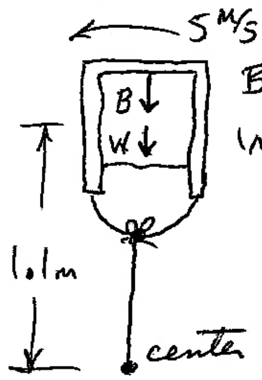
PHY 131 – REVIEW FOR EXAM 1:

(1)



B = force from bucket

W = weight $= mg = (4\,kg)(9.8\,m/s^2) = 39.2\,N$

$$\Sigma F_y = ma$$

$$B + W = m\left(\frac{v^2}{r}\right)$$ (Taking down as positive.)

$$B + 39.2 = \underbrace{(4\,kg)\left(\frac{5^2}{1.1}\right)}_{90.9}$$

$$B = 90.9 - 39.2 = \boxed{51.7\,N}$$ Direction: $\boxed{\text{Down}}$

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(2) given: $v_i = 4.8\,m/s$, $t = 1.5\,s$, $\Delta x = 4.2\,m$ find: a

$$\Delta x = v_i t + \tfrac{1}{2} a t^2$$

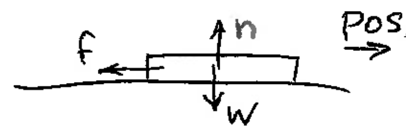
$$4.2 = (4.8)(1.5) + \tfrac{1}{2} a (1.5^2)$$

$$4.2 = 7.2 + 1.125a$$

$$-3.0 = 1.125a$$

$$a = -\frac{3}{1.125} = -2.67\,m/s^2$$

Forces$_x$:



(a) $\Sigma F_x = ma$

$$-f = (.75)(-2.67)$$

$$= \boxed{2.00\,N}$$

(b) $\Sigma F_y = 0$

$$n - W = 0$$

$$n = W$$

$$n = (.75\,kg)(9.8) = 7.35\,N$$

$$f = \mu_k n \Rightarrow \mu_k = \frac{f}{n} = \frac{2.00\,N}{7.35\,N} = \boxed{.272}$$

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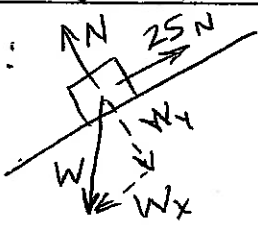
(3) uphill:

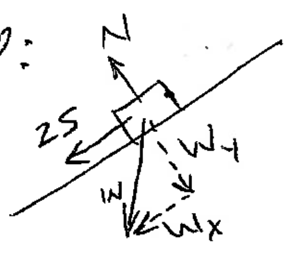


$$\Sigma F_x = ma$$

$$25 - W_x = \underbrace{(6)(1.7\,m/s^2)}_{10.2}$$

$$25 - 10.2 = W_x \Longrightarrow W_x = 14.8\,N$$

downhill:

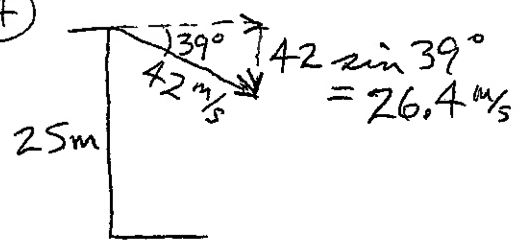


$$\Sigma F_x = ma$$

$$\underbrace{-25 - W_x}_{-39.8} = (6)a$$

$$a = \frac{-39.8}{6} = \boxed{-6.63\,m/s^2}$$ (downhill)

(4)



given: $\Delta Y = 25\,m$, $v_{iy} = 26.43\,m/s$

$a_y = 9.8\,m/s^2$ (down = pos.)

find: t

$$\Delta Y = v_{iy} t + \tfrac{1}{2} a_y t^2$$

$$25 = 26.4t + \tfrac{1}{2}(9.8)t^2$$

$$0 = 4.9t^2 + 26.4t - 25$$

Quadratic formula: $t = \dfrac{-26.43 \pm \sqrt{26.43^2 - 4(4.9)(-25)}}{2(4.9)}$

$$= \frac{-26.43 \pm \sqrt{698.6 + 490}}{9.8} = \frac{-26.43 \pm 34.47}{9.8}$$

Pick the positive root: it can't hit bottom before it was thrown: $\dfrac{-26.43 + 34.47}{9.8} = \dfrac{8.04}{9.8} = \boxed{.820\text{ sec}}$

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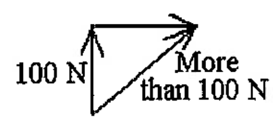
5. a. Negative, negative, negative. A freely falling object's acceleration is 9.8 m/s^2 down regardless of how it is moving.

b. $1\text{ N} = 1\,\dfrac{\text{kg}\cdot\text{m}}{\text{s}^2}$ Look at the units in F = ma. m is in kg, a is in $\dfrac{\text{m}}{\text{s}^2}$

c. t_3. Velocity is the slope of a position graph and t_3 is the only time at which both curves have the same slope.

d. More at A. The normal force is more at A because there isn't as much upward force from the string. Larger n means larger f by f = μn.

e. More than 100 N. $\vec{B}$'s y component equals 100 N, to balance the weight of the box. B itself would be more.

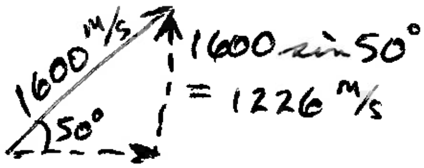


PHY 131

REVIEW OF 1-4

SOLUTIONS

(1) INITIALLY:



IT RISES UNTIL IT STOPS RISING.

SO,

GIVEN: $v_{iy} = 1226 \text{ m/s}$, $v_{fy} = 0$

$a_y = -9.8 \text{ m/s}^2$

FIND: ΔY

$$v_{fy}^2 = v_{iy}^2 + 2a_y \Delta Y$$

$$0^2 = 1226^2 + 2(-9.8)\Delta Y$$

$$19.6\Delta Y = 1226^2 \Rightarrow \Delta Y = \frac{1.502 \times 10^6}{19.6} = \boxed{7.66 \times 10^4 \text{ m}}$$

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(2) $\Delta x = v_i t + \frac{1}{2}at^2 \Rightarrow \Delta x = \frac{1}{2}at^2 \Rightarrow \frac{2\Delta x}{a} = t^2 \Rightarrow t = \sqrt{\frac{2\Delta x}{a}}$

(v_i = 0 (STARTS AT REST))

FIRST APPLE: $\sqrt{\frac{2(8\text{m})}{9.8 \text{ m/s}^2}} = 1.2778$ SEC

SECOND APPLE: $\sqrt{\frac{2(3\text{m})}{9.8}} + \sqrt{\frac{2(5\text{m})}{9.8}} = .7825 + 1.0102 = 1.7927$ SEC

DIFFERENCE BETWEEN THEIR ARRIVALS:

$$1.7927 - 1.2778 = .5149 \approx \boxed{.515 \text{ s}}$$

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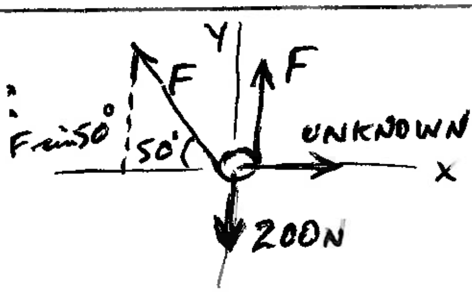
(3) FORCES ON PULLEY:



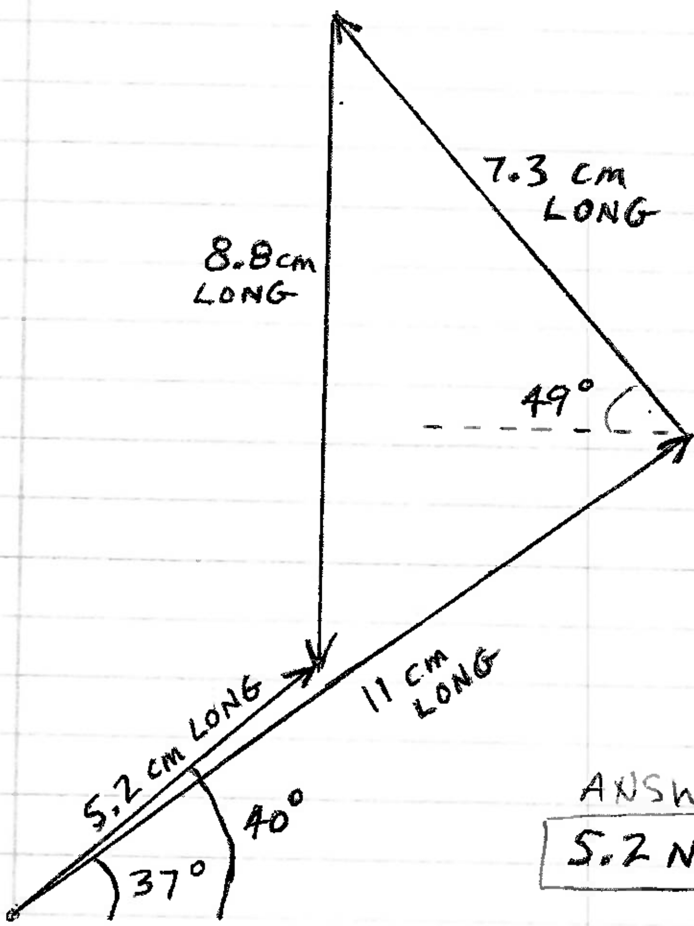
$$\Sigma F_y = 0$$

$$F \sin 50° + F - 200 = 0$$

$$F(\sin 50° + 1) = 200$$

$$F = \frac{200}{(\sin 50° + 1)} = \boxed{113 \text{ N}}$$

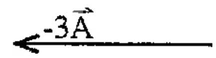
④ SCALE: 1 cm = 1 N



ANSWER:

5.2 N at 40°

5. a. It should be an arrow three times as long as $\vec{A}$, pointing to the left.



b. They should each be 1 unit long, 1 cm in this case. $\hat{i}$ should point in the x direction and $\hat{j}$ in the y direction.

c. i. Actual force. The net force toward the center of the curve.
ii. Inertia effect. An object's tendency to follow a straight line makes it want to move outward instead of following the curve.

d. Up. The scale reads how hard the scale is pushing against the weight. At point A, it pushes with a force greater than what it weighs, causing an upward acceleration.

e. A constant velocity means an acceleration of zero. It doesn't matter if it is 30 m/s or some other speed, the important thing is that it is not changing.