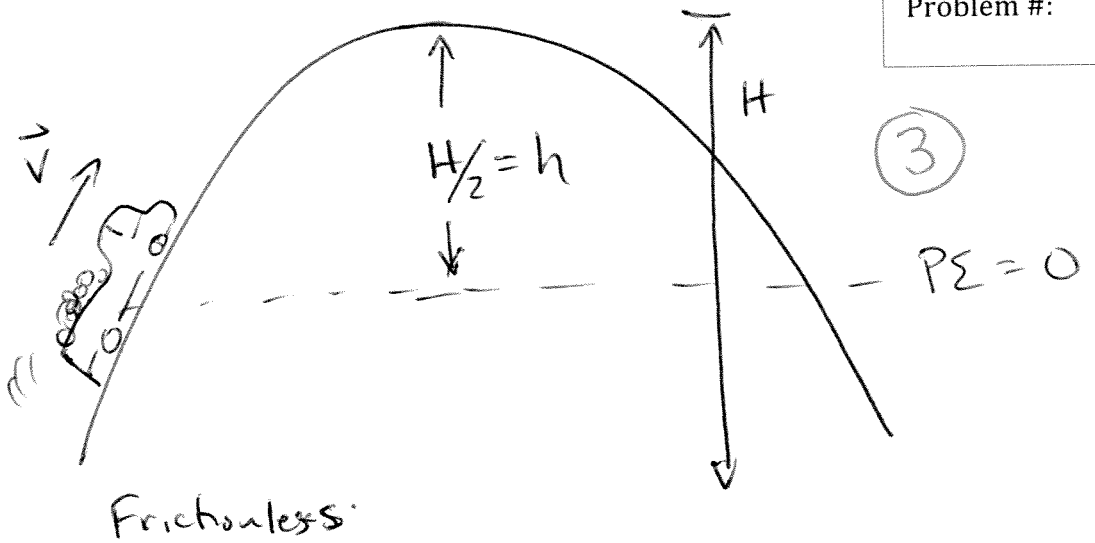
General Problem Solving Guide

Name:	KEY
Lab Time:	
Date:	
Test Code:	
Problem #:	Total /10

List given information, define variables, sketch picture:



3

Simplify question, list target quantity:

0.5 Is truck going fast enough?
(have enough energy to get over hill)

List all related quantitative relationships:

2

$E_i = E_f$ $\quad KE = \frac{1}{2}mv^2$

$PE = mgh$

$E = KE + PE$

Outline approach, sketch diagrams if needed (or sketch next to pictures above):

0.5

Set initial and final energies equal.
Compare velocity needed to truck's velocity
Check if mass makes a difference

Obtain a general solution:

$$mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_f^2$$ (1)

mass cancels

$h_i = 0\ m$

$h_f = h$

$v_i = v$

$v_f = 0\ m/s$ (truck barely makes it to the top of the hill)

$$\frac{1}{2}v^2 = gh$$

$$v^2 = 2gh$$

$$v = \sqrt{2gh}$$

Note $h = H/2$

A: $H = 20\ m$ $v_0 = 13.5\ m/s$

$$v = \sqrt{2 \cdot 9.8\frac{m}{s^2} \cdot 10\ m}$$

$v = 14\ m/s$

B: $H = 29\ m$ $v_0 = 16\ m/s$

$v = 15.3\ m/s$

C: $H = 30\ m$ $v_0 = 18\ m/s$

$v = 17.2\ m/s$

Check Units:

$$\frac{m}{s} = \left(\frac{m}{s^2}m\right)^{1/2} = \left(\frac{m^2}{s^2}\right)^{1/2} = m/s$$ ✓

Check Limiting Cases: (1)

$h \uparrow$ $v \uparrow$ ✓

$g \uparrow$ $v \uparrow$ ✓

mass ↑ doesn't matter ✓

Obtain a numeric solution: (1)

(i.e. plug in the numbers)

A: $13.5\ m/s < 14\ m/s$ OOPS!

B: $16\ m/s > 15.3\ m/s$ success

C: $18\ m/s > 17.2\ m/s$ success

* TRUCK DOES NOT MAKE IT OVER!

Why is solution reasonable? Explain.

(1)

Units check

Limiting cases check

Velocity seems reasonable

Energy conservation is a good choice for this problem

Shape of hill doesn't matter

Mass doesn't matter (just velocity