UN1105 Principles of Economics

Recitation 7: Externalities

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Outline

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  - Q2: K&W Problem 16.07
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Review of Concepts: Externalities (i)

- In the presence of *market failures*, the market outcome may be inefficient. These include
  - Market power, e.g. monopoly,
  - Externalities, which we review today.
  - Others not covered in this course.
- Definition: The cost imposed on, or benefit delivered to, a third party which is not taken into account by the producer or consumer.
- Examples:
  - Negative: environmental costs of pollution, traffic congestion, loud music.
  - Positive: education, technology spillovers, flu shot, deodorant.
- If the private decisions are not incentivised to account for these externalities, the outcome may not be optimal for society as a whole.
  - Too little production if positive externalities are ignored, too much if negative externalities are ignored.
  - The outcome is inefficient because someone can be made better off, without anyone becoming worse off: society could pay an amount (between their benefit and the polluters cost) to the polluter to reduce, and both parties would be better off.

Review of Concepts: Externalities (ii)

- What is the optimal level?
  - As before we want to equate the marginal benefit with its marginal cost – but what marginals?
  - The marginal social cost is the additional cost imposed on society as a whole by an additional unit of production.
    - For example, fracking can contaminate local water, which damages health and local ecosystems.
    - The MSC is the sum of the willingness to pay among all members of society to avoid one more unit of pollution.
  - The marginal social benefit of pollution is the additional gain to society as a whole from an additional unit of pollution.
    - More expensive technology can reduce the adverse effects of fracking, but these actions have an opportunity cost.
    - The MSB is the highest willingness to pay for the right to emit that additional unit measured across all polluters.

Review of Concepts: Externalities (iii)

- Solutions
  - Private:
    - If *transaction costs* are low, parties have an incentive to find a way to make mutually beneficial deals that lead them to "internalize the externality" (Coase, 1960).
  - Public:
    - Regulation. Pros: easy to implement. Cons: Inflexible and don't allow reductions in pollution to be achieved at minimum cost.
    - Taxes and subsidies. Pros: ensures that the marginal benefit of pollution is equal for all sources, thus will allocate more pollution reduction to those who can do it more cheaply. Cons: difficult to know hot to set it.
    - Tradable permits. Pros: achieves pollution at lowest cost. Cons: how many permits to provide.

Review of Concepts: Externalities (iv)

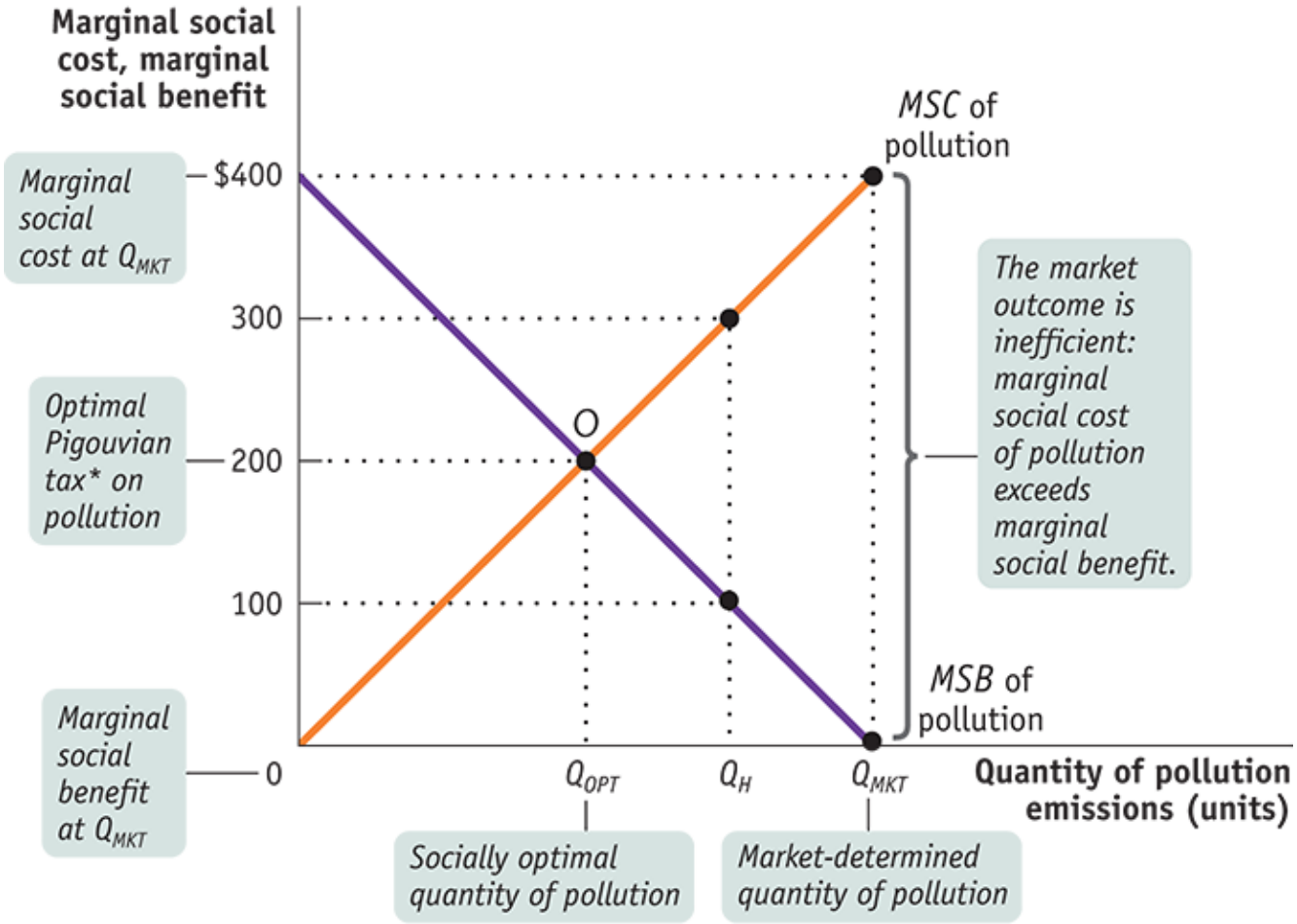


FIGURE 16-2
Krugman/Wells, *Microeconomics*, 5e, © 2018 Worth Publishers

Review of Concepts: Externalities (v)

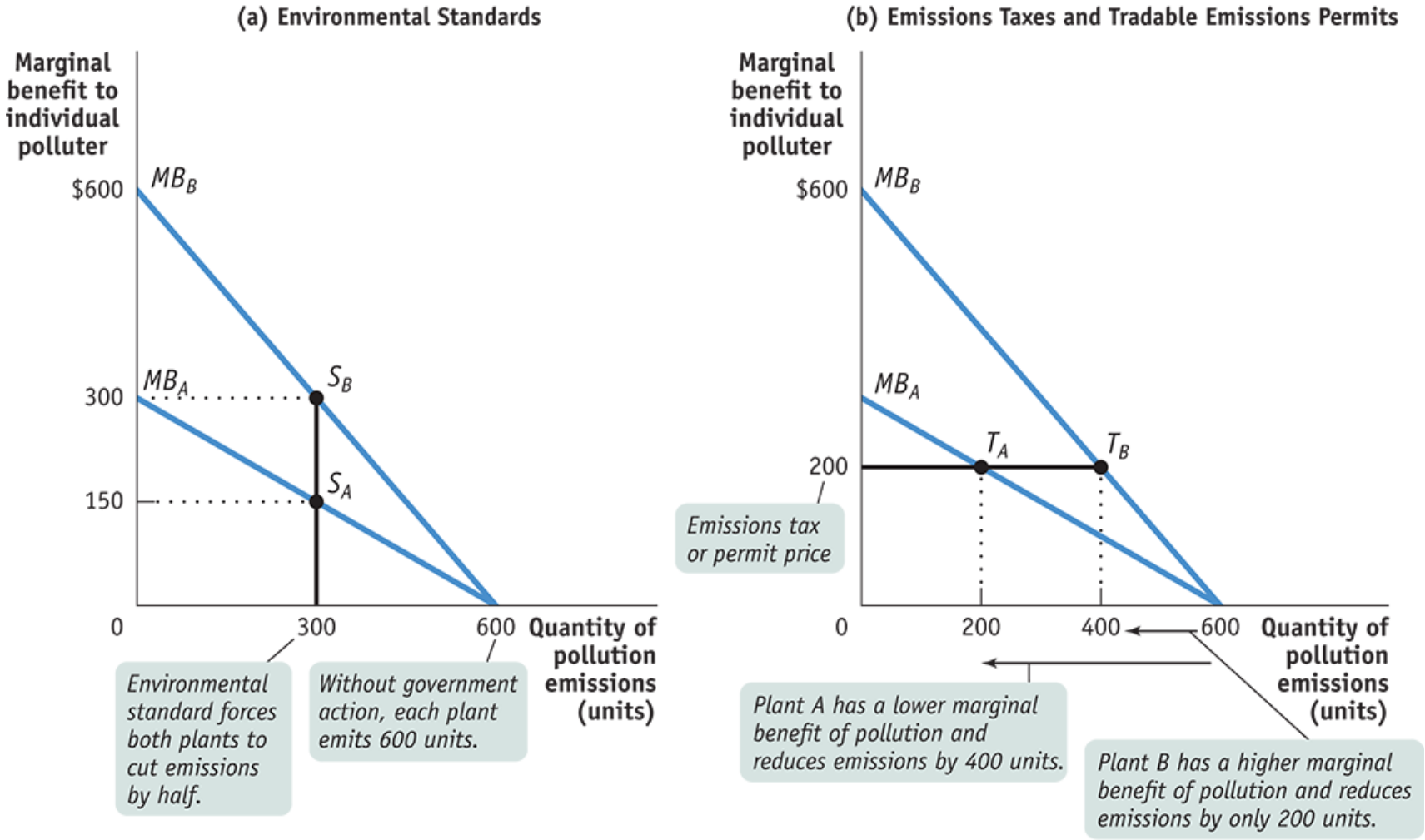


FIGURE 16-3
Krugman/Wells, *Microeconomics*, 5e, © 2018 Worth Publishers

Analytical Questions, Q1: K&W Problem 16.05

The city of Falls Church, Virginia, subsidizes the planting of trees in homeowners' front yards when they are within 15 feet of the street.

(a) Using concepts in the chapter, explain why a municipality might subsidize planting trees on private property, but near the street.

Trees planted near the street provide external benefits.

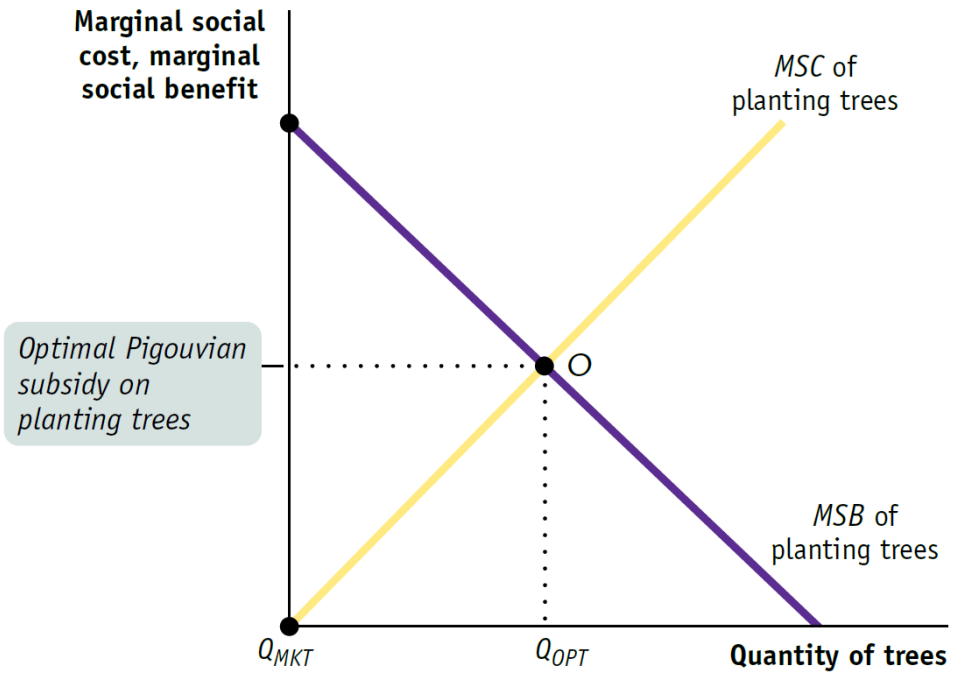
- They provide shade and so keep streets and sidewalks cooler, which makes activities such as walking and bicycling more pleasant for all citizens.
- They beautify neighborhoods and thus can raise property values.
- And they provide habitat for wildlife which helps to preserve biodiversity, although this is not limited to trees near the street.

Without the subsidy, the market equilibrium quantity would be below the socially optimal quantity. An optimal Pigouvian subsidy will lead homeowners to plant the socially optimal quantity of trees.

Analytical Questions, Q1: K&W Problem 16.05

(b) Draw a diagram similar to Figure 16-4 that shows the marginal social benefit, the marginal social cost, and the optimal Pigouvian subsidy on planting trees.

The marginal social benefit is decreasing: the first trees are planted in the most ideal locations (close to frequently traveled streets, etc.), but subsequent trees must increasingly be planted in less ideal locations.
The marginal social cost is increasing: as homeowners have more trees planted, arborists are likely to raise their rates in response to the increased demand for their services.
The diagram shows the market equilibrium quantity, Q_{MKT}, the socially optimal quantity, Q_{OPT}, and the optimal Pigouvian subsidy.



Analytical Questions, Q2: K&W Problem 16.07

The two dry-cleaning companies in Collegetown, College Cleaners and Big Green Cleaners, are a major source of air pollution. Together they currently produce 350 units of air pollution, which the town wants to reduce to 200 units. The accompanying table shows the current pollution level produced by each company and each company's marginal cost of reducing its pollution. The marginal cost is constant.

Companies	Initial pollution level (units)	Marginal cost of reducing pollution (per unit)
College Cleaners	230	\$5
Big Green Cleaners	120	\$2

(a) Suppose that Collegetown passes an environmental standards law that limits each company to 100 units of pollution. What would be the total cost to the two companies of each reducing its pollution emissions to 100 units?
College Cleaners would have to reduce its pollution level by 130 units, costing it 130x\$5 = \$650. Big Green Cleaners would have to reduce its pollution level by 20 units, costing it 20x\$2 = \$40. So the total cost of reducing pollution to a total of 200 units would be \$690.

Analytical Questions, Q2: K&W Problem 16.07

Suppose instead that Collegetown issues 100 pollution vouchers to each company, each entitling the company to one unit of pollution, which can be traded.

(b) How much is each pollution voucher worth to College Cleaners? To Big Green Cleaners? (That is, how much would each company, at most, be willing to pay for one more voucher?)
Each firm is polluting more than 100 units, thus an additional pollution voucher is worth \$5 to College Cleaners and \$2 to Big Green Cleaners. Why? If they obtain one more voucher they avoid the avoid the cost of reduction.

(c) Who will sell vouchers and who will buy them? How many will be traded?
Each voucher is worth more to College Cleaners than to Big Green Cleaners, so Big Green Cleaners will sell all of its 100 vouchers to College Cleaners (for a price between \$2 and \$5).

(d) What is the total cost of the pollution controls under this voucher system?
Big Green Cleaners retains no vouchers, thus they reduce their output of pollution to zero, which will cost it 120x\$2 = \$240. College Cleaners has 200 vouchers, thus must reduce its output of pollution by 30 units, which will cost it 30x\$5 = \$150. The total cost of pollution control under this system is \$390. (The prices paid by College Cleaners and received by Big Green Cleaners in trading vouchers cancel each other out—they are pure "transfers" between the two companies.)

Analytical Questions, Q3: K&W Problem 16.10

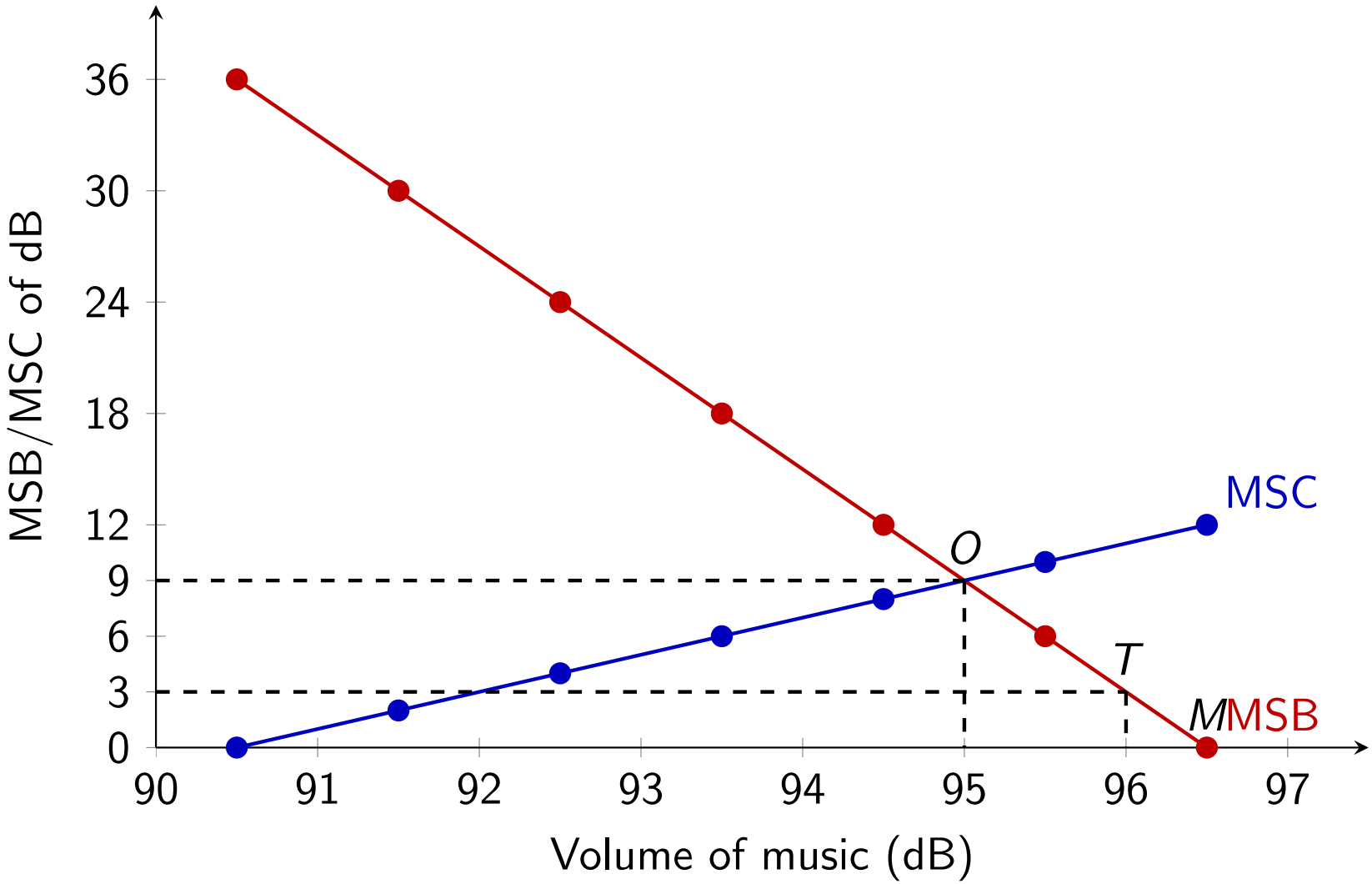
The loud music coming from the sorority next to your dorm is a negative externality that can be directly quantified. The accompanying table shows the marginal social benefit and the marginal social cost per decibel (dB, a measure of volume) of music.

Volume of music (dB)	Marginal social benefit of dB	Marginal social cost of dB
90		
	36	0
91		
	30	2
92		
	24	4
93		
	18	6
94		
	12	8
95		
	6	10
96		
	0	12
97		

(a) Draw the marginal social benefit curve and the marginal social cost curve. Use your diagram to determine the socially optimal volume of music.
See next.

Analytical Questions, Q3: K&W Problem 16.10

Figure 1: Costs and Benefits of Music, by Volume



Analytical Questions, Q3: K&W Problem 16.10

(b) Only the members of the sorority benefit from the music, and they bear none of the cost. Which volume of music will they choose?
Since the members of the sorority do not bear any of the social cost of playing loud music, they will play music up to the volume where the marginal social benefit is zero (point M in the diagram). This is at a volume of 96.5 dB.

(c) The college imposes a Pigouvian tax of \$3 per decibel of music played. From your diagram, determine the volume of music the sorority will now choose.
If the college imposes a Pigouvian tax of \$3 per decibel, the sorority now faces a marginal cost of playing music of \$3. So they will play music up to the volume where the marginal social benefit is just equal to \$3 (point T in the diagram). This is at a volume of 96 dB. This is not the optimal quantity of music, so this is not an optimal Pigouvian tax.

Short-answer Questions, Q4: K&W Problem 16.02

Many dairy farmers in California are adopting a new technology that allows them to produce their own electricity from methane gas captured from animal waste. In addition to reducing their own utility bills, the farmers are allowed to sell any electricity they produce at favorable rates.

(a) Explain how the ability to earn money from capturing and transforming methane gas behaves like a Pigouvian tax on methane gas pollution and can lead dairy farmers to emit the efficient amount of methane gas pollution.
Without the new technology, dairy farmers will release methane gas until the marginal social benefit of emissions is zero. With the new technology, there is now an opportunity cost to the farmer from releasing methane gas because there now exists a profitable alternative—turning it into electricity. If the financial reward is set at the right level—equal to the marginal social cost of a unit of methane gas pollution at the socially optimal level— it will lead dairy farmers to emit the efficient amount of methane gas pollution.

Short-answer Questions, Q4: K&W Problem 16.02

(b) Suppose some dairy farmers have lower costs of transforming methane into electricity than others. Explain how this system of capturing and selling methane gas leads to an efficient allocation of emissions reduction among farmers.

Farmers who have a lower cost of capturing methane will generate more profit from transformation of their methane than farmers who have a higher cost. So farmers with lower costs will transform more units of methane gas into electricity than will farmers with higher costs. As a result, emissions reduction will be allocated efficiently among dairy farmers.