Introduction to Mechanics   **Name :**_____

Exam 1

1) Convert the following to standard SI units. State the dimension of each quantity.

a. 1.2 feet per year

b. 3.4 joules per cubic inch

c. 5.6 Newton seconds

d. 7.8 eV

2) Clara throws a water balloon at 5.0 m/s straight down from the top of the science center, 13 meters above the ground level.

    a. Derive the velocity function $v(t)$ describing the ballon's motion.

    b. Derive the position function $y(t)$ describing the ballon's motion.

    c. Determine the ballon's velocity when it hits the ground.

    d. Determine the position of the ballon 0.5 seconds before hitting the ground.

3) A toy rocket is shot straight up from the ground (of earth) and reaches a maximum height of 33 meters.

The rocket is then shot at the same speed at 25 degrees above the ground.

a. Determine the components of the initial velocity.

b. Determine the time of flight.

c. Determine the maximum height and range of the flight.

d. Determine the velocity (magnitude and direction) for the rocket at t=1.0 second?

4) A ring shaped space station has a 50.0 meter radius and rotates once every 14.2 seconds.

a. Determine the angular velocity and angular acceleration of the space station.

b. Determine the velocity and centripetal acceleration of an astronaut in the rotating ring.

The astronaut then travels at a constant rate of 2.0 meter per second from the outer ring toward the center.

c. Determine $v_{radial}(t)$, $v_{tangential}(t)$ and $v(t)$ during the trip to the center.

d. Determine the magnitude of the astronaut's acceleration 11 seconds before reaching the center.