ARCHIMEDES' PRINCIPLE

- AIM: to test Archimedes' principle
- MATERIALS:

Retord stand and rod	Scale	forcemeter
		
Beaker	**Wood ball**	**Metal ball**
		

- THEORY:

Archimedes' principle states that an object submerged in a fluid is buoyed by a force that is equal to the weight of the displaced fluid.

- PROCEDURE for an object that sinks

Let's calculate the weight of displaced water by the cylinder

1) Pour some water into the beaker.
2) Record this initial volume, Vi

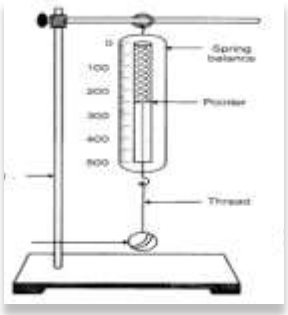
3) Gently immerse one of the metal balls into the water. Record the new water level, Vf

4) Calculate the change in volume. This is the volume of displaced water, ΔV

5) Calculate the weight of displaced water, F_B, (ρ_{water} =1000 kg/m^3)

$$F_B = m_{water} \cdot g = \Delta V \cdot \rho_{water} \cdot g$$

Let's calculate the buoyant force on the object:



1) Suspend the object by a forcemeter.

2) The forcemeter shows the weight of the object in air.

3) Partially fill the graduated cylinder with water.

4) Completely submerge the ball. Do not allow the ball to touch the sides of the container.

5) The forcemeter shows now its weight in water, F_w.

6) The difference between the object's weight in air and its weight in water is the buoyant force on the object, F_B

7) Compare the values obtained for buoyant force.

➢ PROCEDURE for an object that floats in water

1) Measure the mass and volume of the wood cylinder.

2) Partially fill and fine tune the graduated cylinder with water: V_i

3) Gently immerse the wood cylinder into the water. Record V_f and calculate ΔV. This is the volume of displaced fluid.

4) Calculate the weight of the displaced water. Compare this buoyant force to the weight of the wood cylinder. Are they the same?

5) Draw a free-body diagram for this system. Calculate the density of the wood.

➢ QUESTIONS:

1) If air is a fluid, why do we not include the buoyant force caused by the displacement of air by the objects in this experiment? Explain your answer carefully. (Hint: ρ_{water} = 1000 kg/m^3, ρ_{air}=1.21 kg/m3)

2) How can a ship made of steel (ρ_{steel}=7.88 g/cm^3) float in water?

3) Explain how a hot air balloon flies.

4) Calculate the buoyant force that would be exerted on the wood cylinder if you held it under water. How much force must you exert to keep it submerged?

➢ FEED-BACK:

Evaluate the difficulty of this practical. Circle the number that suits the level of difficulty you found while going through this practical:

Very Easy 1 2 3 4 5 *Very Difficult*

Did you enjoy going through this practical? Circle the number that suits your choice

Not at all 1 2 3 4 5 *Very much*