

## Introduction

“Science is facts. Just as houses are made of stones, so is science made of facts. But a pile of stones is not a house and a collection of facts is not science.”

-- Poincaré

## Accessibility Services

Accessibility Services requires dependable volunteer note-takers in this course for one of your classmates who has a disability. Those who are interested in assisting with this essential service will gain valuable volunteer experience. If you are interested in becoming a volunteer note-taker, please see me.

## Test 1



- Tuesday October 31, 6:10 – 7:30 PM
- Locations to be announced
- Students who have a conflict at the time must register with the Course Coordinator's office no later than 17h30 on October 23. They should come to MP129 to fill the registration form.
- Format: some multiple-choice (~60%) and one long answer (~40%)
  - More details when the test is finalised
- You may bring a 8½ by 11 inch sheet of paper on which you have written anything that you wish

## What is examinable

- All sections of the textbook that are listed in the syllabus
- Supplemental Topics that are listed in the syllabus
- Questions can be based on:
  - In-class questions, perhaps slightly modified
  - Problems from MasteringPhysics, perhaps slightly modified
  - Written homework, perhaps slightly modified
  - Some we have just made up

## MasteringPhysics Scores

- Mean (average) through Pre-Class Quiz #3 and Problem Set #3: 88%
  - Together these count for 9% of your course mark

This high average is expected. It will have a consequence regarding our tests. More on this in a moment ...

## About Marks

- The mythical “average” student will receive a mark of 70% in PHY138
- This “average” student will probably get:
  - ~13 marks out of 15 (87%) on the various assignments
  - ~14 marks out of 20 (70%) in the lab
- To end up with a 70% final course mark:
  - 43 out of 65 on the tests and Final Exam

## Test Marks

- 43 out of 65 = 66%
  - Our “average” student got much higher marks than this on tests in High School
- Best 3 out of 4 tests count
  - Each individual test average should be somewhat less than 66%
- *Test Theory*: the best test has an average of 50% with a wide distribution
  - We will try for a higher average than 50%

## What if the test average is too high or too low?

- If it is too high:
  - Congratulations to the class!
  - We will live with it
- If it is too low:
  - We will adjust the marks

The moral of the story: if you feel you are not getting an many questions correct as you think you should, relax and be confident!

## Last Class

- A series of related examples on forces, tensions, etc.
- Momentum & Impulse
- Ballistocardiogram
- New “improved” 2<sup>nd</sup> Law:
 
$$d\vec{p} = \vec{F}_{\text{net}} dt \quad \vec{F}_{\text{net}} = \frac{d\vec{p}}{dt}$$
- Conservation of momentum
- Damage to people in collisions

## Today

- Finish Chapter 9
  - Introduce the angular momentum
- Chapter 10 - Energy

## 4 Rotations of a Tennis Serve

- Racket about the wrist
- Forearm and wrist about the elbow
- Arm and elbow about the shoulder
- Body and shoulder about the tip of the left foot

### Linear Motion

$$a = \text{constant}$$

$$s_f = s_i + v_i t + \frac{1}{2} a t^2$$

$$v_f = v_i + a t$$

$$m$$

### Rotational Motion

$$\alpha \equiv \frac{a_t}{r} = \text{constant}$$

$$\theta_f = \theta_i + \omega_i t + \frac{1}{2} \alpha t^2$$

$$\omega_f = \omega_i + \alpha t$$

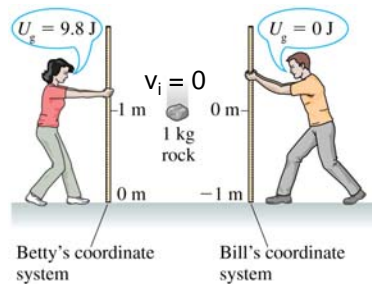
$$mr^2$$

## Kinetic & Gravitational Potential Energy

- Eqn 2.22:  $v_{iy}^2 = v_{iy}^2 + 2 a_y \Delta y$
- Re-write as Eqn. 10.10:  
 $\frac{1}{2} m v_i^2 + mgy_i = \frac{1}{2} m v_f^2 + mgy_f$
- Text:
  - Eqn 10.3:  $(F_{net})_y = ma_y = m dv_y/dt$
  - Bunch o' calculus including integrals
  - Eqn. 10.10

Reminder: we will not do the mathematics of integration until MAT135 gets there in January.

Figure 10.8

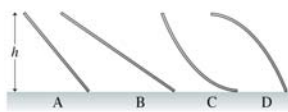


$$v_{f,Betty}^2 = 2g \times (1m) = v_{f,Bill}^2$$

## What happened to the y subscript on $v_i$ and $v_f$ ?

- Eqn 2.22:  $v_{iy}^2 = v_{iy}^2 + 2 a_y \Delta y$
- Eqn. 10.10:  
 $\frac{1}{2} m v_i^2 + mgy_i = \frac{1}{2} m v_f^2 + mgy_f$

**Stop To Think 10.2:** A small child slides down the four frictionless slides A–D. Each has the same height. Rank in order, from largest to smallest, her speeds  $v_A$  to  $v_D$  at the bottom.



## Racing Balls

Two balls are launched at the same time with equal speeds. Both balls reach the end of their tracks. Which ball reaches the end of its track first?



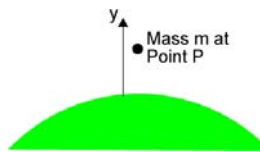
- Ball A
- Ball B
- They reach the end of their tracks at the same time

## Newton on "Action At a Distance"

"That ... one body may act upon another at a distance through a vacuum without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man, who has in philosophical matters a competent faculty of thinking, can ever fall into it."

-- Letter to Bentley, 1693

## Gravitational Fields



$$\vec{F}_{\text{Earth on } m} = m \vec{g} = -mg \hat{j}$$

Divide into two steps:

- Earth creates a gravitational field  $\vec{E}_g$  in all regions of space around it
- $\vec{E}_g$  at point P exerts a force on a mass at that point