PHYS 201 Archimedes’ Principle Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

$F\_{b}=ρ\_{f}v\_{f}g$ Density of water = 1 g/cm3 = 1000 kg/m3.

<https://www.youtube.com/watch?v=eQsmq3Hu9HA>

1. State Archimedes’ principle.

2. Uses for Archimedes’ principle:

1. Volume measurement for density: A solid metal alloy has a mass of 335-g in air and 295-g in water. What is the density of the metal alloy?
2. Cavity detection: A metal ornament (gold) has a mass of 155-g in air and 142-g in water. Does it have a cavity inside? If so what is the volume of the cavity? [Density of gold = 19.3 g/cm3]
3. Loading capacity for floating objects: A cylindrical container of mass 24 kg, height 15 cm, and diameter 94 cm is floating in a fresh water lake. What is the maximum load in Kg it can support without sinking.
4. Density of a liquid: A chunk of metal with a mass of 390 g in air and volume 49 cm3 is found to have an apparent mass of 337 g when completely submerged in an unknown liquid. Calculate the density of the unknown liquid.

3. Conservation of energy:

a. A water slide is constructed so that swimmers, starting from rest at the top of the slide, leave the end of the slide traveling horizontally. If H = 5.5 m and h = 1.5 m, find the velocity of the swimmer at the bottom of the slide? (Ignore friction and air resistance) find the height  in the drawing.



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b. In the figure, a solid 0.2 kg ball rolls smoothly from rest (starting at height *H* = 5.7 m) until it leaves the horizontal section at the end of the track, at height *h* = 1.8 m. Use the conservation of energy to find the velocity of the ball as it leaves the end of track? (Rotational inertia of a solid ball of mass m and radius r, I = 2/5 mr2)



4. A gymnast with mass 46.0 kg stands on the end of a uniform balance beam as shown below. The beam is 5.00 m long and has a mass of 250 kg (excluding the mass of the two supports). Each support is 0.500 m from its end of the beam. Assume that the forces on the beam due to support 1 and support 2 are vertical.
a. Draw a free-body diagram for the beam.

b. Write down a force equation by balancing the forces vertically.

c. Write down a torque equation by balancing the torques.

d. Calculate the forces on the beam due to (a) support 1 and (b) support 2?

 