EXAM II Physics 218 2016

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.

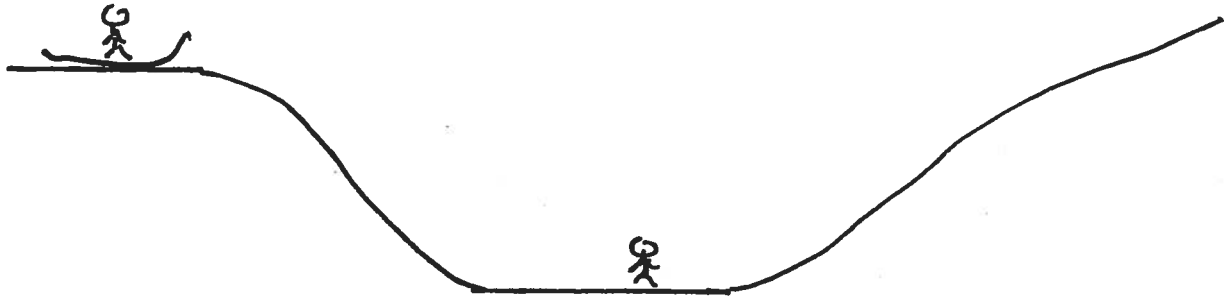
1. On a horizontal table a small block of mass m_1 is on top of a large block mass m_2. The coefficient of friction between the blocks is μ. There is no friction between the large block and the table. A force $\vec{P}$ is applied to the large block. The force is at an angle θ with the horizontal and has a magnitude that varies with time according to $|\vec{P}| = \beta t$ where β is a known constant. At what time will the top block begin to slip off the bottom block?

Free Body Diagrams (If appropriate). Law or Definition

Application

Result

2. A man of mass m_1 is on a sled of mass m_2 sliding on a frictionless, horizontal surface with a velocity of magnitude v_1. He slides down a hill of height H. At the bottom of the hill he collides with a man of mass m_3 who falls into the sled. How high up the hill will the sled and the two men go, assuming all surfaces are frictionless?

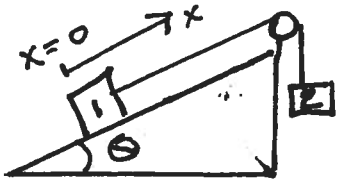


Free Body Diagram (If appropriate). Law or Definition

Application

Result

3. Two blocks are connected by a massless, unstretchable rope which goes over a frictionless pulley. Block 1, mass m_1, slides up the plane where there is friction between the plane and block. The coefficient of friction between the plane and block is a function of the block's position on the plane. It is given by $\mu = \mu_0(1 + \frac{x^2}{S^2})$ where μ_0 and S are known constants. How fast will block 1 be moving when block 2, mass m_2, has moved down a distance H if it started from rest? (All masses and θ are known.)

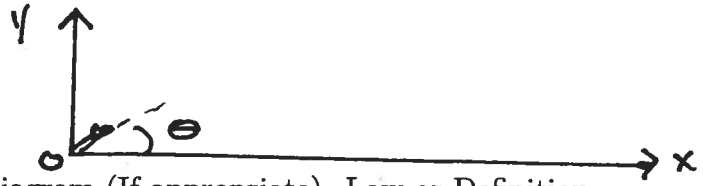


Free Body Diagrams (If appropriate). Law or Definition

Application

Result

4. You are going to fire a cannon with initial velocity v_m at an angle θ with the horizontal. In addition to gravity there is a strange force on the cannon ball that is in the same direction as gravity but has a magnitude that increases with height according to βy^2. What does v_m have to be so that the cannon ball will reach a maximum height of H if the angle θ is known? The cannon ball has mass m.



Free Body Diagram (If appropriate). Law or Definition

Application

Result