Board Meeting Alpha

PHYSICS 203: PROFS. LU, WALTERS, MARTENS YAVERBAUM & BEAN
JOHN JAY COLLEGE OF CRIMINAL JUSTICE, THE CUNY

Make certain to read ALL procedures BEFORE beginning to follow any of them.

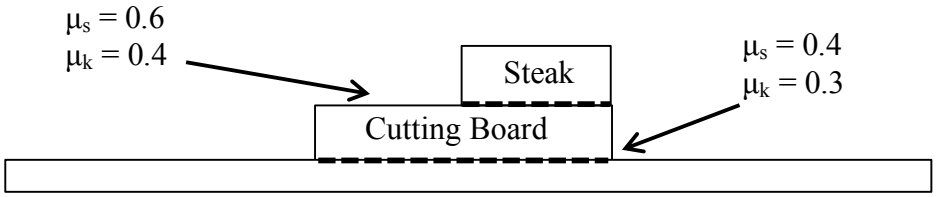
1) Carefully Read the CONCEPTUAL BACKGROUND below.

2) After reading, take at least one large white board for each group.
   With as much clarity, completeness, color, vivacity and verity as possible, on group white boards, respond to the PROBLEM which follows below (on the next page). You may certainly use more than one white board per group.

3) We will leave AT LEAST 45 minutes to 1 hour for the following:
   Gather in an approximate circle, all Boards facing in.
   Discuss the Boards with respect to and for any leading questions posed by the Instructor. The Instructor, however, will play a noticeably minimal role. Whenever s/he is silent and whenever you wonder what to discuss, do the following:
   a) Begin by attempting to identify and reconcile disagreements among boards,
   b) Freely but respectfully follow whatever conceptual/conversation paths emerge from the attempt to reconcile boards.
   c) Emphasize ***Depth*** over ***Breadth***:
      Once the class discovers that it is disagreement or confusion over a particular and fundamental point—
      whether or not this point was originally intended for discussion--
      STICK WITH THE CONCEPT ***PAST*** THE POINT OF FRUSTRATION & SEEMING 'CIRCLES'.
   d) Do not interrupt colleagues.

THE PROBLEM: 'FUNKY FRICTION'
(AKA, THE STEAK & THE BOARD)

A 2 kg steak sits on top of (and at the edge of) a 4 kg wooden cutting board. The cutting board sits on a table. All surfaces are rough; the coefficients of friction between each pair of surfaces are provided in the diagram below.



A confused cat comes along and exerts a purely horizontal leftward pull, ***P***, on the **cutting board**. Assume *for now* that the steak and the cutting board remain stuck together by friction.

A. Draw a system schema of the steak-board system.
B. Draw an FBD of the steak-board system.
C. Write out Newton's 2nd Law. Apply this law to the vertical axis.
D. Compute the normal force between the cutting board and the table.
E. Write out Newton's 2nd Law. Apply this law to the horizontal axis.
F. Compute the maximum force that the cat can pull with before the system will begin to slide across the table. Call this force $\boldsymbol{P_{max}}$.

Now assume the cat pulls with 8 Newtons more force than $\boldsymbol{P_{min}}$.

G. Find the horizontal acceleration of the steak-board system.
H. Draw a system schema of the steak by itself.
I. The cutting board is accelerating to the left. For the steak to stay on the cutting board, it too must move to the left. What force is causing the steak to move to the left and thus stay on the cutting board?
J. Draw an FBD of the steak
K. If the cutting board were to suddenly begin accelerating very quickly, what would happen to the steak? (Think of pulling a tablecloth out from under a dinner plate.) Explain how and why this would happen.
L. Compute the maximum acceleration the board can have before the steak begins to move. Call your answer $\boldsymbol{a_{max}}$.
M. Compute the force that the cat must pull at to make the cutting board move at $\boldsymbol{a_{max}}$. Call your answer ***P****.

Now assume the cat (who is ***incredibly strong***) pulls the board with a force of ***3P****.

N. Compute the new force of friction on the steak.
O. In the lab reference frame, find the magnitude & direction of the steak's acceleration.
P. Draw a free-body-diagram of the cutting board.
Q. In the lab reference frame, find the magnitude & direction of the board's acceleration.