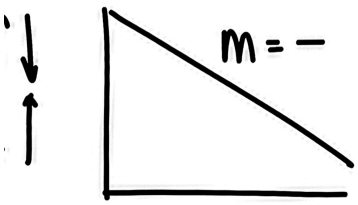
Fundimental Gas Laws

Boyle's Law

$P_1 V_1 = P_2 V_2$

constant T

Indirect Rel.

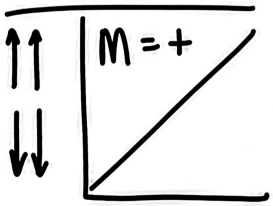


Charles' Law

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

Constant P

Direct Rel.

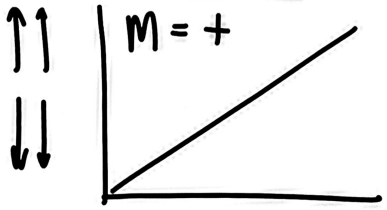


Guy-Lussac's Law

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

constant V

Direct Rel.



●●●

Combined Gas Law

The combination of all three fundimental gas laws into a single gas law eqn.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Nothing is held constant given P_1, V and T

$P_1 V_1 = P_2 V_2$	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$
Boyle's Law	Charles' Law	Guy-Lussac's Law
Constant T	Constant P	Constant V

●●●

Solving the Combined gas law

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$P_1 V_1 T_2 = P_2 V_2 T_1$$

Solve for 1 variable (P_1, V_1, or T)

Solve for V_1

$$\frac{P_1 V_1 T_2}{P_1 T_2} = \frac{P_2 V_2 T_1}{P_1 T_2}$$

$$V_1 = \frac{P_2 V_2 T_1}{P_1 T_2}$$

P = atm V = L T = K

Example

V_1 = ___ L P_1 = 3.08 atm
T_1 = 447.39 K

V_2 = 2.63 L P_2 = 5.50 atm
T_2 = 347.11 K

Solve for V_1 (nothing held constant)

$$V_1 = \frac{P_2 V_2 T_1}{P_1 T_2}$$ (equation) (small sheet)

$$V_1 = \frac{5.50\text{ atm} \cdot 2.63\text{ L} \cdot 447.39\text{ K}}{3.08\text{ atm} \cdot 347.11\text{ K}}$$

$$= 6.05\text{ L}$$

↳ Rnd to 2 places after decimal

Example 2

$V_1 = 2.48\,L \quad T_1 = \_\_ K$

$V_2 = 1.75\,L \quad T_2 = 610.12K$

given V and T

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ / $V_1T_2 = V_2T_1$ \ (Charles' Law)

$\frac{V_1 T_2}{V_2} = \frac{V_2 T_1}{V_2}$

$T_1 = \frac{V_1 T_2}{V_2}$

$T_1 = \frac{2.48\,L \cdot 610.12K}{1.75\,L}$

$T_1 = 864.63K$

Chosing a gas law equation

Look for Missing variable (P, V, or T)

Missing T	Missing P	Missing V	all present
Boyle	Charles	Gay-Lussac	Combined
$P_1V_1 = P_2V_2$	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
(P and V)	(V and T)	(P and T)	(P_1 V and T)

Combined gas law

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$P_1 V_1 T_2 = P_2 V_2 T_1$$

Fundimental Gas Laws

$$\frac{P_1 V_1}{\cancel{T_1}} = \frac{P_2 V_2}{\cancel{T_2}}$$

Constant T

$$P_1 V_1 = P_2 V_2$$

Boyle's Law

$$\frac{\cancel{P_1} V_1}{T_1} = \frac{\cancel{P_2} V_2}{T_2}$$

Constant P

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

Charles' Law