# Physics 100 - Fall 2007 - Recitation Module 1

(1)

Back in 1988, George Bush (the one that could actually pronounce the word "nuclear") ran against Michael Dukakis for President. At the time, I was amused to see a major news organization lead off the nightly news on television with the story that "Dukakis surges past Bush in the Polls". They flashed the following table on the screen:

| | Month 1 | Month 2 | |
|---|---|---|---|
| Bush | 42% | 41% | |
| Dukakis | 40% | 43% | |
| Undecided | 18% | 16% | ±4% |

***Headline: Dukakis surges past Bush in polls!***

What do you make of this?

(1) The essential characteristics of this table and story are correct, though I don't actually remember the exact numbers.

(2) What could lead to a scientific controversy?

(3) Can you think of instances where the outcome of a scientific controversy might affect your life?

(4) Sammy the Weazel drives across town to visit his parole officer. Sammy is frustrated by the stop and go traffic. Sammy travels 12 kilometers in 30 minutes.

What is Sammy's "average speed" during the trip?

How does Sammy's average speed compare to his "instantaneous speed" at different points along his trip?

(5) Late at night, is it possible to drive your car around the inner loop at a CONSTANT speed?

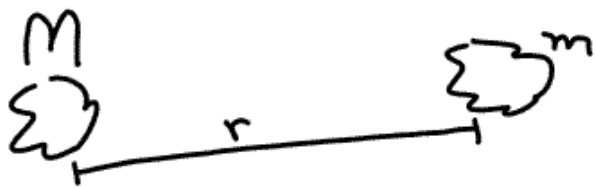
Is it possible to drive your car around the inner loop at a CONSTANT velocity?

(6) Biff Johnson drives his sportscar along a straight, level road at a constant speed. What is Biff's acceleration?

(7) If Biff increases his speed from 10 M/s to 20 M/s in 100 seconds, what is Biff's acceleration? (M/s ≡ meters per second)

(8) If Biff decreases his speed from 20 M/s to 10 M/s in 100 seconds, what is Biff's acceleration?

(9)




The gravitational force of attraction between two objects with mass $M$ and $m$, respectively, separated by distance $r$ is

$$F = \frac{GMm}{r^2}$$

= Mass of $M$ in kg (kilograms)

= Mass of $m$ in kg

$G$ = a CONSTANT that characterizes the strength of the gravitational force.

$$G = 6.67 \times 10^{-11} \frac{N m^2}{kg^2}$$

$r$ = distance between centers of objects in m

IF object $M = M_E$ is the earth and the other object is near earth's surface


This becomes

$$F_{\text{on } m} = \frac{G M_E m}{R_E^2}$$

$M = M_E$ = Mass of Earth = $5.97 \times 10^{24}$ kg

$m$ = mass of object in kg

$R_E$ = Radius of Earth = $6.38 \times 10^{6}$ m

$$F = \frac{G M_E m}{R_E^2} = g m$$

CONSTANT called $g$, units of acceleration ($m/s^2$)

Force → $F = ma$ ← acceleration; mass

always

↳ From Newton's second law as we will see

$g$ represents the acceleration of objects toward the center of the earth due to the gravitational force.

Your recitation leader will supply you with a photograph of a ball falling near the surface of the earth. In this photograph the flash emits light (STROBES) every $\frac{1}{30}$ second. So images of the ball are recorded on the same frame every $\frac{1}{30}$ second as the ball falls.

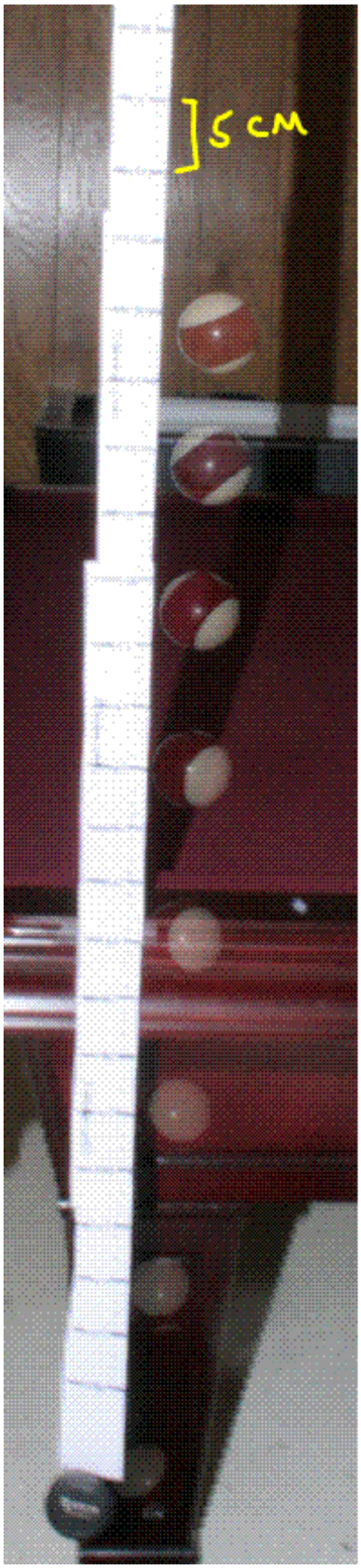
Discuss how you might use this photograph to measure $g$.

Measure $g$ using the photograph

Can you estimate how good is this measurement?

Estimate the uncertainty in your measurement.

How does your value compare to the textbook value of $9.8\ m/s^2$ ?




Flash strobe
at 30 Hz

(1 flash every $\frac{1}{30}$ s)

5 cm spacing between
dark lines