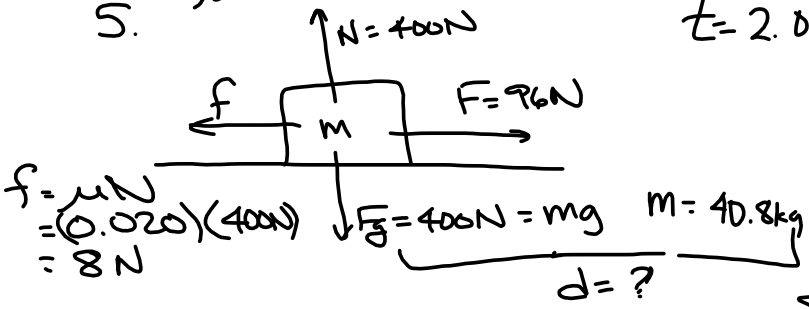
5. $\mu = 0.020$



$t = 2.0\,s$

$f = \mu N$
$= (0.020)(400N)$
$= 8N$

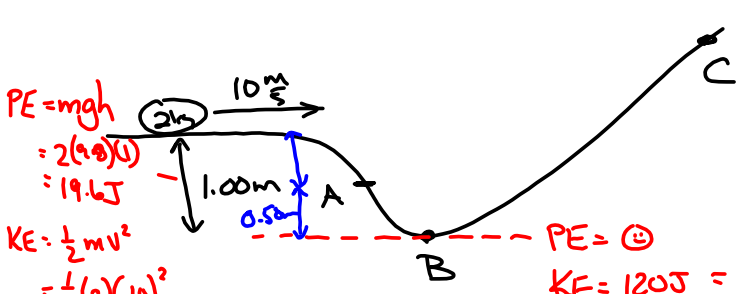
$W = F_{\parallel} d$
$= (96N)(4.32m)$
$= 415\,J$

$W_f = f d$
$= 8(4.32)$
$= 34.6\,J$

$V_f = v_i + at$
$= (2.16)(2) = 4.32\,m/s$

$d = v_i t + \frac{1}{2} a t^2$
$= \frac{1}{2}(2.2\,m/s^2)(2s)^2$
$= 4.32m$

$\Sigma F = F - f = ma$
$96N - 8N = (40.8kg)\,a$
$\frac{88N}{40.8kg} = a$
$a = 2.16\,m/s^2$



$V = ☺ \Rightarrow KE = ☺$

$PE = 120J = mgh$

$120 = 2(9.80)h$

$h = 6.12m$

$KE = 120J = \frac{1}{2}mv^2$

$= \frac{1}{2}(2)v^2$

$v = 11\ m/s$

A: $PE = mgh$

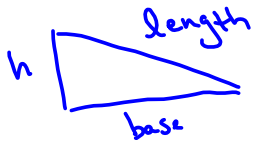
$= 2(9.8)(0.5m)$

$= 9.8J$

$KE = 110J = \frac{1}{2}mv^2$

$= \frac{1}{2}(2)v^2$

$v = 10.5\ m/s$



Power

Power is defined as the rate at which energy is transformed or work is done, i.e.,

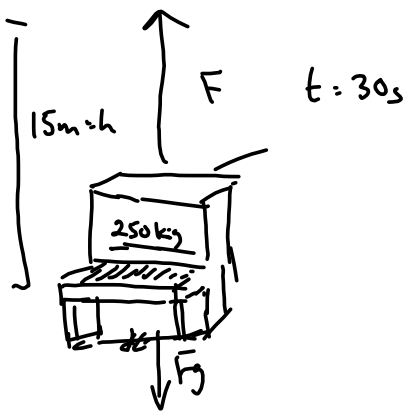
$$P = \frac{W}{t} \quad \text{or} \quad P = \frac{\Delta E}{t}$$

Unit of Power

$1 \frac{J}{s} = 1 W$ ← Watt

Example:

A piano of mass 250 kg is raised 15 m in a time of 30 s. How much power is required?



$$P = \frac{\Delta E}{t} = \frac{PE_f - PE_i}{t} \quad \text{J/s} \quad P = \frac{W}{t} = \frac{Fd}{t}$$

$$= \frac{mgh}{t} = \frac{(250)(9.8)(15)}{30} = \frac{mgd}{t}$$

$$= 1225\,W$$

Another way to look at power

$$P = \frac{W}{t} = \frac{F_{\parallel} d}{t} = F_{\parallel} v_{ave}$$

$$P = F_{\parallel} v_{ave}$$

Homework: # 12-16 on sheet

Power Lab

Purpose: To determine the work and power required for you to climb the stairs

a) walking slowly
b) walking normally
c) walking quickly

Equipment: Stopwatch, metersticks

Procedure: Measure the height (d) of the staircase in meters (you will have to indicate how you have done this in your lab). Determine your weight in Newtons (from the knowledge of your mass in kg). Knowing $W = F_{||} d$ calculate the work required for you to climb the stairs. Walk up the stairs at different speeds, recording the time for each climb. Using the power equation, determine the power required in each case.