Relationships: $F_f = \mu F_N$

$F_f \propto F_N$

Variable:	F_f	μ	F_N
Quantity:	Force of friction	Coefficient of friction	Normal Force
Units:	N	none	N
Type:	vector	scalar	vector

1. What does the **coefficient of friction** measure?

Measures the roughness of two surfaces in contact. As the roughness increases, so does the coefficient.

2. Why are there two types of coefficients of friction? Compare them.

μ_s -(static coefficient)- not moving is greater than μ_K (Kinetic coefficient) which is moving.

3. What materials on top of one another are the: pg 138

   a) easiest to start moving?

   b) hardest to start moving?

   c) easiest to slide over one another?

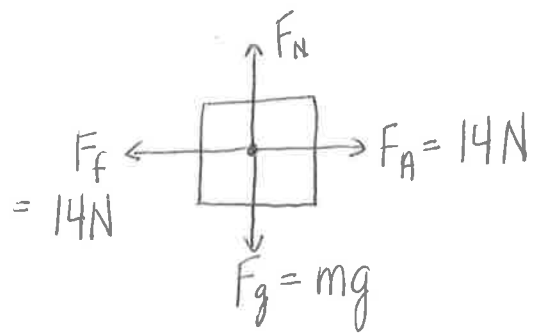
   d) hardest to keep moving?

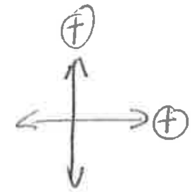
4. What coefficient of friction applies while dragging a wooden crate across a hardwood floor?

5. What coefficient of friction applies when a car skids across a dry asphalt roadway?

6. A 4.0 kg block is being dragged across the floor by a student who finds that he must exert a force of 14.0 newtons to keep the block moving at a constant velocity.

a) Draw and label a free-body diagram for this situation. $\Sigma F = \emptyset N$





b) Determine each force acting on the block.

$F_f = -14N$ $F_A = 14N$

$F_g = -39N$ $F_N = 39N$

$(4.0kg)(-9.8\frac{m}{s^2})$

c) Calculate the coefficient of friction (μ) for the block and the floor in this case.

$|F_f| = \mu_K |F_N|$

$\mu_K = \left|\frac{F_f}{F_N}\right| = \frac{14N}{39N} = 0.36$

d) If that brick is replaced with one that has a mass of 8.0 kg, which of the following will change? If so, how much?

i) Weight $W = mg$ weight will double
$W = (2m)g$

ii) Normal force
normal force will double

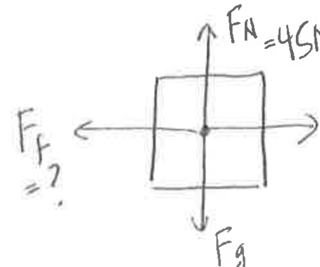
iii) Force of friction
will double

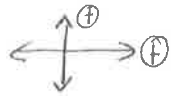
iv) Coefficient of friction stays the same

$F_g = F_N = 45N$

7. A 45 newton sled rests on a frozen pond. A child pulls the sled with a horizontal force of 15.0 newtons and causes it to accelerate at a rate of 1.50 m/s². (F_A, $\vec{a}$)

a) Determine the force of friction.





$\Sigma F = ma$

$F_g + F_N + F_A + F_f = ma$ ($F_g + F_N = 0N$)

$F_f = ma - F_A$

$F_g = 45N = m(-9.8\frac{m}{s^2})$

$m = 4.6Kg$

$F_f = (4.6Kg)(1.50\frac{m}{s^2}) - 15.0N$

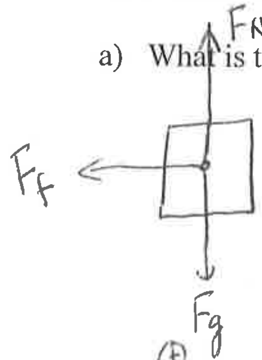
$F_f = -8.1N$

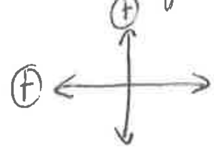
b) Determine the coefficient of friction.

$\mu = \left|\frac{F_f}{F_N}\right| = \left|\frac{-8.1N}{45N}\right| = 0.18$

8. A driver slams on the brakes and her 2.0×10^3 kg car skids to a stop on a dry asphalt highway.

a) What is the force of friction stopping the car?





$\mu_K = 0.8$

$F_f = \mu F_N$

$F_f = (0.8)(2.0 \times 10^3 Kg)(9.8\frac{m}{s^2}) = 1.6 \times 10^4 N$

b) What is the acceleration of the car while it is stopping? ⊕ ⟵⟶ ⊖

$\Sigma F = ma$

$\Sigma F = F_N + F_g + F_f = ma$ ($F_N + F_g = 0N$)

$F_f = ma$

$a = \frac{1.6 \times 10^4 N}{2.0 \times 10^3 Kg} = 7.8\frac{m}{s^2}$