

X2.b

205

PHYS-205(H4) (Kaldon-32024)

Name _____

WMU - Winter 2000

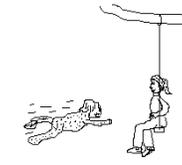
Exam 2L - 100,000 points + 20,000 ☆ points Book Title _____

3/14/2000•Rev.4/Fix..2/2001

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
Feel Free to Ask Any Questions ☆2a ☆2b ☆2c ☆2e

Swinging Around (50,000 points)

1.) Pamela Strangeways ($m_P = 62.5 \text{ kg}$) is sitting at rest on her swing in the backyard. Benjamin, her Old English sheepdog ($m_B = 27.5 \text{ kg}$), leaps up from his rest into the air 1.50 m and moving at 8.00 m/s. (a) How much work was required to get this dog up from his nap?

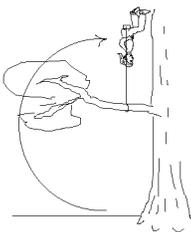


(b) The happy dog crashes into Pamela. With what speed, V , do Pamela and Benjamin move once they are together?



(c) How high does the swing swing above its initial position? *If you didn't get an answer to (b), use $V = 4.00 \text{ m/s}$.*

(d) When we were kids, we thought we could go *so* high on the swing. Suppose that you could get a swing to go so fast that you could do a loop-the-loop. What is the *minimum* speed you would need at the top of the arc so that you don't fall off the swing? *I should point out that the dog didn't make this trip. The swing is 3.85 m long.*



(e) Pamela hears the phone ringing and is running at 6.75 m/s. When the phone stops ringing, she slides to a stop. The coefficients of friction are 1.000 and 0.800. How far does it take for Pamela to stop?

A Star Problem is Born (50,000 points)

2.) ☆(a) Integrate Newton's Law of Universal Gravity, $F = \frac{GmM_E}{r^2}$, to find the work done by gravity in changing the Space Shuttle's orbit from $r = a$ to $r = b$, where $b > a$.

☆(b) Find the work done when $\vec{F} = 3.00 \frac{\text{N}}{\text{m}} x \hat{i} + 7.00 \frac{\text{N}}{\text{m}^2} y^2 \hat{j}$ and the displacement is $\vec{s} = 5.00 \text{ m} @ 45^\circ$.

☆(c) For a force to be a *conservative force*, it must have a potential energy U such that $F_x = -\frac{dU}{dx}$ (or y 's or z 's). Show that the two potential energies that we have learned about so far satisfy this relationship.

(d) They were ski jumping on the big hill in Lake Placid NY last month for the Goodwill Games. Draw the free body diagram for the jumper at the moment he is at an angle θ . Include the small amount of friction, the air resistance, and any components of vectors you think would be necessary to write down the *Sum of the Forces* equations.



☆(e) An object of mass 2.25 kg has a motion that follows the following equations. Find the vector force \vec{F} at time $t = 2.00 \text{ sec}$.

$$x(t) = 1.00m + 2.00m/s^2 t^2 + 4.00m/s^3 t^3$$

$$y(t) = 5.00m + 5.00 m/st + 5.00 m/s^2 t^2$$