

Today, we will:

- Discuss the classification of air pollutants (CAPs, HAPs, NAAQS, etc.)
- Do some practice/review problems to help you get ready for Quiz 1

CLASSIFICATION OF AIR POLLUTANTS (continued)

* Natural — Emission not associated with human activity

e.g.: Volcanoes, lightning, decaying plants & animals, natural forest fires

* Anthropogenic — Emissions produced by human activity

e.g. — power plants, automobile exhaust, etc.

Other Classifications

CAPS

→ Criteria Air Pollutants ≡ Pollutants for which

NAAQS exist

→ National Ambient Air Quality Standards

There are 7:

CAPS

→

CO

SO₂

NO₂

O₃

Pb

PM₁₀

PM_{2.5}

PM = particulate matter

★

→ lead levels are now low — some list of CAPs no longer include lead

PM₁₀ → particulate matter < 10 μm, but > 2.5 μm

Coarse particles

PM_{2.5} → " " < 2.5 μm

FINE PARTICLES

★ hazardous to health.

HAPs

≡ Hazardous Air Pollutants — EPA list

173 on original list — now ≈ 188

Clean Air Act of 1970 → Established the NAAQS & CAPs

Two criteria included to be regarded as a CAP :

- 1) Anticipated level that endangers public health or welfare
(bad for us to breathe)
- 2) Numerous and diverse mobile or stationary sources (ubiquitous)

NAAQS standards → see EPA website, also on the Links tab

★ Primary standards → Protect health of "sensitive" populations
(elderly, children, asthmatics)

★ Secondary standards → Protect public welfare

e.g., Visibility (can see the pollutant)

damage to animals, vegetation
" crops

" buildings, structures

See the NAAQS on EPA website or on Links on our website

↓
They list primary and secondary standards for most of the CAPs

Practice questions to help you prepare for Quiz 1

1. A container has 40.2 g of water vapor. How many mols of water vapor are in the sample? [Note: You will be able to look up $M_{\text{water}} = 18.02 \text{ g/mol}$.]

$$m = nM \rightarrow n = \frac{m}{M} = \frac{40.2 \text{ g}}{18.02 \text{ g/mol}} = 2.2309 \approx \boxed{2.23 \text{ mol}}$$

2. The mol fraction of CO ($M_{\text{CO}} = 28.0 \text{ g/mol}$) in a container of sampled polluted air is 50 PPM. The overall pressure of the gas mixture in the container is 100 kPa. Calculate the mass fraction of the CO in the container in units of mg/kg.

$$f_j = \frac{m_j}{m_t} = y_j \frac{M_j}{M_t} \quad (\text{from eq. sheet}) = (50 \times 10^{-6}) \frac{28.0 \text{ g/mol}}{28.97 \text{ g/mol}} \left(\frac{10^6 \text{ mg}}{\text{kg}} \right) = 48.926 \approx \boxed{48 \text{ g/kg}}$$

3. A container of sampled air contains mostly air, but also some carbon monoxide pollution ($M_{\text{carbon monoxide}} = 28.0 \text{ g/mol}$). The total volume of the container is 0.456 m^3 and the partial volume of CO in the container is $2.43 \text{E-}4 \text{ m}^3$. The container is at STP conditions. Calculate the mass of CO in the container in grams.

Eq sheet \rightarrow $PV_j = n_j R_u T$; $m_j = n_j M_j$ } $m_j = \frac{PV_j}{R_u T} M_j$ * Answer in variable form

PLUG IN #5

$$m_j = \frac{(101.325 \text{ kPa})(2.43 \times 10^{-4} \text{ m}^3)}{(8.314 \frac{\text{kJ}}{\text{kmol} \cdot \text{K}})(298.15 \text{ K})} \left(28.0 \frac{\text{kg}}{\text{kmol}} \right) \left(\frac{\text{kJ}}{\text{m}^2 \cdot \text{kPa}} \right) \left(\frac{\text{kJ}}{\text{kmol} \cdot \text{K}} \right) \left(\frac{1000 \text{ g}}{\text{kg}} \right) = 0.27812 \approx \boxed{0.278 \text{ g}}$$

4. The mass concentration of ammonia ($M_{\text{ammonia}} = 17.04 \text{ g/mol}$) is 1.11 g/m^3 . When the pressure is 97.3 kPa and the temperature is 573.15 K, calculate the mol fraction of the ammonia vapor in PPM.

TRY THIS ONE ON YOUR OWN FOR PRACTICE

ANSWER

$$y_j = \boxed{3190 \text{ PPM}}$$