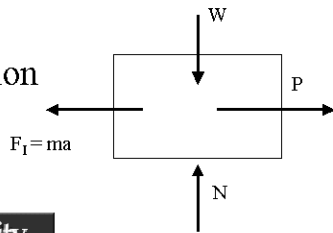


## Chapter 13

Kinetics:  
Linear Motion



Miami University

1

## Objectives

- Dynamic Equilibrium
- Force Equations
- Determine Inertial Forces
- Determine accelerations

2

## Kinetics

- The study of unbalanced forces
- Start with linear motion
- $F = ma$ 
  - $F$  = resultant force
  - $m$  = mass of object
  - $a$  = acceleration

3

## Units

- $F$  = newtons, N
- $m$  = mass in kg
- $a$  = acceleration in  $m/s^2$
  
- 1 newton =  $(1 \text{ kg})(1 \text{ m/s}^2)$

4

## Weight

- $W = mg$
- Based on earth's gravity
- $g = 9.81 \text{ m/s}^2$
- $W = (1 \text{ kg}) \times 9.81 \text{ m/s}^2$
- $W = 9.81 \text{ Newtons}$

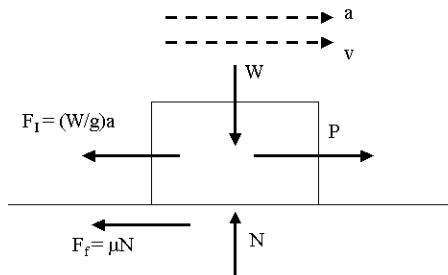
5

## English Units

- Mass =  $W/g$
- Where:
  - $m$  = slugs or  $lb/(ft/s^2)$
  - $W$  = lb
  - $g = 32.2 \text{ ft/s}^2$

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## Dynamic Equilibrium



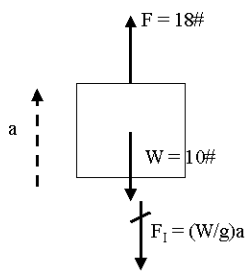
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## Summation of Forces

- Convert all vectors into force
- Sum forces in x and y direction
- Sum of forces = zero

8

## Example 13-1



$$\begin{aligned}\Sigma F_y &= 18 - 10 - \left(\frac{W}{g}\right)a = 0 \\ &= 8 - \left(\frac{10}{32.2}\right)a = 0 \\ a &= 25.8 \text{ ft/s}^2 \uparrow\end{aligned}$$

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## Week 8 Homework

- Chapter 13
  - Problems: 4, 13, 16, 24, 27
- Read Sections 13-3 thru 13-6

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