- worksheet: positron.hep.upenn.edu/p8/files/ws21.pdf
- 5 problems (2 very quick) + 2 XC, all torque/equilibrium.
- day22 video (covers trusses) is due this Wed. Video is online, but I still need to write the questions you'll answer.
- Another **reading/skimming assignment** will be due this Friday. You will **skim** O/K ch3 (mainly trusses, which you'll see first in my day22 video) and O/K ch4 ("load tracing," which helps connect real life with our 2D abstractions).
- In the next few weeks, we will **skim** 7 or 8 chapters of a beautifully illustrated [see onouye_ch01_ch02.pdf] book by Onouye & Kane, "Statics & Strength of Materials for Architecture & Building Construction. You can find your own copy (any edition will do), or you can venmo me $10 for one of my used copies. At the end of the term, you can either keep it or return it to me for a full $10 refund.
- Email **in advance** & file a CAR if you need to miss class.
- Today is my wife's birthday, so I'll try to leave right at 5pm!

torque (lever arm $\times$ force): $\tau = r_{\rm perp}\ F$

For equilibrium: $\sum F_x = 0 \quad \sum F_y = 0 \quad \sum_{\circlearrowleft P}\ \tau = 0.$

Usual torque convention: CCW minus CW. In choosing pivot P, note forces whose lines-of-action pass through P drop out of $\sum \tau$.

$F^K = \mu_k F^N \qquad F^S \leq \mu_s F^N$

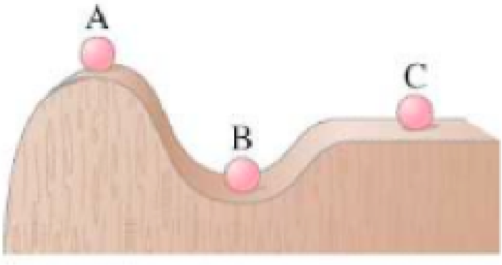
Physics 8, Fall 2021, Worksheet #21.

Upload PDF (smartphone scan or tablet edit) to Canvas at or shortly after end of class on Mon, Nov 15, 2021.

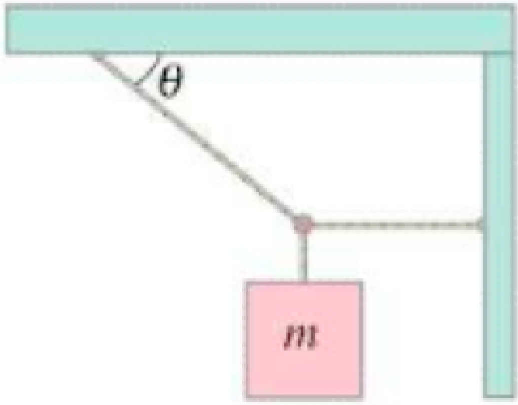
Problems marked with (*) must include your own drawing or graph representing the problem and at least one complete sentence describing your reasoning.

Discuss each problem with your teammates (usually groups of 3), then write up your own solution. Be sure to compare final results with your teammates, as a way to catch mistakes. It can also be very interesting when you and a teammate use different methods to arrive at a result! Do not hesitate to ask for help from other students, from Melina, or from Bill.

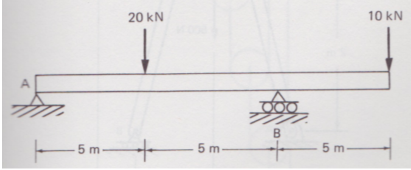
1. Name the type of equilibrium for each position of the ball in the figure.



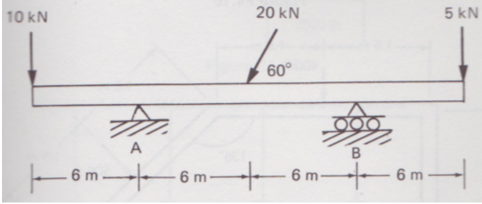
2*. Find the tension in the two cords shown in the figure below (left). Neglect the mass of the cords, and assume that the angle θ is 30° and the mass m is 50 kg.



3*. Using the equations for static equilibrium, find the "reaction" forces exerted by the supports on the beam in the left figure below. (There are three forces: two vertical and one horizontal. You may find that one force equals zero.)

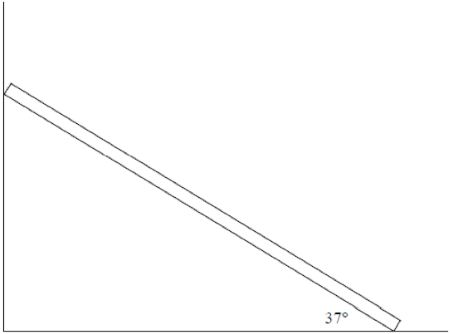


4*. Find the “reaction” forces exerted by the supports **A** and **B** on the beam in the right figure above. (There are three forces to find: two vertical and one horizontal.)



5*. Estimate the maximum torque that a bicyclist can deliver to the pedals. Assume that her inertia is 60 kg, that she is not wearing toe clips, and that she does not pull up very hard on the handlebars while she pushes down on the pedals. (Thus, the largest force she exerts equals her weight.) Also assume that the crank length (from axle to pedal) is 0.15 m. (Hint: this should be very easy.)

6XC*. The top end of a 5.0 m board rests against a smooth wall (shown at right), and the bottom end makes an angle of 37° with the floor. If the board has a mass of 10.0 kg, what are (a) the normal force exerted by the floor on the board and (b) the normal force exerted by the wall on the board? (c) Include as part of your solution an EFBD for the board.



7XC*. Dragster drivers have to avoid supplying too much power to the vehicle because too much power causes the front end to rise in a "wheelie," compromising steering control. (a) Why does this happen? Your explanation should include an extended free-body diagram to indicate the relevant forces and torques. (b) What benefit would come from having front-wheel drive in a dragster? What penalty? (Normally a drag-race car would have rear-wheel drive.) [One unconventional way to solve this problem, using the methods of statics, is to draw the "inertial pseudoforce" corresponding to the car's forward acceleration $\vec{a}$ as a **backward**-facing arrow, $-m\vec{a}$, whose line of action passes through the car's CoM. Or more conventionally, you can use the car's CoM as your pivot for evaluating moments (torques).]