FRICTION

FRICTION

- a force between two surfaces that opposes motion
  - acts opposite the direction of motion
- static – object is stationary (trying to move)
- kinetic – object is moving

- F_f does not depend on velocity or surface area

COEFFICIENT OF FRICTION

- Coefficient of Friction – the ratio of the magnitude of the force of friction between 2 surfaces to the magnitude of the normal force between the surfaces

$$\mu = \frac{F_f}{F_N}$$

Greek letter "mu"

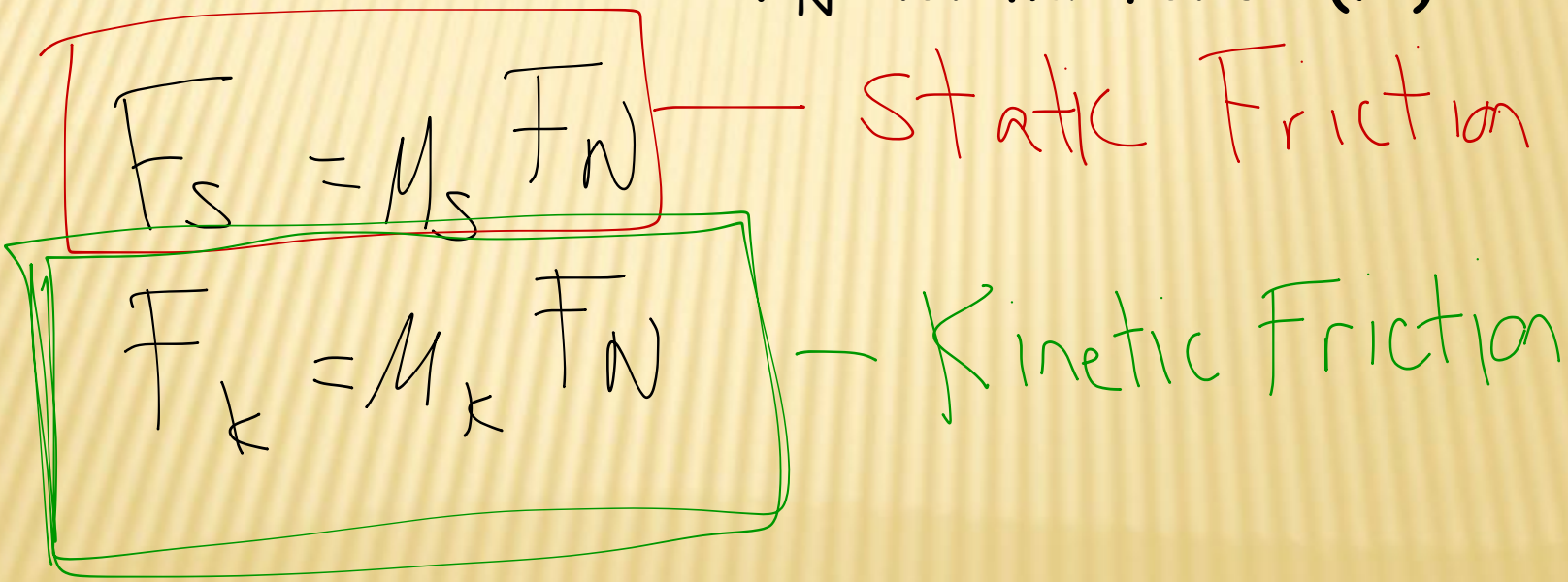
NORMAL FORCE

- Equal to the weight of the object
- $F_N=mg$

FRICTION

$F_f = \mu F_N$

F_f=force of friction (N)
μ=coefficient of friction
F_N=normal force (N)



COEFFICIENT OF STATIC FRICTION

- static – stationary (not moving)
- Coefficient of Static Friction:
  - the ratio of the magnitude of the maximum force of static friction to the magnitude of the normal force

$$\mu_s = \frac{F_s}{F_N}$$

COEFFICIENT OF KINETIC FRICTION

- kinetic – moving
- Coefficient of Kinetic Friction:
  - the ratio of the magnitude of the force of kinetic friction to the magnitude of the normal force

$$\mu_k = \frac{F_k}{F_N}$$

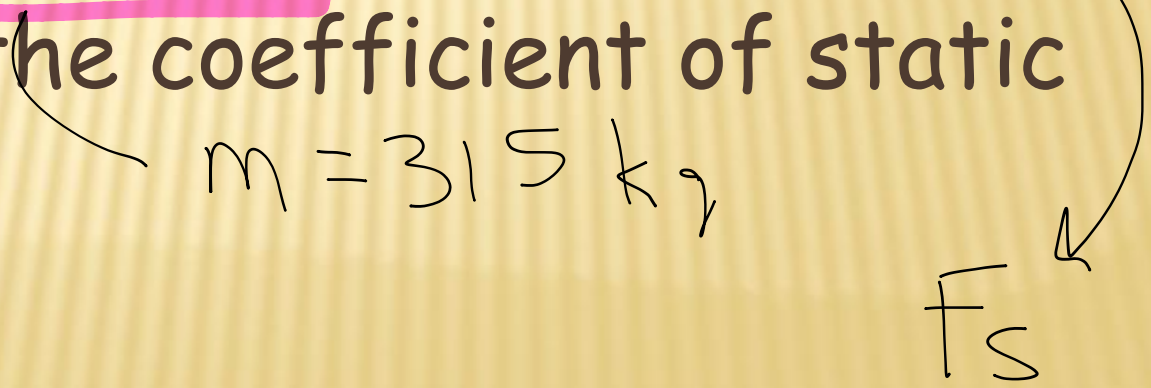
WHERE DO YOU WANT FRICTION…

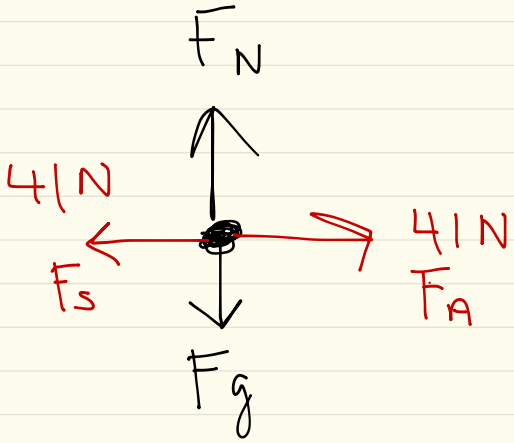
- as low as possible?

- as high as possible?

EXAMPLE #1 – PG.53

- In the horizontal starting area for a bobsled race, 4 athletes, with a combined mass of 295 kg, need a horizontal force of 41 N [forward] to get the 315 kg sled moving. Calculate the coefficient of static friction.





$$F_N = F_g = mg$$

$$= (315\,kg)\left(9.8\,\frac{m}{s^2}\right)$$

$$F_N = 3087\,N$$

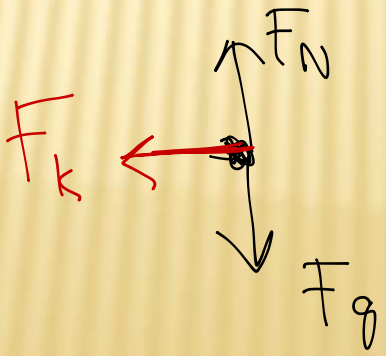
$$F_s = 41N$$

$$\mu_s = \frac{F_s}{F_N} = \frac{41N}{3087N} = 0.013$$

EXAMPLE #2 – PG. 54

- A truck's brakes are applied so hard that the truck goes into a skid on a dry asphalt road. The truck and its contents have a mass of 4.2×10^3 kg, calculate the force of kinetic friction on the truck.

2 Sig digs



$F_N = F_g$

$= mg$

$\mu_k = \frac{F_k}{F_N}$

$F_k = \mu_k F_N$

Table on pg. 53 $\mu_k = 1.0$

$$F_N = mg$$
$$= (4.2 \times 10^3 \text{ kg})\left(9.8 \frac{\text{m}}{\text{s}^2}\right)$$
$$= (4200 \text{ kg})\left(9.8 \frac{\text{m}}{\text{s}^2}\right)$$
$$F_N = 41160 \text{ N}$$

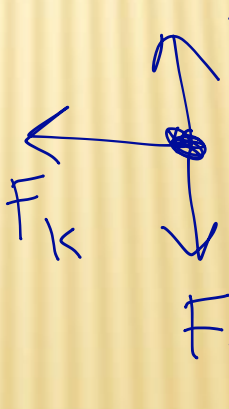
$$F_k = \mu_k F_N$$
$$= 1.0 \times 41160 \text{ N}$$
$$F_k = 41160 \text{ N}$$
$$F_k = 41000 \text{ N}$$

↳ 2 sig digs.

EXAMPLE #3

A loaded 4-man bobsled with a mass of 615kg experiences a frictional force of 66N as it slides down the track. Calculate the coefficient of friction.

$F_k = 66\ N$



$F_N = F_g$

$F_N = mg$

$= (615kg)\left(9.8\frac{m}{s^2}\right)$

$F_N = 6027N$

$\mu_k = \frac{F_k}{F_N}$

$= \frac{66N}{6027N} = 0.011$

HOMEWORK

- Read pgs. 52-55
- Do
  - p.54 # 3 - 5
  - p.55 # 1 - 4