

**CHEMISTRY**<http://www.youtube.com/watch?v=xtrEN-YKLBM>**GAS PRESSURE AND VOLUME**Pressure

Pressure is defined as the force exerted on an object per unit of surface area. The metric system defines pressure using the unit ***Pascal (Pa)***.



Ex: Calculate the pressure you exert by standing on the floor.

<http://www.youtube.com/watch?v=LEY3fN4N3D8>

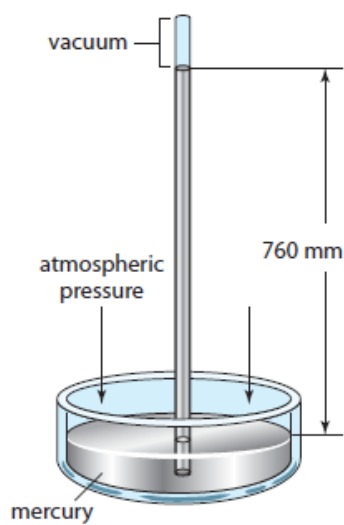
**CHEMISTRY****GAS PRESSURE AND VOLUME**Gases Under Pressure

A gas can exert pressure on an object when it is compressed. The compressed gas will resist further compression by exerting an opposing force. The compressed air molecules inside a balloon push against the inner surface in an attempt to escape.

Atmospheric Pressure

Scientists have estimated the mass of Earth's atmosphere to be 5.1×10^{18} kg. That mass of air is being compressed by the Earth's gravity and exerts a pressure.

Galileo and his secretary Evangelista Torricelli measured this force using an instrument called a barometer. Using this instrument, they found that the air pressure at sea level caused the mercury to move up the tube to a height of 760 mm Hg. The units millimeters of mercury (mm Hg) was shortened to ***torr***. Therefore the earliest measurement of the atmospheric pressure was ***760 torr***.





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GAS PRESSURE AND VOLUME

Pressure Conversion

Standard Atmospheric Pressure is measured at sea level and can be described in many different ways.



Using these relationships we can convert from one unit to another using a “**conversion factor**”.

Ex: Convert 100 kPa to torr.

Ex: Convert 1.068 atm to kPa.

Ex: Convert 690 mm Hg to kPa.



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GAS PRESSURE AND VOLUME

Try This: How much weight do you carry on your shoulders?

The atmospheric pressure over an area of 1 m^2 is about 101.3 kPa.

- What force (in Newtons) does air exert over that m^2 ?
- If $\text{Mass} = \text{Force}/\text{Gravity}$, what mass does air exert over a m^2 ?

Note: Gravity on Earth = 9.81

- Measure the dimensions of your shoulders and calculate the area (in m^2).
- Calculate the weight air exerts on your shoulders:

$$\frac{\text{Area of Shoulders}}{1 \text{ m}^2} \times \text{Mass of Air over } 1 \text{ m}^2$$

- C** Using the relationship $760 \text{ mm Hg} = 760 \text{ torr} = 1 \text{ atm} = 101.3 \text{ kPa}$, convert each of the following units:

- 2.03 atm to kPa
- 85.2 kPa to atm
- 1.50 atm to torr
- 600 torr to kPa

- K/U** Use the kinetic molecular theory. Explain why the air pressure inside a capped syringe increases if the volume decreases from 15 cm^3 to 10 cm^3 .

- K/U** Explain, using the kinetic molecular theory, why pressure is exerted by gases in all directions.

7. What is atmospheric pressure?

8. Explain how Torricelli's apparatus worked.

9. Convert each of the following to the indicated unit.

- | | |
|--------------------|--------------------|
| a. 3.58 atm to kPa | c. 770 mmHg to kPa |
| b. 20.5 psi to atm | d. 470 torr to Pa |

- If the optimum tire pressure for a bicycle is 3 bar, and your tire pressure gauge is in units of psi, develop a formula that you can use to convert these units.

11. Why must mountain climbers understand the relationship between altitude and atmospheric pressure?

- To make a birdbath, you fill a 2 L soft-drink bottle with water and invert it in a dish of water. When the level of the water in the dish falls below the level of the water at the rim of the bottle, water flows from the bottle to refill the dish. Explain why this happens.