PHYSICS

Projectile Motion

- **What is a Projectile?**
  An object that is projected (by an initial _____) and continues (by _____).

- **Projectile Motion**
  - **An object that is projected without gravity being present – just goes straight.**
  - **_____ projected objects in gravity curve downwards.**
  - **_____ projected objects in gravity go straight up, then straight down.**
  - **_____ projected objects in gravity curve upwards, then downwards.**
  - **The curve (trajectory) in pure projectile motion (if only gravity is acting) is always a _____ [$y = x^2$]!**
  - **Question: Which hits the ground first, a bullet fired or a bullet dropped simultaneous to the firing?**

- **Big Bertha**
  In WWI this gun was found by following the _____ of her projectile motion.

- **Calculating Projectile Motion**
  - **Horizontal distance comes from v = d/t, so [$d = vt$].**
  - **Vertical distance is, as you know [$d = \frac{1}{2} gt^2$], or approximately $d = 5t^2$.**
  - **Question: How far below its straight line trajectory will Big Bertha's cannonball be after 5 sec?**
  - **Question: If Big Bertha's horizontal component of velocity is 20 m/sec, how far across the ocean will the cannonball be after 5 sec?**
  - **Question: How fast a projectile launched horizontally from a 5m high platform if it went 50 m before hitting the ground?**

- **Maximum Range of a Projectile is _____° http://www.analyzemath.com/Projectile/Projectile.html**
  Because Earth's curvature is 5m drop for 8km distance and since it takes 1 sec for an object to fall 5m, an object traveling 8km/sec can stay in orbit. This is about 18,000 mph and would even burn up iron.

- **Kepler's Laws of Planetary Motion**
  I. Planets move in _____, with the Sun at one focus.
  II. The line from the Sun to any planet sweeps out equal areas in equal times.
  III. [$T^2 \sim R^3$], where T is time period for a revolution and R is planet's average distance to sun.

- **Derivations the Centripetal Force of Gravity on Planets**
  - **Remembering that Centripetal Force dictates that: $f = m_{planet}v^2/r$ … and since v = d/t, we can say $f = m_{planet}d^2/ rt^2$.**
  - **Also remember that Newton's Law of Gravitation dictates that: $f = Gm_{earth}m_{planet} / d^2$.**
  - **If we put these together (and change times to "T" and distances to "R") we get: $m_{planet}R^2/ RT^2 = Gm_{earth}m_{planet} / R^2$… which simplifies to $T^2 = R^3Gm_{earth}$.**
  - **This confirms Kepler's Third Law [$T^2 \sim R^3$], since G and m_{planet} are constant numbers!**

Escape Velocities in km/s	
Moon	2.4
Mercury	4.3
Mars	5.0
Venus	10.4
Earth	11.2
Uranus	22.3
Neptune	24.9
Saturn	36.0
Jupiter	60.2
SUN	620

- **Why is the escape velocity also the *maximum falling speed*?**