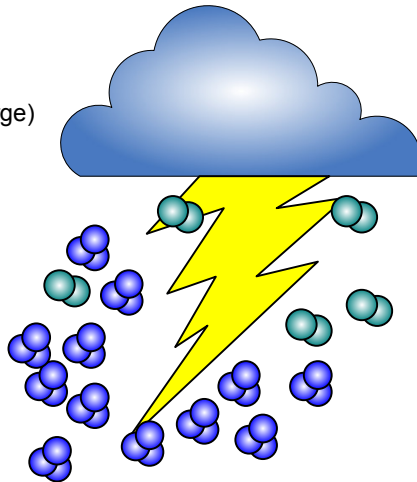


How much ozone does one lightning strike produce?

Lightning
(corona discharge)



Assumptions:

- The lightning strike is 5,280-ft (1-mile) above the ground
- The ionized gas (corona) affected by the lightning strike is 3-ft in diameter and remains constant from cloud to ground
- 99% of the gas in contact with the corona is converted to ozone
- The density of air is constant (0.089-lbs/ft³) through the 1 mile long corona



Calculate the volume of the corona (V_c):

$$V_c = \pi r^2 \times L \quad \{r = 1.5\text{-ft}, L = 5280\text{-ft}\}$$

$$V_c = \pi 1.5^2 \times 5,280 = 37,322 \text{ ft}^3$$

This volume needs to be adjusted since only 20.9% of this volume actually contains oxygen.



$$V_{cc} \text{ (corrected)} = 37,322\text{-ft}^3 \times 0.209 = 7,800.3 \text{ ft}^3$$

Calculate the mass of oxygen (M_{ox}) in the corona:

Density of oxygen (D_o) is 0.089-lbs/ft³ (1.429 kg/m³)

$$M_{ox} = D_o \times V_{cc}$$

$$M_{ox} = 0.0804 \times 7,800.3 = 627.1\text{-lbs of oxygen}$$

Since the average lightning strike is between 100 million & 1 billion volts, we assume that 99% of the oxygen is converted to ozone (O_3), the remaining 1% reverts back to oxygen (O_2):



We now take gas molecular weights (MW) into account.

The MW of oxygen is 32 & the MW of ozone is 48:

$$M_{oz} = 627.1 \times (MW O_2 / MW O_3) * 99\%$$

$$M_{oz} = 627.1 \times 32/48 * 99\% = 413.9\text{-lbs } O_3$$



Using the assumptions above, for every lightning strike there is 418-lbs of ozone produced. The average storm can have as many as 1,000 lightning strikes hit the ground. This equates to 418,000-lbs (209 tons) of ozone produced during each storm!