Semester Review: Physics and Baseball I

Pre-Class Questions

Problem Set (none)

Lecture Outline

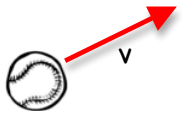
1. Kinematics
2. Newton's Laws
3. Law of Gravitation
4. The Law of Conservation of Energy
5. The Law of Conservation of Linear Momentum
6. The Law of Conservation of Angular Momentum

Example 1: The last pitch of the 2012 World Series was thrown by Sergio Romo to Miguel Cabrera. When it was 48.6ft (14.8m) home plate, it was 5.233ft (1.60m) above the ground and was moving at 88.9mph (39.7m/s) at a downward angle of 1.41°. When it got to home plate it was 2.88ft (0.878m) above the ground traveling at 81.2mph (36.3m/s) at a downward angle of 4.26°. Find (a)the horizontal acceleration of the ball, (b)the vertical acceleration of the ball, and (c)the time to get to home plate.

A force is a force, of course, of course…

For each situation below, draw the forces that act on the object and sketch the free body diagram.

1. A well hit ball flying through the air.



2. A runner sliding into second base.

3. A screen dragged over the infield during the 7th inning stretch.

4. A bat leaning against the dugout wall.

Example 2: An over-excited announcer describing a homerun says, "Boy, he really put that one into orbit!" Find the required speed to put a baseball in orbit just above the surface of Earth.

Drop Zone

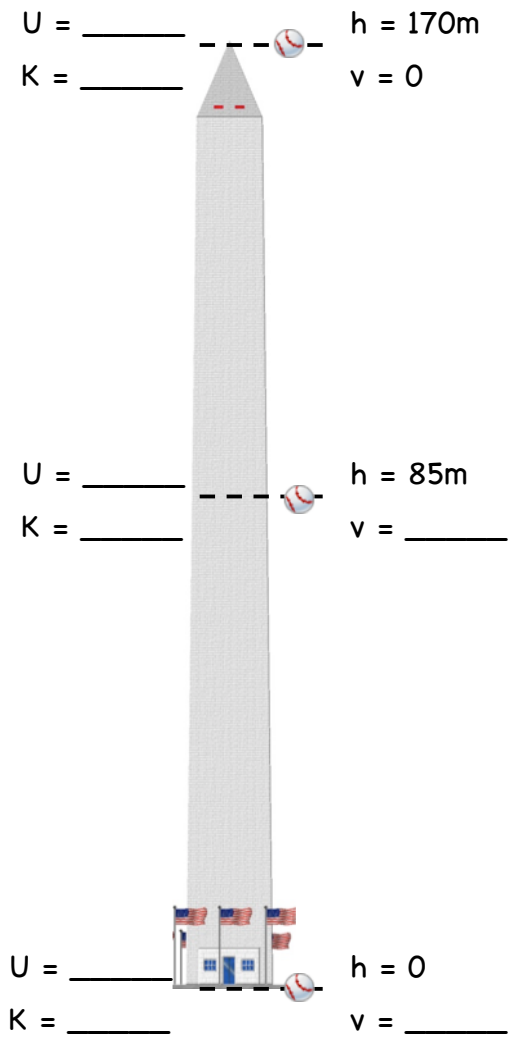
Gabby Street was a catcher for the Washington Senators from 1909 to 1911. He reputedly caught a baseball (m = 150g) dropped from the top of the Washington Monument known to be 555ft (170m) tall. Assume there is no air resistance and g = 10m/s^2. Fill in the blanks at the right.

The principles of physics I used were:

1.

2.

3.



Example 3: A homerun can leave the bat at about 110mph (49m/s), while an average fastball heads toward the batter at about 92mph (41m/s). The mass of a baseball is 145g while a typical bat has a mass of 36oz (1.0kg). The (center-of-mass) speed of the bat when it strikes the ball is about 50mph (22m/s). Find the speed of the bat just after hitting the ball.

Conservation of Linear Momentum

Conservation of Linear Momentum

Example 4: In the previous example, assume the ball hit the bat 75cm from the knob end. Find (a)the initial angular momentum of the ball about the knob and the final angular momentum of the ball about the knob. Assuming the center of mass of the bat is 60cm from the knob, find (c)the initial rotational speed of the bat and (d) the final rotational speed of the bat. (e)Find the rotational inertia of the bat.

No Hands Homer

Lecture 40 - Summary

Major Ideas in Mechanics

1. Kinematics
2. Newton's Laws
3. Law of Gravitation
4. The Law of Conservation of Energy
5. The Law of Conservation of Linear Momentum
6. The Law of Conservation of Angular Momentum