	Piston Cylinder
11.	Automotive Emissions
-	sources contribute approximately 60% of total air pollution (78% of CO 47% of NO 44% of total hydrocarbons 5% of particulates and 2%
	(7870 of CO, 4770 of focal hydrocarbons, 570 of particulates, and 270
1	of SO _X . 20 to 40% of the automobile's total hydrocarbon emissions are from the crankcase
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
2.	exhausted through the vent line.
	- activated carbon canister
	- vent the fuel tank to the crankcase Expanding mat Insulates, seals and
3.	Carburetor Losses. After the engine is shut off, the
	gas in the float valve evaporates to the atmosphere.
	This is called h
	- activated carbon canister
	- vent to the crankcase
4.	Engine Exhaust.
	1. E modifications Lambda Substrate for the catalytic public
	2. F system modifications system modifications system modifications probe metal catalytic layer of Catalytic
	3. E system modifications: residual oxygen content in the Washcoat
	catalytic converter for NO _X and HC control exhaust gas Ceramic substrate
pla	tinum-rhodium or platinum-palladium catalyst - requires temp of 350°C (660°F)
N($O + CO + HC \rightarrow N_2 + CO_2 + H_2O$
5.	Reformulated Gasoline:
a.	1990 Clean Air Act Amendments had two Reformulated Gasoline
	performance targets for reformulated gasoline:
	-15% r in VOCs
	- 15% reduction in a t (e.g.,
	nzene)
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
-	– e – termented from
c	MTDE (mothed tentions bested other) defined from the second of the secon
	 MTBE (methyl tertiary butyl ether) derived from natural gas and c

- ETBE (ethyl tertiary butyl ether) derived from e_____