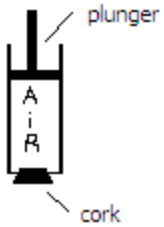
DEMO: "Pop Gun"



Aim: How do we explain the behavior of gases? (Part I)

1. What's happening? $\{\uparrow P, \downarrow V, T_{constant}\}$

a) temperature is constant, the pressure increases as the volume decreases; it's an "inverse" relationship

b) **Boyle's Law**: At constant temperature, the pressure of a gas is inversely related (proportional) to its volume.

c) **Why?** According to the Kinetic Molecular Theory, the pressure of a gas is due to the force of collisions between its molecules and the walls of their container. Therefore, decreasing the volume of a gas increases its pressure because less space leads to more collisions per second.

Other demos: squeeze your cheeks, twisting an empty plastic water bottle to make the top pop off, etc…

2. Quantifying the relationship

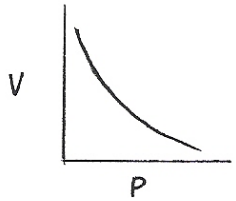
DEMO: pressure gauge attached to syringe (mounted on Plexiglas to project onto board).

a) **DATA**

P	**V**
16 kPa	22 ml
32	11
Double P	Half V,
2/1	1/2

" It flips"

b) **GRAPH**



an "inverse" relationship

c) **FORMULA**

$P \times V =$ a *constant number → $\{P_1 \times V_1 = P_2 \times V_2\}$

16 x 22 = 32 x 11

* The value of the constant depends on the mass of the gas & its temperature.

3. UNITS

P	V	T
101.3 kPa = 1 atm = 760 torr (mm Hg)	1 L = 1000 ml (cm^3)	K = °C + 273

kPa = kilopascal
atm = atmosphere
torr = torricelli
mm Hg =millimeters of mercury

3. Refer to Handout

RCHEM 1/Chille Boyle102.m&e

Boyle's Law: At constant T, P is inversely related to V.

$$\{ P_1 \times V_1 = P_2 \times V_2 \}$$

1) If the volume of a gas is doubled at constant temperature, what will happen to its pressure? P_1 Halved

2) 100 ml (V_1) of a gas exerts 4 torr (P_1) of pressure. If the temperature remains the same, what will be the new pressure ($P_2 = ?$) when the gas is compressed to 50 ml? (V_2)

$P_1 \cdot V_1 = P_2 \cdot V_2$

$4 \cdot 100 = P_2 \cdot 50$

$\frac{400}{50} = P_2 = 8$ torr

Finish the rest of the problems in the handout. **Circle and Label**. Be precise!