

# PhET Ramp Lab ws 3

A.

$\mu = 0.30$

Complete the table below. You may check your answers in the simulation.  
*Force Applied* is the force required (by you for instance) to make the crate move at a constant velocity in either direction or keep it from accelerating (if applicable).

Recall...constant velocity = \_\_\_\_\_ net force.  
 Also note: force applied may change direction as the angle increases!

Angle, $\theta$	Mass	Weight $g = 9.8\text{m/s}^2$	Normal Force, $F_n$	Force parallel $F_{//}$	Friction Force $F_f$	Net Force ( $F_{//} - F_f$ )
0.00°	100. kg			0.00 N		1.
10.0°	100. kg				2.	
20.0°	100. kg			3.		
30.0°	100. kg		4.			
40.0°	100. kg			5.		
50.0°	100. kg				6.	
60.0°	100. kg					7.
70.0°	100. kg				8.	
80.0°	100. kg			9.		
90.0°	100. kg		0.00 N		10.	

B.

**Conclusion Questions:**

- On a horizontal plane, the \_\_\_\_\_ force equals the \_\_\_\_\_.
- As the angle of the ramp is increased, the normal force *increases / decreases / remains the same* and the friction force *increases / decreases / remains the same*.
- As the angle of the ramp is increased, the force parallel *increases / decreases / remains the same*.
- The angle at which the force down the plane was equal to the force of friction (for the cabinet) was \_\_\_\_\_.
- Consider a very low (zero) friction, 5.0 kg skateboard on a ramp at an angle of 15° to the horizontal. What would be the **net force** that would cause acceleration when the skateboard is allowed to move? \_\_\_\_\_ N
- What would be the skateboard's acceleration down the plane? \_\_\_\_\_ m/s<sup>2</sup>
- Now consider the same no-friction 5.0 kg skateboard on the same 15° ramp. If a 45kg teenager jumps on, what would be her acceleration down the ramp? \_\_\_\_\_ m/s<sup>2</sup>
- Imagine you are pushing a 15 kg cart full of 25 kg of bottled water up a 10° ramp.
- If the coefficient of friction is 0.02, what is the friction force you must overcome to push the cart up the ramp? \_\_\_\_\_ N
- Realizing that there is also a force parallel (as a component of weight) you must ALSO overcome, what is the TOTAL force you must apply to push the cart up the ramp at a constant speed?  
 \_\_\_\_\_ N

