

Homework 2

due date

1. Below are the marginal abatement costs for three firms.

Emissions (tons/week)	Marginal Abatement Costs (\$/ton)		
	Firm 1	Firm 2	Firm 3
10	0	0	0
9	4	1	1
8	8	2	2
7	12	4	3
6	16	6	4
5	20	8	5
4	24	12	6
3	28	20	7
2	36	24	8
1	46	28	9
0	58	36	10

Suppose the EPA wants to limit total emissions across firms to fifteen tons per week.

- Calculate total abatement costs across firms if the EPA uses an emissions standard limiting each firm to five tons per week.
- Calculate total abatement costs across firms if the EPA achieves its goal by charging an emissions tax of eight dollars/ton.
- Explain the difference in total abatement costs. Why does the emissions standard, limiting each firm to five tons per week, generate a greater total opportunity cost to society than the emissions tax?
- In a scenario with multiple firms, under what circumstances would an emissions standard generate the same total abatement cost as an emissions tax?

2. Suppose a power generating plant emits particulates that damage crops and affect human health. The relationship between emissions and environmental damage is represented by the marginal damage function,

$MD=9e$ where e represents tons of emissions per month.

The cost to the firm (and society) of eliminating emissions is represented the marginal abatement cost function,

$MAC=108.5 - 6.5e$

Both MD and MAC are dollar costs per month.

- A. If the power generating firm were allowed to ignore the social cost of its emissions, what would be the firm's monthly emission level?
- B. Calculate the socially efficient level of pollution.
- C. If the emissions calculated in part B is a level found to shorten some peoples' lives, could it still be considered socially efficient?
- D. Suppose the EPA set an emission standard at the socially efficient level calculated in part B. Calculate the cost to the firm of achieving this standard.
- E. Suppose that instead of a standard, the EPA charged an emissions tax. What tax rate would it set?
- F. Calculate the total cost to the firm if efficiency is reached through the use of an emissions tax. Explain why it would be less costly for the firm if it were regulated by an emissions standard as opposed to a tax.

Suppose the firm found a new, less costly process for reducing emissions. Its marginal abatement costs has changed to **$MAC=100 - 5.99e$**

- G. What is the efficient level of emissions?
- H. If the firm were charged the tax rate calculated in part E, calculate the firm's emissions with the new MAC. Is the firm now emitting less than the efficient level of pollution?
- I. If the previous emission standard were instead maintained, would the firm now be polluting too much?

3. Below is the schedule of marginal tax rates the SCAQMD charges firms for Nitrogen Oxides emissions.

Annual Emissions (tons/yr)	Nitrogen Oxides (\$/ton)
4 – 25	\$332.25
25 -75	\$527.93
above 75	\$975.08

- How much does a firm's tax liability increase when it emits the 60th ton of nitrogen oxides in a year? Explain.
- By how much will the firm's total tax increase if it increased its NO_x emission from 30 to 130 tons per year?
- Fill in the table.

Total Oxides of Nitrogen Firm Emits in a Year	Total Tax Levied on Firm from above Schedule
20 tons	
40 tons	
60 tons	
80 tons	