Physics 112

Thursday, December 3/15

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Textbook - ISBN

Explain that Stuff #9

1. Check -> Textbook - Page 238, PP #19-21
2. Work-Kinetic Energy Theorem
3. Textbook - Page 245, PP #22-25 - HW
4. Potential Energy
5. Gravitational Potential Energy - To Be Continued

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6. Textbook: Page 250, PP # 27, 29
7. Work-Gravitational Potential Energy Theorem
8. Textbook: Page 254, PP # 30-33
9. Hooke's Law
10. Textbook: Page 258, PP # 35-37

Positive and Negative Work → Types of work.

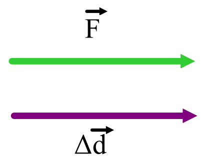
(Page 233)

positive work - $\vec{F}, \vec{d}$ have the same direction
- adds energy to an object

negative work - $\vec{F}, \vec{d}$ have opposite directions
- removes energy from an object.

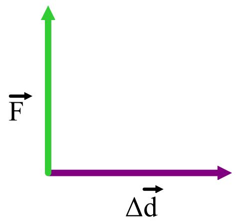
Examples

1.



maximum positive work

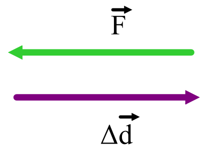
2.



no work is done

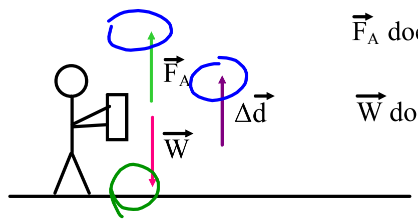
(Case #3)
$F \perp d$

3.



maximum negative work

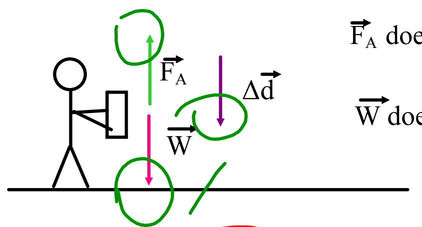
4.



$\vec{F}_A$ does positive work.

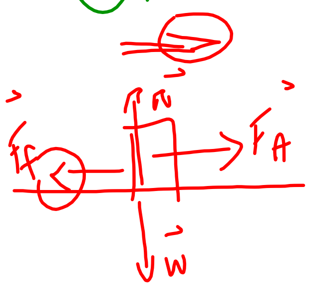
$\vec{W}$ does negative work.

5.



$\vec{F}_A$ does negative work.

$\vec{W}$ does positive work.



$\vec{F}_f$ neg. work

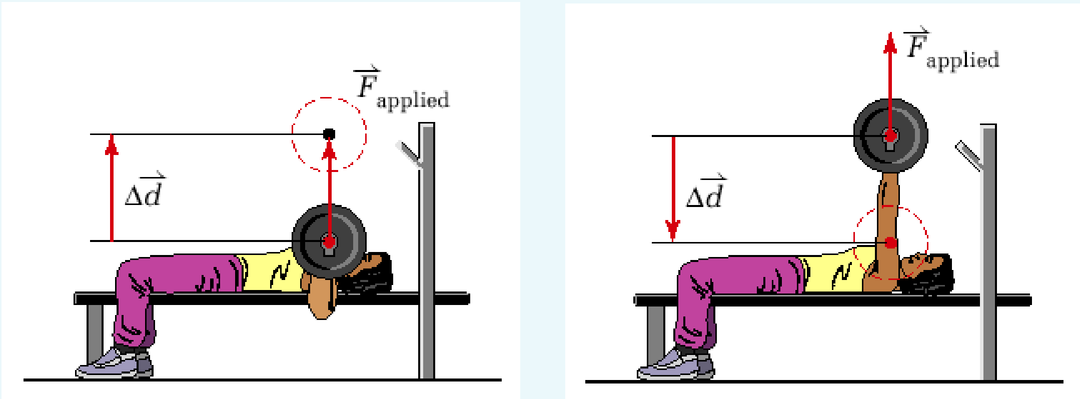
$\vec{F}_A$ pos. work.

$\vec{N}$, $\vec{W}$ no work.

MODEL PROBLEM P.233

Doing Positive and Negative Work

Consider a weight lifter bench-pressing a barbell weighing 6.50×10^2 N through a height of 0.55 m. There are two distinct motions: (1) when the barbell is lifted up and (2) when the barbell is lowered back down. Calculate the work that the weight lifter does on the barbell during each of the two motions.



a)

Lifting

$W = Fd$

$W = (6.50 \times 10^2 \text{ N})(0.55 \text{ m})$

$W = 3.2 \times 10^2 \text{ J}$

$\vec{F}$ ↑ $\Delta\vec{d}$ ↑ $\vec{w}$ ↓

$W = 3.2 \times 10^2 \text{ J}$

positive work

b)

Lowering

$W = Fd$

$W = (6.50 \times 10^2 \text{ N})(0.55 \text{ m})$

$W = 3.2 \times 10^2 \text{ J}$

$\vec{F}$ ↑ ↓ $\Delta\vec{d}$ $\vec{w}$ ↓

$\vec{F_A}$ ↑ $\vec{w}$ ↓

$W = 3.2 \times 10^2 \text{ J}$

negative work

Chapter 6 Work, Power, and Efficiency • MHR 235

PRACTICE PROBLEMS

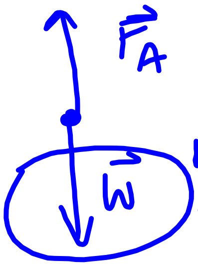
14. A large statue, with a mass of 180 kg, is lifted through a height of 2.33 m onto a display pedestal. It is later lifted from the pedestal back to the ground for cleaning.

(a) Calculate the work done by the applied force on the statue when it is being lifted onto the pedestal.

(b) Calculate the work done by the applied force on the statue when it is lowered down from the display pedestal.

(c) State all of the forces that are doing work on the statue during each motion.

15. A mechanic exerts a force of 45.0 N to raise the hood of a car 2.80 m. After checking the engine, the mechanic lowers the hood. Find the amount of work done by the mechanic on the hood during each of the two motions.



180. kg

m = 180 kg

a) $W = Fd$

$W = mgd$

$W = (180)(9.80)(2.33)$

$W = 4.11 \times 10^3$ J

$\vec{F}_A$ ↑ ↑ $\vec{\Delta d}$ (+ve)

b) $W = 4.11 \times 10^3$ J

$\vec{F}_A$ ↑ ↓ $\vec{\Delta d}$ (−ve)

Unit 3 - Work and Energy

Section 2

Types of Energy and Work-Energy Theorems

(3) (2)

Types of Energy

kinetic energy (due to motion)

potential energy (stored)

- gravitational potential energy (position)
- elastic/spring potential energy (state)

mechanical energy = kinetic energy + potential energy

Kinetic Energy
(Page 236)

$$E_k = \frac{1}{2}mv^2 \qquad \frac{mv^2}{2}$$

E_k -> kinetic energy (J)
m -> mass (kg)
v -> speed (m/s)

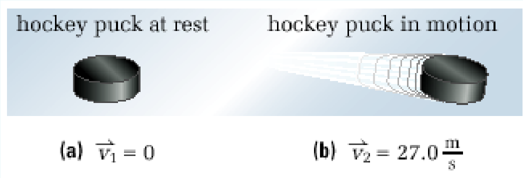
Check Units

J | $kg\left(\frac{m}{s}\right)^2$
$\frac{kgm^2}{s^2}$
$\frac{kgm}{s^2} \cdot m$
$N \cdot m$
J

MODEL PROBLEM

Calculating Kinetic Energy

A 0.200 kg hockey puck, initially at rest, is accelerated to 27.0 m/s. Calculate the kinetic energy of the hockey puck (a) at rest and (b) in motion.



$E_k = 0$ J $\qquad E_k = 72.9$ J

a) $E_k = 0$ J

b) $E_k = \frac{1}{2}(0.200)(27.0)^2$

$E_k = 72.9$ J

$\cancel{k}g \rightarrow kg$

$\frac{km}{h} \rightarrow \frac{m}{s}$

Textbook - Page 238, PP #19-21 — Hw

PRACTICE PROBLEMS

19. A 0.100 kg tennis ball is travelling at 145 km/h. What is its kinetic energy?

20. A bowling ball, travelling at 0.95 m/s, has 4.5 J of kinetic energy. What is its mass?

21. A 69.0 kg skier reaches the bottom of a ski hill with a velocity of 7.25 m/s. Find the kinetic energy of the skier at the bottom of the hill.

#19. $m = 0.100 kg$

$V = 145 \; km/h \rightarrow \frac{m}{s}$

$E_k = ?$

Physics 122 http://mvhs-sherrard.weebly.com/

Thursday, December 3/15

Explain That Stuff #9.

1. Experiment 7.2 - Range of a Projectile
2. Text: Page 549, PP #13
   Page 570, Prob. #17, 19, 20 (omit graph)
3. Worksheet: Projectiles - Problems
4. Assignment: U2 - S1 - Projectiles -> Friday, Dec. 4/15
5. Unit 2 - Section 2 - Circular Motion and Universal Gravtiation

1. a) 0.45 s
   b) 6.7 m/s
   c) -4.4 m/s
   d) 6.7 m/s
2. a) 57.6 m
   b) 10.1 m
3. a) 1.4 s
   b) -14 m/s
   c) 10 m

4. 7.2 m
5. a) 2.76 s b) 64.5 m c) 9.30 m
6. 44 m high, 4.8 m from base
7. 0.61 s
8. a) 1.9 s b) 8.7 m c) 12 m d) 16 m/s
9. height = 1.5 m
10. speed = 14 m/s
11. a) 5.06 s b) 80.1 m c) 38.0 m d) 40.3 m/s 79.3° below horiz.
12. a) 8.1 s
    b) 23°
13. 5.9 m

Science 10

Thursday, December 3/15

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1. Assignment - Calculating Average Speed - To Be Marked
   - 5 Days Late
2. Return Problem #15
3. Check #1 - Worksheet: Position-Time Graph -> HW - Complete
4. Velocity-Time Graphs
5. Worksheet: Velocity-Time Graphs -> To Be Continued

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6. Comparing Velocity and Acceleration Signs
7. Sample Problems - Acceleration
8. Worksheet - Acceleration
9. Assignment - C10, C11 and C12
   - Handout - Topics
10. Demo - Ball Toss

#15. $\vec{v} = 720.0\,\frac{m}{s}$

$\Delta\vec{d} = 324\,m$

$t = ?$

$\vec{v} = \frac{\Delta\vec{d}}{t}$

$t = \frac{\Delta\vec{d}}{\vec{v}}$

$t = \frac{324\,m}{720.0\,\frac{m}{s}}$

$t = 0.4505$

It will take 0.450 s.

$v_{av} = \frac{d}{t}$ — average speed

$\vec{v} = \frac{\Delta\vec{d}}{t}$ — constant velocity

$\vec{v}_{av} = \frac{\Delta\vec{d}_r}{t}$ — average velocity