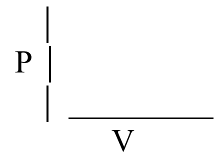
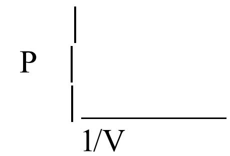
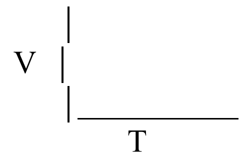
GAS LAWS SUMMARY AP Chemistry SUMMARY #1

1. **BOYLE'S LAW**
   - **$P_1V_1 = P_2V_2$** * when n and T are constant
   - As P ↑, V↓ (indirecttly proportional)





2. **CHARLES'S LAW**
   - $\dfrac{V_1}{T_1} = \dfrac{V_2}{T_2}$ * when n and P are constant
   - As T ↑ , V↑ (directly proportional)
   - Temperature ALWAYS has to be in Kelvin!! T(K) = T(•C) + 273



3. **AVOGADRO'S LAW**
   - 1 mole of *any* gas at STP takes up a volume of **22.4 L**. [$n \propto V$ (when T and P are constant)]
   - STP = standard temperature and pressure = 1 atm and 273 K or 0•C

4. **IDEAL GAS LAW EQUATION** (combines Boyle's and Charles's law)
   - **PV = nRT**
   - Temperature has to be in Kelvin
   - R = 0.0821 atm.L/ K.mol

5. **COMBINED GAS LAW**
   - $\dfrac{P_1V_1}{T_1} = \dfrac{P_2V_2}{T_2}$ [when n is constant]
   - Temperature has to be in Kelvin

6. **GAS LAW EXTENSIONS** (Incorporating molar mass and density of a gas)
   - **Density =** $\dfrac{m}{V} = \dfrac{P\,M}{R\,T}$
   - ***M*** = molar mass of gas (grams/mol), m = mass of gas (grams)
   - Also remember, D of gas = $\dfrac{\text{mass of gas}}{\text{Volume of gas}}$ and MM (molar mass of gas) = $\dfrac{\text{mass of gas}}{\text{moles of gas}}$

7. **GAS STOICH**

moles of given ← (÷ MM) ← grams of given

moles of given ← (÷ 22.4 L @ STP) ← volume of given

moles of unknown → (X MM) → grams unknown

moles of unknown → (X 22.4 L @ STP) → volume unknown

8. **DALTON'S LAW OF PARTIAL PRESSURE**
   - $P_{Total} = P_A + P_B + P_C + P_n$ and **Mole Fraction (of gas A)** = $X_A = \dfrac{n_A}{n_{total}} = \dfrac{P_A}{P_{total}}$