September 28, 2011 Physics 131 Prof. E. F. Redish

■Theme Music: Charles Mingus

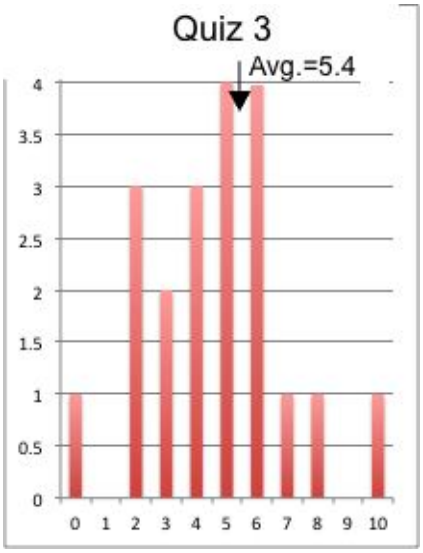
Tension

■Cartoon: Randall Munroe

XKCD

Quiz 3

	3.1	3.2	3.3
A	45%	55%	35%
B	0%	0%	15%
C	50%	5%	35%
D	0%	85%	0%
E	5%	10%	5%
F		20%	10%



9/28/11 Physics 131 **3**

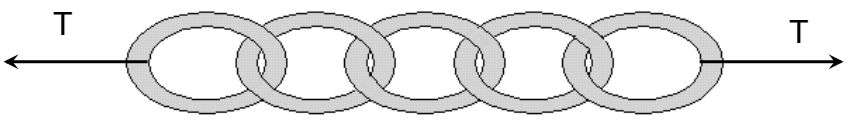
Tension: The Spring

- Recall what we have learned about a spring.
- A spring changes its length in response to pulls (or pushes) from opposite directions.

$$T = k\,\Delta l$$

Tension: The Chain

- Consider a series of links of chain being pulled from opposite directions. What are the forces on each link?

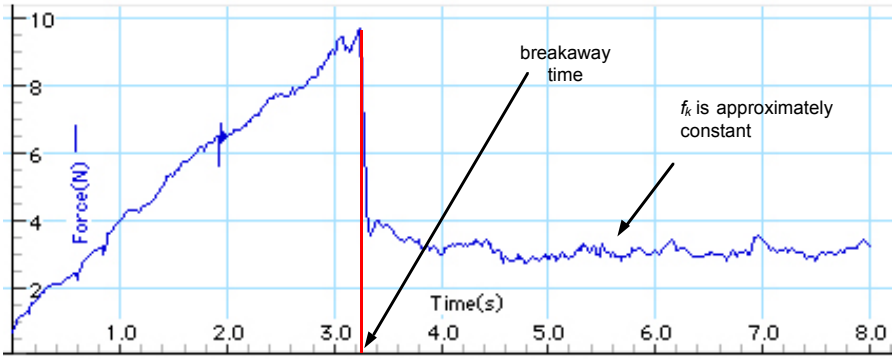


Friction

- Friction is our name for the interaction between two touching surfaces that is parallel to the surface.
- It acts to oppose the relative motion of the surfaces. That is, it acts as if the two surfaces are sticking together a bit.
- Normal forces adjust themselves in response to external forces. So does friction.
- Friction can oppose motion or cause it.

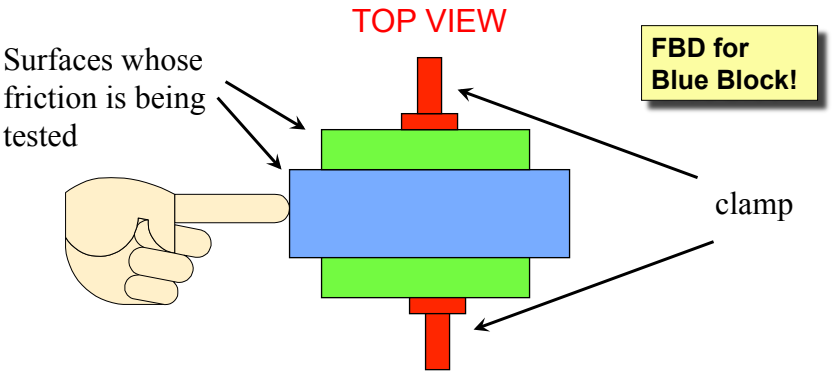
Measuring friction

Show it!



What does friction depend on?

- The friction force increases when the two surfaces are pressed together harder.



The friction relation

- When the surfaces are not sliding on each other, the friction force may take any value up to a maximum.

$$f_{A\to B} \le f_{A\to B}^{\max} = \mu_{AB}^{static} N_{A\to B}$$

- When the surfaces are sliding on each other, the friction force is a constant value (usually less than the maximum possible).

$$f_{A\to B} = \mu_{AB}^{kinetic} N_{A\to B} \qquad \mu_{AB}^{kinetic} \le \mu_{AB}^{static}$$