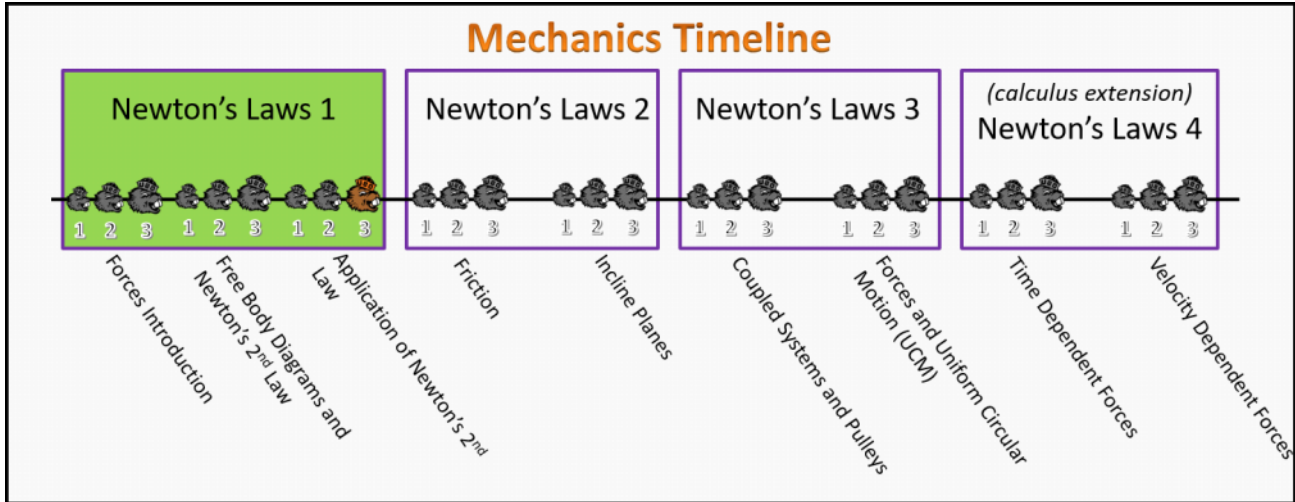


Newton's Laws 1

Foundation Stage (N1.L3.3)

Post-Lecture 3 Application of Newton's 2nd Law



Questions

N1.L3.3-01

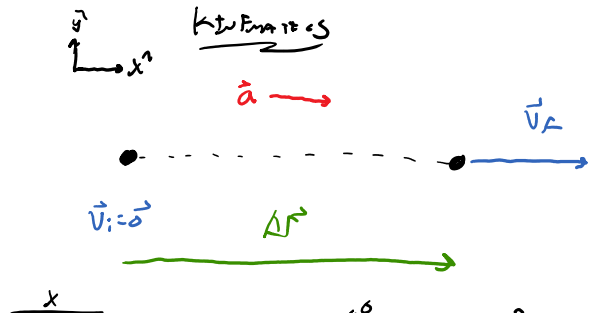
Description: Given forces, mass, and distance, find mass.

Learning Objectives: [?]

Problem Statement: Benny the beaver is relaxing at rest in space on his scooty puff jr space-scooter, the total mass of Benny and the scooter is 150 kg. The evil duckulans suddenly appear out of nowhere right behind Benny. The duckulans trap Benny with a tractor beam that pulls on him with a constant force of 100 N in the negative x-direction. The moment the tractor beam attaches to Benny, he turns on his scooter engine that provide a constant force of 475 N in the positive x-direction. The tractor beam only has a range of 500 meters, and provides a constant 100 N within that range. Assuming Benny starts from rest, how long does it take Benny to escape the evil duckulans?

- (1) 2.5 seconds
- (2) 10 seconds
- (3) 14.1 seconds
- (4) 20 seconds
- (5) 40 seconds
- (6) Benny never escapes the tractor beam since it pulls him in towards the duckulans.

FORCE ANALYSIS



$\sum F_x = m_1 a_x$
 $-F^{ed} + F^{th} = m_1 a_x$
 $-100 + 475 = 150 a_x$
 $a_x = 2.5 \text{ m/s}^2$

x	k	uk
$\Delta x = 500$		
$v_{ix} = 0$		v_{fx}
$a_x = 2.5$		Δt

$\Delta x = v_{ix} \Delta t + \frac{1}{2} a_x \Delta t^2$
 $500 = \frac{1}{2} (2.5) \Delta t^2$
 $\Delta t = 20 \text{ s}$

N1.L3.3-02

Description: Given forces, mass, and distance, find mass.

Learning Objectives: [?]

Problem Statement: A 1.50-kg ball is dropped from rest 19.6 meters above the surface of Earth on a windy day. Assume the wind provides a constant 8.40 N force directly to the right in the horizontal direction. What is the displacement of the ball from its initial location to the moment before it hits the ground? Use a standard coordinate system with the origin at the initial location of the ball the moment it was released from rest. Also use $g = 9.80 \text{ m/s}^2$. Assume no air resistance or wind in the vertical direction.

- (1) $\langle 0, -19.6 \rangle$ meters
- (2) $\langle 78.4, -19.6 \rangle$ meters
- (3) $\langle 44.8, -19.6 \rangle$ meters
- (4) $\langle 19.6, -19.6 \rangle$ meters
- Ⓐ $\langle 11.2, -19.6 \rangle$ meters

Force Analysis

$\sum F_x = m_1 a_x$
 $F^w = m_1 a_x$
 $8.4 = 1.5 a_x$
 $a_x = 5.6 \text{ m/s}^2$

$\sum F_y = m_1 a_y$
 $F^g = m_1 a_y$
 $m_1 g = m_1 a_y$
 $a_y = g$
 $a_y = 9.8 \text{ m/s}^2$

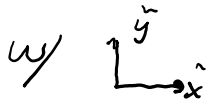
x	k	uk
Δx		
$v_{ix} = 0$		v_{fx}
$a_x = 5.6$		Δt

$\Delta x = v_{ix} \Delta t + \frac{1}{2} a_x \Delta t^2$
 $\Delta x = \frac{1}{2} a_x \Delta t^2$
 $\Delta x = \frac{1}{2} (5.6) \Delta t^2$
 $\Delta x = 2.8 \Delta t^2$

y	k	uk
$\Delta y = 19.6$		
$v_{iy} = 0$		v_{fy}
$a_y = 9.8$		Δt

$\Delta y = v_{iy} \Delta t + \frac{1}{2} a_y \Delta t^2$
 $19.6 = \frac{1}{2} (9.8) \Delta t^2$
 $\Delta t = 2$

$$\Delta x = 11.2 \text{ m}$$



$$\Delta \vec{r} = \langle 11.2, -19.6 \rangle \text{ m}$$