Econ 350
Set 3 Answers

1. Aside from differing demographic makeup across regions (race, gender, age, etc.), regions may also differ according to economic development in terms of the types of industries that are located therein. For example, a requirement of an across-the-board reduction in SO_2 from power plants may impose unnecessarily high costs on a plant in a rural area compared to a similar plant located near an urban area.

2. This question sounds vaguely familiar to one that appeared on Exam 2.

3. Could a local community action group, for instance, help to bring a polluter and the victims of pollution together so that a mutually beneficial agreement could be negotiated?

4. We considered this one in class.

5. Pollution on the lake.
a) The highest valued use of the lake is for the factory to use it to dump its leftovers (i.e., $700 > $500)
b) If you win the right to a clean lake in the court, the factory will have an incentive to "buy" the right from you. The factory is willing to pay up to $700 and you, supposedly, would be willing to accept anything greater than $500. A mutually beneficial trade is possible. In the end, the factory will dump its leftovers in the lake.
c) If the factory wins the right to dump into the lake, then there is not much you can do about it. You can't bribe the factory to keep the lake clean since your value is below that of the factory.

6. We did this one in class.

7. The perverse incentives with equiproportional cutbacks is that this system favors polluters whose emissions were relatively high in past years. The higher the past emissions, the higher the allowable emissions after the percentage cutback. So if there is any inkling by polluters that this type of program might be installed sometime in the future, there is an incentive to keep emissions high so as to have a high base when the cutback is calculated.

8. Consider agricultural runoff of fertilizers/pesticides. It may be extremely difficult to pinpoint the actual sources of such emissions making it very difficult to impose emission standards. An alternative may be to limit the type and amount of such fertilizer/pesticides that may be purchased in the first place. In general, regulators may resort to standards on the use of an input, operating procedures, or allowable technology.

9. Take a look at #15(b) for another version of this same type of question. In general, uniform emission standards do not satisfy the equimarginal principle. If $MAC1 \neq MAC2 \neq MAC3$, then the least cost method of obtaining a given amount of pollution abatement will not be achieved.

10. This one is in the textbook.

11. Like any tax, the economic burden of the tax will be shared between the buyers and sellers within a market. A tax will generally raise the cost of producing a product. The seller will attempt to pass part of the tax onto consumers in the form of higher product prices. The degree of the tax burden on consumers will depend on their price elasticity of demand.

12. Optimal emissions is found by equating MAC = MD. Thus, $100 - 3E = 2E \implies E = 20$. The optimal pollution tax is found by plugging $E = 20$ back into either of the above equations. Tax = MAC = $100 - 3(20) = 40$.

13. Taxes.
a) Land disposal---since taxes are much higher on land disposal than on incineration.
b) We can't conclude that the heavier taxes in Vermont are the sole factor involved. We'd also like to control for the size and number of plants in each state---perhaps Tennessee is a heavily industrialized economy relative to Vermont.
c) Extremely high taxes might lead to pervasive illegal dumping.

14. Tourist-Town gunk.
a) The cost-effective pollution level across two plants requires that their MACs be equal: $MAC_G = MAC_K$. Also, since total pollution must be 100, we know that $(x + y) = 100$. Rewrite this last equation as $y = 100 - x$ and substitute it into MAC_K. You can then solve the following equation for x:

$100 - 4x = 150 - y$
$100 - 4x = 150 - (100 - x) = 50 + x$

⇨ $x = 10$. Since x is 10, we know that y must equal 90.

If the city knew what each firms MAC curve looked like, they could simply ask firm G to cut its emission from 25 down to 10 and ask firm K to cut its emissions from 150 down to 90. It's not clear though that such an approach would be politically feasible.

b) The city might have a difficult time ascertaining the MAC information since the firms have an incentive to inflate their costs. Two "incentive-based" policies are taxes and tradable discharge permits. I'll let you list the advantages each method has over the other.

c) The optimal tax is found by setting $MAC_G = MAC_K$ as above and then substituting the optimal emissions back into the equations. Thus, the optimal tax is $MAC_G = 100 - 4\,(10) = \$60$. This, by definition must also be the price of permits if the number of permits is limited to a total of 100. Total abatement costs under the two systems would look like this:

Tax System:
TAC for Plant G = (15)(60)(1/2) = $450
Tax Bill for Plant G = (60)(10) = $600 ==> total compliance cost of $1050
TAC for Plant K = (60)(60)(1/2) = $1800
Tax Bill for Plant K = (90)(60) = $5400 ==> total compliance cost of $7200

Permits System: Give 50 permits to G and 50 to K. Since K's optimal emissions is 90, they will want to buy 40 permits from G.

TAC for Plant G = (15)(60)(1/2) = $450
Revenue from sale of permits = (40)(60) = $2400 ==> net compliance cost = -$1950
TAC for Plant K = (60)(60)(1/2) = $1800
Cost of buying additional permits = (40)(60) = $2400 ==> net compliance cost = $4200

d) If the marginal benefits of pollution abatement is $64 per unit, then 100 units of pollution is not the optimal level. To solve for the optimal pollution, set each plant's MAC equal to $64 and solve for their emissions level. Thus, firm G's optimal emissions is 9 and firm K's optimal emissions is 86.

15. More polluters.
a) Firm 1's unregulated emissions is 18; Firm 2's emissions is 6.
b) Polluter 1 must set $E_1 = 9$ and Polluter 2 must set $E_2 = 3$. This implies that MAC1 = $9 and MAC2 = $6. (Note that the equimarginal condition does not hold.)

$TAC_1 = (9)(\$9)(.5) = 40.5$
$TAC_2 = (3)(\$6)(.5) = 9.$
Thus, the total abatement cost is 49.5.

c) At a tax of $4, total emissions would be 18 ($E_1 = 14$, $E_2 = 4$). $TAC_1 = 8$ and $TAC_2 = 4$.
A tax of $6 would generate total emissions of 15 ($E_1 = 12$, $E_2 = 3$). $TAC_1 = 18$ and $TAC_2 = 9$.
A tax of $8 would generate total emissions of 12 ($E_1 = 10$, $E_2 = 2$). $TAC_1 = 32$ and $TAC_2 = 16$.
d) To find the market price, set the MAC equations equal to each other and solve for the optimal emissions for each firm. Use the notion that total emissions must sum to 12 (that is, $E_1 + E_2 = 12$). Thus,

$$18 - E_1 = 12 - 2E_2 = 12 - 2(12 - E_1) \implies E_1 = 10 \text{ and therefore } E_2 = 2.$$

The MAC at these emissions levels is $8 and we would expect the price of permits to be at this price. The TAC = 48 and is the same as the t = $8 from part (c) above. Note that in the case of the permits and a tax of $8, the TAC is lower than a simple 50% across the board reduction.

16. This is for you to ponder.