3055 BA SANGAM COLLEGE

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Worksheet 12

School: Ba Sangam College **Year/Level**: 11

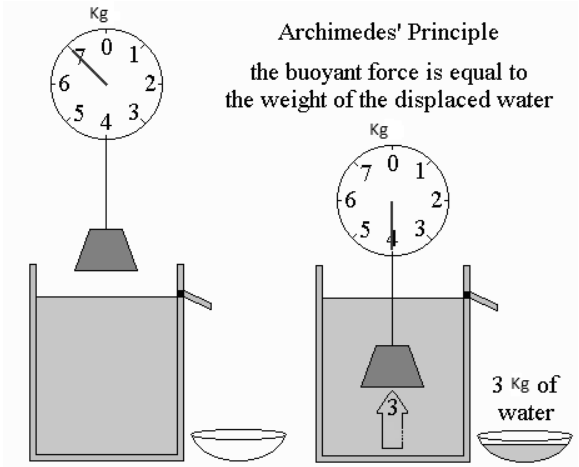
Subject: Physics

Strand	3 – Fluid Statics
Sub-strand	3.2 – Archimedes Principle
Content Learning Outcome	Objective: • Demonstrate an understanding of Archimedes principle, and its application to floating bodies.

ARCHIMEDES PRINCIPLE

"When an object is partially or completely immersed in a fluid, apparent loss of weight is equal to the upthrust on the object which is equal to the weight of the fluid displaced."

Apparent loss of weight = Upthrust = Weight of fluid



Example

An object weighs 30 N in air and 20 N when immersed in water. The density of water is 1000 kg/m^3. Find:

(a) the upthrust applied by water.

Upthrust = Apparent loss of weight =

30N – 20N = 10N

(b) the weight of water displaced.

Upthrust = Weight of water disp = 10N

(c) the mass of water displaced.

$F = mg \Rightarrow m = \frac{F}{g} = \frac{10}{10} = 1kg$

(d) the volume of water displaced.

Density $\rho = \frac{m}{v} \Rightarrow v = \frac{m}{\rho} = \frac{1}{1000} = 0.001\ m^3$ or $1 \times 10^{-3}\ m^3$

ACTIVITY 1

1.A hydrometer measures what of a liquid?

A. temperature

B. taste

C. density

D. pollution

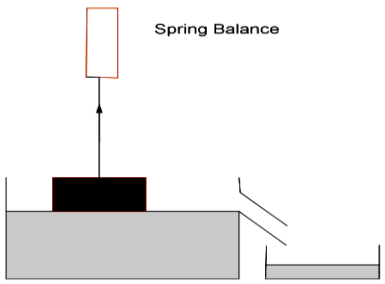
2.Explain in your own words how Archimedes Principle is applied to hydrometers?

PRESSURE

The ***thrust*** experienced per unit area of the surface of liquid at rest is called pressure. F=Force

A = Area

P= Pressure



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of liquid and acceleration due to gravity.

Pascal's Law According to Pascal's Law, the pres
applied to an enclosed liquid is transmitted undimini
to every portion of the liquid and the walls of

PRINCIPLE OF FLOATATION

"A floating body displaces its own weight of the fluid in which it floats"

Law of Floatation

For an object to float, apparent weight in air is equal to Up thrust which is equal to weight of the fluid displaced.

Apparent wt in air= upthrust = weight of fluid displaced

Hydrostatic Pressure Formula is given by

Where, the height is h, density is ρ, gravity is g

Example

An object which weighs 30 N in air floats in water of density 1000kg/m^3.

Calculate:

(a) the upthrust acting on the object.

Apparent weight in air = upthrust = 30N

(b) the weight of water displaced.

Apparent weight in air = weight of water displaced = 30N

(c) the mass of liquid displaced

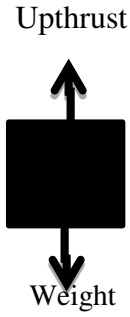
$F = mg \implies m = \frac{F}{g} = \frac{30}{10} = 3$ kg

(d) the volume of water displaced.

$\rho = \frac{m}{v} \implies v = \frac{m}{\rho} = \frac{3}{1000} = 0.003\ m^3$ or $3 \times 10^{-3}\ m^3$

FLOATING AND SINKING

- Fluids provide partial support to any object placed in it.
- Any object when placed in a fluid would seem to weigh less. According to Archimedes, there is an upwards force on the object that comes from the liquid itself and makes the object appear to lose weight. This upward force is called Upthrust.
- It is caused by the pressure difference between two depths in a liquid.
- There are two forces acting on an object when placed in a fluid:



The movement of the object in a fluid depends on the net force arising from these two forces.

Three Cases

1. Upthrust > weight (Object will rise upwards)
2. Upthrust < weight (Object will sink)
3. Upthrust = weight (Object will float)

ACTIVITY **(13 marks)**

1. An object weighs 55 N in air and 20 N when immersed in a liquid of density 800 kg/m^3. Find:

(a) the apparent loss of weight of the object **(2m)**

(b) the upthrust applied by the liquid.

(1 mark)

(1 mark)he weight of liquid displaced.

(1 mark)

(c) the mass of liquid displaced.

(1 mark)

(d) the volume of liquid displaced.

(1 mark)

2. An object which weighs 100 N in air floats in liquid of density 800kg/m^3.

Calculate:

(a) the upthrust acting on the object.

(1 mark)

(b) the weight of liquid displaced.

(1 mark)

(c) the mass of liquid displaced.

(1 mark)

(d) the volume of water displaced.

(1 mark)

3. A block of density 2400 kg/m^3 has a volume of 0.20 m^3. What is

(a) its mass **(1 mark)**

(b) its weight **(1 mark)**

(c) its apparent weight when **completely immersed** in a liquid of density 800 kg/m^3.