Gases

Absolute Temperature

- Absolute temperature is measured in Kelvins (K)
- One Kelvin is equal in size to one Celsius degree
- $K = {}^{o}C + 273$
- ${}^{o}C = K - 273$

“STP”

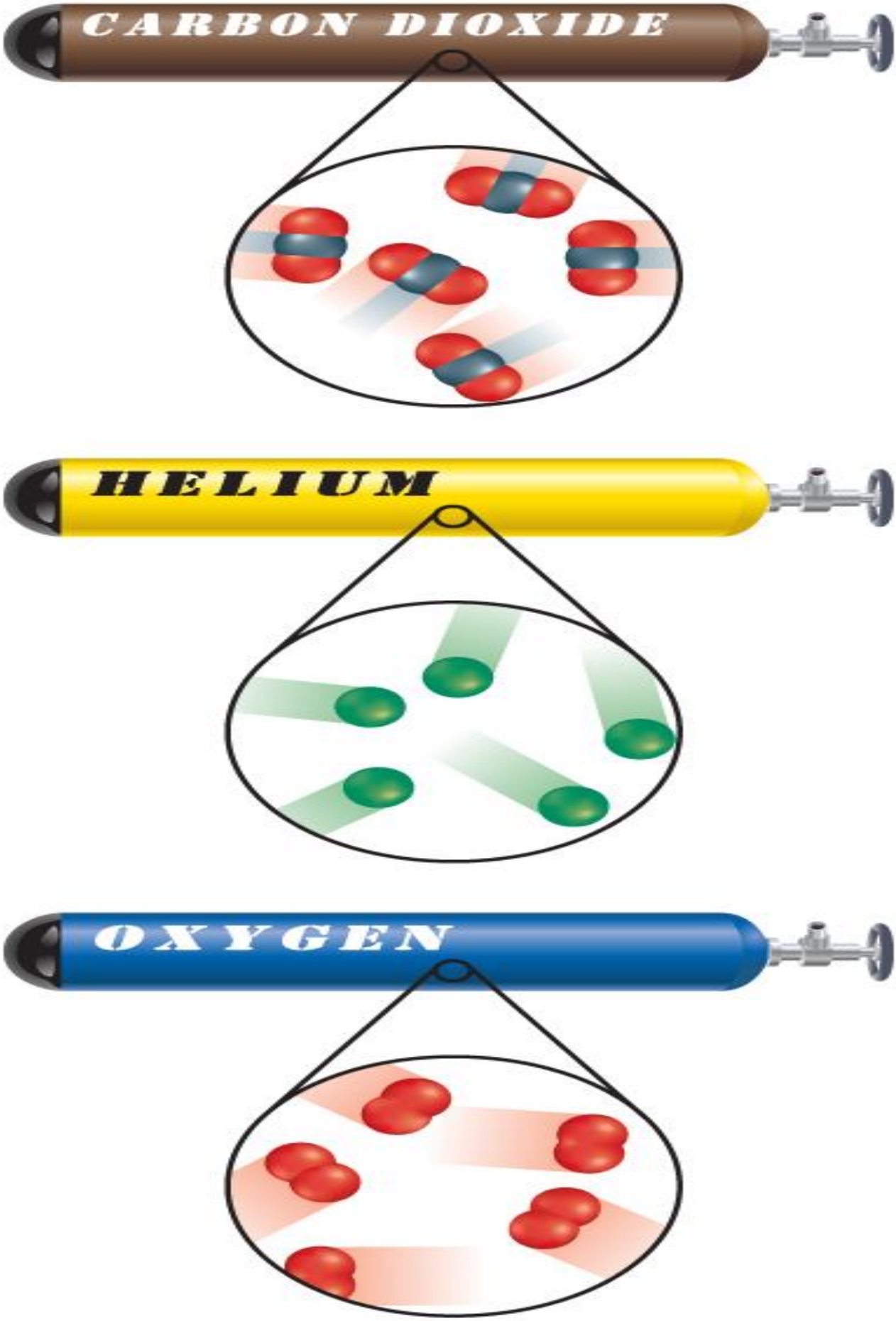
- Standard Temperature = **273K**
- Standard Pressure =
  - 1.00 atm
  - 101.3 kPa
  - 760 mmHg
  - 760 torr

Gas Laws

Avogadro's Hypothesis

- Equal volumes of gases contain equal numbers of moles (n) when compared at the same temperature and pressure
- molar volume of "any" gas:

1 mol = 22.4L @ STP


CARBON DIOXIDE
HELIUM
OXYGEN

If P & T are constant, then…

$$V \propto \mathrm{n} \qquad V = \mathrm{k} \bullet \mathrm{n}$$

$$V = (\mathrm{R}\frac{T}{P})n$$

$$\frac{PV}{T} = \mathrm{nR} \text{ or, } \mathrm{PV} = \mathrm{nRT}$$

Ideal Gas Law

- Combines all four key physical properties of gases

- **$PV = nRT$**

- $R = 0.082\ ^{(atm)(L)}/_{(mol)(K)}$
- $R = 8.31\ ^{(kPa)(L)}/_{(mol)(K)}$
- $R = 62.4\ ^{(mmHg)(L)}/_{(mol)(K)}$

PV = nRT

"R" is the universal gas Law constant

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- $$R = \frac{PV}{nT}$$

$$R = 0.0821 \frac{(atm)(L)}{(mol)(K)}$$

$$R = 8.314 \frac{(kPa)(L)}{(mol)(K)}$$

$$R = 62.4 \frac{(mmHg)(L)}{(mol)(K)}$$