

Directions: Read each question carefully. Write all answers in your blue books. You may use diagrams in your explanations as long as you explain what they show.

Each question is worth 15 points for a total of 60.

1) Short Answers (2-4 sentences for each part)

- a) (5 points) Using your readings in the Fields book, identify and explain two regulations implemented under either the Clean Air Act or the Clean Water Act.

Answer: Any two regulations mentioned by Fields suffice.

- b) (5 points) In Krutilla's "Conservation reconsidered", he argued that the government must step in to conserve the land because the private owner of the land cannot capture all benefits to the society from preservation. Discuss at least two reasons why the private owners fail to capture the social benefits based on your reading.

Answer: There are three such reasons. If one lists more than two, I will look at the two that are correct. If reasons such as "imperfect price discrimination", "insufficient willingness to pay", or "failure to capture option value" are expressed, one gets two points for naming the reasons. One sentence of explanation that makes sense gets one point each for the two reasons along the lines summarized by Emma in her write-up on Krutilla available on the course website. One point for discussion is to the point and shows a student's understanding to Krutilla's paper.

- c) (5 points) Use a diagram to illustrate the dead weight loss resulting when a firm does not pay the full cost of its pollution. Suggest one policy that could be used to eliminate the deadweight loss and illustrate the policy on your graph. Label your diagram clearly. Carefully explain what you have done.

Solution: See Figure 1c.

Grading Criteria: A diagram that correctly illustrates the difference between the firm's private marginal cost and the society's marginal cost gets one point. One point for identification of the DWL triangle. One point for naming a policy, another point for demonstrating correctly the policy on the diagram. Correct explanation of the graph, using terms such as the social optimal should be at where marginal cost of the society crosses demand but the firms are producing too much, gets the last one point.

2)

- a) (9 points) Show in a standard diagram a typical firm's short run AC, AVC and MC. In your diagram, choose a price where the firm produces a positive quantity of output. Identify the profit-

maximizing quantity, fixed costs, variable costs, total costs and profit at this point of production. Label clearly.

- b) (6 points) In a separate diagram draw the standard AC and MC curves of a firm and then mark the price where the profit is exactly zero for the firm and identify the optimal output level in accordance with this price. Without drawing an additional cost curve, identify the variable cost and fixed cost at the point of production. Explain.

Solution: See Figure 2b.

Grading Criteria: 1 point for MC goes through the minimal point of AC.

1 pt: correct price choice.

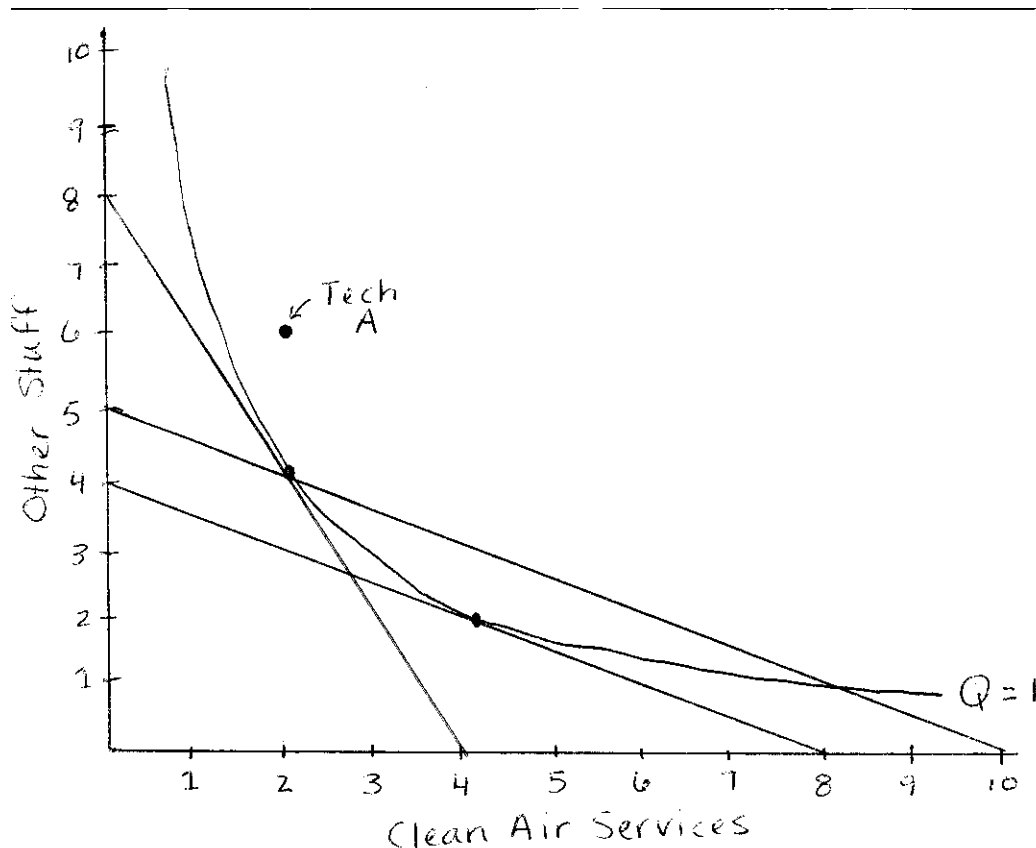
1 pt: identify VC as the area below MC up to  $q^*$

1 pt: identify FC as the area below the zero-profit price and above MC up to the point of production.

2 pt: for reasoning: because the area below MC is VC (1 pt), and the profit is zero at this chosen price, so the area above MC is revenue-VC=profit+FC=0+FC=FC (1 pt). If one correctly identified the whole box  $p^*q$  is the sum of VC and FC, i.e., TC, then she is given one point.

- 3) Refer to Figure 1a. Answers that were close to the magnitudes listed were also accepted.

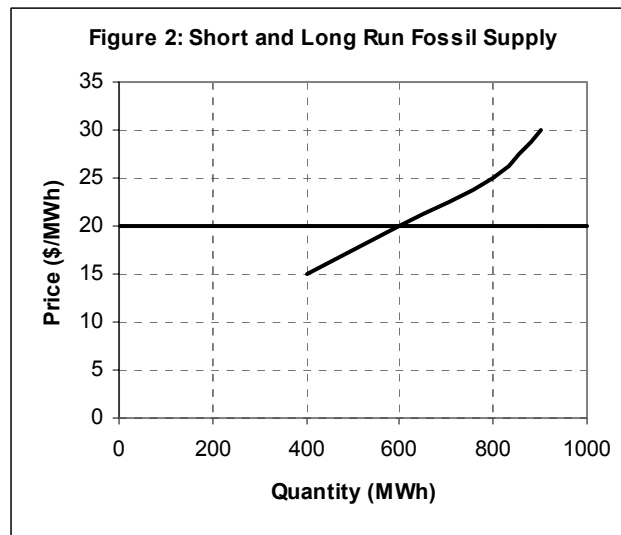
Figure 1a



- a) The firm will produce using as much clean air as it is allowed – 2 units, but on its isoquant leading to the bundle 2 units of clean air, 4 units of other stuff.
- b) Draw a straight line connecting 5 units of other stuff and the chosen bundle (both of which cost \$5) to find the slope of the isocost lines. Shift this line down until you find a tangency with the isoquant (should occur at 4 clean air, 2 other stuff). Alternatively, calculate the price of clean air. If (2,4) costs \$5, the firm must have spent  $4(\$1) = \$4$  on other stuff, leaving \$1 to buy two units of clean air for a cost of \$0.50. You can then use these prices to find the slope of the isocost line.
- c) Draw an isocost line tangent to the isoquant at the regulated bundles. This line goes through 8 and 4 meaning that clean air must cost \$2. If it originally cost \$0.50, the government needs to use a tax of \$1.50 to get the right prices.

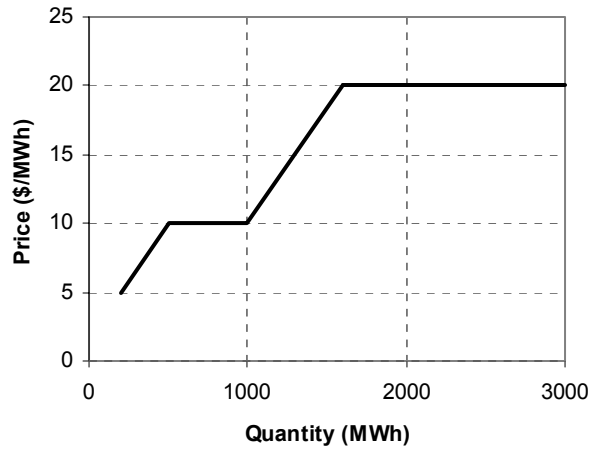
4)

- a) There are 10 fossil fuel plants so the short-run curve is found by multiplying the quantities on an individual firm’s supply curve (MC above min AVC) by 10. The long run curve is horizontal at \$20 because firms will enter or exit the market until there are zero profits (i.e.  $p = MC = AC$ ).

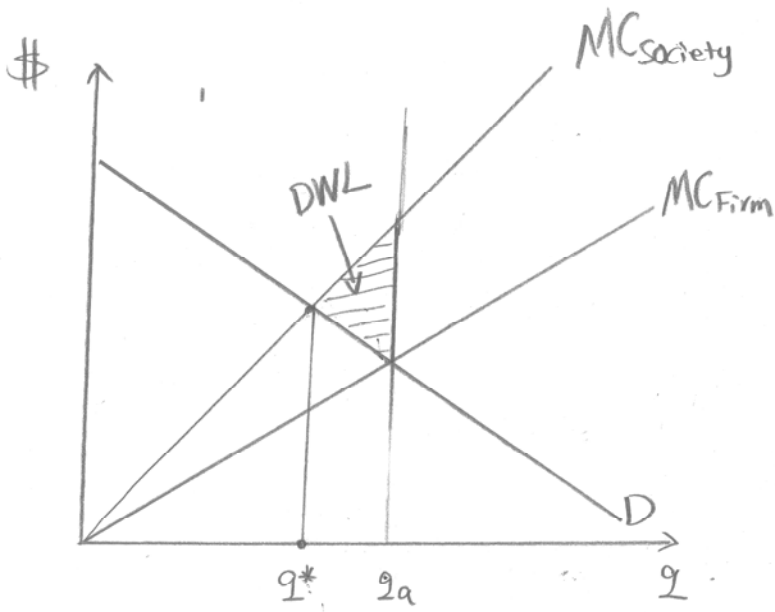


- b) The hydroelectric and nuclear plants can’t enter or leave the industry so their “long run” curves are identical to the short run. Horizontal addition of the three types of curves gives

Figure 2: LR Industry Supply

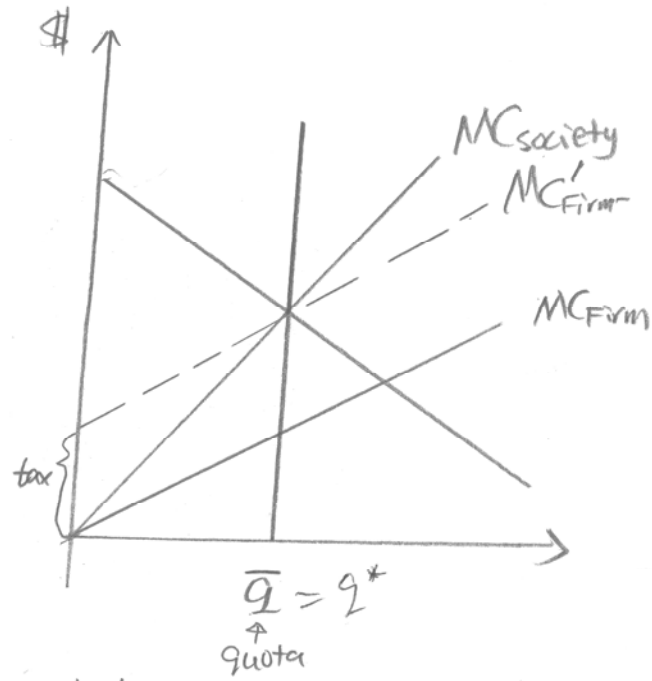


1) c)



$q^*$  - social optimal output level.  
 $q_a$  - actual firm output level

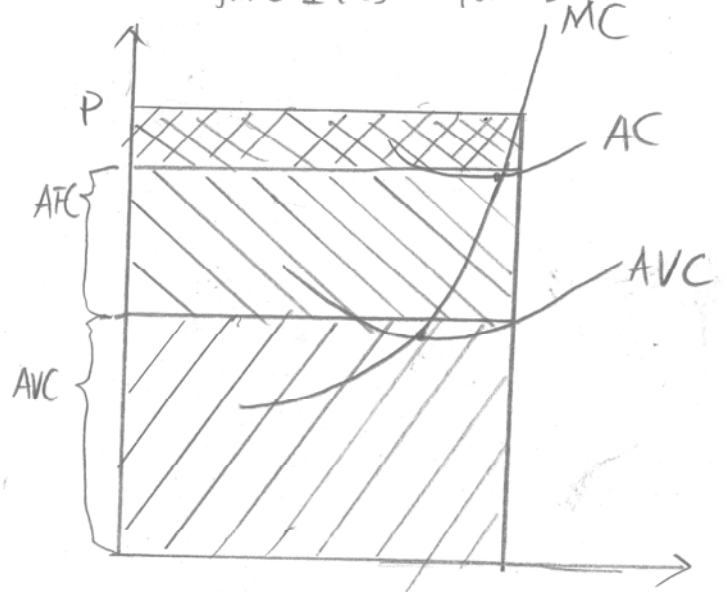
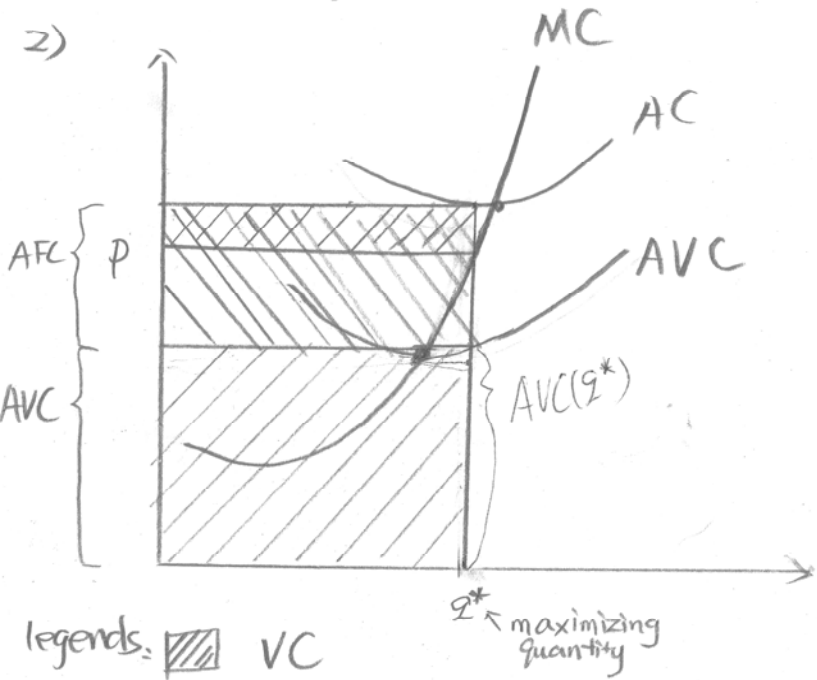
Figure 1. (c) DWL



$MC'_Firm$  - supply curve with tax

$\bar{q}$  - quota level.  
 Figure 1 (c) - policies

2)



- legends:
- VC
  - FC
  - TC = VC + FC
  - profit (loss)

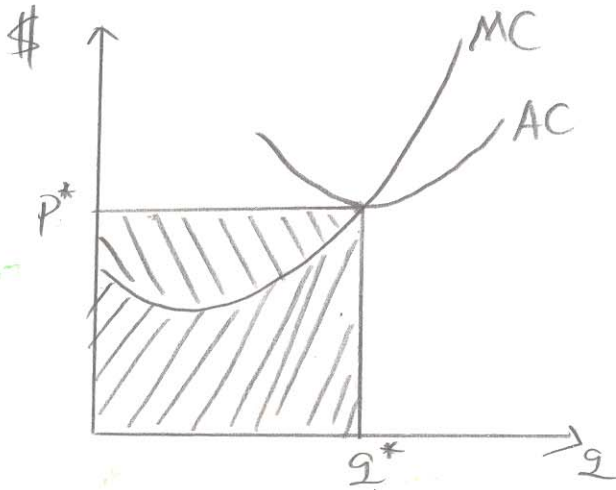
2(a) case 1  $P < \min(AC)$ ,  
 negative profit.

2(a) case 2  $P > \min(AC)$   
 positive profit.

right price choice =  $P \geq \min(AVC)$ .

Figure (2b)

2.b)



$P^*$  - price at which profit = 0.

$q^*$  - optimal output level at  $P^*$ .

 VC - the area under MC to the pt. of production

 FC - at  $P^*$ , profit = 0 so revenue =  $Pq = TC = FC + VC$ .