

1. *Physical Structure of the Atmosphere*: Identify and name the layers of the atmosphere, the boundaries between them, and answer the following questions:

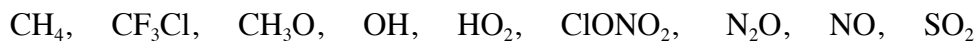
- What physical property distinguishes the layers and/or defines the boundaries?
- What physical/chemical processes dictate the “property” you identified in “a”?
- What are the approximate altitudes of the boundaries between the various layers?
- Which layer contains most of the air (90% by mass!)?
- Fill in the blanks: Vertical mixing occurs readily in the troposphere because the _____ is _____ (+ or –). Vertical mixing is quite slow in the stratosphere because the _____ is _____ (+ or –).

2. *Chemical Composition*: What are the three most abundant substances in the atmosphere? How much of the atmosphere (i.e. % of total) do these species comprise – to the nearest%?

3. *Concentration Units*: Water is a highly variable component of air. At “saturation” (when the air is “full” of water vapor or “100% relative humidity”), there’s about 20.0 Torr of water vapor present. (That is, the *partial pressure* of water at room temperature is 20.0 Torr). **i**) Convert this pressure to units of atm, bar, and mbar. **ii**) Also calculate the *mixing ratio* of water (at 0 km).

4. *More on Concentration Units*: The mixing ratio of ozone at the surface ($X_{O_3}^{0km}$) is about 40.0 ppb, and in the mid-stratosphere ($X_{O_3}^{30km}$) is 8.3 ppm, where the total pressure 11.5 mbar. Calculate **i**) the partial pressure of ozone, and **ii**) the *number density* (C) (in molec/cm³) of ozone at both altitudes. (assume T = 0°C)

5. *Free Radicals*: Which of the following species are *free radicals*?



6. **CHEM 104 review warning**: *Principles of Chemical Reactivity*: Fill in the blanks.

- A “product favored reaction” (i.e. one that “goes”) has a ΔG that is _____ (+ or –), and a K_{eq} value that is _____ (>, <, or equal to) one.
- A “reactant favored reaction” (i.e. one that does not “go”) has a ΔG that is _____ (+ or –), and a K_{eq} value that is _____ (>, <, or equal to) one.

7. *Free Radical Reactions*: Identify the free radicals in the reactions below and classify each reaction as “*initiation*”, “*propagation*”, or “*termination*”. (Note that the •’s I often place above free radicals have been omitted).

