Announcements – 1 Oct 2009

1. **Exam 2 starts today!**
   a. Exam ends Wed Oct 7 (late fee after 1 pm)
   b. Covers Chapters 4 & 5, Homeworks 4-8
      i. But potentially cumulative questions
   c. **3 hour time limit** like last time
   d. **Format**
      i. Mostly the same as exam 1
         1. No notes/books
         2. Equation sheet given as first page
         3. No calculators should be needed (Testing Center ones permitted if you disagree with me)
      ii. 30 problems, 100 points
      iii. Two problems where you turn in work such as FBD and filled-in blueprint equations
      iv. Time estimate: 2 hours on average
   e. **Things to study** like last time
      a. HW
      b. Worked problems from class
      c. Old midterms/final exams, posted to website
      d. Conceptual questions from class (clicker quizzes, etc)
      e. Warmup questions
      f. Demo videos
      g. Also: a couple of problems from last exam will return
2. **TA Exam review tonight**
   a. Time: 6 pm – 7:30 pm
   b. Place: 455 MARB

Review

1. Newton's Laws of Motion
   a. 1st Law: inertia
   b. 2nd Law: $\sum \vec{F} = m\vec{a}$ (not given on exam)
      i. True for each object, as well as for groups
      ii. True for both x- and y-components
   c. 3rd Law: $\vec{F}_{12} = -\vec{F}_{21}$ (not given on exam)
      i. "Partner forces", equal & opposite
      ii. Act on different objects

2. Forces
   a. unit: Newtons
   b. free-body diagrams
   c. weight = mg (is given on exam)
   → new first page posted!
      i. don't need to know "Universal Gravitation" yet
   d. Normal force
   e. friction: $f = \mu N$ (or $f \le \mu N$, for static friction) (is given on exam)
   f. tension
   g. pulleys
   h. spring: $F = -kx$ (is given on exam)

3. Work done **by a force**, **on an object**
   a. $W = F_{//}\,\Delta x = F\cos\theta\,\Delta x$ (not given on exam)

      i. unit: Joules

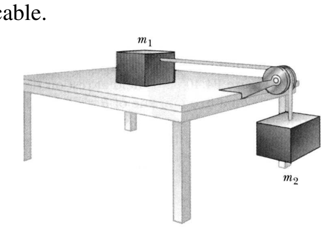
4. Energy
   a. unit: Joules
   b. Kinetic: $KE = ½\, m\, v^2$ (not given on exam)
   c. Gravity: $PE_g = mgy$ (is given on exam)
      i. You don't need to know anything about "Universal Gravitation" yet
   d. Springs: $PE_{spring} = ½\, kx^2$ (is given on exam)
   e. Conserved!! $E_{before} + W_{net} = E_{after}$ (not given on exam)
      i. "before" and "after" pictures
      ii. include PE and KE for all objects in "E" terms
      iii. include all nonconservative forces in W
         1. work occurs "during" the change
         2. positive vs. negative work

5. Power
   a. Definition: $P = \Delta E/\Delta t$ (not given on exam)
      i. unit: Watts
   b. Power from velocity: $P = F_{//}\cdot v$ (is given on exam)

Note about equations that are given on the exam:
I give you the equations, but not necessarily the context. Be sure to look over the equation sheet on the class webpage before you go to take the exam.

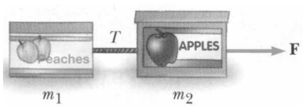
Some HW problems (missed by many):

HW 5-5. A mass, m_1 = 1 kg, resting on a frictionless horizontal table is connected to a cable that passes over a pulley and then is fastened to a hanging mass, m_2 = 2 kg. Find the acceleration of the masses and the tension in the cable.



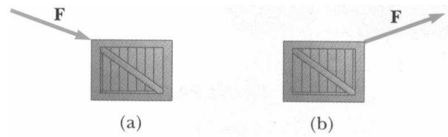
Answers: 6.53 m/s^2; 6.53 N

HW 6-3. Two boxes of fruit are connected by a light string with m_1 = 20 kg and m_2 = 25.4 kg. A force of 52.1 N is applied to the 25.4-kg box. The coefficient of kinetic friction between each box and the surface is 0.10. Determine the acceleration of each box and the tension in the string.



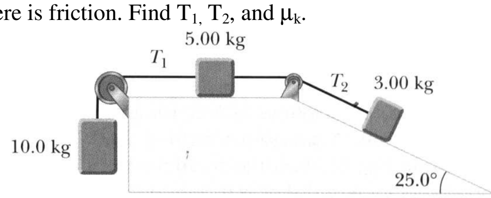
Answers: 0.1678 m/s^2; 22.95 N

HW 6-4. A 1410 N crate is being pushed across a level floor at a constant speed by a force F of 312 N at an angle of 23.7° below the horizontal as shown in Figure (a). (a) What is μ_k? (b) Next suppose the 312-N force is pulling the block at an angle of 23.7° *above* the horizontal. What will be the acceleration of the crate now?



Answers: 0.186; 0.324 m/s^2

HW 6-5. The three blocks of masses 10.0 kg, 5.0 kg, and 3.0 kg are connected by light strings that pass over frictionless pulleys as shown in the figure. The acceleration of the 5.00-kg block is 2.41 m/s^2 to the left. There is friction. Find T_1, T_2, and μ_k.



Answers: 73.9 N; 34.5 N; 0.558

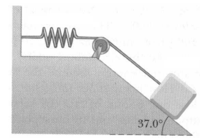
HW 7-6. Tarzan swings on a 28.6-m long vine initially inclined at an angle of 20° with the vertical. (a) What is his speed at the bottom? (b) What is his speed at the bottom if he pushes off with a speed of 4.28 m/s?

Answers: 5.814 m/s; 7.220 m/s

HW 8-2. In the dangerous "sport" of bungee jumping, a daring student jumps from a balloon with a specially designed elastic cord attached to his waist The unstretched length of the cord is 25.3 m, the student weighs 800 N, and the balloon is 36.5 m above the surface of a river below. Calculate the required force constant of the cord if the student is to stop safely 4.00 m above the river.

Answer: 1003 N/m

HW 8-3. A 5-kg block situated on a rough incline is connected to a spring of negligible mass having a spring constant of 119 N/m. The block is released from rest when the spring is unstretched, and the pulley is frictionless. The block moves 22.3 cm down the incline before coming to rest. Find μ_k.



Answer: 0.4145

HW 8-5. A skier of mass 74.9 kg is pulled up a slope by a motor-driven cable. (a) How much work is required to pull him 63.2 m up a 9°-slope (assumed frictionless) at a constant speed of 3 m/s? (b) How many horsepower must a motor have to perform this task? (1 hp = 745.7 W)

Answers: 45.82 kJ, 2.917 hp

HW 8-6. A 500-kg elevator starts from rest. It moves upward for 3 s with constant acceleration until it reaches its cruising speed, 1.66 m/s. (a) What is the average power of the elevator motor during this interval? (b) Compute its power during an upward cruise with constant speed (equal to its cruising speed).

Answers: 5.762 hp, 10.908 hp

“So, Dr. Colton, what’s *really* going to be on the exam?”