EXAM I Physics 206 2019

Last Name.....First Name.....Section Number.....

USEFUL INFORMATION

In each problem you should obtain a set of equations that could be solved for the unknowns. Solving the algebraic equations will not be worth many points.

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

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

For the **SPECIAL CASE:**
CONSTANT ACCELERATION IN ONE DIMENSION

$$v(t) = a_c t + v(0)$$

$$x(t) = \frac{1}{2}a_c t^2 + v(0)t + x(0).$$

$$v^2(t_2) - v^2(t_1) = 2a_c\Big[x(t_2) - x(t_1)\Big]$$

The symbol g stands for the magnitude of the acceleration vector due to gravity and, as such, it is a positive quantity.

Free Body Diagrams are very important

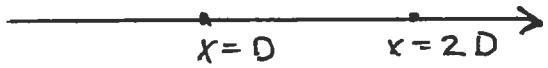
1.

2.

3.

4.

1. (25 Points)An object with mass m moves along the x-axis. It is observed to have a velocity in the plus x direction with magnitude $c_1 t^2$ where c_1 is a positive, known constant and t is the time in seconds. At $t = 1sec$ it is observed to be at the point $x = D$. When does the object reach the point $x = 2D$?

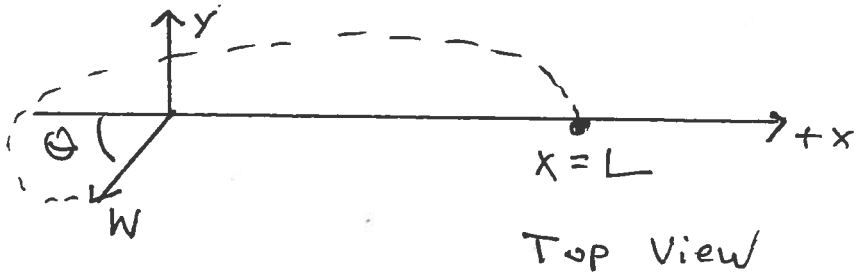


Law or Definition

Application

Result

2. (25 Points)In a video game an object is to be shot from the origin with the velocity of unknown magnitude W at the angle θ as shown below. The motion takes place on a horizontal surface and the acceleration of the object is given to be $\vec{a} = c_1 t\vec{i} + c_2 t\vec{j}$ where c_1 and c_2 are given constants and t is the time with $t = 0$ being the time when the object is shot. If θ is known, obtain the set of equations that could be used to solve for W in order for the object to hit the x axis at the point L as shown? (Do Not Attempt to Solve the Equations.)

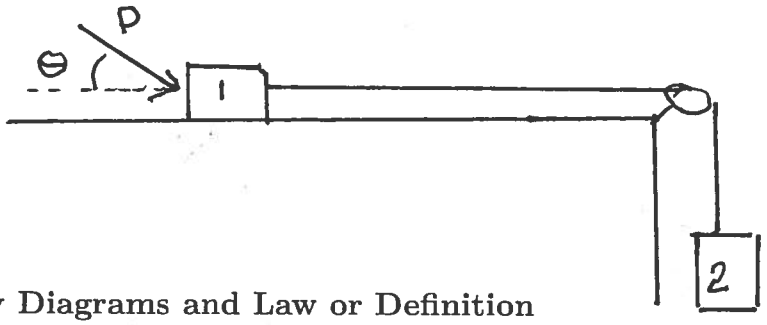


Law or Definition

Application

Result

3. (25 Points) A block, mass m_1 moves to the right on a horizontal surface. It is being pulled by a massless, unstretchable rope that goes over a frictionless pulley connected to a block of mass m_2. The coefficient of friction between block 1 and the surface is μ. Another force, of known magnitude P, acts at the known angle θ. Find the accelerations of the blocks.



Free Body Diagrams and Law or Definition

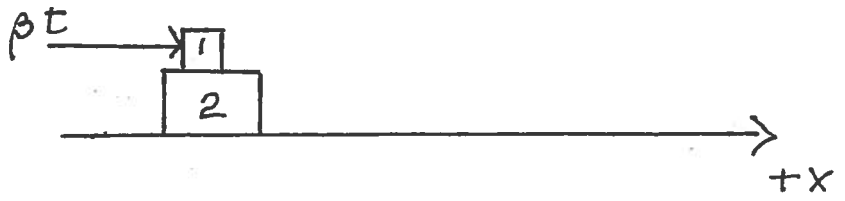
Application

Result

4. (25 points) A block of mass m_1 is on top of a block of mass m_2. The coefficient of friction between the blocks is μ and the surface they move on is frictionless. At $t = 0$ a horizontal force of magnitude βt is applied to the upper block, where β is a known, positive constant.

a. Assuming the two blocks move together, find every force acting on each block in terms of the given quantities.

b. At what time will the upper block begin to slip so that the two blocks will no longer move together?



Free Body Diagrams and Law or Definition

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