

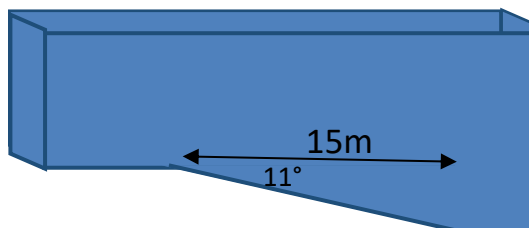
Name: \_\_\_\_\_

Date: \_\_\_\_\_

## AP Physics 2 Summer Fluids Problem Set

*Use Chapter 3 of “AP Physics 2 Essentials” along with your initiative, creativity and perseverance to teach yourself enough to complete this problem set. For this class, Bozeman Science and Khan Academy videos are useful, as is HyperPhysics, but there are many useful resources that will be sufficient for you to master these concepts and skills.*

1. A swimming pool has four perpendicular walls and a bottom that slopes downwards at an angle of  $11^\circ$  below the horizontal for a distance of 15 meters. By how much does the pressure at the bottom of the deep end differ from the pressure at the bottom of the shallow end? The water has a density of  $1000\text{kg/m}^3$ .



2. If a diver descends too quickly underwater, the pressure inside their inner ear may remain at atmospheric pressure while the pressure in the middle ear increases due to the depth. This pressure may cause the ear drum to burst. Pressure differences of only 35kPa can burst an ear drum. At what depth would this pressure be exerted? Sea water has a density of  $1024\text{kg/m}^3$ .
3. A duck floats on a lake of clean water ( $\rho=1000\text{kg/m}^3$ ) with 25% of its body submerged. What is the average density of the duck?

- The density of ice is  $917\text{kg/m}^3$  and the density of seawater is  $1025\text{kg/m}^3$ . A polar bear climbs onto a piece of floating ice with a volume of  $5.2\text{m}^3$ . What is the weight of the heaviest bear that the ice can support without sinking completely below the water?
- A dentist's chair and patient combined have a mass of  $120\text{kg}$ . It sits on a hydraulic output plunger with a radius of  $0.25\text{m}$ . The dentist steps on the input plunger (radius  $10\text{cm}$ ). What is the force needed for the dentist to begin to lift the patient and chair?
- A shop teacher has a circular piston with a radius of  $0.1\text{m}$  that is compressible to a depth of  $1\text{m}$ . He can exert a maximum force of  $75\text{N}$ . What is the radius of the piston he needs to lift a  $600\text{kg}$  motorcycle? How high can he lift it?

7. Puney wishes to lift his dog, but is too weak to do so on land. He knows that if he puts his dog in water (density =  $1000\text{kg/m}^3$ ), the buoyancy force will help him. If Puney can lift  $150\text{N}$ , and the dog has a mass of  $30\text{kg}$  with an average density of  $850\text{kg/m}^3$ , what is the minimum amount of water that needs to be displaced so Puney can lift the dog?
8. A basketball floats in a tub of water. The ball has a mass of  $0.5\text{kg}$  and a diameter of  $22\text{cm}$ . What volume of water is displaced by the basketball as it floats? Assume the water has a density of  $1000\text{kg/m}^3$ .
9. Wood has a density of  $574\text{kg/m}^3$ . What percentage of a cube would be submerged in distilled water ( $\rho=1000\text{kg/m}^3$ )?

Due on the first day of class.

Questions? Email [mapqar@fairfieldschools.org](mailto:mapqar@fairfieldschools.org)