Introduction

"Here arises a puzzle that has disturbed scientists of all periods. How is it possible that mathematics, a product of human thought that is independent of experience, fits so excellently the objects of physical reality? Can human reason without experience discover by pure thinking properties of real things?"

-- Einstein

Association of Part-Time Undergraduate Students

"..To ensure that part- time undergraduate students have access to the full range of programs services and resources..."

- Seeking up to 3 part-time students to represent PHY138
  - "Part-time" = 3.5 credits or less
- To volunteer, contact me

Test #1

- Tuesday November 1, 6:00 – 7:30 PM
  - If you have a demonstrable conflict, contact Dr. Savaria or Ms. Seeley in MP129 no later than Monday, October 24
- Ideal class average: ~62%
- Multiple-choice and long answer
  - To be finalised this afternoon

Announcements

- Pre-Class Quiz Chapt 13
  - Released
  - Due by 10 AM on Monday October 24
- MP Problem Set Chapt 13
  - Released
  - Due by 5 PM on Friday October 28
- Both of these are the last assignments of this quarter

About MP

The *review part* button becomes active after you have completed work on a question.

The button allows you to review all the tutorials and hints available for the question.

Reminder

- "Was Einstein Right?"
  - Clifford Will, Washington Univ., St. Louis
- Tonight:
  - 7:30 PM
  - OISE – 252 Bloor Street W.
  - Room 161/2

Last Time

- Console crash
- Kinetic Energy $K = \frac{1}{2} m v^2$
- Gravitational Potential Energy $U_g = mgy$
- Free fall:
  - $K + U_g$ = constant
  - $\Delta K = -\Delta U_g$ Note the minus sign
- Gravitational Field

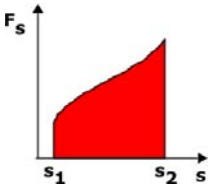
Today

- Almost Work-Energy Theorem §11.2
- Spring-Mass system §10.4 – 10.5
- Elastic Collisions §10.6
- Work & Kinetic Energy Chapter 11
  - Dot Product of Vectors
- Conservation of Energy
- Power

Remember?

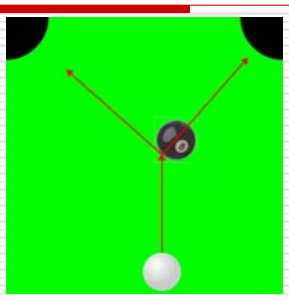
- Each concept in physics builds on previous ones
- That is now becoming true in PHY138

Area Under F_s – s Curve

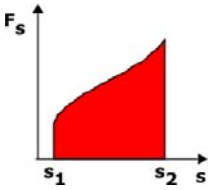


$$\int_{s_1}^{s_2} F_s \, ds = \frac{1}{2} m v_{sf}^2 - \frac{1}{2} m v_{si}^2$$

A "Scratch Shot"

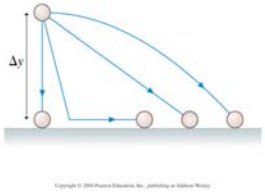


Area Under F_s – s Curve



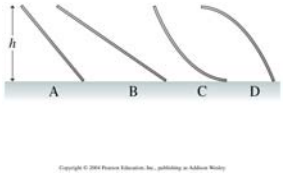
$$\int_{s_1}^{s_2} F_s \, ds = \frac{1}{2} m v_{sf}^2 - \frac{1}{2} m v_{si}^2$$

Figure 11.20



W_{grav} the same

Stop To Think 10.2



ΔU_g the same

Last Time

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About Heat

- Previously thought to be a *fluid*: "caloric"
- Mayer (1842):
  - People in warm climates consume less oxygen, i.e. need to produce less energy
  - Heat is a form of energy
- Joule (1847): a classic experiment "Mechanical Equivalent of Heat"
  - Available in the lab