

Physics 31A 1st Test (100 Points MAX)

Winter 2004

- (a) The radius of the Moon (R_M) is 1.738×10^3 km. Assume the Moon is a sphere and determine its volume to two significant figures.

(b) A solid sphere having a volume of 1.00 m^3 fits tightly in a cubical box. What is the volume contained within the box?
- (a) A firefighter dashes up a 26-m ladder (making an angle of 67.4° with the ground). What is the vertical displacement of her feet at the top? In other words, what is the y-component of her displacement vector?

(b) A three-lap relay race is run at average speeds for each lap of 10 km/h, 12 km/h, and 14 km/h. What is the average speed for the entire race? Guess at the answer and then calculate it. Draw a diagram.
- A toy car moves along the z -axis in a manner described by the formula $z(t) = C[A + Bt^2]$ where A , B , and C are constants having units of m^2 , m^2/s^2 , and m^{-1} , respectively. Determine an expression for the instantaneous speed of the car as a function of time.
- (a) A chicken is resting at a location 3.0 m north of a stationary farmer who weighs 185 lb. The chicken then meanders to a new location 3.0 m east of the farmer in a time of 2.0 s. Compute the bird's average velocity during its little journey.

(b) A salmon is dropped by a hovering eagle. How far will the fish fall in 2.5 s? Ignore air drag.
- A projectile is launched at a speed v_0 , at an angle θ . Neglecting air friction, use the calculus to show that $y = x \tan \theta + \frac{gx^2}{2v_0^2 \cos^2 \theta}$. Take up as positive so that $g = -9.81 \text{ m/s}^2$. Show that this equation reduces to the range equation when $y = 0$.
- (a) Someone wants to push a (100-kg) box full of books along the floor by exerting a constant horizontal force of 600 N. Given that the coefficient of static friction is 0.6 and the coefficient of kinetic friction is 0.1, determine the resulting motion of the box.

(b) The speed of a 10.0-kg vehicle moving along the x -axis is given by $v(x) = (4.0 \text{ m}^{-1} \text{ s}^{-1})x^2$. Determine the net force acting on the vehicle as a function of x .