Algebra-based Physics-1: Mechanics (PHYS135A-01): Week 7

Jordan Hanson

October 16th - October 20th, 2017

Whittier College Department of Physics and Astronomy

WEEK 6 REVIEW

Week 6 Review

1. Angular kinematics and dynamics
    - Angular displacement
    - Angular velocity
    - Centripetal acceleration
2. Newton's Law of Gravity and circular orbits
3. Kepler's Laws

WEEK 6 REVIEW PROBLEM

WEEK 6 REVIEW PROBLEM

On the game show Wheel of Fortune, a large wheel is divided into sections worth varying dollar amounts. Contestants try to spin the wheel such that they get the good ones. Player 1 notices that the $10,000 marker is on the opposite side (180 degrees away). What is this angle in radians? If she has great luck and spins such that the wheel turns exactly 180 degrees, in 2 seconds, what is the angular speed in radians per second?

- A: $\pi/2$ radians, $\pi/4$ radians per second
- B: 0 radians, 0 radians per second
- C: π, $\pi/2$ radians per second
- D: π, $\pi/4$ radians per second

WEEK 6 REVIEW PROBLEM

Astronomers are observing two planets orbiting a star for several months. They observe that planet 1 orbits twice as fast as planet 2. If the orbital radius of planet 1 is 1 AU, what is the orbital radius of planet 2, in AU?

- A: 1 AU
- B: 1.6 AU
- C: 4 AU
- D: 3.2 AU

WEEK 7 SUMMARY

WEEK 7 SUMMARY

1. Work has a scientifically precise definition
    - Units
    - As a product of force and displacement vectors
2. Kinetic Energy and the Work-Energy Theorem
3. Gravitational potential energy
    - Potential energy
    - *Simplifying otherwise complex calculations*
    - Potential energy near Earth's surface
    - ...in space
4. Definition of a **conservative force**
    - Relationship between conservative forces and potential energy
    - Conservation of energy for conservative forces

DEFINITIONS OF WORK

Physical Definition of Work

Let $\vec{F}$ be a force exerted on a system, which is displaced by a displacement $\vec{x}$. The **work** done on the system is $W = \vec{F} \cdot \vec{x}$

The units of work are N m, or *Joules*.

Extra credit opportunity: **Do you like beer**? Write a 10-page paper on the on the scientific challenge faced by James Prescott Joule, who began to formulate the modern view of energy in the 19th century, contrary to the prior paradigm (*caloric theory*).

Let θ be the angle between the force and the displacement. Then this equation

$$W = \vec{F} \cdot \vec{x} \tag{1}$$

becomes

$$W = Fx \cos\theta \tag{2}$$

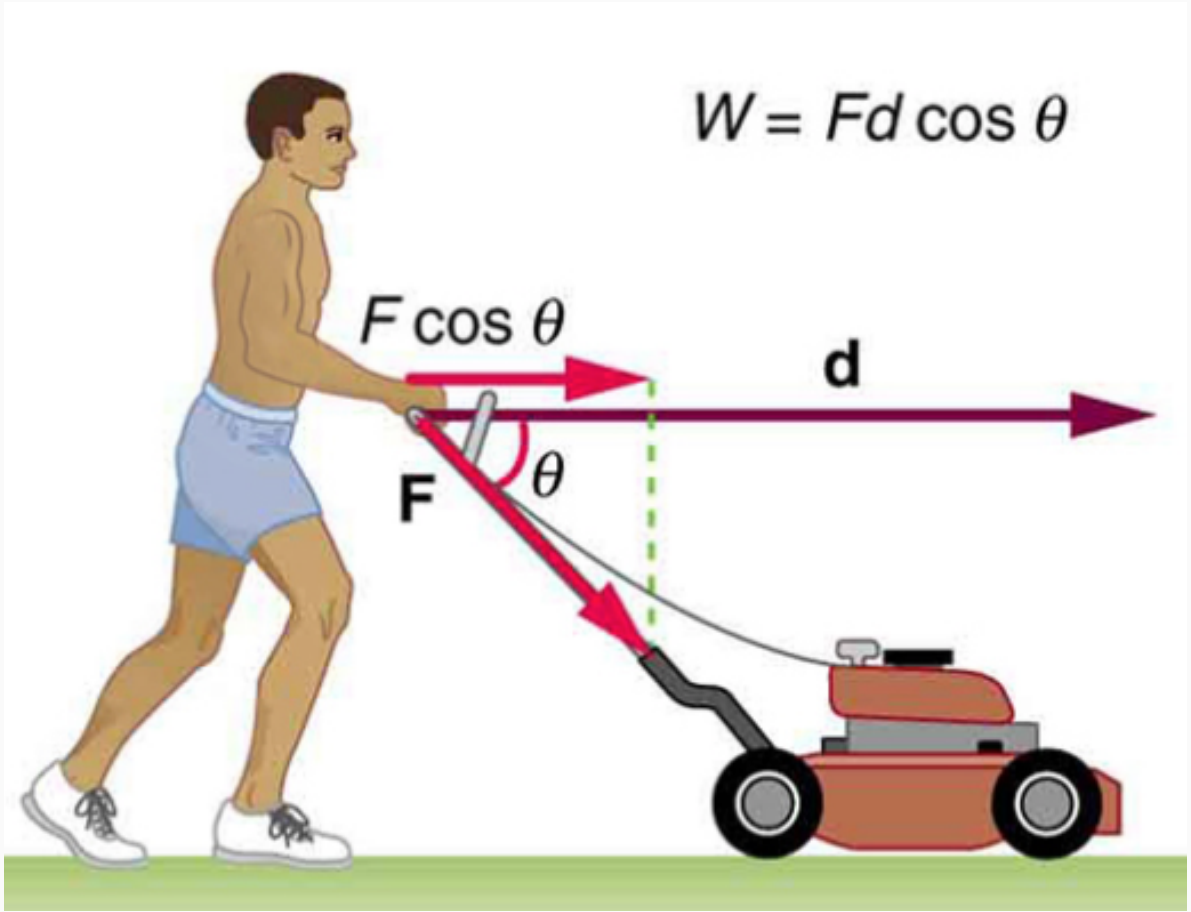

Figure 1: A case where $\theta \neq 0$.

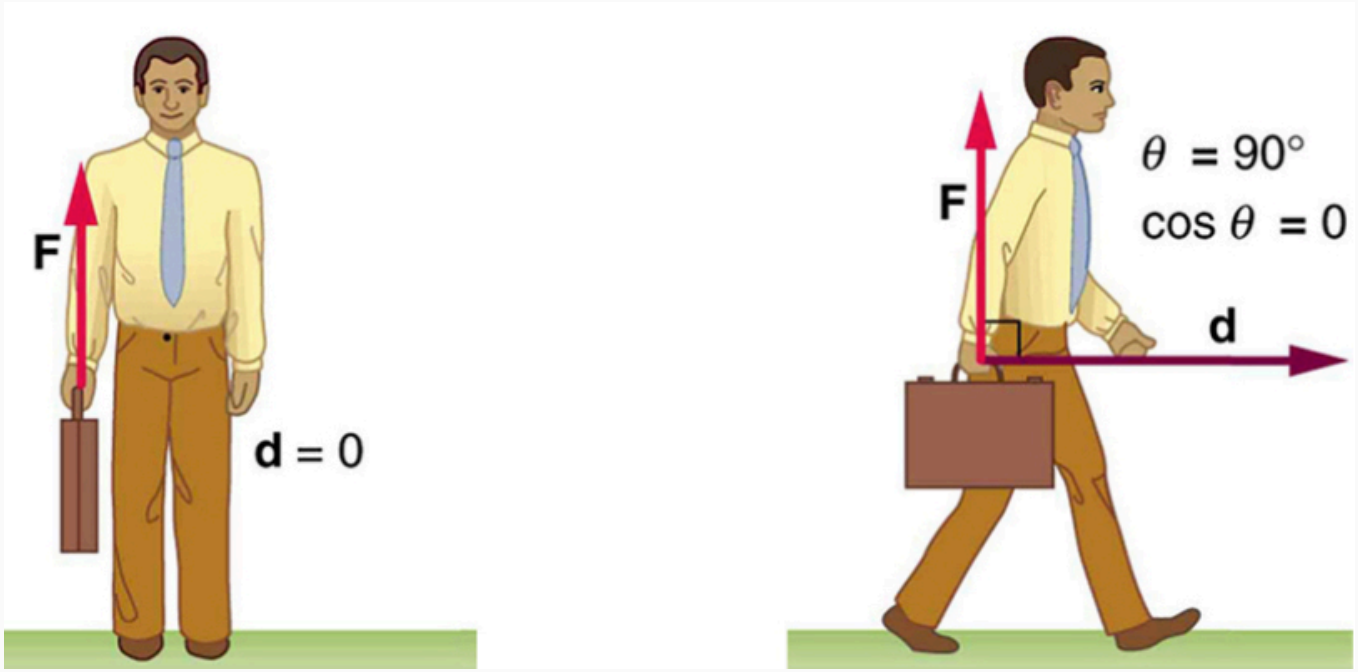

Figure 2: (Left): A case where $x = 0$, so $W = 0$. (Right): A case where $\theta = 90°$, so $W = 0$.

CONCLUSION

WEEK 7 SUMMARY

1. Work has a scientifically precise definition
    - Units
    - As a product of force and displacement vectors
2. Kinetic Energy and the Work-Energy Theorem
3. Gravitational potential energy
    - Potential energy
    - *Simplifying otherwise complex calculations*
    - Potential energy near Earth's surface
    - ...in space
4. Definition of a **conservative force**
    - Relationship between conservative forces and potential energy
    - Conservation of energy for conservative forces

ANSWERS

ANSWERS

- π, $\pi/2$ radians per second
- 1.6 AU
- ...