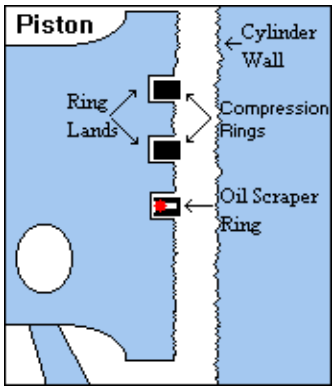
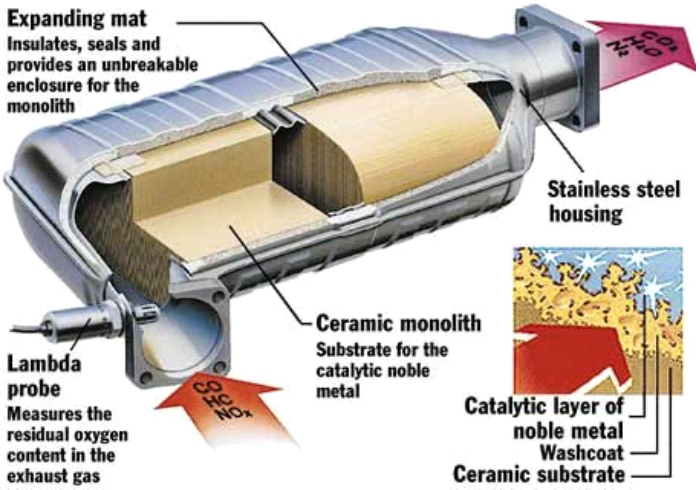
II. Automotive Emissions



- _____ sources contribute approximately 60% of total air pollution (78% of CO, 47% of NO_X, 44% of total hydrocarbons, 5% of particulates, and 2% of SO_X.

1. 20 to 40% of the automobile's total hydrocarbon emissions are from the crankcase. This emission is called _____.
   - function of s_____
   - after 1963 all vehicles are required to have a positive c_____ ventilation (PCV) valve
   - the PCV valve opens up more at h_____ speeds to allow more crankcase fumes to be sucked into the intake manifold
2. **Fuel tank e_____.** As the fuel tank warms, the vapors in the headspace are exhausted through the vent line.
   - activated carbon canister
   - vent the fuel tank to the crankcase
3. **Carburetor Losses.** After the engine is shut off, the gas in the float valve evaporates to the atmosphere. **This is called h_____ s_____.**
   - activated carbon canister
   - vent to the crankcase
4. **Engine Exhaust.**
   1. E_____ modifications
   2. F_____ system modifications
   3. E_____ system modifications: catalytic converter for NO_X and HC control

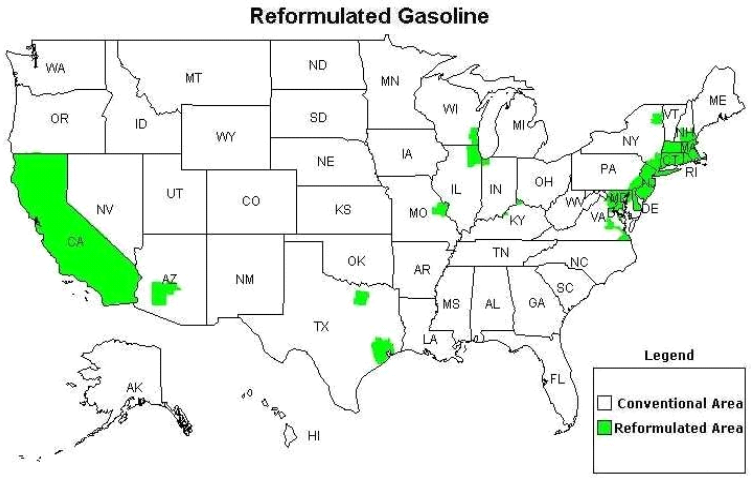


platinum-rhodium or platinum-palladium catalyst - requires temp of 350˚C (660˚F)

$NO + CO + HC \rightarrow N_2 + CO_2 + H_2O$

5. **Reformulated Gasoline:**

a. 1990 Clean Air Act Amendments had two performance targets for reformulated gasoline:
   – 15% r_____ in VOCs
   – 15% reduction in a_____ t_____ (e.g., benzene)



b. one third of U.S. uses r_____ gasoline

c. Congress mandated that reformulated fuel contains 2% o_____

d. common oxygenates include:
   – m_____
   – e_____ – fermented from c_____
   – MTBE (methyl tertiary butyl ether) derived from natural gas and c_____
   – ETBE (ethyl tertiary butyl ether) derived from e_____