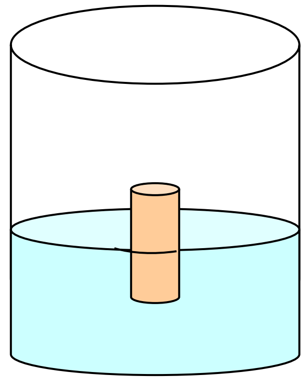
Hand-In Problem 5 Ph 212 -- Winter 2021

a. A cylindrical cork of mass **m**, radius **r**, and height **h** is floating in a tub of water as shown. The density of water is ρ_{water}. You push down on the cork a distance **s** at it starts bobbing up and down. What is the period of oscillation? State your answer in terms of givens: m, r, h, s, ρ_{water} and g.



b. You push the cork down a distance of 5.0cm and let go. At the end of the third complete oscillations, you find that the cork's maximum descent is now only 3cm. Create and print out a graph (using Excel, VPython, Matlab, by hand, or whatever you like) for 10 cycles for this damped situation where m=25g, r=1.2cm, and h=6.2cm.

Problem Solving Techniques for Chapter 15:

This chapter covers Oscillations. We still need to have a firm grasp on all the past problem-solving techniques from the first 14 chapters. In addition to those past tools and techniques, we are now going to add the following.

a) If your FBD boils down to an equation of form: $\frac{d^2x}{dt^2} = -\omega^2 x$

then you know that you have "Simple Harmonic Motion" and the equation of motion that describes the motion of the object is given as:

$x(t) = A\cos(\omega t + \phi_o)$.

b) In the cases of objects that have small oscillations (i.e. $\theta < 10°$) then you can use the "small angle approximation" where $\sin\theta \approx \tan\theta \approx \theta$ (θ, of course, has to be expressed in radians).

c) In the cased of a damped oscillator, the equation of motion is going to have the form:

$x(t) = Ae^{-t/\tau}\cos(\omega t + \phi_o)$ where τ is known as the "time constant".