

UNIVERSITY OF ALABAMA
Department of Physics and Astronomy

PH 105 LeClair

Summer 2012

Problem Set 10

Instructions:

1. Answer all questions below. All questions have equal weight.
2. Due Wed 20 June 2012 at the start of lecture.
3. You may collaborate, but everyone must turn in their own work.

1. An object of mass m is dropped from a height h above the surface of a planet of mass M and radius R . Assume the planet has no atmosphere so that friction can be ignored. Further assume the planet has no life that may be harmed by subsequent portions of this problem.

What is the speed of the mass just before it strikes the surface of the planet? Do *not* assume that h is small compared with R .

2. A satellite is in a circular Earth orbit of radius r . The area A enclosed by the orbit depends on r^2 because $A = \pi r^2$. Determine how the following properties depend on r : (a) period, (b) kinetic energy, (c) angular momentum, and (d) speed.

3. The density of water is 1000 kg/m^3 , while that of ice is 916.7 kg/m^3 . If a block of ice is placed in water, what volume fraction of the ice is below the surface?

4. Superman attempts to drink water through a very long straw. With his great strength, he achieves maximum possible suction. The walls of the straw do not collapse. Find the maximum height through which he can lift the water.