Schedule

Fri: July 26 } Finish Lessons
Mon July 29 }

Tues July 30 → Review Pay
→ Lab Pretest

Wed July 31 → Theory Pretest

Thurs Aug 1 → Correct Theory Pretest
(maybe lab too)

Fri: Aug 2 → Lab Day 1

Mon Aug 5 → Lab Day 2

Tues Aug 6 → Theory Exam

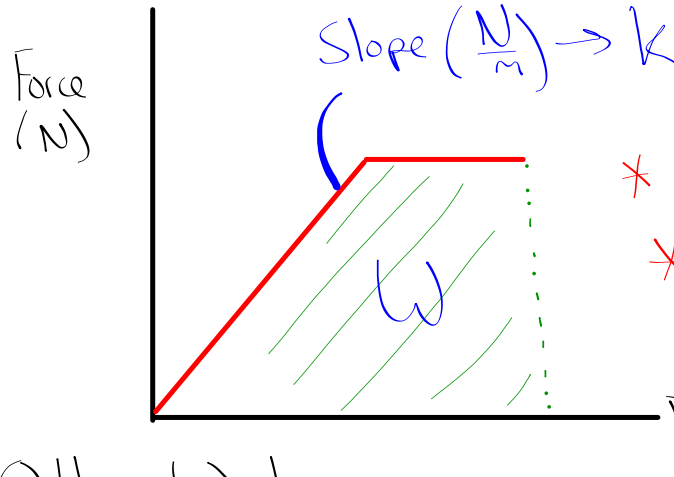
Wed Aug 7 → Possible Make ups - 5061

Work (cont'd)

Recall: $W = F \cdot d$

at an angle $W = F\cos\theta \cdot d$

Graphically:



* Area Under Curve = Work
* Slope = Spring Constant

Other Work

Spring: $F_{spring} = k \cdot x$ $\quad W_{spring} = \frac{1}{2}kx^2$

Vertical: $W = m \cdot g \cdot h$

Moving Object: $W = \frac{1}{2}mv^2$

July 26, 2019

Energy

1st Law of Thermodynamics

- Energy can't be created or destroyed, it simply changes shape

Exercise:

Think about the different changes in energy for the following situations:

i) Shooting an arrow

ii) Playing a DVD

iii) Lighting a Firecracker

Potential Energy
- stored energy

gravity: $PE = mgh$

Spring: $PE = \frac{1}{2}kx^2$

Kinetic Energy - Energy associated with movement

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

Total Energy

$TE = PE + KE$

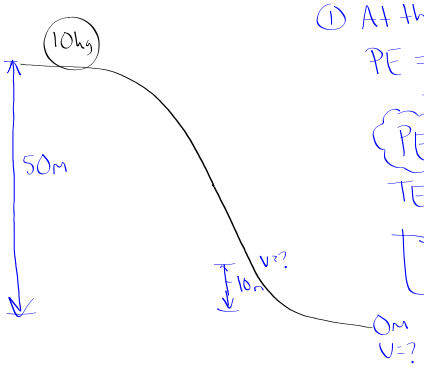
$TE_{Before} = TE_{After}$

Ex. A 10kg ball rests on a hill 50m high.

i) How fast will the ball be moving at a height of 10m from the bottom?

ii) How fast will the ball move at the bottom?

iii) How high is the ball if it's moving at 20m/s?



① At the Top – All PE

$PE = mgh$

$= (10)(9.8)(50)$

$PE = 4900\,J$

$TE = KE + PE$

$TE = 4900\,J$

i) $TE = PE + KE$

$TE = mgh + \frac{1}{2}mv^2$

$4900 = (10)(9.8)(10) + \frac{1}{2}(10)v^2$

$4900 = 980 + 5v^2$

$\frac{3920}{5} = \frac{5v^2}{5}$

$\sqrt{784} = \sqrt{v^2}$

$v = 28\,m/s$

ii) Bottom: $TE = KE + PE$

$TE = \frac{1}{2}mv^2$

$4900 = \frac{1}{2}(10)v^2$

$\frac{4900}{5} = \frac{5v^2}{5}$

$\sqrt{v^2} = \sqrt{980}$

$v = 31.3\,m/s$

iii) $TE = KE + PE$

$TE = \frac{1}{2}mv^2 + mgh$

$4900 = \frac{1}{2}(10)(20)^2 + (10)(9.8)h$

$4900 = 2000 + 98h$

$\frac{2900}{98} = \frac{98h}{98}$

$h = 29.6\,m$

Ex A spring is compressed 15cm in order for it to propel a 2kg block of frozen spaghetti sauce up an inclined frictionless track. If the spring has a constant of 400N/m,

i) What height will the block reach?

ii) What will be its velocity as it's released from the spring?

i) $TE_{Before} = TE_{after}$

$\frac{1}{2}kx^2 = mgh$

$\frac{1}{2}(400)(0.15)^2 = (2)(9.8)h$

$h = 0.23$

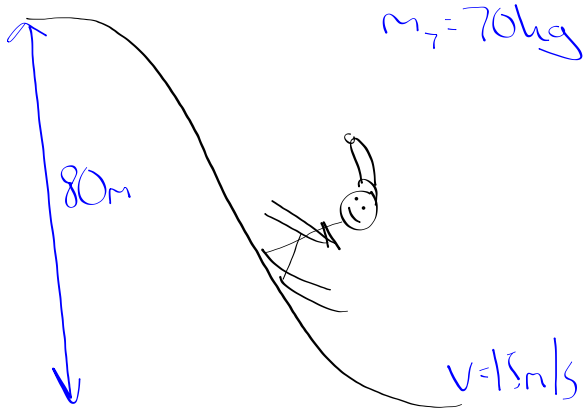
ii) $TE_{Before} = TE_{After}$

$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$

$\frac{1}{2}(900)(0.15)^2 = \frac{1}{2}(2)v^2$

$v = 2.12 m/s$

Ex. You reach the bottom of a ski hill with a velocity of 15m/s. The hill is 80m high. How much energy due to friction is produced during your descent if you weigh 64kg and your skis weigh 6kg?



$m_T = 64 + 6$

$m_T = 70kg$

$TE_{Top} = mgh$

$TE_{Top} = (70)(9.8)(80)$

$TE_{Top} = 54880J$

$TE_{Bottom} = \frac{1}{2}mv^2$

$= \frac{1}{2}(70)(15)^2$

$TE_B = 7875J$

$TE_{Top} \neq TE_{Bottom}$

$\therefore$ Difference = Energy from friction

$E_{Friction} = 54880 - 7875$

$E_{fr} = 47005J$