Experiment No. 1

Date

Physics

Force and Density

Unit - 1

Experiment - 1

Aim: To determine the density of a solid (denser than water) by using a spring balance and a measuring Cylinder.

Material Required

⇒ A spring balance of an appropriate range, a measuring Cylinder of an appropriate range, thread, a Solid body, water beaker and a stand.

Theory

⇒ Density of a body defined as mass per unit volume i.e.

Density = $\frac{\text{Mass}}{\text{Volume}}$	or $D = \frac{M}{V}$

S.I unit of Density is kg/m³ or kg/m^{-3}.

The mass of a given body can be estimated by a spring balance. Volume of the Same body can be estimated by immersing the Solid in water). will give the volume of the solid. With the help of mass and Volume of the body, density can be calculated.

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Procedure

1. Find the least count and zero error of spring balance.
2. Suspend the body with the help of spring balance and note down the reading. (Let the weight of the body be 'w'
   Therefore the mass of the body is 'm'.
3. Find the least count of a measuring Cylinder and partially Fill it with water.
4. Note down the inital reading of measuring Cylinder. Let it be V_1.
5. Now immerse the given body completely in water and note down the final reading. Let it Be V_2.
6. The difference $(V_2 - V_1)$ between the two readings is the volume of the body.
7. Repeat the steps twice or thrice and note the readings.
8. Find the ratio in each case which is the required density of the body.
9. Find the mean value of density.

Observations :-.

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1. Range of spring Balance, R= ...... g wt.
2. Number of divisions in the spring Balance, N = ...
3. Least Count of spring Balance $\frac{R}{N}$ = ... g wt/ div.
4. Least Count of measuring Cylinder = ... ml.
5. Weight of Solid body, W = ... g.
6. Mean density = $\frac{total}{3}$ = ... g/ml
⇒ ...... Kg/m³. (1g/ml = 1000kg/m³)

S.No.	Volume of body (ml)	Density $D = \frac{W}{V}$ g/ml
1.		
2.		
3.		

Result

The density of solid Block is found to be ..... Kg/m³.

Precautions

1. Spring balance should be error free and Sensitive engough to detect small variations.
2. Measuring cylinder should be dry and clean.
3. The rock block should be wiped with a dry cloth before repeating the readings since it will change the reading.
4. The body should be fully immersed while taking the Readings.

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Ch - 2 Wave Motion and Sound

Aim

To determine the speed of a pulse propagated through a stretched string / Slinky. (helical spring).

Materials Required

A spring balance of appropriate range, stand and clamp, thread (cotton) overflow can, beaker, water (tap water) and salty water), two solids weights.

Theory

1. Archimedes' Principle states that when a body is partially or fully immersed in a liquid, it experiences an apparent loss in weight, which is equal to the weight of the liquid displaced by it.

2. The apparent loss in weight can be calculated by weighing the body with the help of a spring balance first in air, then completely immersing it in water.

Weight on immersing it in water.

Weight on immersion = weight in air - upthrust.

Procedure

1. Find the least count and zero error of spring

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balance.

3. Now weight with empty beaker using spring balance.
4. Fill the overflow can with tap water till the overflow level.
5. Completely immerse the solid weight held by a spring balance into the overflow can, containing tap water.

Observations

1. Least count of the spring balance = ± .... g wt.
2. Zero error in the spring balance = ± .... g wt.
3. Weight of stone in air S_a = ... g wt.
4. Weight of empty beaker W_a = ... g wt.
5. Range of spring balance R = ... g wt.

Table. 1. With tap water

S.No	Solid No.	Weight of stone in tap water S_w	Weight of beaker with tap water W_b
1.	Solid 1		
2.	Solid 2		

Loss in weight or upthrust $U = S_a - S_w$	Weight of tap water displaced $W = W_b - W_a$	$U - W$

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The value of u and w are expected to be same.

Table 2. with Salty water

S.No	Solid No	Weight of stone in salty water	weight of beaker with tap salty Wb	Loss in weight or upthrust U = So - Sw

Weight of tap water salty displaced w = wb - wa	u - w

Result

The value of weight of liquid displaced has been found to be the same as the loss in weight or upthrust.

$w = u$

Weight of liquid displaced = Loss in weight when immersed in a liquid

Precautions:-

1. The beaker should be dry without any drop of water since it will change the weight of the liquid.

2. Spring balance should be 100% accurate.

3. While taking measurements spilling of liquid should not happen.

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Chapter-2 Wave Motion and Sound

Experiment = 3

Aim

To determine the speed of a pulse propagated through a skoretched string / slinky (helical spring)

Material Required.

A slinky or helical spring of negiligible mass, a stop wAtch, a meter scale and a fixed support with a hook.

Theory

A long flexible spring is called a slinky. A wave produced by a single disturbance in a given medium is known as pulse.

$$\text{Speed} = \frac{\text{Length Covered}}{\text{Time Taken}} \quad (\text{cm/s or m/s})$$

With the same slinky we can produce transverse waves and can determine the speed of transverse pulse propagation.

Procedure

1. Tie a spring of negligible mass to a rigid support.
2. Stroch the spring and create a disturbance in it.
3. Simultaneously switch on the stop watch.
4. Note how the disturbance is being transferred to

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the fixed end.

5. Note the time taken upto which the disturbance reaches the other end.

6. Measure the Natural length of spring.

Observations

S. No	Natural length in the spring (In Cm)	Time taken by pulse (in Sec)	Speed (in cm/sec)
	Longitudinal		
1	$L_1 \Rightarrow$		
2	$L_2 \Rightarrow$		
3	$L_3 \Rightarrow$		
	Transverse		
1.	$L_1 \Rightarrow$		
2.	$L_2 \Rightarrow$		
3.	$L_3 \Rightarrow$		

Result ⇒

The speed of a pulse created in a spring will be different for different lengths.

Precautions

1. Hold the Slinky in such a way that the slinky should be parallel to the ground.

2. While giving the jerk, slinky itself should not move as a whole.

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3. The start and stop of the watch have to be done very well, since it may make the speed vary.
4. The stop watch may be of least count for accuracy of readings.
5. The spring should be massless since it will change the speed.
6. Measure the length of the spring accurately.

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Experiment - 4

Aim

To verify the laws of reflection of sound.

Materials Required

Polished metallic plate, white sheets, two hollow glass tubes, watch, obstacle.

Theory

Sound waves are produced when an object vibrates in air making the particles of that medium vibrate with same Frequency. Sound waves are reflected in the same way like waves and follows the laws of reflection. The law of reflection for sound waves are.

1. The angle of incidence is always equal to angle of Reflection.

2. The Incident ray Reflected Ray and normal to the Reflecting surface at the point of incidence, all lie in the same plane.

Procedure

1. Place a white sheet on a table and set a

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Polished metallic plate vertically on the sheet

2. Arrange two hollow glass tubes in front of the Metallic plate.

3. Place a cardboard between two glass tubes.

4. Note down the Position of glass tubes A and B and mark the angle of incidence and Angle of Reflection.

Observations

S. No	Angle of incidence ∠i	Angle of Reflection ∠r	(i-r)
1.			
2.			
3.			
4.			
5.			

Result

The angle of incidence and angle of reflection are found to be ....

Precautions

1. The reflecting surface should not be sound absorbing.

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2. The ear, clock and Reflecting surface should be in the same plane.
3. The angle of Incidence of and angle of reflection should be measured accurately.
4. The glass tubes used should be long and of smaller diameter.