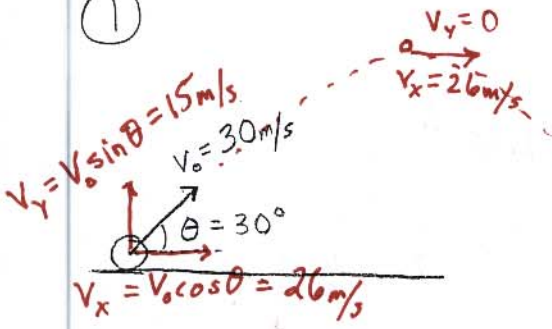
AP1 Practice Set 1

~~$v^2 = V_0^2 - 2g\Delta y$~~

$\Delta y = \frac{V_0^2}{2g} = \boxed{11.25\,m}$

a) Calculate for the max height of the ball using kinematics

(1)



b) Calculate for the max height using ~~Bottom~~ Top COE.

V at top is $V_x = 26 m/s$

$\boxed{11.2\,m}$

$K_0 + \cancel{U_0} = K + U$

$\frac{1}{2}mv_0^2 = \frac{1}{2}mv^2 + mgh$ ← this is 30 m/s

$h = \frac{\frac{1}{2}V_0^2 - \frac{1}{2}v^2}{g} = \uparrow$

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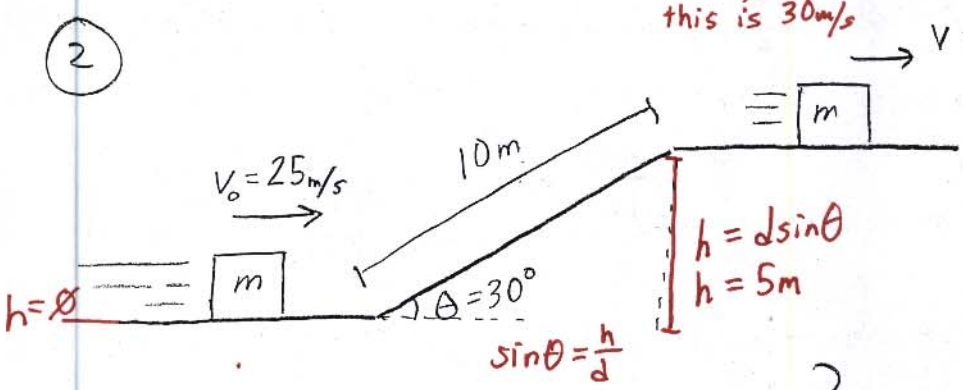
(2)



What is V at the top? (No Non-conservative forces)

COE

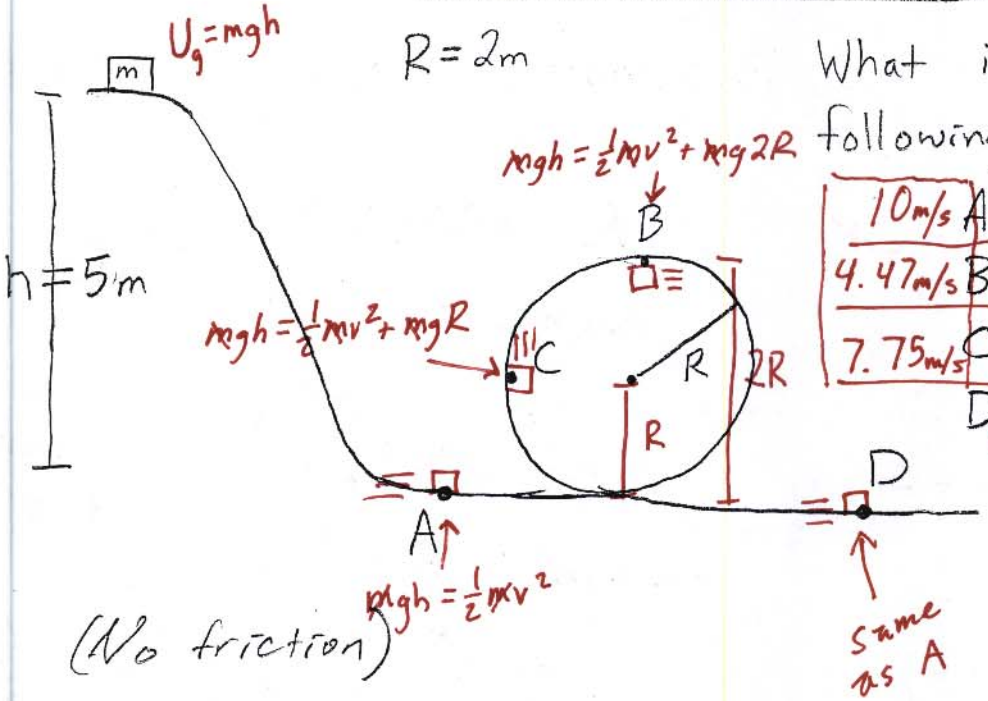
$\cancel{U_0} + K_0 = K + U$

$\frac{1}{2}mv_0^2 = \frac{1}{2}mv^2 + mgh$

$\frac{1}{2}V_0^2 - gh = \frac{1}{2}v^2$

$v = \sqrt{2(\frac{1}{2}V_0^2 - gh)}$

$\boxed{v = 22.9 m/s}$



What is (v) at the following points?

A. $U_0 = K_A$ $mgh = \frac{1}{2}mv^2$ $v = \sqrt{2gh}$ — 10 m/s

B. $v = \sqrt{2(gh - g2R)}$ — 4.47 m/s

C. $v = \sqrt{2(gh - gR)}$ — 7.75 m/s

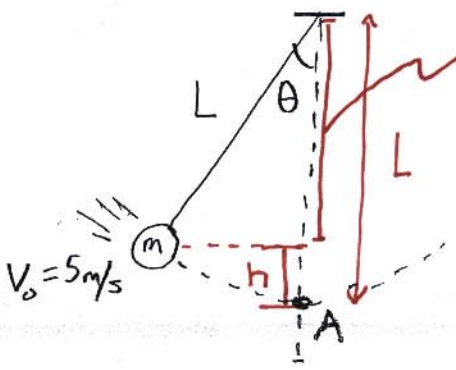
D. same as A — $\boxed{v = 10 m/s}$

(4)

$L = 3m$

$\theta = 30°$

$m = 2kg$



$h = L - L\cos\theta$

a) $v = 5.75 m/s$

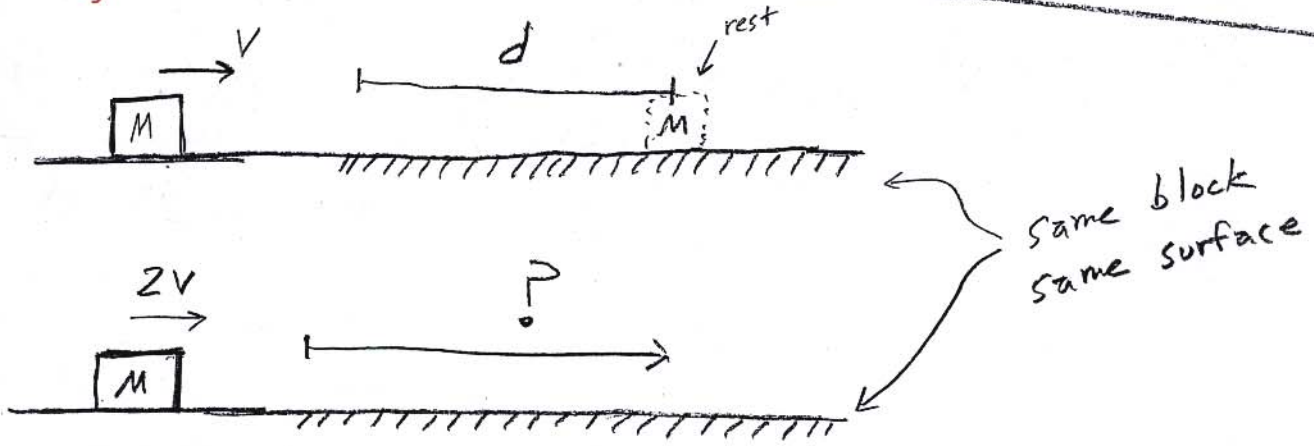
a) How fast is the ball going at point A?

COE $K_o + U_o = K + U$ $\quad \frac{1}{2}mv_o^2 + mgh = \frac{1}{2}mv^2$ $\quad v = \sqrt{2\left(\frac{1}{2}v_o^2 + g(L - L\cos\theta)\right)}$

b) What is the tension in the string at point A?

$\Sigma F_c = m\frac{v^2}{r}$ $\quad T - mg = \frac{mv^2}{L}$ $\quad T = \frac{mv^2}{L} + mg$ $\quad T = 42N$

(5)



How far will the 2nd block slide in terms of d?

1st block $\quad \Sigma W = \Delta K$ $\quad -F_f \cdot d = K - K_o$ $\quad d = \frac{v_o^2}{2\mu g}$

$v_o = v$ $\quad -\mu mgd = -\frac{1}{2}mv_o^2$

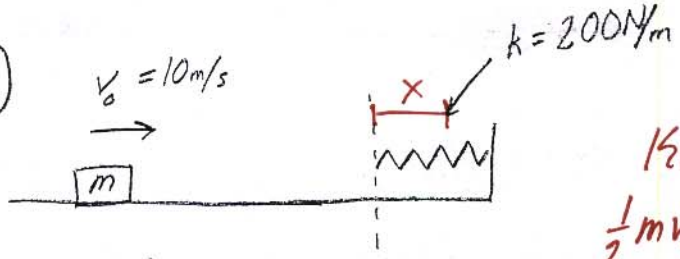
2nd block $\quad \Sigma W = \Delta K$ $\quad -F_f \cdot d = K - K_o$ $\quad$ Compare 4x greater

$v_o = 2v$ $\quad -\mu mgd = -\frac{1}{2}mv_o^2$

$d = \frac{v_o^2}{2\mu g}$ $\quad d = \frac{(2v)^2}{2\mu g} = \frac{4v^2}{2\mu g}$

~~4d~~ $\quad$ 4d

(1)



(no friction)

$m = 1kg$

How far will the block compress the spring?

COE

$K_0 + U_0 = K + U$

$\frac{1}{2}mv_0^2 = U_s$

$\frac{1}{2}mv_0^2 = \frac{1}{2}kx^2$

$x = \sqrt{\frac{mv_0^2}{k}} = \boxed{0.7m}$

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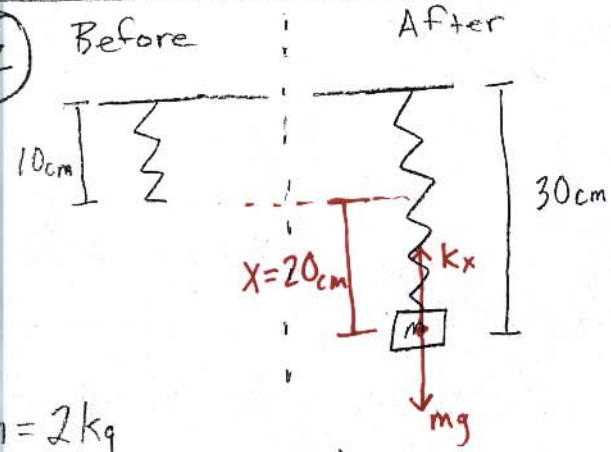
(2)



$m = 2kg$

(vertical)

What is the spring constant?

$\Sigma F = \emptyset$

$kx - mg = \emptyset$

$kx = mg$

$k = \frac{mg}{x} = \boxed{100 N/m}$

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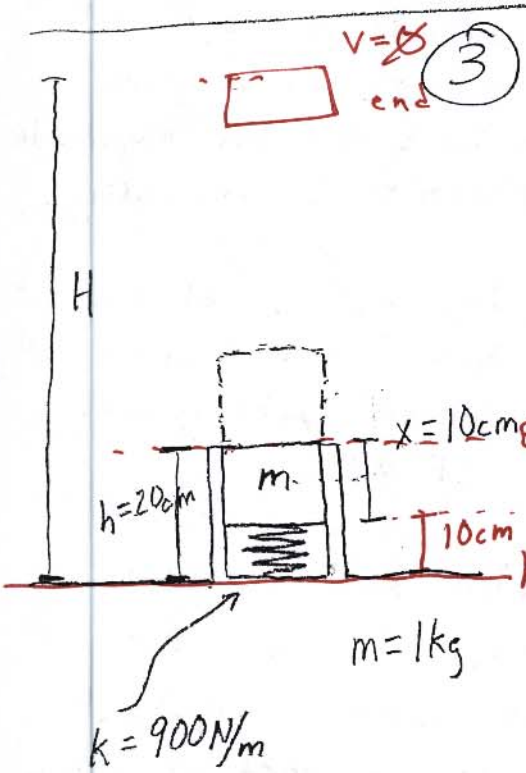
(3)



How high (H) above the ground will the block rise?

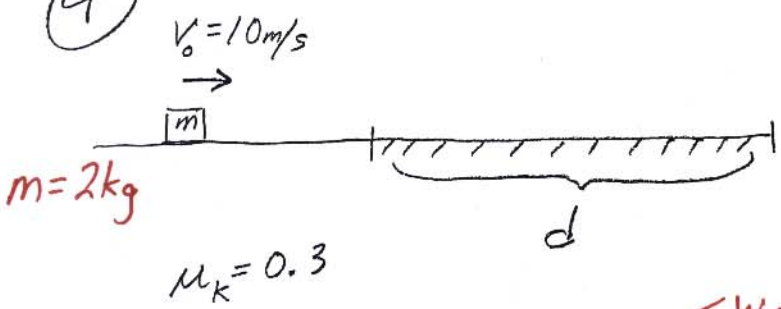
$U_0 + K_0 = K + U$

$U_{g_0} + U_{s_0} = U_g$

$mgx + \frac{1}{2}kx^2 = mgH$

$H = \frac{mgx + \frac{1}{2}kx^2}{mg} = \boxed{0.55m}$

(4)



(a) How much work will friction do to bring the block to rest.

$\Sigma W = \Delta K$ $\quad -W_f = \cancel{K} - K_o$ $\quad W_f = \frac{1}{2}mv_o^2 = \boxed{100J}$

(b) How much kinetic energy does the block start with? $K_o = \frac{1}{2}mv_o^2 = \boxed{100J}$

(c) How far (d) will the block slide?

$\Sigma W = \Delta K$ $\quad -F_f \cdot d = \cancel{K} - K_o$ $\quad \mu mgd = \frac{1}{2}mv_o^2$ $\quad d = \frac{v_o^2}{2\mu g} = \boxed{16.7m}$

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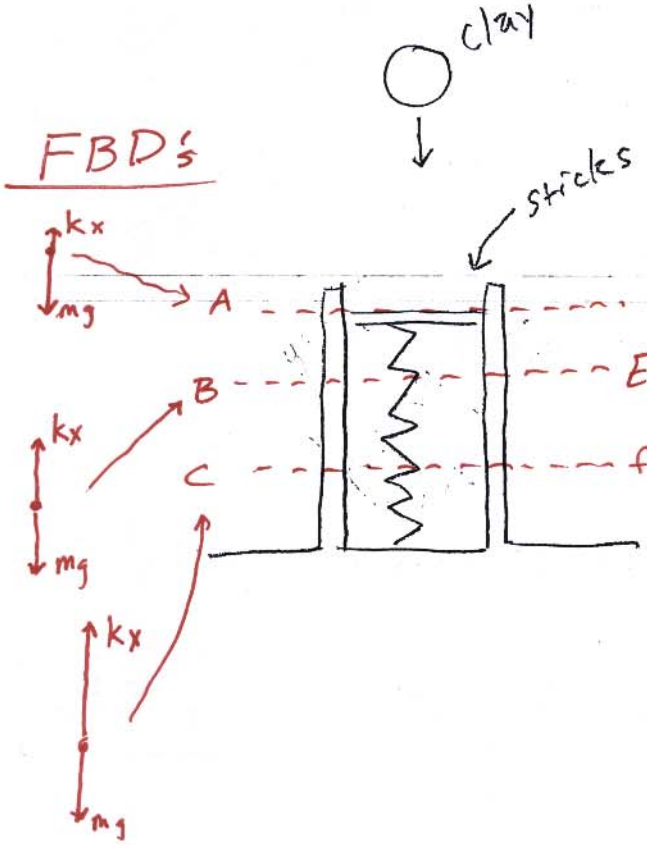
(5)

Describe the ball of clays motion starting when it first hits the spring.



A-B • At first contact the ball is still speeding up. The net force is still downward but the magnitude of the acceleration is decreasing.

B • The ball is at max speed but is no longer speeding up. $\Sigma F = \emptyset$

B-C • The ball is now slowing down as the ΣF is upward. The ball is brought to rest at point C.