pg 259 #1 (chapter 12)

MS1 = 5 – e1 MS2 = 8 – 2e2

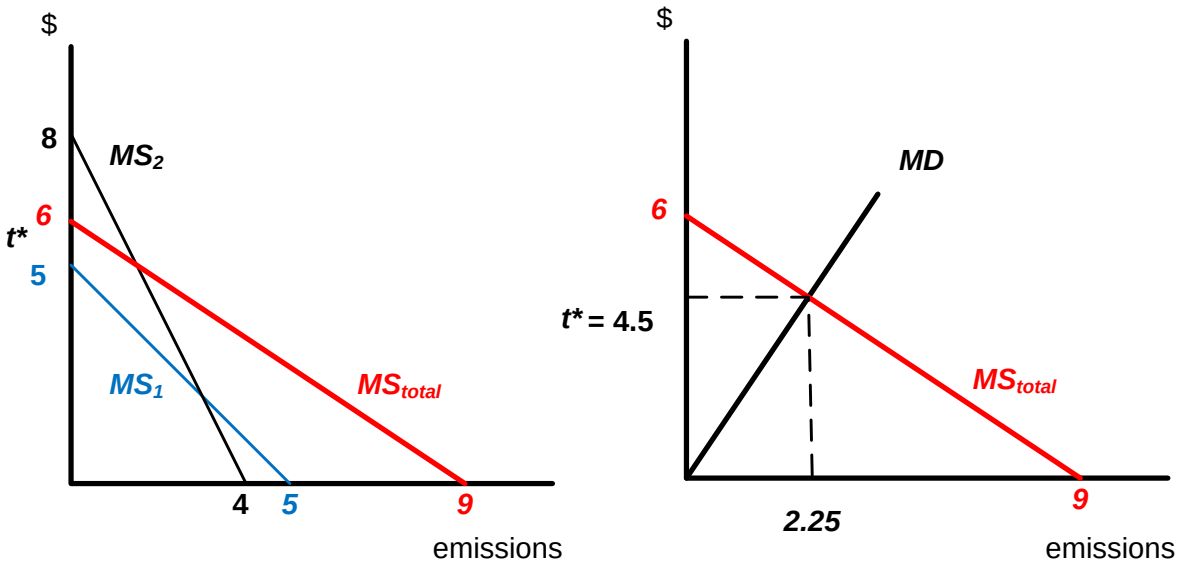
To aggregate re-write each as e1 = 5 – MS and e2 = 4 – 0.5MS

(e1 + e2) = e = 9 – 1.5MS or MS = 6 – 0.67e

Aggregate MD, add vertically: MD1 + MD2 = MD = 2e

MD = MS => 2e = 6 – 0.67e 2.67e = 6 e* = 2.25

The optimal tax is where MD = MS or t* = 4.4



pg 259 #4 (chapter 12)

F be Fireyear and G be Goodstone

Total pollution emissions generated are $E_F + E_G = Q_F + Q_G$. The marginal damage of pollution is constant per unit of E at $12

(a) G: $60(30) – 500 – (30)^2 = 400$

(b) Apply tax to firm's MC: $MC_{NEW} = MC + t$

P = MC+t **F:** $60=4Q_F + 12$, $Q_F = 12$ **G:** $60 = 2Q_G + 12$, $Q_G = 24$

Profits (after tax) PxQ – TC – tQ

F: $60(12) – 300 – 2(12)^2 – 12(12) = -12$

G: $60(24) – 500 – (24)^2 – 12(24) = 76$

(c) Profits(after subsidy, s) $PxQ–TC +s(Q_a–Q_b)=PxQ–TC +sQ_a–sQ_b$ Where Q_a is output from part (a) and Q_b is output from part (b)

From the book and lecture, we know optimal subsidy equals optimal tax. For every unit of output the firm adds a unit of emissions to the environment. Therefore the subsidy is a "cost" in terms of opportunity cost, thus

P = MC + s is the profit max rule. Since s = t = 12, output under subsidy is the same as (b)
F: $60(12) – 300 – 2(12)^2 – 12(12) + [15x12] = -12+ 180=168$
G: $60(24) – 500 – (24)^2 – 12(24) + [30x12] = 76 + 360 = 436$

(d) *Under the tax policy, Fireyear will exit the market in the long run. Under the subsidy, both firms will remain. There may be entry into the market due to the subsidy unless there are barriers to entry.*

pg 260 #5 Chapter 12

P = 10 $C = Q^2$ $E = 2Q$
MD = 2 per E TD = 2E = 4Q

(a) $\pi = TR – TC = 10Q – Q^2 – 4Q$ $\pi' = 10 – 2Q – 4 = 0$ $Q = 3$ $\pi = 9$
(b) $Q = E$ $\pi = TR – TC = 10Q – Q^2 – 2Q$ $\pi' = 10 – 2Q – 2 = 0$ $Q = 4$ $\pi = 16$ $\Delta\pi = 7$
(c) $Q = 5$ $\pi = 25$

Handout Question 1

Suppose that the ***MD = 5E*** and with its current technology, the firm's MS is given by

$$MS_1 = 200 - 5E.$$

a) Determine the socially optimal level of emissions E.
200 – 5E = 5E, therefore E = 20

b) Determine the emissions tax that would achieve the socially optimal level of emissions.
Tax, t = MS = 200-5E = 200 – 5(20) = 100

Now suppose the firm can adopt a new technology that changes is MS to

New $MS_2 = 160 - 4E$

Calculate change in costs for the firm from adopting the new technology when:

c) The government uses an emissions standard equal to your answer in (a) above
If Standard set at E = 20, Old Technology has a TAC = $1000. New Technology has MS = 80 and a TAC = 800. Savings from switching is $200

d) The government uses an emissions tax equal to your answer in (b)
(Assume no change to standard or tax rate after the change in technology)

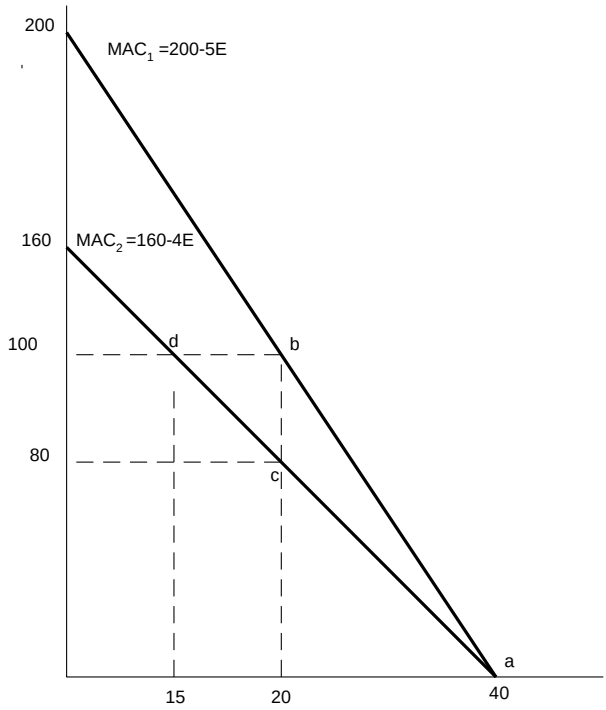
With $100 tax

Old: $MS_1 = 200 - 5E = 100$ tax E = 20

New $MS_2 = 160 - 4E = 100$ tax E = 15

	Tech 1 (old)	**Tech 2 (new)**
TAC	**100x20x(1/2) = 1000**	**25x100x(1/2) = 1250**
TAX Bill	**100x20 = 2000**	**100x15 = 1500**
	$3000	**$2750**

Savings from switching is $250



Now suppose the government adjusts the standard and/or the tax such that MD = New MS. Calculate the change in total costs for the firm from adopting the new technology when:

e) The government adjusts the standard, and
f) The government adjusts the tax rate

Under NEW technology:

MS_2 = MD

160 – 4E = 5E

E = 17.8 and MS = 88.9

With a standard equal to 17.8

TAC = (40 – 17.8)(88.9)*(1/2) = 986.8

Savings = 1000 – 986.8 = 13.2

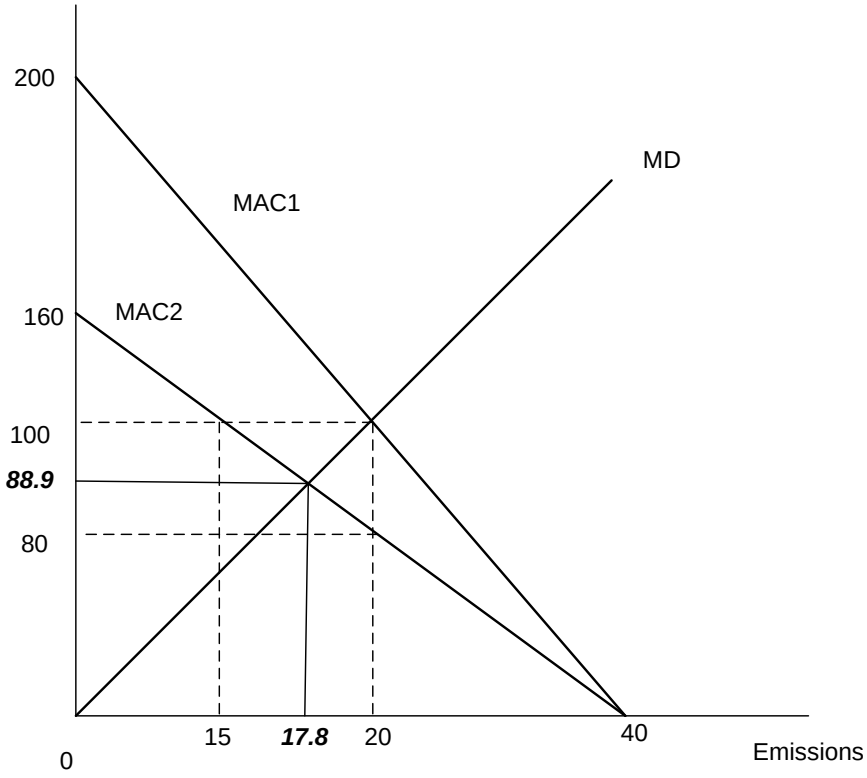
Under Tax rate of t = 88.9, E = 17.8

Tax bill = (88.9)(17.8) =1582.4

And TAC = 986.8

TAC + Taxbill = 2569.2

Savings = 3000 – 2569.2 = 430.8



Note in Graph: MAC_1 is MS_1 and MAC_2 is MS_2