

Sustainability Profiles in General Chemistry

Combined Learning Goals

SIMPLE SUBSTANCES

1. Identify the environmental and sustainability importance of the substances listed in this Sustainability Profile: N_2 , O_2 , H_2O , CO_2 , CO , SO_2 , SO_3 , NO , NO_2 , CH_4 , N_2O , O_3 , OH , NaCl , silicates, SiO_2 , Fe_2O_3 , Fe_3O_4 , bauxite, CaCO_3 , NH_3 , CFC, HCFC, SF_6 . (You do not need to know at this point in the course other aspects discussed such as nomenclature, Lewis structures, molecule shape. However, when these topics come up later in the course and there are specific associated learning goals, you should refer back to this Sustainability Profile as examples.)
2. Memorize the main components of air and their relative percentage (N_2 , O_2 , H_2O , Ar, CO_2). Distinguish between air and dry air.
3. List the common air pollutants (CO , SO_2 , SO_3 , NO , NO_2 , N_2O , CH_4 , N_2O , O_3 , OH).
4. Explain the difference between freshwater and sea water.
5. Classify each substance discussed in this Sustainability Profile as being an element, a compound, or a mixture.

GREENHOUSE GASES

6. Explain how the Earth's temperature is affected by gases that absorb IR radiation.
7. Explain how polar molecules such as H_2O can absorb IR radiation, causing them to vibrate in a way that changes their dipole moment.
8. Explain how nonpolar molecules such as CO_2 and CH_4 can absorb IR radiation, causing them to vibrate in a way that produces a temporary dipole moment.
9. Explain why the most abundant atmospheric gases (N_2 , O_2 , Ar) are not greenhouse gases.
10. Explain the source of the major greenhouse gases (H_2O , CO_2 , and CH_4).

FOSSIL FUEL COMBUSTION AND CO_2 EMISSIONS

11. Relate the burning of fossil fuels and biofuels to the increase of CO_2 concentrations over the past several decades as seen in the Keeling curve and other historical records.

NO_x AND SO_x

12. Identify the sources of NO_x and SO_x gases and explain their importance in the formation of photochemical smog.

AMMONIA

13. Explain the Haber process for the production of ammonia and its importance in the history of explosives and food production.

ACID RAIN

14. Describe the definition of, sources of, consequences of, and solutions to, acid rain.

OCEAN ACIDIFICATION

15. Describe the definition of, sources of, consequences of, and solutions to, ocean acidification.

NUCLEAR REACTORS

16. Identify the components and function of different parts of a conventional nuclear power plant and the so-called next generation reactors.