X1.5a **1130**

PHYS-1130(5) (Kaldon-40443) **Name** _____S O L U T I O N_____

WMU - Fall 2007

Exam 1A - 100,000 points **Book Title** _____

Rev. 09/25/07 Tu.4.r1

State Any Assumptions You Need To Make – Show All Work – Circle Any Final Answers
Use Your Time Wisely – Work on What You Can – Be Sure to Write Down Equations
Short Answers Should Be Short! – Feel Free to Ask Any Questions

EXAM 1 [FORM - A]

PHYS-1130 (KALDON-5)

FALL 2007

WMU

Farmer Bob drives his corn crop to market,
where corn is selling at a record price
to make ethanol to blend with gasoline to make E85 fuel,
except his corn crop is stunted due to the drought and heat
wave caused by global warming and he can't sell the corn,
ending up having to drive home sad and flat broke.

What was Farmer Bob's average speed on his trip?
(grin)

Draggin´ Mah Pick ´Em Up Truck (50,000 points)

1.) Farmer Bob has to drive 100. miles (160.9 km) in his pickup truck, which he does in 100. minutes. (a) Calculate the average speed to make the trip, in meters/second (m/s).

$$t = 100.\,\text{min}(60\,\text{sec}/\,\textit{hour}\,\text{min}) = 6{,}000.\,\text{sec}$$
$$v = \frac{d}{t} = \frac{160{,}900m}{6{,}000\,\text{sec}} = 26.82m/\,\text{sec}$$

(b) In his actual trip, Farmer Bob drives the first half of the trip (80.45 km) in 57.0 minutes. How fast must he go during the second half of the trip?

$$t = 100.\,\text{min} - 57.0\,\text{min} = 43.0\,\text{min} = 2580.\,\text{sec}$$
$$v = \frac{d}{t} = \frac{80{,}450m}{2580.\,\text{sec}} = 31.18m/s$$

(c) The pickup truck goes from zero to 60 mph (v_f = 26.8 m/s) in ten seconds flat (Δt = 10.00 s). Find *a*.

$$a = \frac{\Delta v}{\Delta t} = \frac{26.8m/s - 0}{10.0\,\text{sec}} = 2.680m/s^2$$

(d) A box sitting in the back of the pickup truck is 28 inches (0.711 m) above the ground. Farmer Bob's pickup truck doesn't have a tailgate anymore, so when he starts his trip the box falls off the truck. How much time does it take for the box to fall to the ground?

$$y = y_0 + v_{oy} - \tfrac{1}{2}gt^2$$
$$0 = y_0 - \tfrac{1}{2}gt^2$$
$$\tfrac{1}{2}gt^2 = y_0$$
$$t^2 = \frac{2y_0}{g}$$
$$t = \sqrt{\frac{2y_0}{g}} = \sqrt{\frac{2(0.711m)}{9.81m/s^2}} = 0.3807\,\text{sec}$$

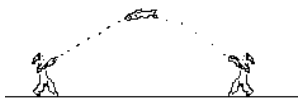
(e) For this falling box, what is its speed, v_y, when it hits the ground? *This problem can be solved without the answer to (d).*

$$v_y = v_{0y} - gt = -gt$$
$$= -(9.81m/s^2)(0.3807\,\text{sec})$$
$$= -3.735m/s$$

OR

$$v^2 = v_0^2 - 2g(y - y_0) = 2gy_0$$
$$v = \sqrt{2gy_0} = \sqrt{2(9.81m/s^2)(0.711m)} = -3.735m/s$$

Anthony Bordain – *No Reservations – Seattle* (50,000 points)



2.) In the giant fresh fish market of Seattle, a large salmon is tossed from one worker to the next, from left to right, a horizontal distance of 50.0 feet (15.3 meters). (a) If the fish is in the air for 3.00 seconds, find v_{0x} .

$$(a_x = 0)$$
$$v_{0x} = \frac{d}{t} = \frac{15.3m}{3.00\,\text{sec}} = 5.100m/s$$

(b) To simplify the problem, let's assume the launch height and landing height are the same. How high, h , does the fish go?

$$\text{Time to rise} = \text{Time to fall} = \tfrac{1}{2}(3.00\,\text{sec})$$
$$y = y_0 + v_{0y}t - \tfrac{1}{2}gt^2$$
$$0 = h - \tfrac{1}{2}gt^2$$
$$h = \tfrac{1}{2}gt^2 = \tfrac{1}{2}(9.81m/s^2)(1.500\,\text{sec})^2$$
$$= 11.04m$$

(c) Find the y-component of the velocity, v_{oy} .

$$v_y = v_{0y} - gt$$
$$0 = v_{0y} - gt$$
$$v_{0y} = gt$$
$$= (9.81m/s^2)(1.500\,\text{sec})$$
$$= 14.72m/s$$

OR

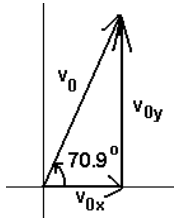
$$v_y = v_{0y} - gt$$
$$-v_{0y} = v_{0y} - gt$$
$$2v_{0y} = gt$$
$$= \tfrac{1}{2}(9.81m/s^2)(3.00\,\text{sec})$$
$$= 14.72m/s$$

OR

$$v_y^2 = v_{0y}^2 - 2g(y - y_0)$$
$$0 = v_{0y}^2 - 2gh$$
$$v_{0y} = \sqrt{2gh}$$
$$= \sqrt{2(9.81m/s^2)(11.04m)}$$
$$= +14.72m/s$$

(d) Find the initial velocity vector $\vec{v}_0$. *Give the answer in Standard Form.*

$$v_0 = \sqrt{v_{0x}^2 + v_{0y}^2}$$
$$= \sqrt{(5.100m/s)^2 + (14.72m/s)^2}$$
$$= 15.58m/s$$
$$\theta = \tan^{-1}\left(\frac{v_{0y}}{v_{0x}}\right) = \tan^{-1}\left(\frac{14.72m/s}{5.100m/s}\right) = 70.9°$$
$$\vec{v}_0 = 15.58m/s\,@\,70.9°$$



(e) When the fish is tossed, it goes from rest to the initial speed v_o in a distance of 0.800 meters. Find the acceleration a the fish undergoes, first in m/s² and then as a multiple of g. *If you did not find v_0, use 12.0 m/s.*

$$v^2 = v_0^2 + 2a(x - x_0) = 2ax$$
$$a = \frac{v^2}{2x} = \frac{(15.58m/s)^2}{2(0.800m)} = 151.7m/s^2$$
$$\frac{151.7m/s^2}{9.81m/s^2} = 15.46\,gee's$$