?

EXIT

Table of Contents





1. Which of the following is an example of a force?

- a. water
- b. other fluids
- c. gravity
- d. mass





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 b. other fluids
 c. gravity
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2. A fluid can be

- a. a gas only.
- b. a liquid only.
- c. a solid or a gas.
- d. a liquid or a gas.





2. A fluid can be
a. a gas only.
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d. a liquid or a gas.





- 3. The velocity of an object is
 - a. its standard reference point.
 - b. the rate of change of its position.
 - c. the process of speeding it up.
 - d. its change in direction.





MENU

3. The velocity of an object is

a. its standard reference point.



b. the rate of change of its position.

c. the process of speeding it up.

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4. Earth's gravity pulls you down with a force

- a. greater than your weight.
- b. the size of your feet.
- c. equal to your weight.
- d. half your weight.





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How can you predict if an object will sink or float in a fluid?

You dive into a pool wearing a life vest. Wearing the vest makes you bigger and makes you weigh more. So why do you float?











Identify Multiple Meanings

Word	Everyday Meaning	Scientific Meaning
fluid	<i>n.</i> A liquid	<i>n.</i> A substance that can easily flow; a gas or a liquid
	Example: It's good for your health to drink plenty of <u>fluids</u> every day.	Example: Like water, air is a <u>fluid</u> .







Identify Multiple Meanings

Word	Everyday Meaning	Scientific Meaning
force	<i>v.</i> To use power to make someone do something Example: She had to force herself to get up early.	 <i>n.</i> A push or a pull exerted on an object Example: You exert <u>force</u> when you open and close a door.







Identify Multiple Meanings

Word	Everyday Meaning	Scientific Meaning
pressure	<i>n.</i> A feeling of being pushed to do things	<i>n.</i> The force exerted on a surface divided by the total area over which the force is exerted
	Example: Students may feel <u>pressure</u> from adults to do well on tests.	Example: When air leaks from a tire, the <u>pressure</u> is reduced and the tire becomes soft.







Apply It!

Read the sentences below. Then identify the term that has a scientific meaning.

- 1. When a gas is heated, the *pressure* of the gas increases.
- 2. Her parents are putting *pressure* on her to find a job.

Sample: The first sentence deals with gas, which is a science topic. The second sentence is about a girl and her parents. The first is clearly giving "pressure" a scientific meaning.

MENI





End of Chapter Preview









Section 1: Pressure

- What does pressure depend on?
- How do fluids exert pressure?
- How does fluid pressure change with elevation and depth?





What Is Pressure?

The amount of pressure you exert depends on the area over which you exert a force.





Area

The area of a surface is the number of square units that it covers. To find the area of a rectangle, multiply its length by its width. The area of the rectangle below is 2 cm X 3 cm, or 6 cm^2 .







Area

Practice Problem

EXIT







MENU

End of

EXIT

Fluid Pressure

All of the forces exerted by the individual particles in a fluid combine to make up the pressure exerted by the fluid.



Variations in Fluid Pressure



EXIT

As your elevation increases, atmospheric pressure decreases.

Variations in Fluid Pressure

Water pressure increases as depth increases.







Links on Fluids and Pressure



Click the SciLinks button for links on fluids and pressure.







End of Section: Pressure







Section 2: Floating and Sinking

- How can you predict whether an object will float or sink in a fluid?
- What is the effect of the buoyant force?









Calculating Density

The density of a substance is its mass per unit of volume.

$$Density = \frac{Mass}{Volume}$$

For example, a sample of liquid has a mass of 24 g and a volume of 16 mL. What is its density?

Density =
$$\frac{24 \text{ g}}{16 \text{ mL}}$$

= 1.5 g/mL





Calculating Density

Practice Problem



A piece of metal has a mass of 43.5 g and a volume of 15 cm³. What is its density?













Density

Changes in density cause a submarine to dive, rise, or float.







Density

Changes in density cause a submarine to dive, rise, or float.









EXIT

Density

Changes in density cause a submarine to dive, rise, or float.



End of Slide





The pressure on the bottom of a submerged object is greater than the pressure on the top. The result is a net force in the upward direction.









Buoyancy

The buoyant force works opposite the weight of an object.









Buoyancy

Archimedes' principle states that the buoyant force acting on a submerged object is equal to the weight of the fluid the object displaces.

Floating When the film can is empty, it floats. The volume of displaced fluid is equal to the volume of the submerged portion of the can.

150

005

250

MENU

Film can

Displaced

End of Slide

fluid

Sinking When the film can has film in

EXIT

it, it sinks. The volume of fluid displaced by the can is equal to the volume of the can.



EXIT

Buoyancy

A solid block of steel sinks in water. A steel ship with the same weight floats on the surface.



Density



Click the Video button to watch a movie about density.







End of Section: Floating and Sinking







Section 3: Pascal's Principle

- What does Pascal's principle say about change in fluid pressure?
- How does a hydraulic system work?







Transmitting Pressure in a Fluid

When force is applied to a confined fluid, the change in pressure is transmitted equally to all parts of the fluid.







Hydraulic Devices





EXIT

In a hydraulic device, a force applied to one piston increases the fluid pressure equally throughout the fluid.

MENU

End of

Slide

Hydraulic Devices



 $\frac{\text{Force}}{\text{Area}} = \text{Pressure} = \frac{\text{Larger force}}{\text{Larger area}}$

EXIT

By changing the size of the pistons, the force can be multiplied.



Hydraulic Systems Activity



Click the Active Art button to open a browser window and access Active Art about hydraulic systems.









Math

Comparing Hydraulic Lifts



EXIT

In a hydraulic device, a force applied to the piston on the left produces a lifting force in the piston on the right. The graph shows the relationship between the applied force and the lifting force for two hydraulic lifts.





Analyzing Data

Math

Comparing Hydraulic Lifts Hydraulic Lifts 12,000 10,000 Lift A Lifting Force (N) 8,000 6,000 4,000 Lift B 2,000 0 1,000 0 2,000 3,000 Applied Force (N)

EXIT

Reading Graphs:



Suppose a force of 1,000 N is applied to both lifts. Use the graph to determine the lifting force of each lift.



Lift A: 4,000 N; lift B: 2,000 N



EXIT

Math Analyzing Data **Comparing Hydraulic Lifts Reading Graphs: Hydraulic Lifts** For Lift A, how much force Q. 12,000 must be applied to lift a 10,000 12,000-N object? Lift A Lifting Force (N) 8,000 6,000 4,000 3,000 N Α Lift B 2,000 0 1,000 2,000 0 3,000 Applied Force (N) End of Slide

Math Analyzing Data **Comparing Hydraulic Lifts Hydraulic Lifts** 12,000 10,000 Lift A Lifting Force (N) 8,000 6,000 4,000 Lift B 2,000 0 1,000 0 2,000 3,000 Applied Force (N)

EXIT

Interpreting Data:



By how much is the applied force multiplied for Lift A? Lift **B**?



Lift A: applied force is multiplied by four; lift B: applied force is multiplied by two.

MENU

End of Slide

Analyzing Data

Math

Comparing Hydraulic Lifts Hydraulic Lifts 12,000 10,000 Lift A Lifting Force (N) 8,000 6,000 4,000 Lift B 2,000 0 1,000 0 2,000 3,000 Applied Force (N)

EXIT

Interpreting Data:



What does the slope of each line represent?



The slope gives the ratio of the lifting force to the applied force. The greater the slope, the more the lift multiplies force. End of





Slide

Analyzing Data

Math

Comparing Hydraulic Lifts Hydraulic Lifts 12,000 10,000 Lift A Lifting Force (N) 8,000 6,000 4,000 Lift B 2,000 0 1,000 0 2,000 3,000 Applied Force (N)

EXIT

Drawing Conclusions:



Which lift would you choose if you wanted to lift a weight of 4,000 N? Explain.



Lift A, because it multiplies force more than lift B.

MENU

End of Slide



End of Section: Pascal's Principle







Section 4: Bernoulli's Principle

- How is fluid pressure related to the motion of a fluid?
- What are some applications of Bernoulli's principle?







Bernoulli's Principle

Bernoulli's principle states that as the speed of a moving fluid increases, the pressure exerted by the fluid decreases.



EXIT





Applying Bernoulli's Principle

Bernoulli's principle helps explain how planes fly.







EXIT

Applying Bernoulli's Principle

An atomizer is an application of Bernoulli's principle.



Applying Bernoulli's Principle

Thanks in part to Bernoulli's principle, you can enjoy an evening by a warm fireplace without the room filling up with smoke.







Applying Bernoulli's Principle

Like an airplane wing, a flying disk uses a curved upper surface to create lift.





Links on Bernoulli's Principle



Click the SciLinks button for links on Bernoulli's principle.







End of Section: Bernoulli's Principle







QuickTake Quiz



Click to start quiz.





