ESM 204: REGULATORY INSTRUMENTS

1. Consider an economy with two firms that emit an environmentally harmful uniformly mixed fund pollutant as a by-product of their production process. Suppose that it has been decided that there should be a *reduction* in total emissions of 21 units. The marginal cost relations faced by each firm for abating a given amount are $MC1 = 100q1$ and $MC2 = 200q2$ where $q1$ and $q2$ are the units of reduction (i.e. abatement) undertaken by firm 1 and firm 2 respectively. In the absence of any regulation, each firm emits 32 units of the pollutant (Total pollutant is equal to 64).

   a) The regulator decides to use the "roll-back" method (uniform standard) to achieve a reduction of 21 units. What is the amount of reduction by each firm? What is the total cost of reduction for each firm?

   b) Find the cost-effective allocation of individual abatement requirements. Calculate the per-unit fee that the government would have to implement to achieve this allocation. Calculate the amount that would be paid by firms in fees and abatement.

   c) If the regulator decided to implement a tradable permit system, how many permits would be distributed? What would be the equilibrium permit price?

   (Solutions on next page)

ESM 204: REGULATORY INSTRUMENTS SOLUTION

a) Each will abate the same amount (half of 21) → q1= 10.5 & q2 = 10.5
   TC(firm 1) = C = ½*1050*10.5 = $5512.50
   TC(firm 2) = A + B +C = ½*2100*10.5 = $11,025

   Total Costs = TC(firm 1) + TC(firm 2) = $16537.50
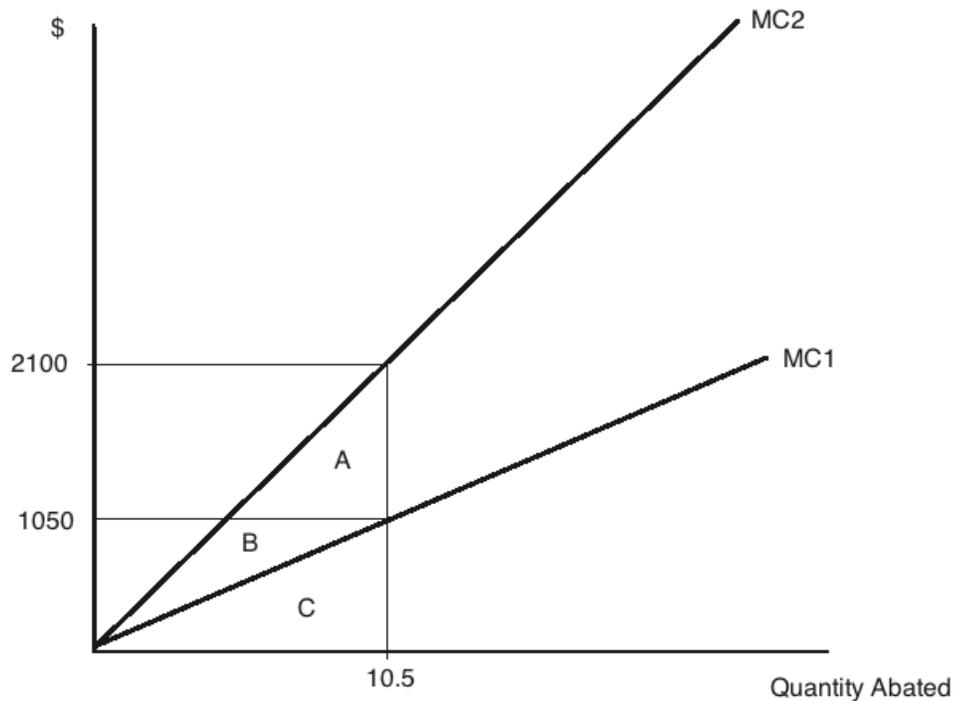
b)

Part i) The cost-effective allocation must satisfy the equimarginal principle, meaning the marginal costs for both firms should be equal at this allocation. The total amount of abatement must equal 21.

$$q_1+q_2 = 21$$
$$MC1(q_1)= MC2(q_2)$$
$$100q_1 = 200q_2$$
$$100q_1 = 200(21-q_1)$$
$$q_1 = 14 \text{ & } q_2 = 7$$

Part ii) The fee is equal to the marginal cost at the cost effective allocation.

$$\text{Fee} = MC_1(14) = MC_2(7) = 1400$$

Part iii) The number of permits distributed should be equal to the desired amount of emissions. The desired reduction is 21 and the original level of emissions is 64 meaning a total of 43 permits should be distributed. The equilibrium permit price will be the same as the tax above (price = 1400)