

Encyclopedic Entry

barometer

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A **barometer** is a scientific **instrument** used to measure **atmospheric pressure**, also called **barometric pressure**. The **atmosphere** is the layers of **air** wrapped around the Earth. That air has a weight and presses against everything it touches as **gravity** pulls it to Earth. Barometers measure this pressure.

Atmospheric pressure is an indicator of **weather**. Changes in the atmosphere, including changes in air pressure, affect the weather. **Meteorologists** use barometers to predict short-term changes in the weather.

A **rapid** drop in atmospheric pressure means that a **low-pressure system** is arriving. Low pressure means that there isn't enough force, or pressure, to push clouds or **storms** away. Low-pressure systems are associated with **cloudy**, **rainy**, or **windy** weather. A rapid increase in atmospheric pressure pushes that cloudy and rainy weather out, clearing the skies and bringing in cool, dry air.

A barometer measures atmospheric pressure in units of **measurement** called atmospheres or bars. An **atmosphere (atm)** is a unit of measurement equal to the average air pressure at **sea level** at a **temperature** of 15 degrees Celsius (59 degrees Fahrenheit).

The number of atmospheres drops as **altitude** increases because the **density** of air is lower and **exerts** less pressure. As altitude **decreases**, the density of air **increases**, as does the number of atmospheres. Barometers have to be **adjusted** for changes in altitude in order to make **accurate** atmospheric pressure readings.

Types of Barometers

Mercury Barometer

The **mercury barometer** is the oldest type of barometer, **invented** by the Italian **physicist Evangelista Torricelli** in 1643. Torricelli **conducted** his first barometric experiments using a tube of water. Water is relatively light in weight, so a very tall tube with a large amount of water had to be used in order to **compensate** for the heavier weight of atmospheric pressure.

Torricelli's water barometer was more than 10 meters (35 feet) in height, which rose above the roof of his home! This odd device caused **suspicion** among Torricelli's neighbors, who thought he was involved in **witchcraft**. In order to keep his experiments more secretive, Torricelli **deduced** that he could create a much smaller barometer using **mercury**, a silvery liquid that weighs 14 times as much as water.

A mercury barometer has a glass tube that is closed at the top and open at the bottom. At the bottom of the tube is a pool of mercury. The mercury sits in a circular, shallow dish surrounding the tube. The mercury in the tube will adjust itself to match the atmospheric pressure above the dish. As the pressure increases, it forces the mercury up the tube. The tube is marked with a series of measurements that track the number of atmospheres or bars. **Observers** can tell what the air pressure is by looking at where the mercury stops in the barometer.

Aneroid Barometer

In 1844, the French scientist Lucien Vidi invented the **aneroid barometer**. An aneroid barometer has a sealed **metal chamber** that **expands** and **contracts**, depending on the atmospheric pressure around it. Mechanical tools measure how much the

chamber expands or contracts. These measurements are **aligned** with atmospheres or bars.

The aneroid barometer has a circular display that **indicates** the present number of atmospheres, much like a clock. One hand moves clockwise or counterclockwise to point to the current number of atmospheres. The terms stormy, rain, change, fair, and dry are often written above the numbers on the dial face to make it easier for people to **interpret** the weather. Aneroid barometers slowly replaced mercury barometers because they were easier to use, cheaper to buy, and easier to **transport** since they had no liquid that could spill.

Some aneroid barometers use a mechanical tool to track the changes in atmospheric pressure over a period of time. These aneroid barometers are called barographs. **Barographs** are barometers connected to needles that make marks on a roll of **adjacent graph paper**. The barograph records the number of atmospheres on the **vertical axis** and units of time on the **horizontal**. A barograph's tracking tool will **rotate**, usually once every day, week, or month. The spikes in the graph show when air pressure was high or low, and how long those pressure systems lasted. A severe storm, for instance, would appear as a deep, wide dip on a barograph.

Digital Barometers

Today's **digital** barometers measure and **display complex** atmospheric **data** more accurately and quickly than ever before. Many digital barometers display both current barometric readings and **previous** 1-, 3-, 6-, and 12-hour readings in a bar chart format, much like a barograph. They also account for other atmospheric readings such as wind and **humidity** to make accurate weather forecasts. This data is **archived** and stored on the barometer and can also be downloaded onto a computer for further **analysis**. Digital barometers are used by meteorologists and other scientists who want up-to-date atmospheric readings when conducting experiments in the lab or out in the field.

The digital barometer is now an important tool in many of today's **smartphones**. This type of digital barometer uses atmospheric pressure data to make accurate **elevation** readings. These readings help the smartphone's **GPS receiver** pinpoint a location more accurately, greatly improving **navigation**.

Developers and researchers are also using the smartphone's **crowdsourcing** capabilities to make more accurate weather **forecasts**. **Apps** like PressureNet automatically collect barometric measurements from each of its users, creating a **vast network** of atmospheric data. This data network makes it easier and faster to map out storms as they develop, especially in areas with few **weather stations**.

VOCABULARY

| Term | Part of Speech | Definition |
|--------------------------|------------------|---|
| accurate | <i>adjective</i> | exact. |
| adjacent | <i>adjective</i> | next to. |
| adjust | <i>verb</i> | to change or modify something to fit with something else. |
| air | <i>noun</i> | the layer of gases surrounding Earth. |
| air pressure | <i>noun</i> | force pressed on an object by air or atmosphere. |
| align | <i>verb</i> | to put in a straight line. |
| altitude | <i>noun</i> | the distance above sea level. |
| analysis | <i>noun</i> | process of studying a problem or situation, identifying its characteristics and how they are related. |
| aneroid barometer | <i>noun</i> | tool that determines atmospheric pressure by measuring how much a metal chamber expands or contracts. |
| app | <i>noun</i> | (application) specialized program downloaded onto a mobile device. |
| archive | <i>verb</i> | to keep records or documents. |

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|-------------------------------|--------------------|---|
| associate | <i>verb</i> | to connect. |
| atmosphere | <i>noun</i> | layers of gases surrounding a planet or other celestial body. |
| atmosphere (atm) | <i>noun</i> | (atm) unit of measurement equal to air pressure at sea level, about 14.7 pounds per square inch. Also called standard atmospheric pressure. |
| atmospheric pressure | <i>noun</i> | force per unit area exerted by the mass of the atmosphere as gravity pulls it to Earth. |
| axis | <i>noun</i> | an invisible line around which an object spins. |
| bar | <i>noun</i> | (b) unit of measurement for pressure; 1 bar is about equal to the atmospheric pressure at sea level. |
| barograph | <i>noun</i> | barometer that tracks changes in atmospheric pressure over time. |
| barometer | <i>noun</i> | an instrument that measures atmospheric pressure. |
| barometric pressure | <i>noun</i> | atmospheric pressure as read by a barometer. |
| chamber | <i>noun</i> | sealed compartment. |
| cloud | <i>noun</i> | visible mass of tiny water droplets or ice crystals in Earth's atmosphere. |
| compensate | <i>verb</i> | to make up for a loss or injury, usually in money, goods, or services. |
| complex | <i>adjective</i> | complicated. |
| conduct | <i>verb</i> | to transmit, transport, or carry. |
| contract | <i>verb</i> | to shrink or get smaller. |
| crowdsourcing | <i>noun</i> | technique that enlists the public to assist with a specialized task. |
| data | <i>plural noun</i> | (singular: datum) information collected during a scientific study. |
| decrease | <i>verb</i> | to lower. |
| deduce | <i>verb</i> | to reach a conclusion based on clues or evidence. |
| density | <i>noun</i> | number of things of one kind in a given area. |
| digital | <i>adjective</i> | having to do with numbers (or digits), often in a format used by computers. |
| display | <i>verb</i> | to show or reveal. |
| elevation | <i>noun</i> | height above or below sea level. |
| Evangelista Torricelli | <i>noun</i> | (1608-1647) Italian physicist. |
| exert | <i>verb</i> | to force or pressure. |
| expand | <i>verb</i> | to grow or get larger. |
| forecast | <i>verb</i> | to predict, especially the weather. |
| GPS receiver | <i>noun</i> | device that gets radio signals from satellites in orbit above Earth in order to calculate a precise location. |
| graph paper | <i>noun</i> | paper marked with small boxes, or intersecting horizontal and vertical lines. |
| gravity | <i>noun</i> | physical force by which objects attract, or pull toward, each other. |

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|----------------------------|------------------|---|
| horizontal | <i>adjective</i> | left-right direction or parallel to the Earth and the horizon. |
| humidity | <i>noun</i> | amount of water vapor in the air. |
| indicate | <i>verb</i> | to display or show. |
| instrument | <i>noun</i> | tool. |
| interpret | <i>verb</i> | to explain or understand the meaning of something. |
| invent | <i>verb</i> | to create. |
| low-pressure system | <i>noun</i> | weather pattern characterized by low air pressure, usually as a result of warming. Low-pressure systems are often associated with storms. |
| measurement | <i>noun</i> | process of determining length, width, mass (weight), volume, distance or some other quality or size. |
| mercury | <i>noun</i> | chemical element with the symbol Hg. |
| mercury barometer | <i>noun</i> | tool that determines atmospheric pressure by measuring how much mercury moves in a glass tube. |
| metal | <i>noun</i> | category of elements that are usually solid and shiny at room temperature. |
| meteorologist | <i>noun</i> | person who studies patterns and changes in Earth's atmosphere. |
| navigation | <i>noun</i> | art and science of determining an object's position, course, and distance traveled. |
| network | <i>noun</i> | series of links along which movement or communication can take place. |
| observer | <i>noun</i> | someone who watches, or observes. |
| physicist | <i>noun</i> | person who studies the relationship between matter, energy, motion, and force. |
| predict | <i>verb</i> | to know the outcome of a situation in advance. |
| pressure | <i>noun</i> | force pressed on an object by another object or condition, such as gravity. |
| previous | <i>adjective</i> | earlier, or the one before. |
| rain | <i>noun</i> | liquid precipitation. |
| rapid | <i>adjective</i> | very fast. |
| rotate | <i>verb</i> | to turn around a center point or axis. |
| sea level | <i>noun</i> | base level for measuring elevations. Sea level is determined by measurements taken over a 19-year cycle. |
| smartphone | <i>noun</i> | mobile telephone with additional features, such as a web browser or music playing device. |
| storm | <i>noun</i> | severe weather indicating a disturbed state of the atmosphere resulting from uplifted air. |
| storm glass | <i>noun</i> | glass container filled with water or another liquid that responds to changes in atmospheric pressure. |
| suspicion | <i>noun</i> | doubt or mistrust. |
| temperature | <i>noun</i> | degree of hotness or coldness measured by a thermometer with a numerical scale. |
| transport | <i>verb</i> | to move material from one place to another. |

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|------------------------|------------------|--|
| vast | <i>adjective</i> | huge and spread out. |
| vertical | <i>noun</i> | up-down direction, or at a right angle to Earth and the horizon. |
| weather | <i>noun</i> | state of the atmosphere, including temperature, atmospheric pressure, wind, humidity, precipitation, and cloudiness. |
| weather station | <i>noun</i> | area with tools and equipment for measuring changes in the atmosphere. |
| wind | <i>noun</i> | movement of air (from a high pressure zone to a low pressure zone) caused by the uneven heating of the Earth by the sun. |
| witchcraft | <i>noun</i> | changing of everyday events using supernatural or magical powers. |

For Further Exploration

Websites

- NOAA: Making Two Types of Barometers
- The Weather Radio Broadcast Network: The Barometer Bob Show



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