

SCIENCE
FUSION Physical Science
HOLT McDOUGAL

PowerNotes

Unit 1 Lesson 5 Fluids and Pressure

Feel the Pressure!

What are fluids?

- A **fluid** is any material that can flow and that takes the shape of its container.
- A fluid can flow because its particles easily move past each other.
- Liquids and gases, including water and air, are fluids.



Why do fluids exert pressure?

- **Pressure** is the measure of how much force is acting on a given area. All fluids exert pressure.
- When you pump up a bicycle tire, you push air into the tire. Like all matter, air is made of tiny particles that are constantly moving. The particles bump against one another and against the walls of the tire, creating pressure. The particles move in all directions and act on every part of the tire.



Why do fluids exert pressure?

- Why does the air in a balloon exert pressure on the balloon?



How is pressure calculated?

- Pressure equals force divided by area.
- The SI unit for pressure is the **pascal**. One pascal (1 Pa) is the force of one newton exerted over an area of one square meter (1 N/m²).
- A greater force results in greater pressure. Pressure also depends on the area over which the force is exerted. A greater area results in less pressure.



Under Pressure

What are two familiar fluids that exert pressure?

- Because gravity pulls the gases in Earth's atmosphere toward Earth's center, the atmosphere has weight. The pressure caused by the weight of the atmosphere is called **atmospheric pressure**.
- Atmospheric pressure is exerted on everything on Earth, including you. Atmospheric pressure is usually expressed in kilopascals (kPa). A kilopascal is equal to 1,000 pascals.



What are two familiar fluids that exert pressure?

- Gravity also pulls water toward Earth's center. The weight of water causes pressure on objects under its surface. Underwater objects also have the weight of the air above the water pushing down on them.
- As a result, the total pressure under water is the sum of the pressures of the atmosphere and the water above.



How does depth affect fluid pressure?

- As an object travels deeper into the atmosphere, the atmospheric pressure increases because the greater weight of the air exerts a greater force.
- Water pressure also increases as depth increases.



Thar She Blows!

What are some examples of fluid motion due to pressure?

- At any given altitude, fluids flow from areas of higher pressure to areas of lower pressure.
- You can observe this property of fluids by drinking liquid through a straw and by breathing.
- Air also moves from areas of higher pressure to areas of lower pressure. This movement of the air is known as wind.



Sink or Swim?

What causes buoyant force?

- **Buoyant force** is an upward force that fluids exert on all matter.
- When an object is immersed in fluid, pressure is exerted on all sides of the object. The pressure exerted to the sides balances out. But because pressure increases with depth, pressure will be greater against the bottom of the object than the top. So overall, the fluid pushes against the object with an upward, or buoyant, force.



How is buoyant force calculated?

- The buoyant force acting on an object in a fluid is an upward force equal to the weight of fluid that the object displaces.
- This is known as **Archimedes' principle**, named for a Greek mathematician who lived in the third century B.C.E.



What can happen as a result of weight and buoyant force?

- An object in a fluid will float if the object's weight is equal to the buoyant force.
- An object in a fluid will sink if the object's weight is greater than the buoyant force.
- If the buoyant force on an object is greater than the object's weight, the object is buoyed up. The object moves upward in the fluid until the buoyant force equals the object's weight. When this happens, the object floats.



What can happen as a result of weight and buoyant force?

- Will these objects float, sink, or be buoyed up when submerged in water?



What affects the density of an object?

- The density of an object equals its mass divided by its volume.
- A submarine dives by filling its ballast tanks with seawater. As water flows into the tanks, the submarine's mass increases, but its volume stays the same. Thus, its overall density increases, and it sinks below the surface.



What affects the density of an object?

- A submarine rises by emptying its ballast tanks. This process decreases its mass, which decreases its density.



What affects the density of an object?

- Ships float on water because they are built with a hollow shape. The hollow shape increases the overall volume of the ship. Increasing the ship's volume decreases its density. When the ship's density is lower than that of water, the ship will float.
- Most bony fish have an organ called a *swim bladder*. This organ is filled with gases. By adjusting the volume of gas in its swim bladder, the fish can move to different depths of water.

