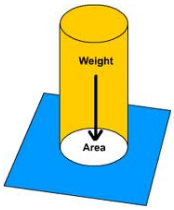
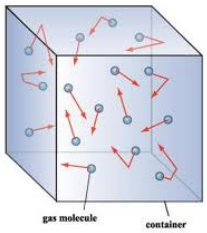
WKS –Chem H
Introduction to Pressure

Name _____
Date_____ **Period**_____

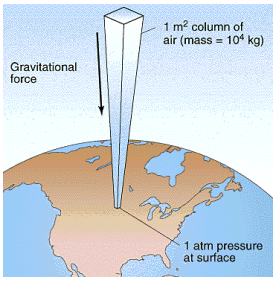
Read Textbook, *10-2 Pressure*, pg. 308-312.



1) Define Pressure. What two properties can we change to change pressure?
Pressure is a force divided by area.
Pressure can be changed by changing total force or by changing area by changing the volume of the container.



2) What causes pressure in a container of a gas?
Gas pressure is caused by collisions of gas particles with the wall of the container.



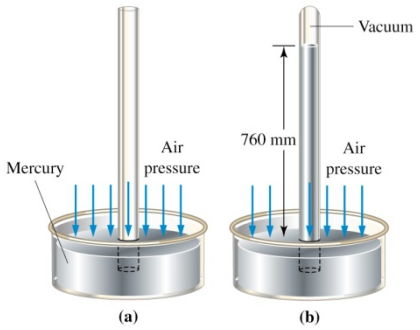
3) What causes atmospheric pressure?
Atmospheric pressure is caused by the weight of the atmosphere.

4) What units are used to express pressure measurements?

English units: psi = pounds per square inch = $\frac{lbs}{in^2}$

Metric units: kiloPascals (kPa) where 1 Pa = $\frac{1N}{m^2}$

Units based on a mercury barometer: mm Hg (also called torr)
Common units for measuring atmospheric pressure: atmospheres



5) Convert the following pressures to pressure in standard atmospheres:
Equivalents: 1 atm = 760 mm Hg = 760 torr = 101.325 kPa

a) $151.98\ \text{kPa} \times \frac{1\ \text{atm}}{101.325\ \text{kPa}} = \boxed{1.4999\ \text{atm}}$

b) $456\ \text{torr} \times \frac{1\ \text{atm}}{760\ \text{torr}} = \boxed{0.600\ \text{atm}}$

c) $912\ \text{mm Hg} \times \frac{1\ \text{atm}}{760\ \text{mmHg}} = \boxed{1.20\ \text{atm}}$

6) What is the pressure exerted by a 180 lb man wearing loafers with surface area 25 in^2? What pressure is exerted by a 120 lb woman wearing high heels with surface area 0.25 in^2?

$$P_{man} = \frac{Force}{Area} = \frac{180\ \text{lbs}}{25\ \text{in}^2} = \boxed{7.2\ \text{lbs/in}^2 = 7.2\ \text{psi}}$$

$$P_{woman} = \frac{120\ \text{lbs}}{0.25\ \text{in}^2} = \boxed{480\ \text{lbs/in}^2 = 480\ \text{psi}}$$

7) What is the value of atmospheric pressure at sea level, in newtons per square centimeter?
Definition: 1 Pa = 1 N/m^2

$$P = 101.325\ \text{kPa} \times \frac{1\times10^3\ \text{Pa}}{1\ \text{kPa}} \times \frac{1\ \text{N}}{\text{m}^2 \cdot \text{Pa}} \times \left(\frac{1\times10^{-2}\ \text{m}}{1\ \text{cm}}\right)^2 = \boxed{10.1325\ \text{N/cm}^2}\ (\text{about } 1\ \text{kg/cm}^2)$$

8) What is the device used to measure atmospheric pressure? What must be true about the weight of the liquid inside the device? Why does the height of the liquid not depend on the diameter of the tube?
A barometer measures atmospheric pressure. The weight of the liquid inside the barometer must equal the weight of the atmosphere that would be in an equal diameter tube. The height does not depend on the diameter because the pressure is per unit area, so as area increases force increases but pressure stays the same.

9) As we saw in class, the height of the liquid in a barometer is inversely proportional to the density of the liquid (at constant pressure). If the atmosphere can support a column of mercury 760 mm high at sea level, what height (in mm) of each of the following could be supported, given the relative density values cited? $D_{Hg} = 13.6$ g/mL

a) Water, whose density is 1.00 g/mL.

From class, $h_{Hg} = \frac{P}{D_{Hg}g} \Rightarrow P = h_{Hg}D_{Hg}g$; since P is constant,

$$h_{H_2O} = \frac{P}{D_{H_2O}g} = \frac{h_{Hg}D_{Hg}g}{D_{H_2O}g} = \frac{760\text{ mm} \times 13.6\text{ g/mL}}{1.00\text{ g/mL}} = \boxed{10300\text{ mm} = 10.3\text{ m}}$$

b) A hypothetical liquid with a density 1.40 times that of mercury.

From class, $h_{Hg} = \frac{P}{D_{Hg}g} \Rightarrow P = h_{Hg}D_{Hg}g$; since P is constant,

$$h_{H_2O} = \frac{P}{D_{X}g} = \frac{h_{Hg}D_{Hg}g}{D_{X}g} = \frac{760\text{ mm} \times D_{Hg}}{1.4\ D_{Hg}} = \boxed{543\text{ mm}}$$