Physics 102 – Spring 2014 – Recitation module 3

Suppose I offered to give you *either* a hunk of gold that weighs a certain amount on Earth or a hunk that weighs the same amount on the moon – which would you choose? Is there a difference?

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

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

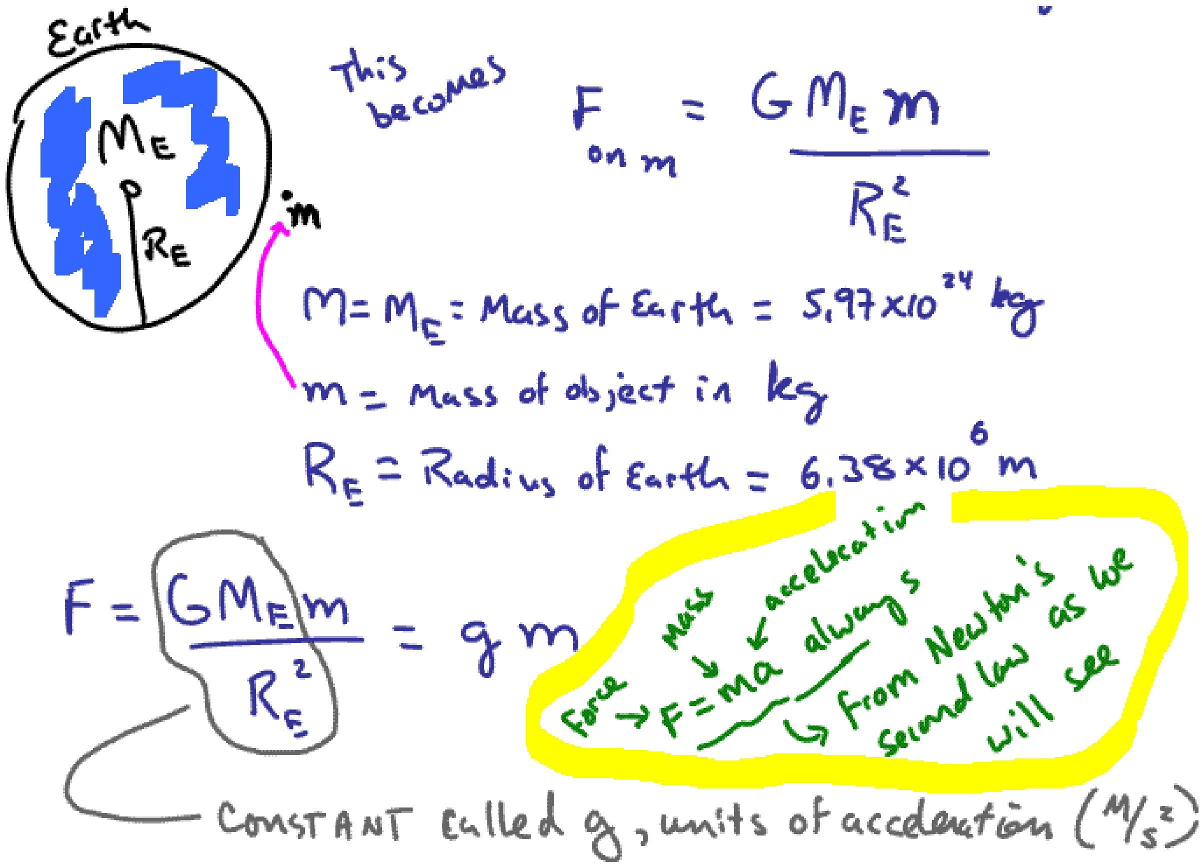
= Mass of M in kg (kilograms)
= Mass of m in kg

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



What is the difference between mass and weight?

Now … Suppose I offered to give you *either* a hunk of gold that weighs a certain amount on Earth or a hunk that weighs the same amount on the moon – which would you choose?

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.

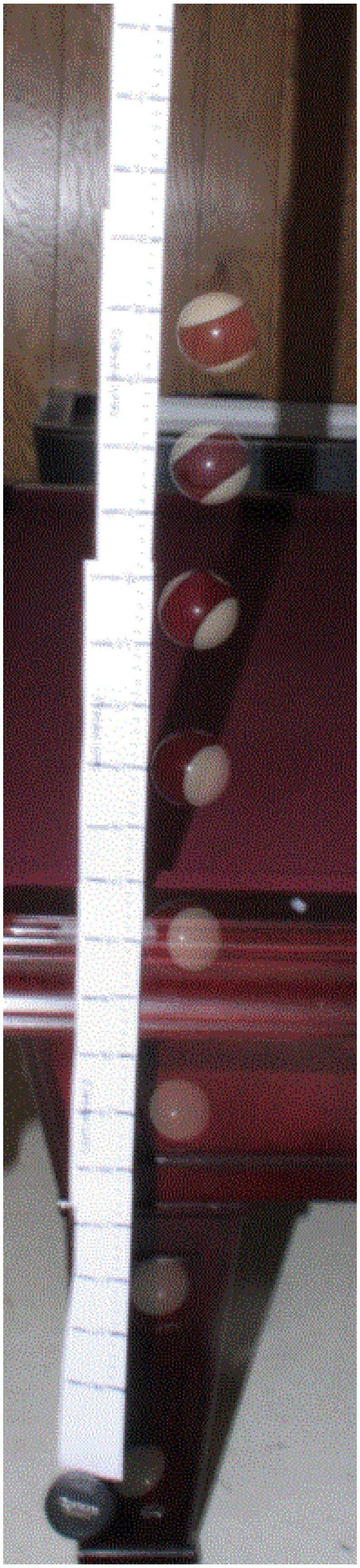
Discuss how you might use this photograph to measure g.

Measure g using the photograph

How "good" is your measurement? That is

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

Velma bicycles northward at 4 m/s. Mort, standing by the side of the road, throws a ball northward at 10 m/s. What is the ball's speed and direction of motion, relative to Velma? What if Mort had instead thrown the ball southward at 10 m/s?

Velma's spaceship approaches Earth at 0.75c. She turns on a laser and points the beam toward Earth. How fast does she perceive the laser light to move away from her? How fast does an Earth-based observer see the beam approach Earth?

A spaceship moves past you moving at 0.95c. You measure its length to be 10 meters. How long would this spaceship appear to be if it were at rest next to you?

Velma passes Earth at a speed of 0.95c. She watches a video program that runs 1 hour. How long does the program run as measured by an Earth-based observer?

Velma passes Earth at a speed of 0.95c. On Earth, a person watches a video program that runs 1 hour. How long does the program run as measured by an Velma?

Can you make sense of your answers to the last two questions?