

Answer on Question #62357-Physics-Mechanics

The gravitational force on a baseball is $-F_g\mathbf{j}$. A pitcher throws the baseball with velocity v_i by uniformly accelerating it straight forward horizontally for a time interval $\Delta t = t - 0 = t$. If the ball starts from rest, determine the following: (Use any variable or symbol stated above along with the following as necessary: g for the acceleration due to gravity.)

(a) Through what distance does it accelerate before its release?

(b) What force does the pitcher exert on the ball?

Solution

(a) The acceleration imparted by the pitcher is $\frac{\Delta v}{\Delta t} = \frac{v_i}{t}$. The distance moved under uniform acceleration a is $0.5at^2$ substitute for a to get

$$s = 0.5 \left(\frac{v}{t} \right) t^2 = 0.5vt$$

(b)

The mass of the ball is $\frac{F_g}{g}$. The force imparted in the \mathbf{i} direction by the pitcher is Ma . The \mathbf{i} force component is then

$$F_i = Ma = \frac{F_g}{g} \left(\frac{v}{t} \right)$$

The \mathbf{j} component is $+F_g$ (to keep the motion horizontal and counteract gravity). The total force exerted by the pitcher is then

$$\mathbf{F} = \frac{F_g}{g} \left(\frac{v}{t} \right) \mathbf{i} + F_g \mathbf{j}$$