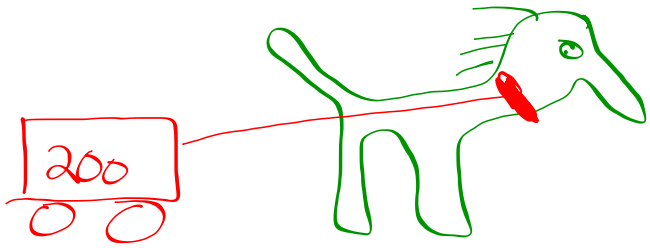
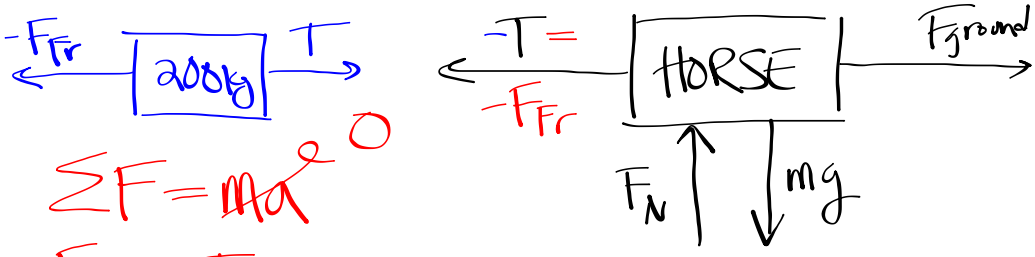
3. How much work did a horse do that pulled a 200-kg wagon 80 km without acceleration along a level road if the effective coefficient of friction was 0.060?

↳ 80,000m




$W = \frac{1}{2}mv^2 - \frac{1}{2}mv^2 = 0$ (same)

to the cart...




$\Sigma F = ma = 0$

$-F_{Fr} + T = 0$

$T = F_{Fr}$

$F_{Fr} = \mu F_N$

$= 0.06 \cdot (200)(9.8)$

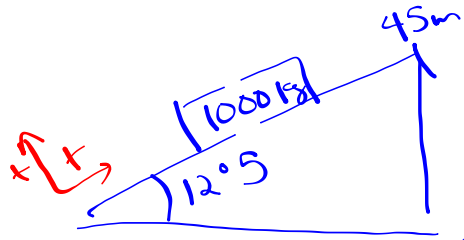
$= 117.6\,N$

$W = F \times d$

$= 117.6 \times 80{,}000$

$= 9{,}408{,}000\ J$

5. What is the minimum work needed to push a 1000-kg car 45.0 meters up a 12.5° incline?
   a) Ignore friction.
   b) Assume the effective coefficient of friction is 0.30.




Work → change KE

Vehicle has $a = 0$

$\Sigma F = ma = 0$

$F + -mg\sin 12.5 = 0$

$F = (1000)(9.8)(\sin 12.5) = 2121\ N$

$W = F \times d = 2121 \times 45$

$= 95455\ J$

17. How much work must be done to stop a 1000-kg car traveling at 100 km/hr?

$v = 100 \frac{km}{hr} \cdot \frac{1\ hr}{3600\ s} \cdot \frac{1000\ m}{km} = 27.8\ m/s$

1000 kg

$v = 0$

$v_0 = 27.8\ m/s$

~~$W = F \times d$~~

$W = KE - KE_0$

$= \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$

19. A baseball (m = 140 grams) traveling 30 m/s moves a fielder's glove backward 35 cm when the ball is caught. What was the average force exerted by the ball on the glove?

$v_0 = 30\ m/s$

$v = 0\ m/s$

$W = F \cdot d$

$F = m \cdot a$

$W = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$

$= -\frac{1}{2}(0.14\ kg)(30\ m/s)^2$

$W = -63\ J$

$W = F \cdot d$

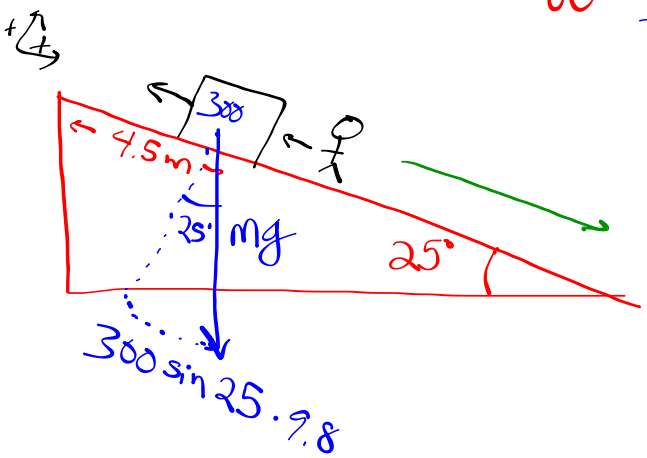
$-63 = F \cdot (0.35)$

$F = -180\ N$

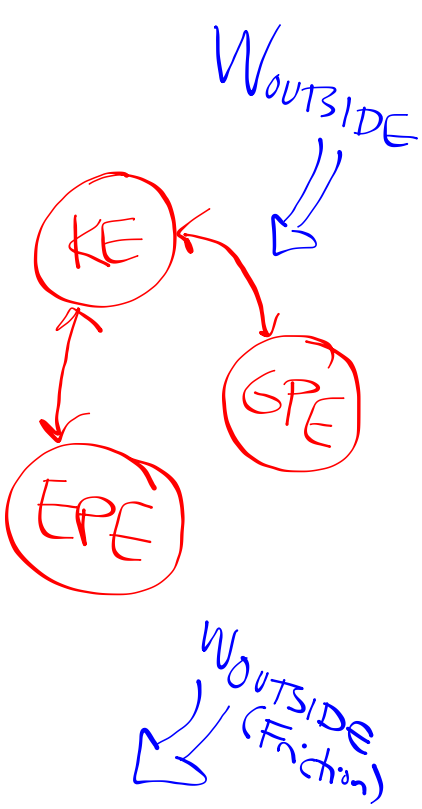
9. A 300-kg piano slides at constant speed 4.5 meters down a 25° incline. It is kept from accelerating by a man who is pushing back on it. The effective coefficient of friction is 0.39. Calculate

a) the net work done on the piano.
b) the work done by the man on the piano.
c) the work done by gravity on the piano.

$W = F \times d$ (4.5)

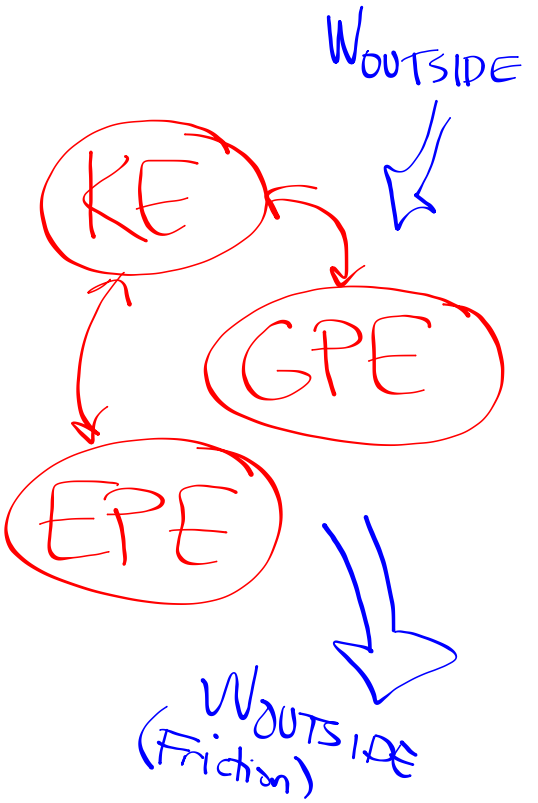



$W = (300)(9.8)\sin 25 \cdot 4.5$
$= 5591\ J$




Transfer
- Work
  - Arbitrary force (+ or −)
  - Friction (−) → thermal

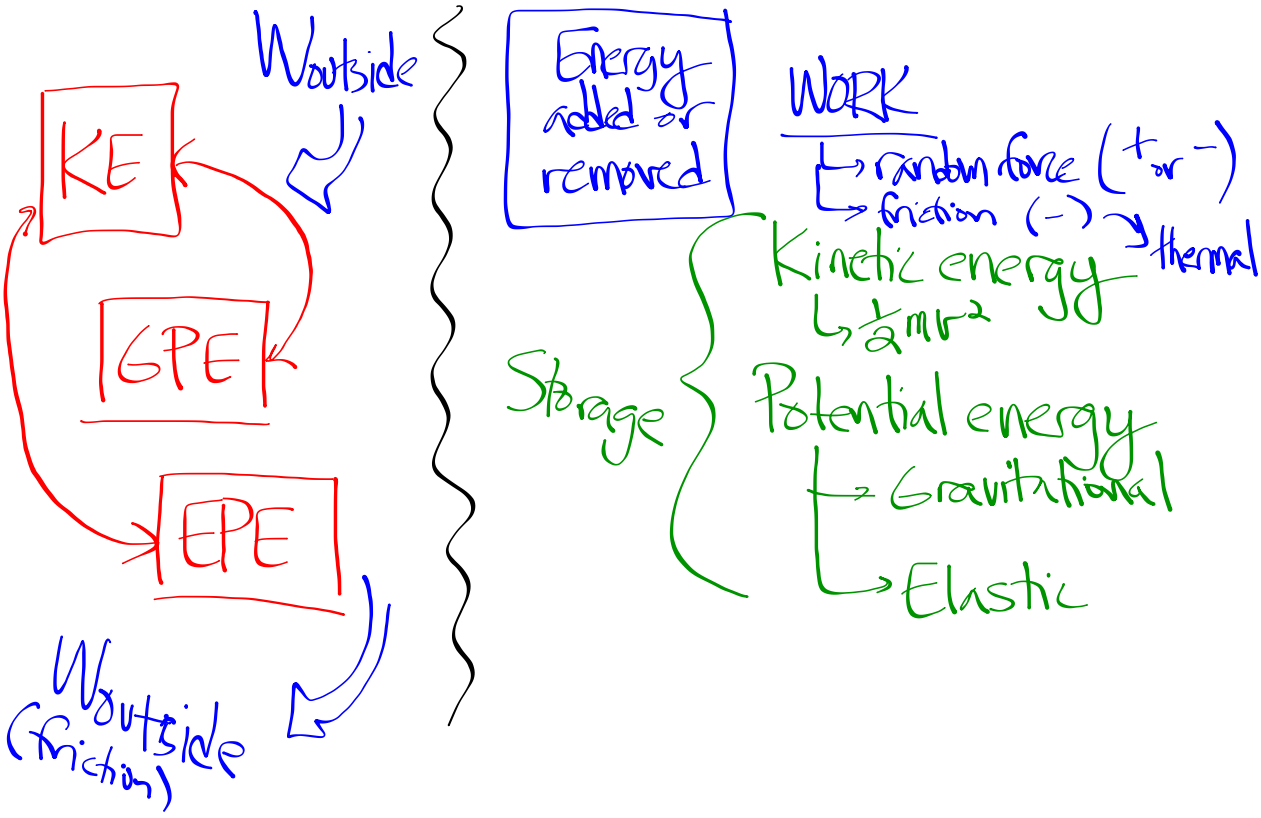
Stored
- Kinetic energy
  - $\frac{1}{2}mv^2$
- Potential energy
  - gravitational
  - elastic




Work
- arbitrary force (+/−)
- friction (−) → THERMAL

Kinetic
- $\frac{1}{2}mv^2$

Potential
- gravitational
- elastic


KE
GPE
EPE
Woutside
Woutside (friction)
Energy added or removed
WORK
random force (+ or −)
friction (−)
thermal
Kinetic energy
½mv²
Storage
Potential energy
Gravitational
Elastic