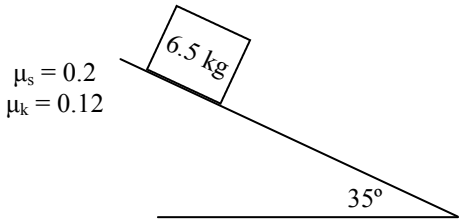
1. Which of the following MUST point in the same direction: mass; net force; velocity; time; force; distance; acceleration.

2. *Where could you put the 200 g mass to balance the lever so that the net torque is zero. (Hint: treat each 10 cm as just "1" so that the 500's torque is just 500(2) = +1000.

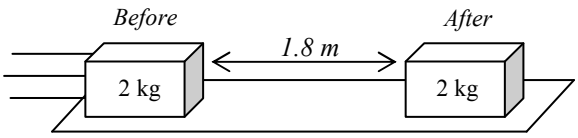


3. On the above lever, if the 100 g mass were moved to the 30 cm mark…
   A. Would it provide more or less torque?
   B. How much more or less?

4. A. If the angle decreases, the force down the ramp:
   B. If the angle increases the normal force:
   C. * Calculate the object's acceleration.



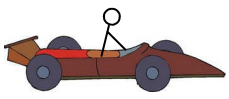
   D. * If the object is 3.5 m up the ramp and starts at rest, how fast is it going at the bottom of the ramp?



5. A 2 kg box slides to a stop in 0.65 seconds.
   A. * Calculate the acceleration of the object. (Since you don't have force, use a different equation with acceleration in it.)

   B. Calculate the force of friction and the coefficient of friction (μ).

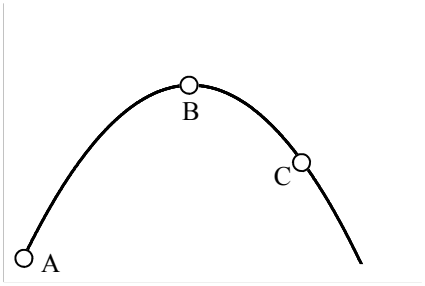
6. What provides the centripetal acceleration for the following situations?
   A. A car turning a corner.
   B. The earth moving around the sun.
   C. A ball being spun around on a string.
   D. A roller coaster at the bottom of the track.



7. Slim Jim and his go-cart are280kg. He is moving 12 m/s as it moves around a circular track that has a radius of 35m.
   A. Which way does the centripetal acceleration point?
   B. What force provides the centripetal force that keeps the cart moving in the circle?
   C. * Calculate the centripetal acceleration of the cart.

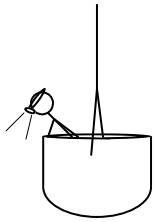
   D. Calculate the force keeping the cart in the circle.

   E. Describe the path of the car after it hits a patch of ice.



8. The diagram shows a 2 kg projectile AFTER it has been shot. A, B, C or all 3?
   A. ___ Where is the vertical speed the greatest?
   B. ___ Where is the horizontal speed greatest?
   C. ___ Where is the force on the object greatest?
   D. ___ Where is the acceleration the greatest?

9. What is the force acting on the object at the very top?



10. Slim Jim is also a cave explorer (known as a spelunker). A mining company asks our famous spelunker to explore part of their gold mine. Slim Jim is a slim 60 kg and the bucket is a hefty 980 kg.
    A. * Calculate the tension in the rope when he begins to accelerate downward at $-1.5\ m/s^2$.

    B. Calculate the tension in the rope when the bucket is lowered at constant speed.

    C. When it starts to slow down (just before it stops) it has an acceleration of $+2.4\ m/s^2$. Calculate the tension in the rope

Comparison time. Yeah!!!! *For each of these questions, start by writing down the equation. But first, a word from our sponsor…*

$$F_1 = G\frac{m_1 m_2}{r_1^2} \text{ and } F_2 = G\frac{m_1 m_2}{r_2^2}$$

Understanding proportionality.

Q: If the distance is doubled, by how much does gravity change? ($r_2 = 2r_1$)

Substitute $r_2 = 2r_1$ $\quad F_2 = G\frac{m_1 m_2}{(2r_1)^2} = G\frac{m_1 m_2}{4r_1^2}$

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Answer: The force is 1/4 as strong.

Pull out F_1 $\quad F_2 = \frac{1}{4}\left(G\frac{m_1 m_2}{r_1^2}\right) = \frac{1}{4}F_1$

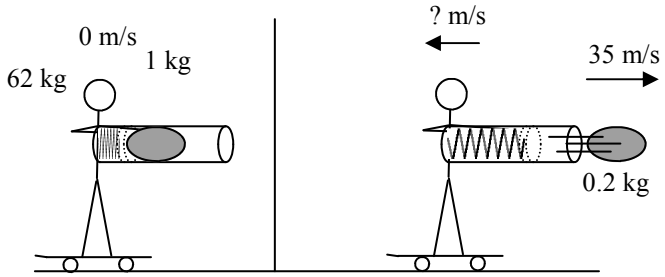
You should then be able to see that since the r is squared and in the denominator, then put a 2 in, gives a 4 on the bottom = 1/4.

Of course you will have to start with the appropriate equation.

11. If the distance is doubled, by how much does the torque change?

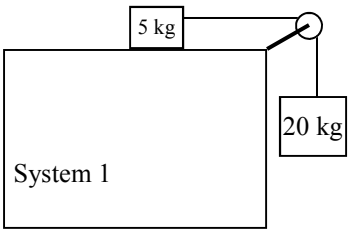
12. * If one of the masses is doubled and the distance is 1/3 as much, by how much does the gravitational force change?

13. That crazy Slim Jim shots a spring loaded potato gun (*I have no idea if the potato is loaded*), while on his skate board.
    A. What does the potato push on?
    B. Does Jim feel a force, too?
    C. Will Jim move faster or slower than the potato?
    D. Why?
    E. Draw a force diagram for Jim and the potato below:

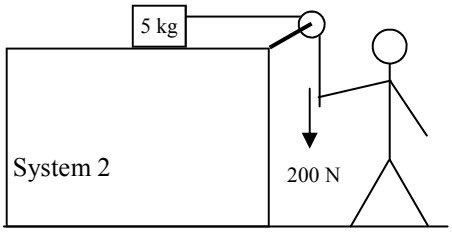


Jim *Spud*

*Ok, let's solve this misconception right now. The spud feels ONE force pushing it to the right. Jim feels ONE force pushing him to the left. These forces **<u>are equal</u>** but THEY OCCUR ON DIFFERENT OBJECTS. That's the point of the 3rd Law, which doesn't talk about acceleration at all. This is not like two equal forces pushing on an object, causing equilibrium or constant speed. In that case there are two equal objects occurring on the SAME object. (O—and the potato doesn't push on Jim. Hmmm, what does????)*



14. System 1 has a 20 kg object connected (via a rope) to a 5 kg object. Assume there is no friction on the table.
    A. How much force pulls down the 20 kg object?
    B. If the 20 kg object had nothing attached to it, what would be its acceleration?
    C. What is the maximum acceleration of system 1?
    D. As the top mass gets bigger, does the acceleration of the system increase or decrease?
    E. Why?
    F. Calculate the * acceleration and tension in this system.



15. System 2 has the 20 kg mass replaced by a 200N force. (*Thanks, Jim!)*
    A. How much force pulls down the 20 kg object?
    B. As Slim Jim pulls harder and harder, does the acceleration of the system increase or decrease?
    C. What is the maximum acceleration of system 2?
    D. Calculate the acceleration and tension in this system.
    E. Why is it different?

Q2: at 70 cm (which is "2" to the right)
Q4: Fn = 53.4 N; Fx = 37.3; a = 4.75 m/s^2 Q4D: use a kinematic: v_f = 5.77 m/s
Q5: −8.5 m/s^2 Q7: 4.1 m/s^2 Q10: 8840 N (since m_{total} = 1040 kg)
Q12: See answer at the right.
Q14: 8 m/s^2

mult. by recipr.

$$\frac{2}{(1/3)^2} = \frac{2}{1/9} = 2\left(\frac{9}{1}\right) = 18$$