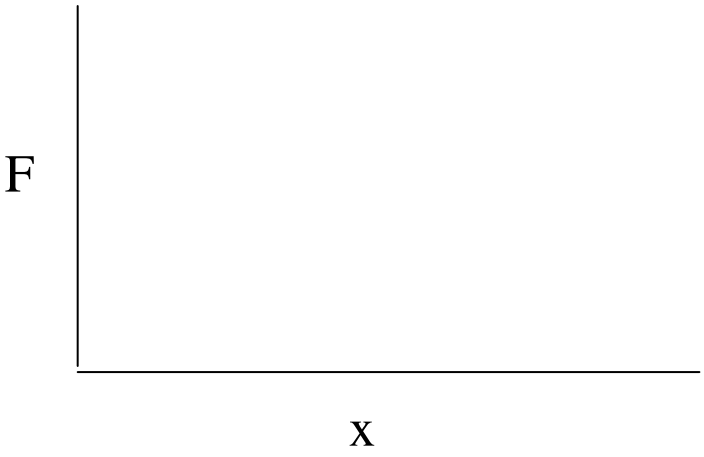
Physics 105 Class 9
ENERGY AND POWER

Springs



Hooke's Law:

Work done to compress:

Potential energy stored in spring: $PE = \frac{1}{2}kx^2$

You must choose x=0 at _____

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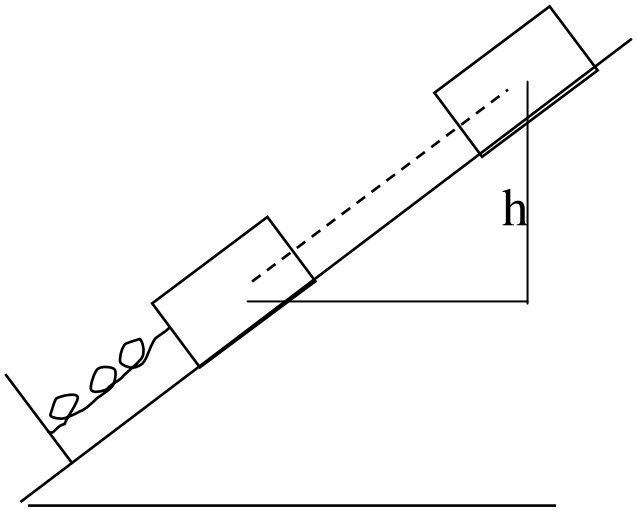
A spring is first compressed a distance d along an incline. A block of mass m is place in front of the spring (but not attached to the spring) and released from rest. How far (h) will the block rise above the horizontal when it stops? Ignore friction.



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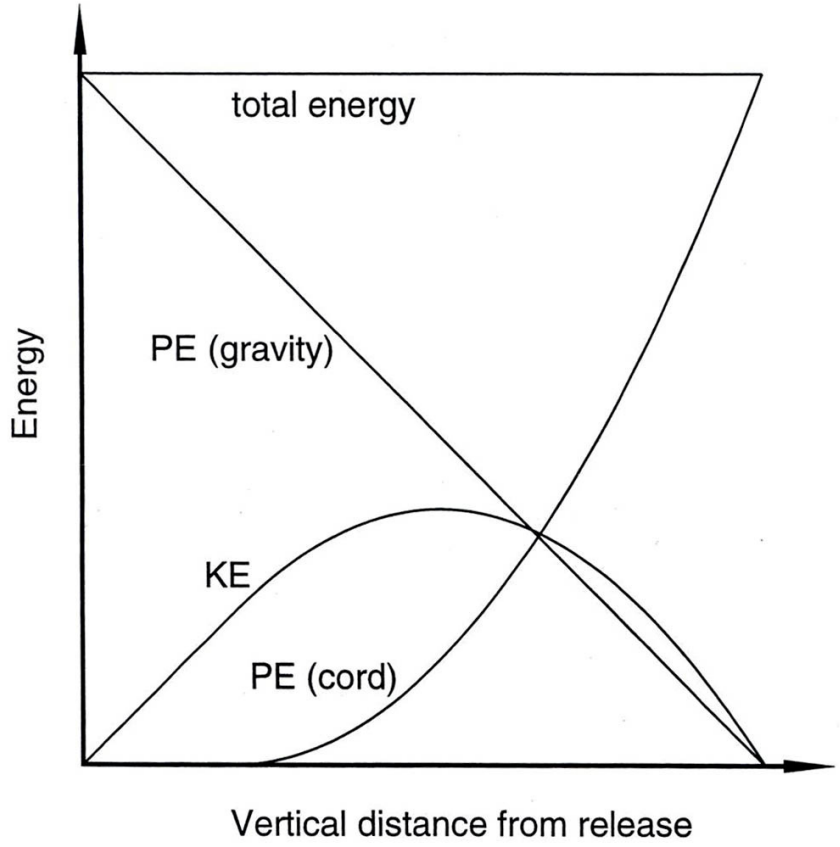
Bunji jumping



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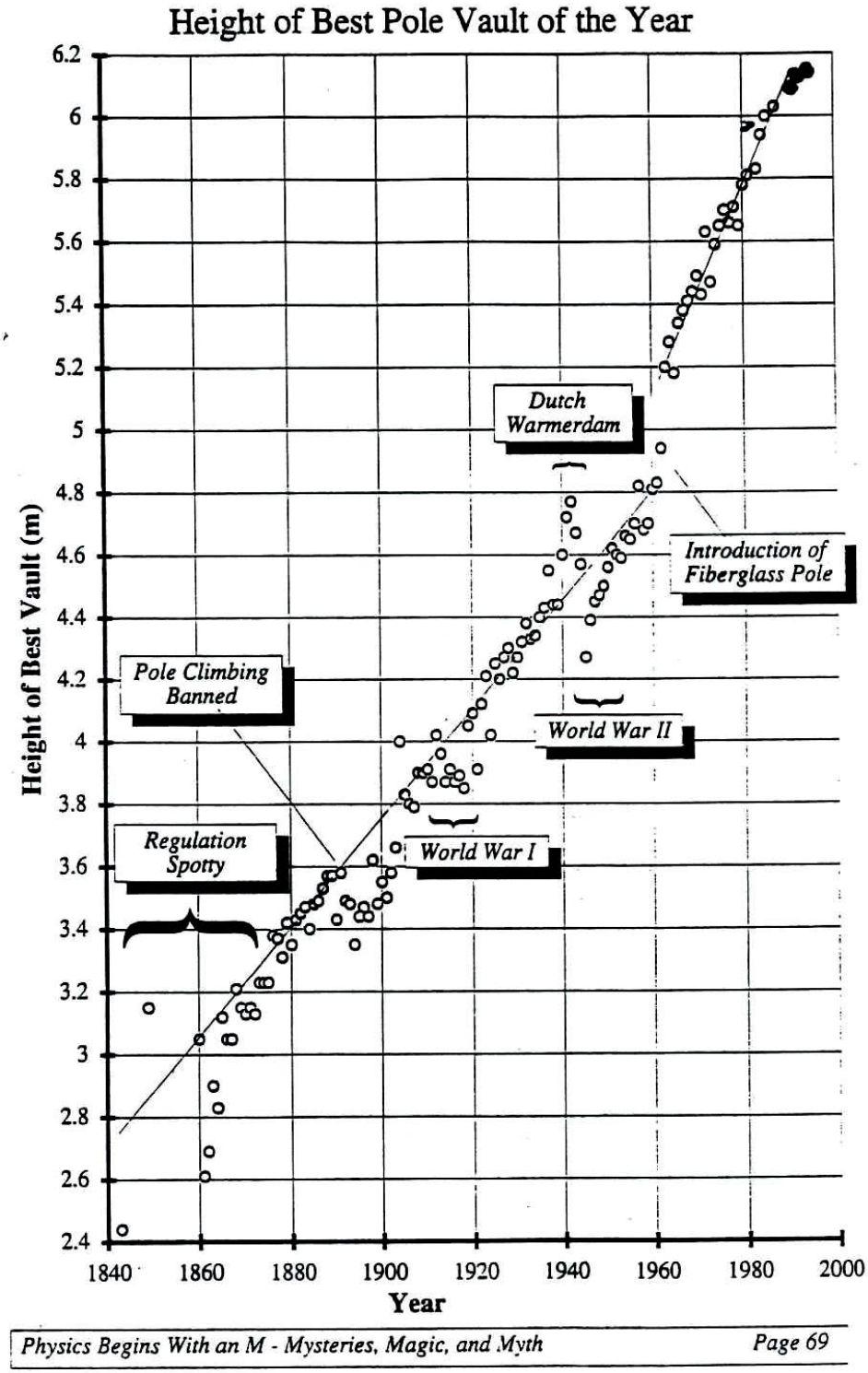
Pole Vaulting



Record (1994)

h=6.14 m=20.15 ft.,

Sergey Bubka (Ukr)

$KE_i = PE_{gravity}$?

$$\frac{1}{2}mv^2 = mgh \qquad h = \frac{v^2}{2g}$$

Record sprint speed:
v~10 m/s

→h~5.1 m

Where does the extra height come from?

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Pole Vaulter's Homework Problem:

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Nonconservative forces and energy conservation

"Mechanical energy": KE + PE

Other forms of energy

Where does frictional work go? Microscopic picture:

"Degradation" of energy

Conservation of energy equation with nonconservative work:

Text: $W_{nc} = (KE_f + PE_f) - (KE_i + PE_i)$

Nonconservative work changes the mechanical energy!

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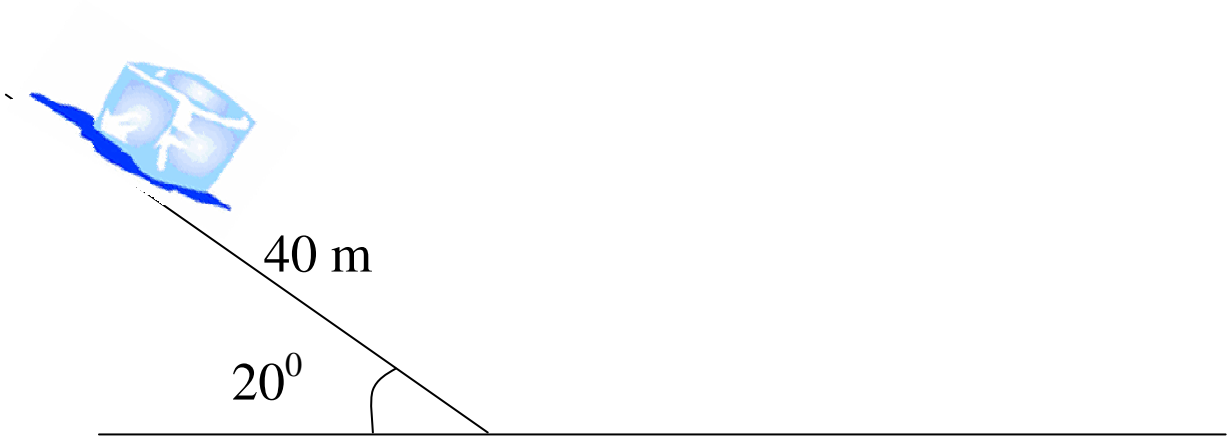


Fred, 50 kg (including ice), goes ice-blocking on the grass. Starting from rest he rides 40 m down a hill which has a 20° slope. $\mu_k = 0.2$ between the ice and grass. On the way down, Fred pushes with his hands with an average forward force of 5 N.

For each force decide how we keep track of the work done by the force

P2. Gravity _____

P3. Friction_____

P4. Normal force_____

P5. Fred's pushing_____

P6. Find the work done by Fred's pushing (in Joules)

P7. Find the work done by friction in Joules

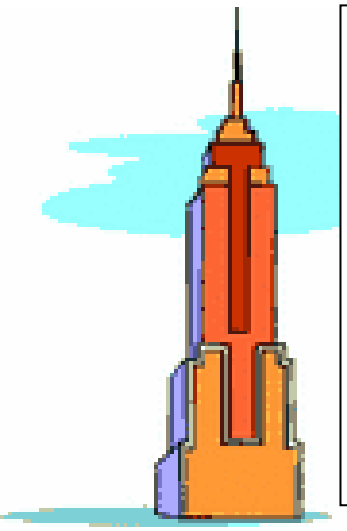
What is his speed at the bottom?

How far will will he go horizontally after he reaches the bottom? (Fred is not pushing along the horizontal portion .)

Power!

1Watt=

1Horse-power=746 W.



Empire state building:
Height: 1,250 feet, 443 meters
Stories: 102
There are 1,575 steps from the building's lobby to the 86th floor. Paul Crake holds the record for racing these steps in 10 minutes, 15 seconds.

What average power did he expend against gravity?
(Assume m=80 kg)

From work:

From velocity:

A car weighing 3000 N moves at a speed of 30 m/s on level ground. To do this, it pushes backwards on the road with a 5000 N force.

a) **P8.** What is the power output of the car engine?

b) Where does this power go if the car moves at constant speed?

Physics 105 Class 9

HOMEWORK HINTS: