CHAPTER 5 | Externalities, Environmental Policy, and Public Goods

Chapter Summary and Learning Objectives

5.1 Externalities and Economic Efficiency (pages 138–141)

Identify examples of positive and negative externalities and use graphs to show how externalities affect economic efficiency. An **externality** is a benefit or cost to parties who are not involved in a transaction. Pollution and other externalities in production cause a difference between the **private cost** borne by the producer of a good or service and the **social cost,** which includes any external cost, such as the cost of pollution. An externality in consumption causes a difference between the **private benefit** received by the consumer and the **social benefit,** which includes any external benefit. If externalities exist in production or consumption, the market will not produce the optimal level of a good or service. This outcome is referred to as **market failure.** Externalities arise when property rights do not exist or cannot be legally enforced. **Property rights** are the rights individuals or businesses have to the exclusive use of their property, including the right to buy or sell it.

5.2 Private Solutions to Externalities: The Coase Theorem (pages 141–147)

Discuss the Coase theorem and explain how private bargaining can lead to economic efficiency in a market with an externality. Externalities and market failures result from incomplete property rights or from the difficulty of enforcing property rights in certain situations. When an externality exists, and the efficient quantity of a good is not being produced, the total cost of reducing the externality is usually less than the total benefit. According to the **Coase theorem**, if **transactions costs** are low, private bargaining will result in an efficient solution to the problem of externalities.

5.3 Government Policies to Deal with Externalities (pages 147–154)

Analyze government policies to achieve economic efficiency in a market with an externality. When private solutions to externalities are unworkable, the government sometimes intervenes. One way to deal with a negative externality in production is to impose a tax equal to the cost of the externality. The tax causes the producer of the good to internalize the externality. The government can deal with a positive externality in consumption by giving consumers a subsidy, or payment, equal to the value of the externality. Government taxes and subsidies intended to bring about an efficient level of output in the presence of externalities are called **Pigovian taxes and subsidies.** Although the federal government has sometimes used subsidies and taxes to deal with externalities in dealing with pollution, more often it has used a command-and-control approach. A **command-and-control approach** involves the government imposing quantitative limits on the amount of pollution allowed or requiring firms to install specific pollution control devices. Direct pollution controls of this type are not economically efficient, however. As a result, Congress decided to use a system of tradable emissions allowances to reduce sulfur dioxide emissions.

©2015 Pearson Education, Inc.

5.4 Four Categories of Goods (pages 154–161)

Explain how goods can be categorized on the basis of whether they are rival or excludable and use graphs to illustrate the efficient quantities of public goods and common resources. There are four categories of goods: Private goods, public goods, quasi-public goods, and common resources. **Private goods** are both rival and excludable. **Rivalry** means that when one person consumes a unit of a good, no one else can consume that unit. **Excludability** means that anyone who does not pay for a good cannot consume it. **Public goods** are both nonrivalrous and nonexcludable. Private firms are usually not willing to supply public goods because of free riding. **Free riding** involves benefiting from a good without paying for it. **Quasi-public goods** are excludable but not rival. **Common resources** are rival but not excludable. The **tragedy of the commons** refers to the tendency for a common resource to be overused. The tragedy of the commons results from a lack of clearly defined and enforced property rights. We find the market demand curve for a private good by adding the quantity of the good demanded by each consumer at each price. We find the demand curve for a public good by adding vertically the price each consumer would be willing to pay for each quantity of the good. The optimal quantity of a public good occurs where the demand curve intersects the curve representing the marginal cost of supplying the good.

Chapter Review

Chapter Opener: Can Economic Policy Help Protect the Environment? (page 137)

Should the government act to reduce greenhouse gases? If so, what policy would be best? A large majority of people believe that the government should act to reduce greenhouse gases, but they differ on what policy is best. The government has used a command-and-control policy by requiring automobile companies to produce cars with better gas mileage. Many economists disagree with this policy and believe that a market-based policy would be better. A carbon tax is an example of a market-based policy. Yet, some businesses are opposed to this policy. In this chapter, you will see that economic analysis has an important role in the debate over environmental policies.

5.1 Externalities and Economic Efficiency (pages 138–141)

Learning Objective: Identify examples of positive and negative externalities and use graphs to show how externalities affect economic efficiency.

An **externality** is a benefit or cost that affects someone who is not directly involved in the production or consumption of a good or service. Positive externalities refer to benefits received from a good or service by consumers who do not pay for them. Negative externalities refer to costs incurred by individuals not involved in the production or consumption of a good or service. Externalities interfere with the economic efficiency of market equilibrium by causing a difference between the private cost of production and the social cost, or between the private benefit from consumption and the social benefit.

A **private cost** is a cost borne by the producer of a good or service. A **social cost** is the total cost of production, including both the private cost and any external cost. A **private benefit** is the benefit received by the consumer of a good or service. A **social benefit** is the total benefit from consuming a good, including both the private benefit and any external benefit.

A negative externality causes the social cost of production for a good to be greater than the private cost. As a result, more than the economically efficient level of output is produced. A positive externality causes the social benefit from the production of a good to be greater than the private benefit. As a result, less than the economically efficient level of output is produced. Externalities result from the absence of

©2015 Pearson Education, Inc.

property rights for resources (for example, air) or inadequate legal enforcement of property rights. **Property rights** are the rights individuals or businesses have to the exclusive use of their property, including the right to buy or sell it.

Market failure refers to situations where the market fails to produce the efficient level of output. Figure 5.1 illustrates the effect of acid rain on the market for electricity and the deadweight loss that occurs due to a negative externality. Figure 5.2 illustrates the impact of a positive externality in the market for a college education and the deadweight loss caused by this externality.

Study Hint

In Chapter 4, you learned that the equilibrium price in a competitive market results in the economically efficient level of output, where marginal benefit equals marginal cost. That is still true, but only if the demand curve reflects all of the relevant marginal benefits in the market and the supply curve reflects all of the relevant marginal costs. If there are external benefits and costs that make the social and private costs unequal, then the market equilibrium will not be efficient.

Extra Solved Problem **5.1**

The Influenza Pandemic of 1918

Supports Learning Objective 5.1: Identify examples of positive and negative externalities and use graphs to show how externalities affect economic efficiency.

From 1914 to 1918, World War I caused more than 8 million military deaths, a total that dwarfed the number of deaths suffered in any previous war in history. But this total is much lower than the number of people who died during the influenza pandemic of 1918–1919. There were at least 20 million, perhaps as many as 40 million, victims of the so-called "Spanish Flu" or "La Grippe." Ironically, many American soldiers who survived the war would carry the influenza virus home with them from Europe. An estimated 675,000 Americans died during the pandemic, 10 times the number who died in the war. With no known cure for the deadly disease, public health officials distributed gauze masks for people to wear in public. Stores were forbidden to hold sales, and railroads refused to carry passengers who did not have signed certificates stating that they were free of the virus. There were serious shortages of health care workers, morticians, and gravediggers, conditions not unlike those experienced during the Black Death of the Middle Ages.

a. Draw a graph illustrating the demand and supply for research directed at finding a cure for a highly contagious disease such as the 1918 flu. Assume that all research efforts are funded through private markets.

b. Describe how an externality causes an equilibrium level of output that is not economically efficient.

Source: "The Influenza Pandemic of 1918." http://www.stanford.edu/group/virus/uda/

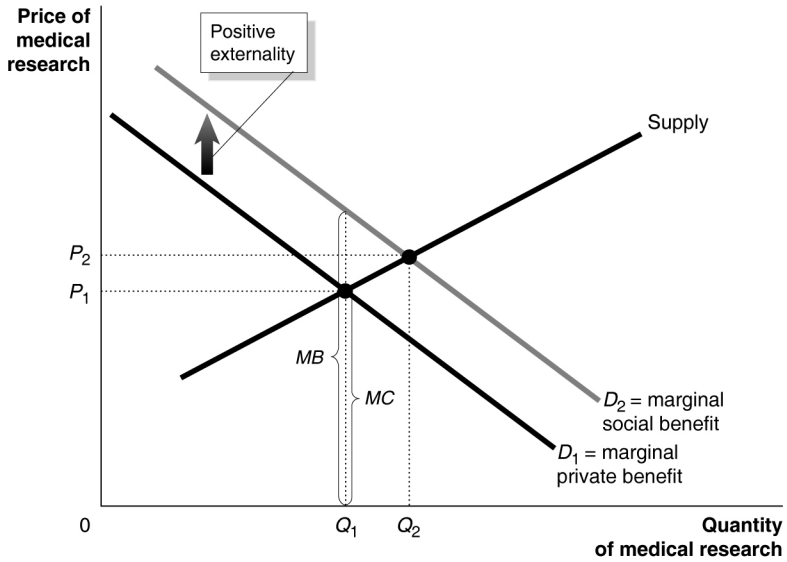
Solving the Problem

Step 1: Review the chapter material.

This problem is about externalities and efficiency, so you may want to review the section "Externalities and Economic Efficiency," which begins on page 138 in the textbook.

©2015 Pearson Education, Inc.

Step 2: Draw a graph to illustrate the externality associated with privately funded research to cure influenza.



Step 3: Describe how the externality causes a deviation from economic efficiency.

There is a positive externality associated with medical research because of the external benefits the research generates. Assume that researchers had found a cure for the so-called "Spanish Flu" in 1918 at the beginning of the pandemic. The benefits to those people who would be protected from contracting the deadly disease would be substantial. If we estimate the benefit at $100 for each person, the external benefits range in the billions of dollars. Of course, medical research is by nature uncertain, and scientists and doctors can work many years without finding a cure for any disease. Private hospitals and research laboratories are likely to receive a relatively small amount of the social benefit from their efforts. As the graph in Step 2 shows, the demand curve for medical research that includes only private benefits will be below the demand curve that includes all social benefits. The private market equilibrium price and quantity would be P_1 and Q_1. At this point the marginal (social) benefit (*MB*) would exceed the marginal cost (*MC*). The economically efficient price and quantity would be P_2 and Q_2 where marginal (social) benefit is equal to marginal cost.

5.2 Private Solutions to Externalities: The Coase Theorem (pages 141–147)

Learning Objective: Discuss the Coase theorem and explain how private bargaining can lead to economic efficiency in a market with an externality.

Ronald Coase argued that private bargaining may improve inefficient market results caused by externalities. The **Coase theorem** states that if transactions costs are low, private bargaining will result in an efficient solution to the problem of externalities. **Transactions costs** are the costs in time and other resources that parties incur in the process of agreeing to and carrying out an exchange of goods and services. Successful application of the Coase theorem requires that the bargaining parties have full information regarding the costs and benefits associated with the externalities and are willing to accept a reasonable agreement. In practice, private solutions are often not feasible because transactions costs are too high.

©2015 Pearson Education, Inc.

Study Hint

Because pollution generates a negative externality, many people believe the optimal or "efficient" level of pollution is zero pollution. However, there are not only benefits to cleaning up pollution—there are also costs to cleaning up pollution. As Figure 5.4 shows, declining marginal benefits and increasing marginal costs result in a level of pollution that is still positive. Only if the marginal benefit is equal to the marginal cost at 100 percent reduction of pollutants would zero pollution be efficient.

Extra Solved Problem **5.2**

The Dog Next Door

Supports Learning Objective 5.2: Discuss the Coase theorem and explain how private bargaining can lead to economic efficiency in a market with an externality.

Assume that your next-door neighbor owns a large dog named Rufus who spends a significant amount of the night in the backyard. While in the yard, Rufus barks continuously and prevents you from getting a good night's sleep. Consider an attempt by you and your neighbor to come to an agreement that would deal with this negative externality.

a. What would you be willing to pay the neighbor to have him get rid of Rufus? What would the neighbor require in payment to get rid of Rufus?

b. Who will pay? Will you pay the neighbor to get rid of his dog, or will he pay you to listen to the dog bark?

Solving the Problem

Step 1: Review the chapter material.

This problem is about private solutions to externalities, so you may want to review the section "Private Solutions to Externalities: The Coase theorem," which begins on page 141 in the textbook.

Step 2: Consider the value to you of being able to sleep, and consider the value of Rufus to the neighbor.

You would be willing to pay the neighbor a dollar amount up to the value of the bark-free nights. Your neighbor would only agree to get rid of Rufus if you paid him an amount greater than the value he places on owning Rufus.

Step 3: Compare the value you place on quiet nights to the value the neighbor places on the ownership of the dog.

If the neighbor values the ownership of his dog more than you value a good night's rest, then the neighbor will pay you to listen to Rufus' barking. If you value a good night's rest more than the neighbor values owning Rufus, then you will pay the neighbor to get rid of his dog. But who pays also depends on the local government's regulations on barking dogs. If your town has a strict rule against dogs being allowed to bark at night, then your neighbor may need to pay you to allow him to keep his barking dog. In this case you would accept the payment only if it is greater than the value you place on a good night's sleep.

5.3 Government Policies to Deal with Externalities (pages 147– 154)

Learning Objective: Analyze government policies to achieve economic efficiency in a market with an externality.

In the absence of private solutions to externalities, government intervention may be warranted. To achieve economic efficiency, governments may intervene in different ways. The government may impose a

©2015 Pearson Education, Inc.

Pigovian tax or provide a **subsidy** to cause consumers and firms to internalize the externalities associated with consumption and production. The tax or subsidy would be equal to the dollar amount of the externality. To reduce pollution, governments have often used a command-and-control approach. A **command-and-control approach** refers to government-imposed quantitative limits on the amount of pollution firms are allowed to generate. Under this approach, the government may require installation of specific pollution control devices. Since 1990, a market-based approach of tradable permits has reduced emissions of sulfur dioxide from electric utilities at lower than expected cost. The success of this approach has led economists to advocate more extensive use of market-based approaches and less use of command-and-control policies.

Study Hint

At the end of Chapter 4, you learned that taxes reduce efficiency and create deadweight loss. This is not necessarily the case when externalities are present. When externalities exist, taxes and subsidies can actually promote efficiency by encouraging demand and supply to better reflect the true marginal costs and marginal benefits to society.

5.4 Four Categories of Goods (pages 154–161)

Learning Objective: Explain how goods can be categorized on the basis of whether they are rival or excludable and use graphs to illustrate the efficient quantities of public goods and common resources.

Goods may be classified into four categories based on whether their consumption is rival and/or excludable. If I consume one more unit of a product and that means you cannot consume the same unit, then the product is called **rival.** If anyone who wants to consume one unit of a product must pay for that unit, then the product is **excludable.** Products can be either rival or nonrivalrous and excludable or nonexcludable. This gives us four possible combinations of characteristics.

A **private good** is a good that is both rival and excludable. The economically efficient quantity of a private good can be supplied in a market without government intervention. Quasi-public goods are goods that are excludable but not rival. A **common resource** is a good that is rival but not excludable. Externalities typically are associated with common resources. The **tragedy of the commons** refers to the tendency for a common resource to be overused. The tragedy of the commons results from a lack of clearly defined and enforced property rights. A **public good** is a good that is both nonrivalrous and nonexcludable. **Free riding** refers to benefiting from a good without paying for it. Because of free riders, public goods are usually supplied by government rather than private firms.

In contrast with private goods, each consumer will consume the same quantity of a public good as every other consumer. The demand for a public good is determined by adding the price each consumer is willing to pay for each quantity of the good. Because no consumer can be excluded from receiving the good, it is difficult to determine consumers' true preferences and willingness to pay because of the free rider problem. Governments typically provide public goods, such as national defense, and determine the quantity supplied through cost-benefit analysis or a political process.

©2015 Pearson Education, Inc.

Study Hint

Solved Problem 5.4, "Determining the Optimal Level of Public Goods," shows how we aggregate individual demand curves to determine the optimal level of public goods. For private goods, market demand is determined by summing the quantities individual consumers are willing and able to purchase at various prices. Because quantity is measured on the horizontal axis, adding the individual quantities together to determine the market quantity is called "horizontal summation."

For a public good, because the good is nonrivalrous, the units consumed by one individual are the same units consumed by other individuals in the market. The demand for a public good then comes from summing the individual marginal benefits associated with a given quantity of output. Because marginal benefit is measured on the vertical axis of a demand curve, we call this a "vertical summation" of the demand curves.

Key Terms

Coase theorem The argument of economist Ronald Coase that if transactions costs are low, private bargaining will result in an efficient solution to the problem of externalities.

Command-and-control approach An approach that involves the government imposing quantitative limits on the amount of pollution firms are allowed to emit or requiring firms to install specific pollution control devices.

Common resource A good that is rival but not excludable.

Excludability The situation in which anyone who does not pay for a good cannot consume it.

Externality A benefit or cost that affects someone who is not directly involved in the production or consumption of a good or service.

Free riding Benefiting from a good without paying for it.

Market failure A situation in which the market fails to produce the efficient level of output.

Pigovian taxes and subsidies Government taxes and subsidies intended to bring about an efficient level of output in the presence of externalities.

Private benefit The benefit received by the consumer of a good or service.

Private cost The cost borne by the producer of a good or service.

Private good A good that is both rival and excludable.

Property rights The rights individuals or businesses have to the exclusive use of their property, including the right to buy or sell it.

Public good A good that is both nonrival and nonexcludable.

Rivalry The situation that occurs when one person's consuming a unit of a good means no one else can consume it.

Social benefit The total benefit from consuming a good or service, including both the private benefit and any external benefit.

Social cost The total cost of producing a good or service, including both the private cost and any external cost.

Tragedy of the commons The tendency for a common resource to be overused.

Transactions costs The costs in time and other resources that parties incur in the process of agreeing to and carrying out an exchange of goods or services.

©2015 Pearson Education, Inc.

Self-Test

(Answers are provided at the end of the Self-Test.)

Multiple-Choice Questions

1. An externality
   a. is a benefit or cost to parties who are not involved in a transaction.
   b. can be positive or negative.
   c. arises when property rights don't exist or can't be enforced.
   d. All of the above are true of externalities.

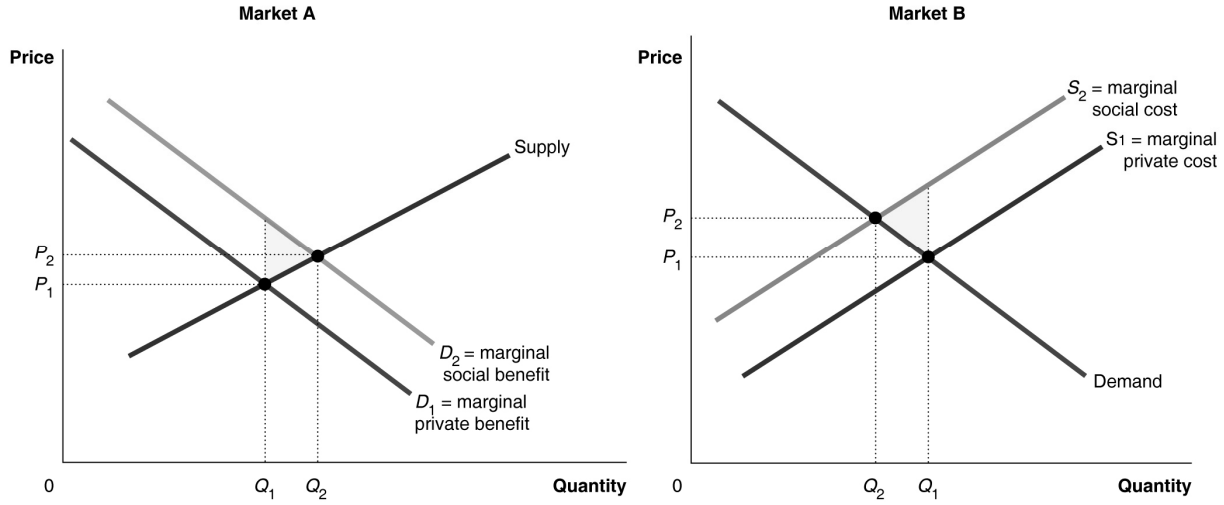
2. A negative externality causes the social cost of production to be
   a. greater than the private cost.
   b. less than the private cost.
   c. the same as the private cost.
   d. none of the above.

3. Fill in the blanks. The private benefit is _____, while the social benefit is _____.
   a. the benefit received by the consumer of a good or service; the total benefits from consuming the good
   b. the total benefit from consuming the good; the benefit received by the consumer of a good or service
   c. the benefit received by the consumer of a good or service; the external benefit
   d. None of the above is true.

4. Market failure is
   a. a situation where the market doesn't produce the optimal level of a good or service because of externality.
   b. can be a consequence of externalities.
   c. both (a) and (b).
   d. none of the above.

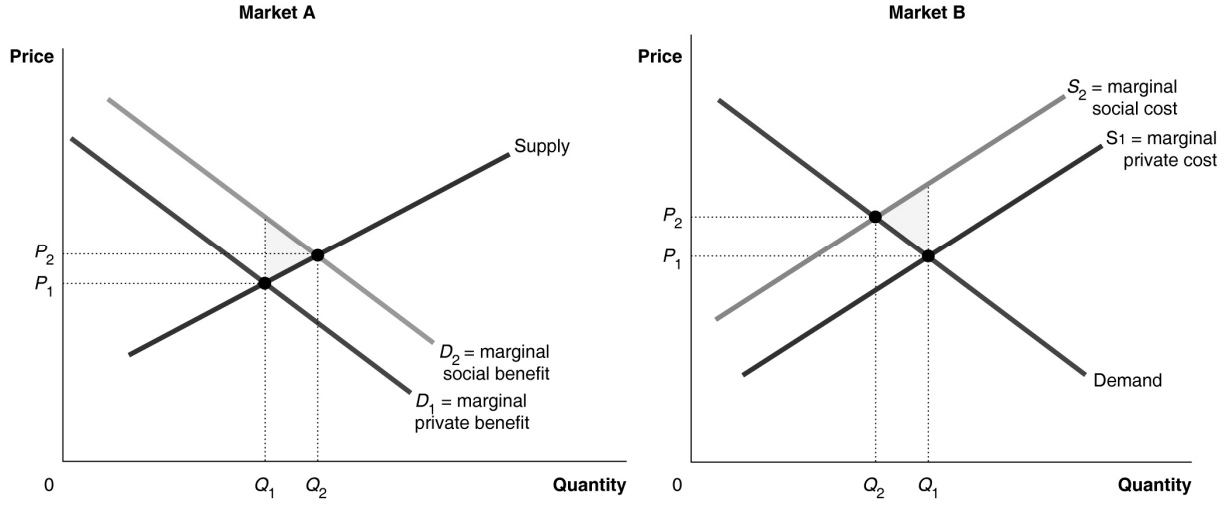
©2015 Pearson Education, Inc.

5. Refer to the graphs below. In which of these markets is an externality present?



a. in Market A
b. in Market B
c. in both Market A and Market B
d. Neither market exhibits an externality.

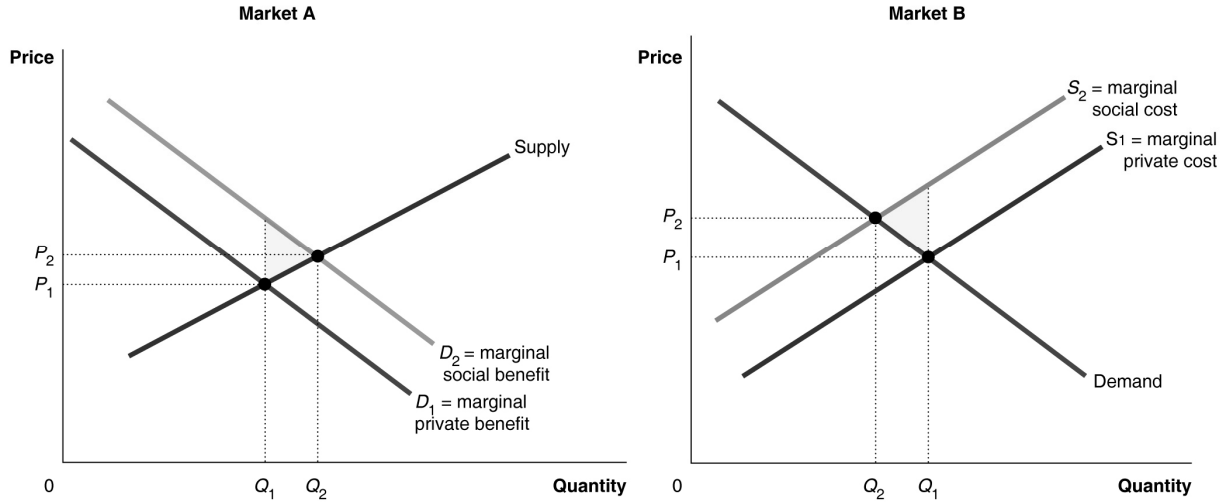
6. Refer to the graphs below. Which of the following statements is correct?



a. Market A exhibits a negative externality because the marginal private benefit exceeds the marginal social benefit.
b. Market B exhibits a negative externality because the marginal social cost exceeds the marginal private cost.
c. Market A exhibits a negative externality because the marginal social benefit exceeds the marginal private benefit.
d. Market B exhibits a positive externality because the marginal private cost exceeds the marginal social cost.

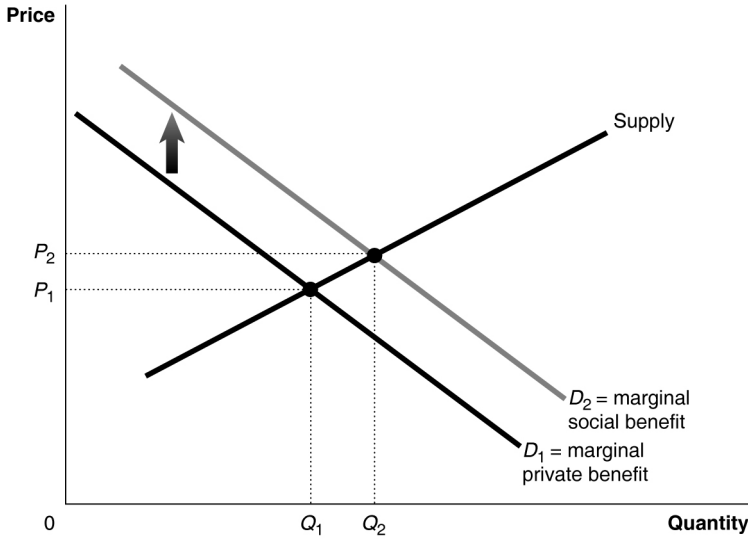
©2015 Pearson Education, Inc.

7. Refer to the graphs below. In which of the markets is the quantity Q_1 less than the economically efficient quantity?



a. in Market A
b. in Market B
c. in both markets
d. in neither of the two markets

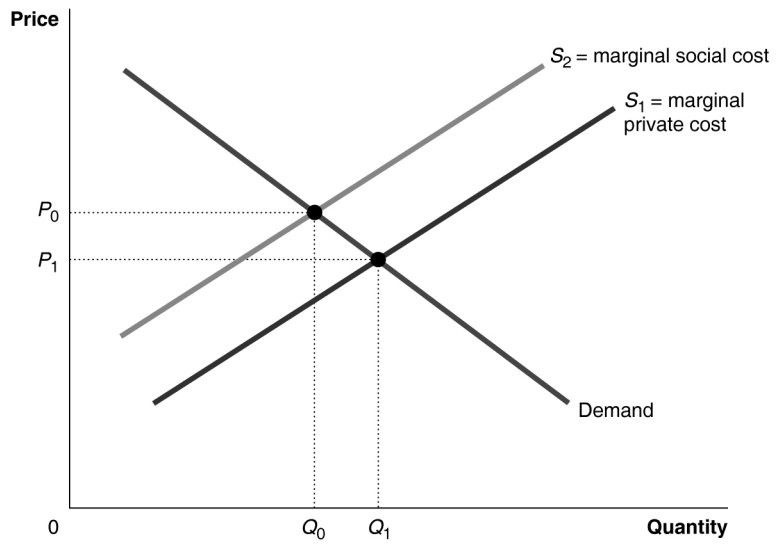
8. Refer to the graph below. The arrow in the graph refers to the difference between D_1 and D_2. What does this difference represent?



a. an external benefit
b. an external cost
c. private cost
d. social cost

©2015 Pearson Education, Inc.

9. Refer to the graph below. When an externality is present, which combination of price and quantity does the market yield without government intervention?



   a. P_0, Q_0
   b. P_1, Q_1
   c. P_0, Q_1
   d. P_1, Q_0

10. Fill in the blanks. Positive externality_____ cause a market failure and negative externality_____ cause a market failure.
   a. cannot; can
   b. can; cannot
   c. cannot ; cannot
   d. can; can

11. The Coase theorem states that
   a. if transaction costs are low, private bargaining will lead to an efficient solution to externalities.
   b. if transaction costs are high, private bargaining will lead to an efficient solution to externalities.
   c. if transaction costs are low, public bargaining will lead to an efficient solution to externalities.
   d. None of the above apply to the Coase theorem.

12. When we talk about property rights in the discussion of externalities, which rights do we refer to?
   a. the rights of individuals to pollute
   b. the rights of individuals to have exclusive use of their property
   c. the rights of individuals to buy but not sell their property
   d. all of the above

13. Externalities result in
   a. market failure.
   b. deadweight loss.
   c. both (a) and (b).
   d. none of the above.

©2015 Pearson Education, Inc.

14. Successful application of Coase theorem requires that
    a. the bargaining parties have full information regarding the costs and benefits associated with the externalities.
    b. the bargaining parties are willing to accept a reasonable agreement.
    c. transaction costs are low.
    d. all of the above.

15. Fill in the blanks. Positive externality results in producing _____ than the economically efficient level of output, whereas negative externality results in producing _____ than the economically efficient level of output.
    a. less; less
    b. more; more
    c. less; more
    d. more; less

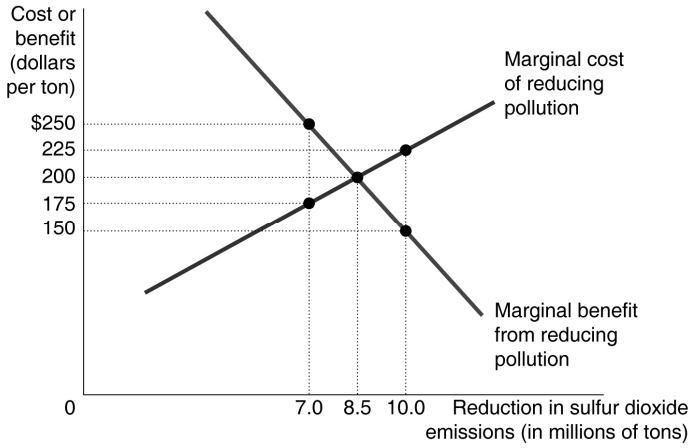
16. Fill in the blanks. To get the market demand curve for a private good, you add _____. To get the market demand curve for a public good, you add_____.
    a. the price each consumer is willing to pay for each quantity of the good; the price each consumer is willing to pay for each quantity of the good
    b. the quantity of the good demanded by each consumer at each price; the quantity of the good demanded by each consumer at each price
    c. the price each consumer is willing to pay for each quantity of the good; the quantity of the good demanded by each consumer at each price
    d. the quantity of the good demanded by each consumer at each price; the price each consumer is willing to pay for each quantity of the good

17. Fill in the blanks. _____ causes a positive externality, while a _____ causes a negative externality.
    a. Neighbor's dog barking all night; neighbor's dog barking all night
    b. Higher education; higher education
    c. Neighbor's dog barking all night; higher education
    d. Higher education; neighbor's dog barking all night

18. If we are considering further reductions in pollution, what rule should we follow to maximize the net benefit to society?
    a. The marginal benefit from another ton of reduction should be greater than the marginal cost.
    b. The marginal benefit from another ton of reduction should be less than the marginal cost.
    c. The marginal benefit from another ton of reduction should be equal to the marginal cost.
    d. The marginal benefit from another ton of reduction should equal zero.

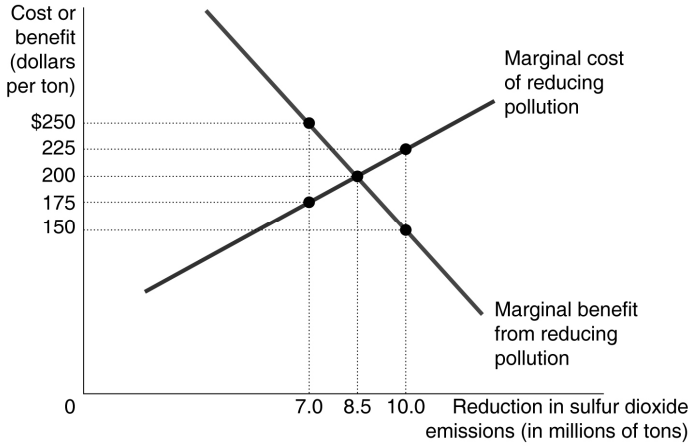
©2015 Pearson Education, Inc.

19. Refer to the graph below. Which of the following is true when the reduction in sulfur dioxide equals seven tons?



a. The marginal benefit of reducing sulfur dioxide emissions is greater than the marginal cost.
b. Further reductions will make society worse off.
c. The optimal amount of pollution reduction has been found.
d. All of the above are true.

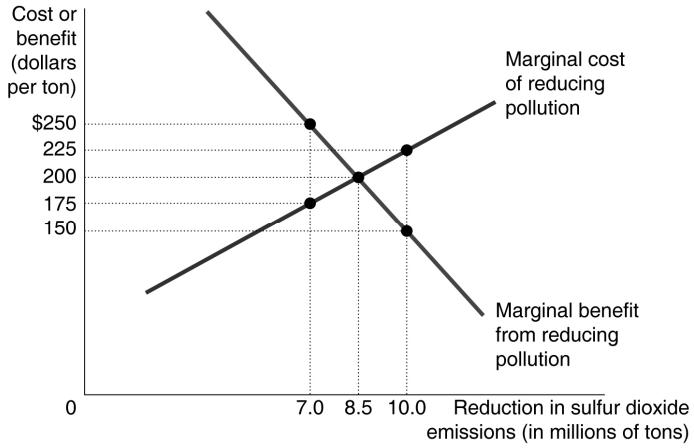
20. Refer to the graph below. Which of the following is true when the reduction in sulfur dioxide equals 10 tons?



a. The marginal benefit of reducing sulfur dioxide emissions is greater than the marginal cost.
b. Further reductions will make society worse off.
c. The optimal amount of pollution reduction has been found.
d. All of the above are true.

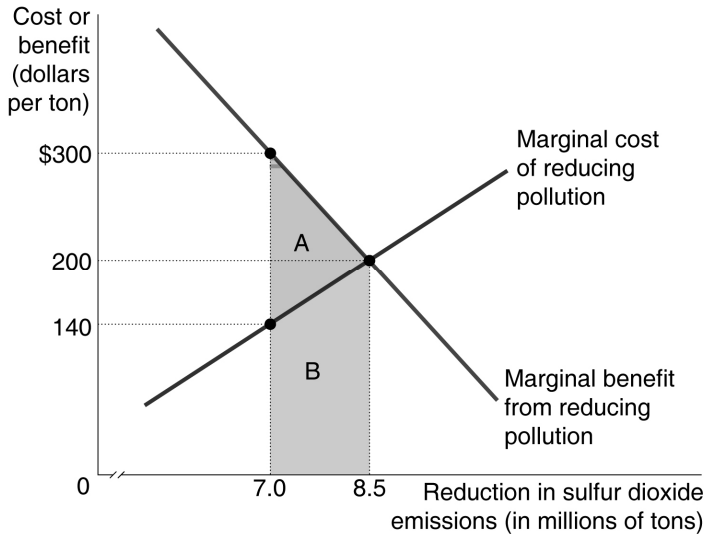
©2015 Pearson Education, Inc.

21. Refer to the graph below. How much reduction in sulfur dioxide can be considered economically efficient?



a. 7.0 million tons
b. 8.5 million tons
c. 10.0 million tons
d. all of the above

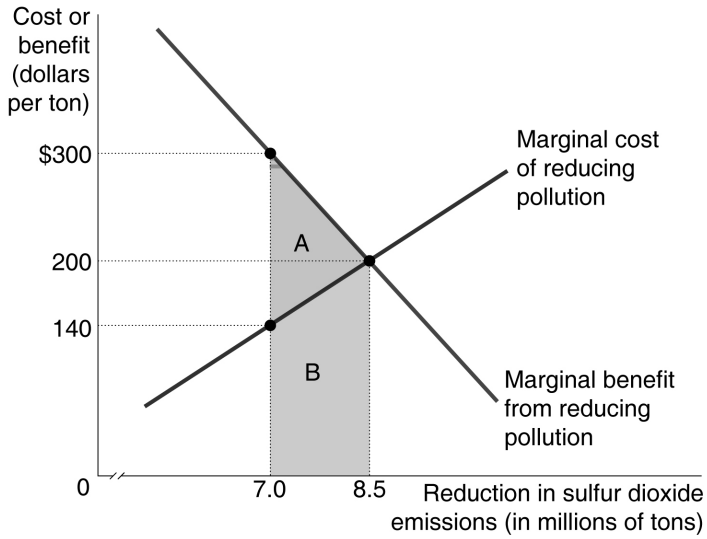
22. Refer to the graph below. What area represents the total benefit of increasing the reduction of sulfur dioxide from 7.0 million to 8.5 million tons?



a. Area A
b. Area B
c. Area A + B
d. None of the above; the graph shows only marginal benefit.

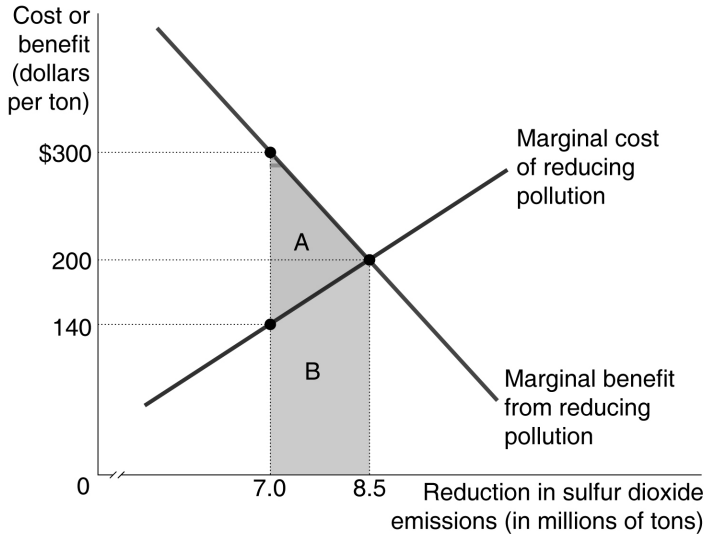
©2015 Pearson Education, Inc.

23. Refer to the graph below. What area represents the total cost of increasing the reduction of sulfur dioxide from 7.0 million to 8.5 million tons?



a. Area A
b. Area B
c. Area A + B
d. None of the above; the graph shows only marginal benefit.

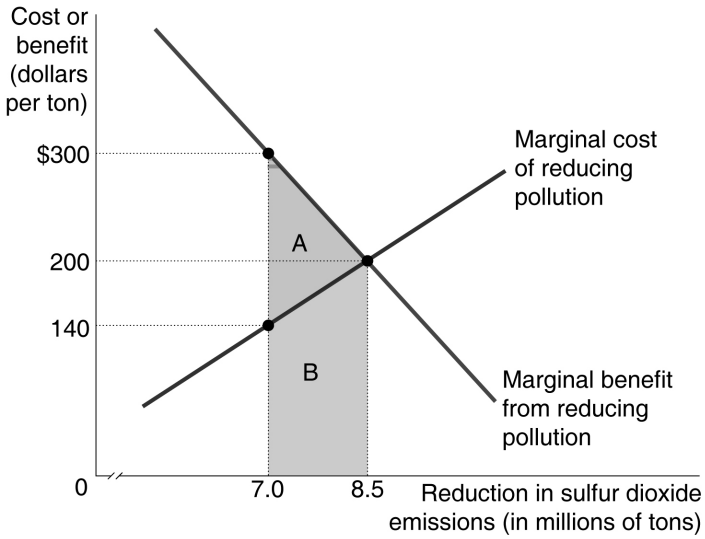
24. Refer to the graph below. What is the net benefit of increasing the reduction of sulfur dioxide from 7.0 million to 8.5 million tons?



a. Area A
b. Area B
c. Area A + B
d. None of the above; the graph shows only marginal benefit.

©2015 Pearson Education, Inc.

25. Refer to the graph below. How much is the net benefit (in millions) of increasing the reduction of sulfur dioxide from 7.0 million tons to 8.5 million tons?



a. $255 million
b. $120 million
c. $200 million
d. none of the above

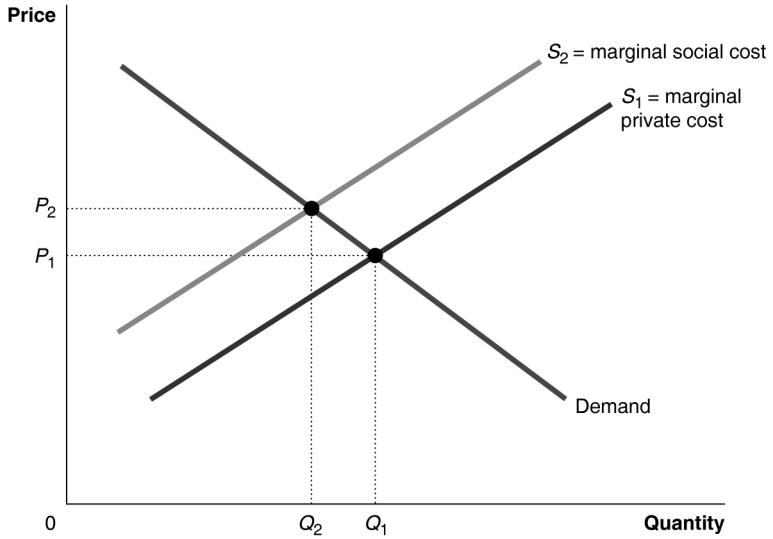
26. Pigovian taxes and subsidies are intended to
a. internalize the externality associated with production or consumption.
b. bring about the efficient level of output in the presence of externality.
c. Both (a) and (b) are correct.
d. None of the above is correct.

27. Fill in the blank. According to the Coase theorem, if transaction costs are low _____ will result in an efficient solution to the externality problem.
a. public bargaining between the parties
b. private bargaining between the parties
c. government intervention
d. none of the above

28. The command-and-control approach
a. is used to reduce pollution.
b. involves the government imposing quantitative limits on the amount of pollution firms are allowed to generate.
c. Both (a) and (b) are true.
d. None of the above is correct.

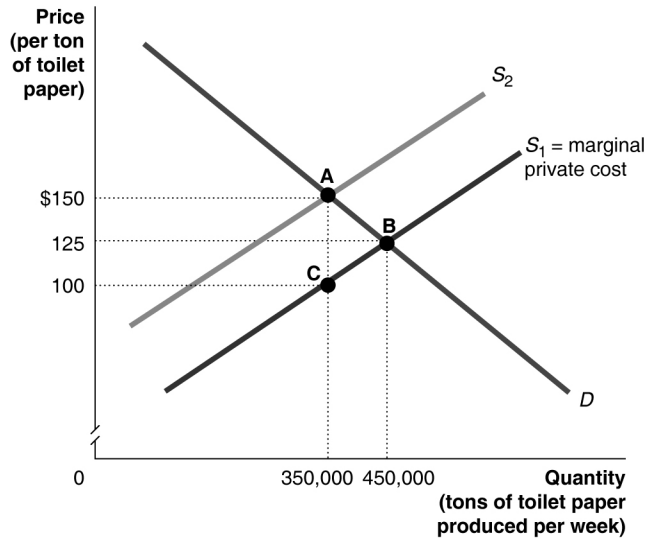
©2015 Pearson Education, Inc.

29. Refer to the graph below. Which of the following best represents a tax equal to the value of the negative externality?



a. S_1
b. S_2
c. the vertical distance between S_1 and S_2
d. $P_2 - P_1$

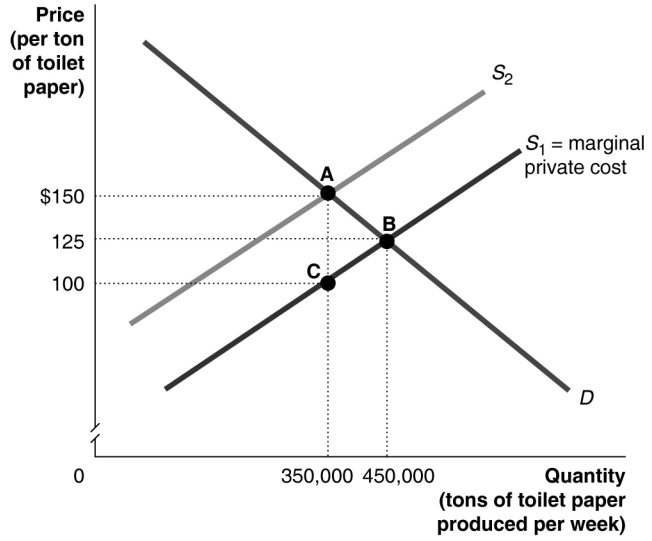
30. Refer to the graph below. After the negative externality has been internalized, which point would best represent market equilibrium?



a. Point A
b. Point B
c. Point C
d. none of the above

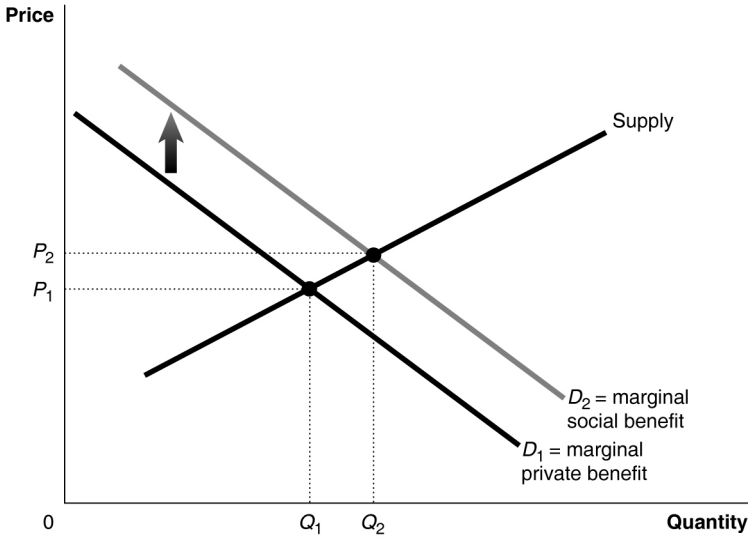
©2015 Pearson Education, Inc.

31. Refer to the graph below. What Pigovian tax would push the market to efficiency?



a. $25
b. $50
c. $100
d. $125

32. Refer to the graph below. To achieve economic efficiency, what should the magnitude of the arrow in the graph be equal to?



a. the amount of a subsidy
b. the amount of a tax
c. the amount of a price increase
d. the social benefit of education

©2015 Pearson Education, Inc.

33. To deal with externalities, the government uses
    a. Pigovian tax and subsidy.
    b. command-and-control approach.
    c. both (a) and (b).
    d. none of the above.

34. Fill in the blanks. A public good is _____, while a private good is _____.
    a. rival and excludable; rival
    b. excludable; nonexcludable
    c. rival and excludable; nonrival and nonexcludable
    d. nonrival and nonexcludable; rival and excludable

35. A common resource is
    a. rival but not excludable.
    b. nonrival but excludable.
    c. nonrival and nonexcludable.
    d. rival and excludable.

36. A quasi-public good is
    a. rival but not excludable.
    b. excludable but not rival.
    c. nonrival and nonexcludable.
    d. rival and excludable.

37. Refer to the table below. From the examples given, which box applies to the concept of common resources?

A: *Examples: Big Macs Levi's Jeans*	B: *Examples: Tuna in the ocean Public pasture land*
C: *Examples: Cable TV Toll road*	D: *Examples: National defense Court system*

    a. A
    b. B
    c. C
    d. D

©2015 Pearson Education, Inc.

38. Refer to the table below. Which of the boxes applies to goods that are excludable and nonrivalrous?

A: *Examples: Big Macs, Levi's Jeans*	B: *Examples: Tuna in the ocean, Public pasture land*
C: *Examples: Cable TV, Toll road*	D: *Examples: National defense, Court system*

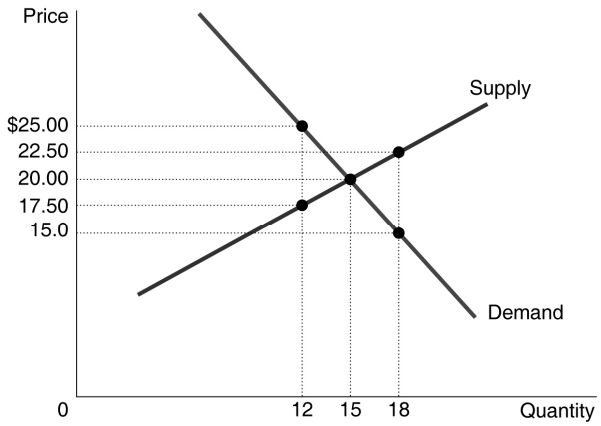
a. A
b. B
c. C
d. D

39. Refer to the graphs below. What procedure does this series of graphs show?

a. the construction of market demand for a private good
b. the construction of market demand for a public good
c. the construction of market demand for a rival good
d. the construction of market demand for an excludable good

©2015 Pearson Education, Inc.

40. Refer to the graph below. What is the optimal quantity of this public good?



a. 12 units
b. 15 units
c. 18 units
d. none of the above

41. Refer to the table below. The table refers to the Solved Problem that begins on page 158 in the textbook. How many hours of protection maximize economic surplus?

DEMAND FOR PROTECTION

Joe		Jill
Price (dollars per hour)	Quantity (hours of protection)	Quantity (hours of protection)
$20	0	1
$18	1	2
$16	2	3
$14	3	4
$12	4	5
$10	5	6
$8	6	7
$6	7	8
$4	8	9
$2	9	10

SUPPLY OF PROTECTION

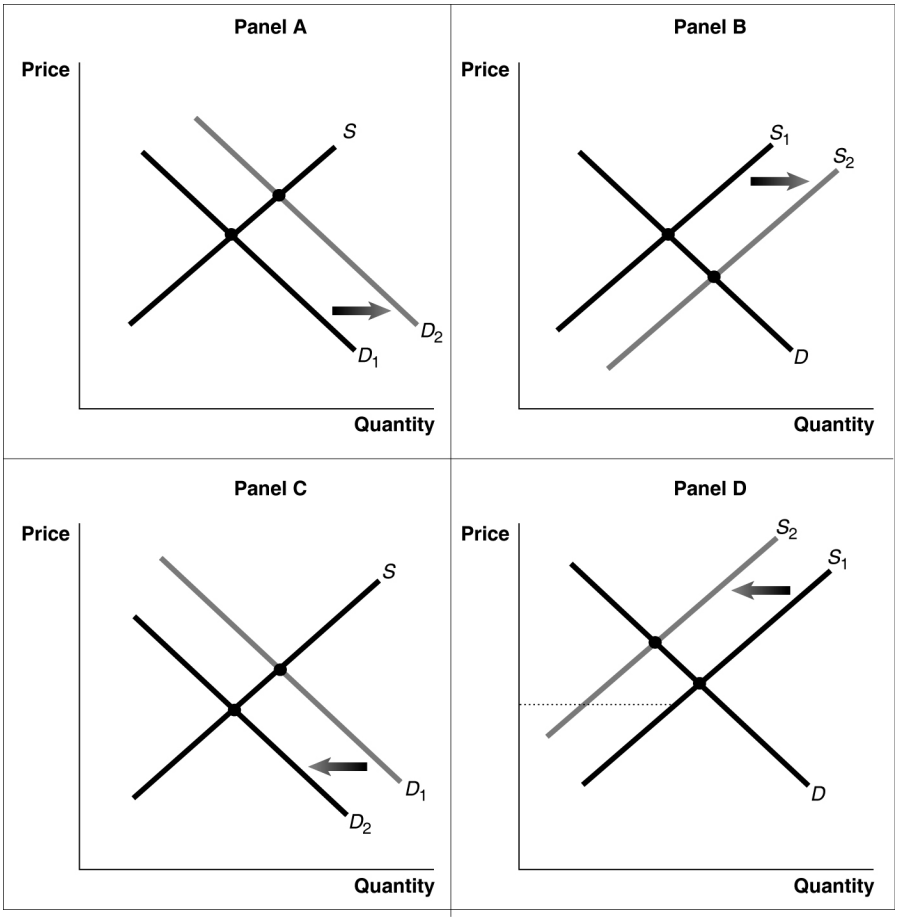
Quantity (hours of protection)	Price (dollars per hour)
1	$8
2	$10
3	$12
4	$14
5	$16
6	$18
7	$20
8	$22
9	$24

a. 1 hour
b. 9 hours
c. 5 hours
d. 6 hours

42. What is the tragedy of the commons?
a. The tragedy of the commons refers to the fact that some people benefit from a good without paying for it.
b. The tragedy of the commons is the tendency for some goods to be excluded from public consumption.
c. The tragedy of the commons refers to the fact that a good can be rival and excludable.
d. The tragedy of the commons refers to the tendency for a common resource to be overused.

©2015 Pearson Education, Inc.

43. Refer to the graphs below. Which graph best describes the move from an inefficient use of a common resource to an efficient use of it?



a. Panel A
b. Panel B
c. Panel C
d. Panel D

Short Answer Questions

1. Explain why the marginal benefit from reducing air pollution in the United States in 1970 was greater than the marginal benefit of reducing air pollution by an equivalent amount would be today.

_____

_____

_____

©2015 Pearson Education, Inc.

2. Steven Cheung of the University of Washington has written about the positive externalities associated with beekeeping and apple growing. Explain why the solution to this externalities problem is an application of the Coase theorem.

3. Air and water pollution impose external costs on people without their consent. Why isn't it economically efficient to completely eliminate these external costs by reducing the amounts of air and water pollution to zero?

4. In order to get the market demand curve for a private good, we add horizontally, while for the market demand curve for the public good, we add vertically. Do you agree with this statement? Explain your answer.

5. A student argues that "Negative externality interferes with economic efficiency because it is negative, whereas positive externality does not." Comment on this argument.

©2015 Pearson Education, Inc.

True/False Questions

T F 1. Positive externality causes the level of output produced to be more than the efficient level of output.

T F 2. Externality can cause a deadweight loss.

T F 3. Higher education causes positive externalities.

T F 4. Negative externality causes the social cost of producing a good to exceed its private cost.

T F 5. The federal government rather than private firms provides national defense because consumers of national defense have an incentive to be free riders.

T F 6. Congress authorized a command-and-control approach to reducing sulfur dioxide emissions by electric utilities in 1990.

T F 7. The Coase theorem states that if transaction costs are high, private bargaining between the parties involved can lead to an efficient level of output produced.

T F 8. Pigovian tax or subsidy cause consumers and firms to internalize the externalities associated with consumption and production of the good.

T F 9. If the marginal cost of reducing emissions of some pollutant is greater than the marginal benefit, society will be better off if these emissions are increased.

T F 10. Free riding means that you benefit from the good without paying for it.

T F 11. The tragedy of the commons refers to the tendency for a common resource to be underused.

T F 12. The 1983 requirement by the federal government to install catalytic converters on all new automobiles is an example of a command-and-control approach to reducing pollution.

T F 13. The actual cost to electric utilities of complying with Congress' program to reduce sulfur dioxide emissions in 2010 is greater than was originally estimated by the General Accounting Office in 1994.

T F 14. Most European governments favor an international system of tradable emissions permits to reduce carbon dioxide emissions. The U.S. government favors a program that would require individual countries to reduce emissions by a specified amount.

T F 15. The demand for a public good is determined by adding the price each consumer is willing to pay for each quantity of the public good.

Answers to the Self-Test

Multiple Choice Questions

Question	Answer	Comment
1.	d	An externality is a benefit or cost to parties who are not involved in a transaction, can be positive or negative, and results from the nonexistence of property rights or if they are not enforced.
2.	a	Negative externality causes the social cost, which includes both the private and the external costs, to be greater than the private cost.
3.	a	Private benefit is the benefit received by the consumer from consuming this good or service, while the social benefit includes both private benefit and any external benefit.

©2015 Pearson Education, Inc.

Question	Answer	Comment
4.	c	Market failure is a situation where the market doesn't produce the optimal level of a good or service because of externality and can be a consequence of externalities.
5.	c	There is a difference between private and social benefits and/or costs in both markets.
6.	b	When the social cost is greater than the private cost of production, the market suffers from a negative externality.
7.	a	The economically efficient quantity of output in Market A is Q_2, where the marginal private cost equals the marginal social benefit.
8.	a	An external benefit exists when the marginal social benefit is greater than marginal private benefit. The private market produces less than the efficient quantity.
9.	b	The free market fails to account for external costs. The market produces too much output and charges too low a price when external costs are present.
10.	d	Both positive and negative externalities can cause a market failure if the efficient level of output isn't produced.
11.	a	The Coast theorem states that private bargaining between the parties involved will lead to an efficient solution for externality as long as transaction costs are low.
12.	b	Property rights refer to the rights individuals or businesses have to the exclusive use of their property, including the right to buy or sell it.
13.	c	Since the efficient level of output isn't produced, externalities result in a market failure and a deadweight loss.
14.	d	Successful application of Coase theorem requires that the bargaining parties have full information regarding the costs and benefits associated with the externalities, the bargaining parties are willing to accept a reasonable agreement, and transaction costs are low.
15.	c	A positive externality causes the social benefit from the production of a good to be greater than the private benefit, and as a result, less than the economically efficient level of output is produced. Negative externality causes the social cost from the production of a good to be greater than the private cost, and as a result more than the economically efficient level of output is produced.
16.	d	To get the market demand curve for a private good, you add the quantity of the good demanded by each consumer at each price (add horizontally). To get the market demand curve for a public good, you add the price each consumer is willing to pay for each quantity of the good (add vertically).
17.	d	Higher education causes a positive externality, while a neighbor's dog barking all night causes a negative externality.
18.	c	It is optimal to reduce pollution up to the point where the marginal benefit of the last unit of pollution eliminated is equal to the marginal cost of eliminating that unit.
19.	a	If the marginal benefit of reducing sulfur dioxide emissions is greater than the marginal cost, further reductions will make society better off.
20.	b	Further reductions have an additional cost which is greater than the additional benefit. If the marginal benefit of reducing sulfur dioxide emissions is less than the marginal cost, further reductions will make society worse off. Refer to Figure 5.3 on page 143 in the textbook.
21.	b	The economically efficient quantity is found where marginal benefit is equal to marginal cost.

©2015 Pearson Education, Inc.

Question	Answer	Comment
22.	c	The total benefit equals the area under the marginal benefit curve.
23.	b	The total cost equals the area under the marginal cost curve.
24.	a	The net benefit equals the total benefit minus the total cost.
25.	b	The value of the benefits is \$375 million or (1.5 million tons × \$200 per ton) + (½ × 1.5 million tons × \$100 per ton). The value of the costs is \$255 million or (1.5 million tons × \$140 per ton) + (½ × 1.5 million tons × \$60 per ton). If the people who would benefit from a reduction in pollution could get together, they could offer to pay the electric utilities \$255 million to reduce the pollution to the optimal level. After making the payment, they would still be left with a net benefit of \$120 million. Because the net benefit (see previous question) equals area A, the value of net benefits is equal to (\$300 − \$140) × 0.5 × 1.5 million = \$120 million.
26.	c	In case of externality, the government can intervene by using a Pigovian tax or subsidy to cause the producer or the consumer to internalize the externality so that the efficient level of output is produced.
27.	b	According to the Coase theorem , if transaction costs are low, private bargaining between the parties will result in an efficient solution to the externality problem.
28.	c	The command-and-control approach is used to reduce pollution and involves the government imposing quantitative limits on the amount of pollution firms are allowed to generate.
29.	c	The tax is equal to the difference between private cost and social cost.
30.	a	At point A, marginal social cost equals marginal benefit.
31.	b	A \$50 Pigovian tax is equal to the value of the negative externality of \$50 (the distance between points A and C).
32.	a	When there is a positive externality, a subsidy can bring about the efficient level of output.
33.	c	To deal with externalities, the government tries to internalize the externalites using either Pigovian tax and subsidy or command-and-control approach.
34.	d	A public good is nonrival (more than one person can consume the good at the same time) and nonexcludable (anyone who doesn't pay for the good can't be excluded from consuming it). A private good is rival (if one consumes one unit of it, the others can't consume the same unit) and excludable (anyone who doesn't pay for the good can't consume it).
35.	a	A common resource is rival because if anyone consumes one unit of it, the others can't consume the same unit, but not excludable because we can't exclude those who did not pay for it from consuming it.
36.	b	A quasi-public good is excludable because we can exclude those who did not pay for it from consuming it but not rival because more than one consumer can consume it at the same time.
37.	b	Common resources are rival and nonexcludable.
38.	c	These goods are quasi-public goods.
39.	b	To arrive at a demand curve for a public good, we don't add quantities at each price, as with a private good. Instead, we add the price each consumer is willing to pay for each quantity of the public good. This gives us a value for the total dollar amount consumers as a group would be willing to pay for that quantity of the public good.

©2015 Pearson Education, Inc.

Question	Answer	Comment
40.	b	The optimal quantity of a public good will occur where the demand curve intersects the supply curve. When this quantity is produced, the sum of consumer surplus plus producer surplus is maximized.
41.	d	For example, for every hour beyond 6, the supply curve is above the demand curve. Therefore, the additional benefits received will be less than the additional cost of supplying these hours. This results in a deadweight loss and a reduction in economic surplus. Joe is willing to pay $8, and Jill is willing to pay $10 for 6 hours of protection. Their total willingness to pay is equal to the price needed ($18) to provide 6 hours of protection. Joe and Jill are willing to pay more than the price needed to provide fewer than 6 hours of protection, but they are not willing to pay more than the price needed to provide more than 6 hours of protection.
42.	d	The tragedy of the commons is the tendency for a common resource to be overused. A modern example is the forests in many poor countries.
43.	d	See Figure 5.11 on page 160 in the textbook.

Short Answer Responses

1. Since the passage of the Clean Air Act in 1970, emissions of the six main forms of air pollution have fallen by almost half. With the lower level of air pollution, the marginal benefit (due to the reduction in illness, etc.) of reducing air pollution by an equivalent amount today would be much less.

2. Cheung noted that intervention by government was not necessary to address the problem because beekeepers and apple growers came to their own solution. Contracts are written between these two groups that specify payments between the parties. This is what the Coase theorem is about: Private negotiation between parties involved to reach an efficient outcome to externalities as long as transaction costs are low.

3. The marginal cost of reducing the last amounts of air and water pollution—the amounts that would remain when nearly all forms of pollution were eliminated—would be very high. It might be necessary, for example, to ban all automobiles. The marginal benefit from reducing the last amounts of pollution would be low.

4. Yes, you should agree with the statement. To get the market demand curve for a private good, we add the quantity of the good demanded by each consumer at each price. Because the quantity is measured on the horizontal axis, we add horizontally. To get the market demand curve for a public good, we add the price each consumer would be willing to pay for each quantity. Because the price is measured on the vertical axis, we add vertically.

5. The student is wrong: Both positive and negative externalities interfere with economic efficiency. Positive externality causes the social benefit from consuming the good to exceed the private benefits. Negative externality, on the other hand, causes the social cost of production to exceed the private cost.

True/False Answers

Question	Answer	Comment
1.	F	A positive externality causes the level of output produced to be less, not more, than the efficient level of output.

©2015 Pearson Education, Inc.

Question	Answer	Comment
2.	T	An externality can cause a deadweight loss because the level of output produced isn't the efficient level of output.
3.	T	Higher education causes the social benefits to exceed the private benefit and as a result causes positive externalities.
4.	T	The social cost of producing the good includes both private cost and any external cost. With a negative externality, there is external cost of producing the good, making the social cost greater than the private cost.
5.	T	National defense is a public good.
6.	F	In 1990, Congress enacted the tradable emissions allowances program.
7.	F	The Coase theorem states that if transaction costs are low (not high), private bargaining between the parties involved can lead to efficient level of output produced.
8.	T	A Pigovian tax or subsidy is designed so that consumers and firms will internalize the externalities associated with consumption and production of the good.
9.	T	Emissions should be reduced up to the point where the marginal benefit is equal to the marginal cost of pollution reduction.
10.	T	Free riding exists when someone benefits from the good without paying for it.
11.	F	The tragedy of the commons refers to the tendency for a common resource to be overused, not underused.
12.	T	See page 152 in the textbook.
13.	F	The actual cost of the program is much lower than original estimates.
14.	F	The United States refused to sign the Kyoto Treaty, which required countries to reduce emissions by some fixed percentage. This would indicate that the U.S. government is not in favor of these blanket reductions.
15.	T	To get the market demand for a public good, we add the price each consumer would be willing to pay for each quantity of the public good.

©2015 Pearson Education, Inc.