EXAM II Physics 218 2018

Last Name.....First 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

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

Errors on Free Body Diagrams will have serious consequences

1.

2.

3.

4.

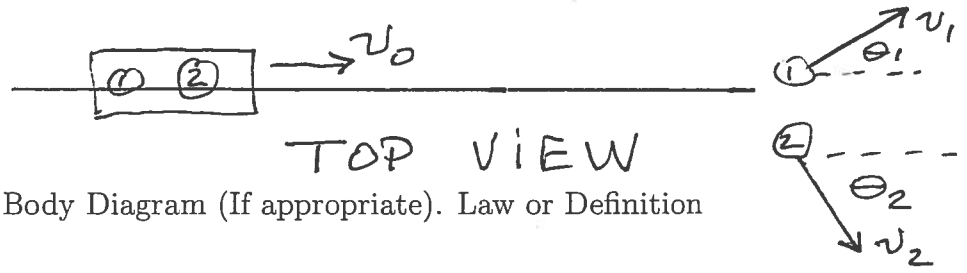
1. A small block of mass m on a horizontal surface starts at the point marked $x = A$ with velocity of magnitude v_1 to the right. The coefficient of friction between the block and the surface is μ. A force is exerted on the block which points to the right and has magnitude kx^2, where k is an unknown constant. What must k be if the block is to have velocity $2v_1$ to the right at the point $x = 2A$?

Free Body Diagrams (If appropriate). Law or Definition

Application

Result

2. A sled of mass m_3 is sliding on an icy, frictionless, horizontal surface with velocity of magnitude v_0. There are two riders on the sled, one with mass m_1 and a second with mass m_2. They both decide to jump off the sled. Their horizontal velocities are known and shown below. What is the velocity of the sled after they jump?



Free Body Diagram (If appropriate). Law or Definition

Application

Result

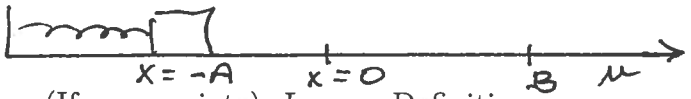
3. The motion of a small object of mass m is observed as it moves along the x axis, starting at rest at $x = A$. There are two forces acting on the object. One is given by $F_{1x} = c_1 x$, where c_1 is a known constant, and another given by $F_{2x} = c_2 x^{-2}$ where c_2 is a known constant. Show that these forces are conservative by finding their potential energy functions. Use these functions to find the kinetic energy of the object as a function of x.

Free Body Diagram (If appropriate). Law or Definition

Application

Result

4. A spring is not stretched or compressed at the point $x = 0$. A block of mass, m, pushed against the spring to the point $x = -A$. The block is released from rest and slides on a frictionless surface. At the point marked $x = B$ the surface changes and the coefficient of friction between the block and the surface becomes μ. At $t = 0$, defined to be the instant that the block reaches the point $x = B$, a force acts on the block which points to the left and has magnitude βt. At what time will the block come to rest?



Free Body Diagram (If appropriate). Law or Definition

Application

Result