Instruction manual

C15-5534-W0

Discovering Underwater Forces Apps

March. 2022

⚠Safety Precaution

- **Do not disassemble, repair and remodel this product. This product might stop working and warranty will be void.**
- **Keep Newton Meter dry. Otherwise, the product can be damaged, short-circuited or create a shock hazard.**
- **Teacher or trainer must instruct students about the safe ways of conducting experiments with this product before actually conducting experiments.**
- **When you find that something is broken, please do not repair the product by yourself and contact your distributor.**

Introduction

Set of equipment required for students' experiments in groups to determine water pressure and to measure buoyant force, including [1] "Water Pressure Indicator" (C15-5530-W0), [2] "Square Prism Water Tank" (C15-5550), [3] "Cubic specimens set for measuring buoyant force" (C15-5351) and [4] "Newton Meter GN-1" (A05-4065). Features of [1], [2] and [3] are as follows:

[1] Easy to observe visualized water pressure by checking how the degree of dent in the thin rubber film changes depending on the water pressure exerted at the water depth where the indicator is.

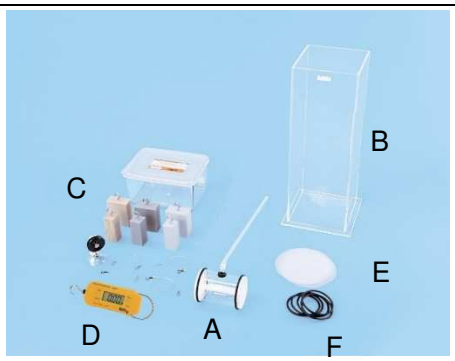
[2] Versatile acrylic tank for various type of water pressure experiments in combination with "Water Pressure Indicator", thanks to its vertically long shape for sufficient water depth.

[3] Possible to measure the buoyant force of each cube by comparing the gravity forces in newton unit acting on the cube in the air and underwater respectively. Designed to understand Archimedes' principle by measuring buoyant forces acting on cubes that differ in substance, weight and volume.

Set includes in total six cubes. Two cubes each made of aluminum, polyvinyl chloride (PVC) and wood with different volumes.

Contents and Specifications

	Item	Cat.No.	Quantity
A	Water Pressure Indicator - Body: Transparent acrylic plastic, φ50 x 70 mm - L shape pipe: Transparent acrylic plastic, φ5 x 300 mm - O ring: φ45 mm x 5 pcs - Replacement Rubber film (ca.φ90 × t0.07mm): 5 pcs	C15-5530-W0	1 set
B	Square Prism Water Tank - Material: Acrylic resin - Size: 100 x 100 x 300 mm	C15-5550	1 pc
C	Cubic specimens set for measuring buoyant force FK-1 - Materials: Aluminum, PVC, Wood - Bigger block: size: 20 x 40 x 50mm (1 pc each) - Smaller block: size: 20 x 20 x 50mm (1 pc each) - String with metal ring x 4 pcs (long, short , 2 pcs each) - Pulley with a suction cup (1 pc)	C15-5351	1 set
D	Newton Meter GN-1 - Size: 157 (whole length) x 45 x 24mm - Range: 0~±19.99 N, 0~±1,999g - Resolution: ±0.01N, ±1g - Display: LCD - Operating temperature range: 0~40℃ - Power supply: AAA dry cell battery x 2 (not included) - Function: Zero calibration, Unit change, Auto power off, Hold function	A05-4065	1 pc
E	Rubber film (φ90 × t0.07mm)		5 pcs
F	O ring		5 pcs



Sample Experiment 1.: Water Pressure

[What to prepare:]

A: Water Pressure Indicator (Cat. No. C15-5530-W0)

B: Square Prism Water Tank (Cat. No. C15-5550)

[Procedures:]

1. Turn the head of water pressure indicator to horizontal position and sink it into the water of a tank. You can observe the difference of dent degree of rubber film of the indicator by its depth (Fig1.)
2. When you change its depth, the degree of dent changes depending on the depth in the water, because the water pressure applied to the rubber film changes.
3. When both sides of the indicator stand at the same depth, the degree of dent will also be the same.
4. Turn the head of water pressure indicator to the vertical position and sink it into the water of a tank. You can observe how the degree of dent differs between top and bottom of rubber films at a glance. (Fig.2).
5. You can intuitively understand that the difference represents water pressure level applied at each depth.

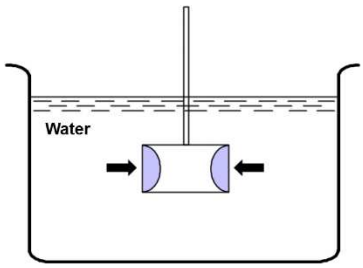


Fig.1

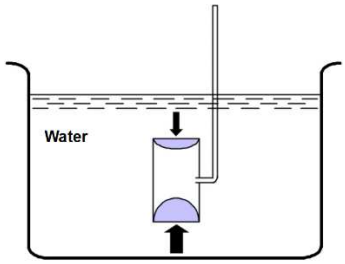


Fig.2

*The air in the indicator is evacuated through the pipe by water pressure.

[Maintenance:]

1. Remove O ring and rubber film from the indicator.
2. Put a new rubber film on the rim of indicator.
3. Set and fix the O ring without stretching the rubber film.
4. After fixing the rubber film on one side, replace the rubber film on the other side following the same steps (1 – 3).
5. After fixing the rubber films on both sides, adjust the tension of the two rubber films equally. Submerge the indicator into the water and check the degree of dent of each rubber film.
6. When the degree of dent differs between the two films, adjust the tension by stretching until degree of dent at each side matches. Finally, cut the rubber film to fit the size of the indicator.

[NOTE] To prevent the rubber films from being deteriorated faster, keep them dry and store them in dark and cool place.

Sample Experiment 2.: Buoyant force

Possible to measure the buoyant force of each cube by comparing the force of gravity in the newton unit acting on the cube in the air and underwater respectively. Designed to understand Archimedes' principle by measuring buoyant forces acting on cubes that differ in substance, weight and volume.

1. Using an object heavier than water (Using a material that sinks in water).

[What to prepare:]

B: Square Prism Water Tank

C: Cubic specimens set for measuring buoyant force

- Aluminum block
- String with metal ring (short length)

D: Newton Meter GN-1

[Procedures:]

1. Hang an object (the Aluminum block) from the hook of Newton Meter using the string in between and measure the force of gravity applied to the object in the air.
2. Fully submerge the object in the water of the tank and measure the force of gravity applied to the object.
3. Compare the measured values obtained in above 1. and 2. to calculate the difference between them as the buoyant force applied to the object.

For example,

Measured force value in the air = 1.1 [N]

Measured force value in the water = 0.7 [N]

Buoyant force applied to the object in the water = 1.1 - 0.7 = 0.4 [N]

2. Using an object lighter than water (Using a material that floats on water).

[What to prepare:]

C: Cubic specimens set for measuring buoyant force

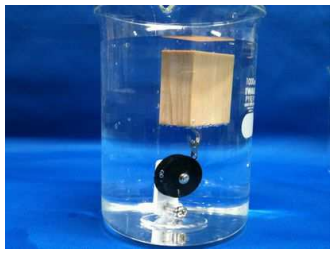
- Wooden block
- String with metal ring (long length)
- Pulley with a suction cup (1 pc)

D: Newton Meter GN-1

A large-diameter water container

[Procedures:]

1. Wax an object (the wooden block) to make it waterproofed.
2. Hang the object from the hook of Newton Meter using the string in between, and measure the force of gravity applied to the object in the air.
3. Pass the string connected with the object through the pulley (with a suction cup) and hook the other end of the string on Newton Meter.
4. Fix the suction cup on the bottom of the water container. and pour enough water to fill the container.
5. Measure the force applied to the object in the water using Newton meter.



For example,

Measured force value in the air = 0.2 [N]

Measured force value in the water = -0.2 [N]

Buoyant force applied to the object in the water = 0.2 – (-0.2) = 0.4 [N]

Above experimental results represent that the buoyant force acts on an object is determined by its volume, not its mass.

Note: How to use Newton Meter is not covered by this document. Refer to the instruction manual for Newton Meter included in the package.

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