2008

EXAM II Physics 218

Name.....Section Number.....

USEFUL INFORMATION

$$If \quad f(x) = kx^n \qquad \frac{df}{dx} = nkx^{n-1}$$

$$If \quad f(x) = kx^n \qquad \int_A^B f(x)dx = \frac{1}{n+1}k(B^{n+1} - A^{n+1})$$

$$If \quad f(x) = kx^n \qquad \int f(x)dx = \frac{1}{n+1}kx^{n+1} + C$$

$$\int_{\vec{r}_1}^{\vec{r}_2} \vec{F}_{tot} \cdot d\vec{r} = \frac{1}{2}mv^2(\vec{r}_2) - \frac{1}{2}mv^2(\vec{r}_1)$$

If $\vec{F}$ is conservative:

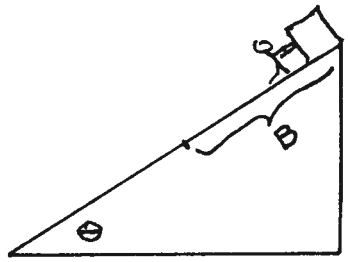
$$\int_{\vec{r}_1}^{\vec{r}_2} \vec{F} \cdot d\vec{r} = -[U(\vec{r}_2) - U(\vec{r}_1)]$$

and

$$F_x = -\frac{\partial U}{\partial x} \qquad F_y = -\frac{\partial U}{\partial y}$$

DO NOT WASTE TIME DOING ARITHMETIC

1. (25 points) A box of mass m is on an inclined plane with coefficient of friction μ between the box and the plane. A man is trying to keep the box from moving by pushing on the box with a force parallel to the plane. The box starts from rest and slides down the plane to the point a distance B from the top and then gets pushed back to the top where it is again at rest.

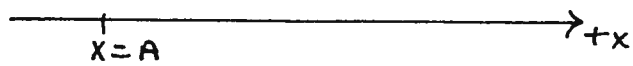


a. How much work is done by the force of gravity for the total distance the box moves?

b. How much work is done by the force of friction for the total distance the box moves?

c. How much work is done by the force exerted by the man for the total distance the box moves?

2. (25 points) An object of mass m is placed at the point $x = A$ on a horizontal table and given, at $t = 0$, a velocity of magnitude v_1 to the right. The coefficient of friction between the table and the object is μ. (NO ALGEBRA PLEASE!)

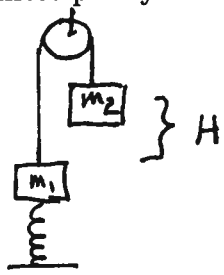


a. (5 points)Where will the object stop if μ has the constant value μ_0?

b. (10 points) Where will the object stop if μ is a function of x given by $\mu = \mu_0(1 + \frac{x}{L})$ where L is a known distance?

c. (10 points) Where will the object stop if μ is a function of t given by $\mu = \mu_0(1 + \frac{t}{S})$ where S is a known time?

3. (25 points) Two unequal masses are connected by a massless, unstretchable string which goes over a frictionless pulley.



The lighter mass, m_1 is attached to a spring which is also attached to the floor. The spring has spring constant k and is unstretched when the masses are held at rest in the positions shown. The masses are then released.

a. Isolate m_2 and draw the free body diagram for it.

b. Isolate m_1 and draw the free body diagram for it.

c. Apply the Work Energy Theorem to each mass if the heavier mass moves down a distance H.

d. Find the velocity of the heavier mass when it has moved down a distance H.

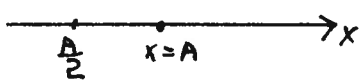
4. (25 points)This is a one-dimensional problem. You need not concern yourself with the y direction. An object of mass m is acted upon by a force given by

$$F_x = -\beta(x - c)$$

where c and β are positive constants.

a. Determine whether or not this force is conservative.

b. If the object is placed at the point $x = A$ and given a velocity of magnitude v_1 in the positive x direction, what will its velocity be at the point $x = \frac{A}{2}$ if the above force is the only force acting on the object?



c. Where will the kinetic energy have its maximum value?