**Key Concepts**

### Externalities in Our Lives

An **externality** is a cost or benefit that arises from production and falls on someone other than the producer or a cost or benefit that arises from consumption and falls on someone other than the consumer.

- **Negative externality** — an externality that imposes an external cost.
- **Positive externality** — an externality that provides an external benefit.

There can be negative production externalities (pollution) and positive production externalities (bees making honey fertilizing an orchard). There also can be negative consumption externalities (a noisy party) and positive consumption externalities (flu vaccination).

### Negative Externalities: Pollution

Environmental problems can be divided into air pollution, water pollution, and land pollution. The trends in air pollution show generally decreasing pollution.

- **Marginal private cost** \((MC)\) — the cost of producing an additional unit of a good or service that is paid by the producer of the good or service.
- **Marginal external cost** — the cost of producing an additional unit of a good or service that falls on people other than the producer.
- **Marginal social cost** \((MSC)\) — the marginal cost incurred by the entire society, the producer and by everyone else on whom the cost falls. In an equation, \(MSC = MC + \) Marginal external cost.

Figure 18.1 shows the marginal cost curve, which is the private supply curve, labeled \(MC = S\), and the marginal social cost curve, labeled \(MSC\). The marginal external cost is the vertical distance between the two curves, which is equal at \(Q_1\) to the length of the double headed arrow. The demand curve is the same as the marginal benefit curve and is labeled \(D = MB\). The efficient quantity is \(Q_e\), where the \(MSC\) and \(MB\) curves intersect and the equilibrium quantity is \(Q_0\), where the \(D\) and \(S\) curves intersect. A deadweight loss is created because more than the efficient amount is produced.

The inefficiency can sometimes be reduced by establishing a property right.

- **Property rights** — legally established titles to the ownership, use, and disposal of factors of production and goods and services.
- **Coase theorem** — the proposition that if property rights exist, if only a small number of parties are involved, and transactions costs are low, then private transactions are efficient. **Transactions costs** are the...
opportunity costs of conducting a transaction. The Coase theorem implies that, regardless to whom the property right is given (the polluter or the victim), as long as a property right is granted, the efficient level of pollution results.

The government has three main methods it can use to cope with external costs:

- **Taxes** — the government can levy a tax equal to the marginal external cost. Such a tax is called a Pigouvian tax. Imposing a tax equal to the marginal external cost shifts the private supply curve so that it is the same as the marginal social cost curve, \( MSC \).

- **Emission charges** — a price per unit of pollution that the government sets and the polluter pays. It is difficult to determine the correct price.

- **Marketable permits** — each polluter is given a pollution limit. If it reduces its pollution below this limit, it can sell the "excess" reduction to other firms who then do not need to reduce their pollution by this amount. Marketable permits provide a sharp incentive to find technologies that reduce pollution.

**Positive Externalities: Knowledge**

Knowledge as well as research and development can create external benefits.

- **Marginal private benefit** (\( MB \)) — the benefit from an additional unit of a good or service that the consumer of that good or service receives.

- **Marginal external benefit** — the benefit from an additional unit of a good or service that people other than the consumer enjoy.

- **Marginal social benefit** (\( MSB \)) — the marginal benefit enjoyed by the entire society, both by the consumer and by everyone else. In an equation, \( MSB = MB + \) Marginal external benefit.

Figure 18.2 shows the marginal benefit curve, which is the private demand curve and is labeled \( MB = D \). The marginal social benefit curve is labeled \( MSB \). The marginal external benefit is the vertical distance between the two curves, equal at \( Q_1 \) to the length of the double headed arrow. The supply curve is the same as the marginal cost curve and is labeled \( S = MC \). The efficient quantity is \( Q_1 \), where the \( MC \) and \( MSB \) curves intersect. The equilibrium quantity is \( Q_0 \), where the \( D \) and \( S \) curves intersect. A deadweight loss is created because less than the efficient quantity is produced.

The government has four methods it can use to attain a more efficient outcome when external benefits exist:

- **Public provision** — a public authority that receives its revenue from the government can produce the good or service. In Figure 18.2, the government would produce the efficient quantity, \( Q_1 \). It would then set the price equal to \( P_2 \) to insure that demanders buy \( Q_1 \).

- **Private subsidies** — a subsidy is a payment from the government to the private producers of the good or service. A subsidy increases the supply of the good and thereby increases the quantity produced.

- **Voucher** — A voucher is a token that the government provides to households, which they can use when they buy specified goods or services. In Figure 18.2, a voucher equal to the length of the double headed arrow would shift the demand curve so that the quantity would be \( Q_1 \), the efficient amount, and the price, including the voucher, would be \( P_1 \).

- **Patents and copyrights** — Patents and copyrights are government-sanctioned exclusive rights granted to the inventor of a good, service, or new production technique for a given number of years. Patents and copyrights help ensure that the inventor will personally profit from the invention and so increase the incentive to innovate, which benefits society. But, once the invention is made, patents and copyrights give the developer a monopoly, which harms society.
Helpful Hints

1. The Equilibrium Quantity Compared to the Efficient Quantity: The equilibrium quantity in a competitive market is the amount at which the marginal private cost equals the marginal private benefit. The efficient quantity is the amount at which the marginal social cost equals the marginal social benefit. If the marginal private cost equals the marginal social cost and the marginal private benefit equals the marginal social benefit, the two quantities are the same.

In most transactions, there are no external costs or benefits. In other words, private and social costs coincide as do private and social benefits and so competitive markets are efficient. But when external costs or benefits arise, competitive markets are not be efficient. With external benefits, the marginal private benefit is less than the marginal social benefit. With external costs, the marginal private cost is less than the marginal social cost. In both instances, the amount produced in an unregulated market, the amount at which the marginal private benefit and private cost curves intersect, is not the efficient amount.

Questions

True/False and Explain

Externalities in Our Lives
1. Externalities can arise from both production and consumption.
2. Flu vaccination is a good example of a negative production externality.

Negative Externalities: Pollution
3. Because pollution reflects an external cost, there can be no demand for a pollution-free environment.
4. If the production of a good involves an external cost, the marginal social cost exceeds the marginal private cost.
5. When external costs are present, the private market produces less than the efficient level of output.
6. The Coase theorem states that if property rights exist, the number of parties is small, and transaction costs are low, there will be no externalities regardless of who owns the property rights.
7. The inefficiency created by a negative production externality can be overcome if the government subsidizes production of the good.
8. Emission charges and marketable permits can be used to cope with the problem of a negative production externality.

Positive Externalities: Knowledge
9. Knowledge is an example of a product with external benefits.
10. The private market produces more than the efficient amount of a good having an external benefit.
11. A subsidy can be the appropriate policy for a good or service with an external benefit.
12. Taxing private producers of education can help overcome the externality problem of education.
13. Patents increase the incentive to discover new products and new production techniques.

Multiple Choice

Externalities in Our Lives
1. An externality can be a cost or benefit arising from the production of a good that falls upon a. consumers but not producers. b. producers but not consumers. c. the consumer and the producer both. d. someone other than the consumer or producer.
2. A noisy party that keeps neighbors awake is an example of a a. negative production externality. b. positive production externality. c. negative consumption externality. d. positive consumption externality.
3. Which of the following illustrates the concept of external cost? a. Bad weather decreases the size of the wheat crop. b. An increase in the demand for cheese raises the price paid by consumers of pizza, thereby harming these consumers. c. Smoking harms the health of the smoker. d. Smoking harms the health of nearby non-smokers.
CHAPTER 18
Negative Externalities: Pollution

4. Which of the following statements is correct?
   a. Most air pollution arises from generating electric power.
   b. Air pollution in the United States is becoming less severe for most substances.
   c. Lead from gasoline remains a major air pollution problem.
   d. All of the above statements are correct.

Use Figure 18.3 for the next five questions.

FIGURE 18.3
Multiple Choice Questions 5, 6, 7, 8, 9

5. As illustrated in Figure 18.3, the production of paper creates
   a. only an external benefit.
   b. only an external cost.
   c. both external benefits and costs.
   d. no externalities.

6. The amount of the externality illustrated in Figure 18.3 is
   a. $14 per ton.
   b. $12 per ton.
   c. $2 per ton.
   d. $0 per ton because no externality is produced.

7. In the absence of any government intervention, how many tons of paper are produced in a year?
   a. 60 million tons.
   b. 50 million tons.
   c. 40 million tons.
   d. 30 million tons.

8. The efficient amount of paper produced in a year is
   a. 60 million tons.
   b. 50 million tons.
   c. 40 million tons.
   d. 30 million tons.

9. What amount of tax is necessary to lead to production of the efficient amount of paper?
   a. $14 a ton
   b. $12 per ton
   c. $2 per ton
   d. zero because the efficient amount is produced without any government intervention.

10. A copper ore refiner pollutes the water upstream from a brewery. The transactions costs of reaching an agreement between the two are low. When will the amount of copper refining be at its efficient level?
    a. If the property right to the stream is assigned to the ore refiner but not if it is assigned to the brewery.
    b. If the property right to the stream is assigned to the brewery but not if it is assigned to the ore refiner.
    c. Whenever the property right to the stream is assigned to either the refiner or the brewer.
    d. None of the above because there is no such thing as the efficient level of copper refining since refining copper creates pollution.

11. Suppose that the government allows firms to emit sulfur dioxide and pollute the air as long as the firms pay the government $70 per ton of sulfur dioxide emitted. This approach to handling pollution is an example of
    a. the Coase theorem.
    b. an emission charge.
    c. a marketable permit.
    d. None of the above answers are correct.

12. Production of rubber for sneakers creates an external cost of $2 per ton of rubber, but no external benefits. What government tax or subsidy program will lead to the efficient amount of rubber being produced?
    a. A subsidy of more than $2 per ton of rubber.
    b. A subsidy of $2 per ton of rubber.
    c. A tax of more than $2 per ton of rubber.
    d. A tax of $2 per ton of rubber.
Positive Externalities: Knowledge
Use Table 18.1 for the next four questions.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Marginal private cost (dollars)</th>
<th>Marginal private benefit (dollars)</th>
<th>Marginal social benefit (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>$5</td>
<td>$9</td>
<td>$11</td>
</tr>
<tr>
<td>550</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>600</td>
<td>7</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>650</td>
<td>8</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>700</td>
<td>9</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

13. Table 18.1 represents the market for a good with
a. only an external cost.
b. only an external benefit.
c. both external costs and benefits.
d. no externalities.

14. Left unregulated, the equilibrium quantity is
a. 550.
b. 600.
c. 650.
d. 700.

15. The efficient level of output is
a. 550.
b. 600.
c. 650.
d. 700.

16. What can the government do so that the efficient amount is produced?
a. Subsidize suppliers $8 per unit.
b. Subsidize suppliers $2 per unit.
c. Tax suppliers $2 per unit.
d. Tax suppliers $8 per unit.

17. An unregulated market produces too ___ of a good with an external cost and too ___ of a good with an external benefit.
a. much; much
b. much; little
c. little; much
d. little; little

18. Which of the following is a possible government solution to the problem posed by a good with an external benefit?
a. Subsidize the production of the good.
b. Tax the production of the good.
c. Tax the consumption of the good.
d. All of the above are possible solutions.

19. Which of the following statements about knowledge is FALSE?
a. Knowledge can have an external benefit.
b. As a productive resource, knowledge might not be subject to diminishing productivity.
c. Intellectual property rights can help create incentives for accumulation of more knowledge.
d. Patents help create incentives for creating knowledge and do so without any cost.

20. Patents are a solution to the external
a. benefit from attending college.
b. benefit from discovering new knowledge.
c. cost from attending college.
d. cost from discovering new knowledge.

**Short Answer Problems**

**Figure 18.4**

**Short Answer Problem 1**

1. The figure above shows the market for lead. The production of lead creates pollution. What is the efficient quantity? If the market is left unregulated, what is the equilibrium quantity? How much is the deadweight loss and illustrate it in the figure.
2. Farmer Dave’s and farmer Mark’s farms are next to each other. They get along well so transactions costs are low. The only problem in their existence is Dave’s pig, Justin, who occasionally gets into Mark’s corn field and eats the corn. If Justin did not get into the corn, he would eat valueless garbage, not the corn. A fence can keep Justin out of the corn. Suppose that Justin eats $350 of corn per year and that to erect a fence to keep Justin off Mark’s farm costs $250 per year. Either Dave or Mark can erect the fence and, once the fence is in place, Justin eats none of the corn.

Property rights that allow Justin to roam, or that keep Mark’s farm free from Dave’s pig, have yet to be assigned.

a. Suppose that the property right is given to Dave, so that Justin can roam free any time he desires. Will Mark erect a fence?

b. Now suppose that the property right is given to Mark, so that he can charge Dave whenever Justin shows up on Mark’s farm and eats the corn. Will Dave erect a fence?

c. What general proposition is illustrated in this question?

3. Explain how a tax can be used to achieve efficiency in the face of external costs.

4. In a small town two factories — factory A and factory B — each produce 10 units of pollution so that the total pollution is 20 units. Factory A can decrease its pollution at a constant marginal cost of $50 per unit; factory B can reduce its pollution at a constant marginal cost of $100 per unit.

a. If both factories A and B decrease their pollution by 5 units, what is the total amount of pollution in the town and what is the total cost of reaching this level of pollution?

b. If factory A decreases its level of pollution by 10 units and factory B does not decrease its pollution, what is the total amount of pollution in the town and what is the total cost of achieving this level of pollution?

c. From a social standpoint, to reach a total of 10 units of pollution, which is more desirable: both factories cutting back by 5 units each or A cutting back by 10 units and B not cutting back? Why?

d. Suppose that the EPA determines that the efficient level of pollution is 10 units. The EPA introduces marketable permits and grants each firm 5 permits. Each permit allows the firm to produce 1 unit of pollution. What is likely to occur? In particular, will factory A or B want to sell its permits to the other factory and is the other factory willing to buy them? If there is a potential buyer and seller of the permits, what is the price range in which the permits will trade?

e. From a social standpoint, what have marketable permits accomplished?

5. At public colleges and universities, governments provide education at a price (tuition) less than cost. What economic argument supports the policy of charging students at public universities less than the full cost of their education?

6. Vaccination creates an external benefit and has no external costs. Use Figure 18.5 to illustrate the market for chicken pox vaccination. Label the doses that will be taken in the absence of any government intervention as \( Q_0 \) and label the efficient number of doses \( Q_1 \). How can the government move this market toward efficiency?

7. The first two columns of Table 18.2 (on the next page) give the demand schedule for education in Transylvania, and the third column gives the marginal private cost. Because education generates external benefits, the marginal social benefit shown in the last column is greater than marginal private benefit. Education creates no external costs.

a. What equilibrium price and quantity would result if the market for education is unregulated?
TABLE 18.2
Education in Transylvania

<table>
<thead>
<tr>
<th>Quantity (number of students)</th>
<th>Marginal private benefit (dollars)</th>
<th>Marginal private cost (dollars)</th>
<th>Marginal social benefit (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$500</td>
<td>$200</td>
<td>$800</td>
</tr>
<tr>
<td>2</td>
<td>400</td>
<td>250</td>
<td>700</td>
</tr>
<tr>
<td>3</td>
<td>300</td>
<td>300</td>
<td>600</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>350</td>
<td>500</td>
</tr>
<tr>
<td>5</td>
<td>100</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>450</td>
<td>300</td>
</tr>
</tbody>
</table>

b. What is the efficient quantity of students in Transylvania?

c. In an attempt to address the inefficient level of education in his nation, Igor — the newly appointed minister of education — has decided to provide a low-cost public university, Igor Omphesus (Igor’s middle name is Omphesus) Uni-

versity. To attain the efficient level of schooling, what must tuition be at the new university, I.O.U.?

d. What is the marginal cost of schooling the last student at this university?

You’re the Teacher

1. “I just don’t understand some of this stuff. I mean, even after the government taxes a product with pollution, there’s still an external cost. I mean, that’s got to mean that there’s some pollution, right? I mean, come on, pollution is bad; we don’t want any of it. I mean, the best level of pollution has to be zero, right?” Aside from having a severe “I mean” problem, this student also has a severe problem understanding that the efficient level of pollution is not zero. You probably can’t do anything about the “I mean” problem, but you should be able to help the student grasp why zero pollution is not desirable.
Answers

True/False Answers

Externalities in Our Lives
1. T Externalities can arise from both production and consumption and can be either positive or negative.
2. F Flu vaccination is a good example of a positive consumption externality.

Negative Externalities: Pollution
3. F The existence of negative production externality, such as pollution, means that the private marginal cost differs from the social marginal cost but has no effect on the demand. The demand for a clean environment continues to exist.
4. T The marginal social cost equals the marginal private cost plus the marginal external cost. So, if there is a marginal external cost then the marginal social cost is greater than the marginal private cost.
5. F The existence of external costs means that the private market produces more than the efficient amount of the good.
6. T The question essentially is the definition of the Coase theorem.
7. F If production of a good creates an external cost, to attain efficiency its production needs to be taxed, not subsidized.
8. T Both emission charges and marketable permits are methods the government can use to overcome the inefficiency from a negative production externality such as pollution.

Positive Externalities: Knowledge
9. T Knowledge has benefits that spill over to others, so knowledge has external benefits.
10. F The private market produces less than the efficient amount of a good with an external benefit.
11. T Left alone, the private market would produce less than the efficient amount of the good. A subsidy will increase the amount produced.
12. F Education has an external benefit, so the right policy is to subsidize, not tax, education.
13. T Patents are one method the government uses to overcome the problem of knowledge’s external benefit.

Multiple Choice Answers

Externalities in Our Lives
1. d Answer (d) is correct because an externality falls upon someone who is neither the producer nor consumer of the good or service.
2. c The party-goers are “consuming” the services of the party and they are inflicting an external cost on the neighbors.
3. d The bystanders are not the consumers of the cigarettes, so the harm that befalls them is an external cost.

Negative Externalities: Pollution
4. b Not widely recognized is the fact that for most substances, air pollution is becoming less of a problem.
5. b Because the MSC curve is above the MC curve, the figure indicates that paper production creates an external cost.
6. c The vertical distance between the MSC curve and the MC curve is the marginal external cost, which in this case is $2 per ton.
7. b In the absence of any intervention, the private market produces where the private demand curve (which is the same as the private marginal benefit curve) intersects the private supply curve (which is the same as the private marginal cost curve).
8. c Efficiency requires that production be the amount for which marginal social cost, MSC, equals marginal social benefit, MSB.
9. c The tax must shift the private MC curve until it is the same as the MSC curve. Imposing a $2 tax shifts the MC curve by the amount of the tax, $2, which is the amount desired. More generally, by imposing a tax equal to the marginal external cost, the new marginal private cost, which includes the tax, is the same as the marginal social cost.
10. c The Coase theorem shows that when transactions costs are low and the number of parties involved is small, to whom a property right is assigned makes no difference: The externality will be eliminated and the efficient level of production will result.
11. b Emission charges allow firms to pollute as long as they pay the fee for the pollution. Emission
challenges are common in Europe, but are less common in the United States.

12. d Imposing a tax equal to the marginal external cost sets the marginal private cost — which includes the tax — equal to the marginal social cost, thereby ensuring that the efficient amount of rubber will be produced.

**Positive Externalities: Knowledge**

13. b At any level of output, the marginal social benefit exceeds the marginal private benefit, which indicates that there must be an external benefit.

14. b The private market produces the level of output that equalizes the marginal private cost (the private supply curve) and the marginal private benefit (the private demand curve).

15. c Efficiency requires that the amount of the good produced equalize the marginal social cost and the marginal social benefit. In this case, efficiency requires that output be 650.

16. b If suppliers are granted a $2 per unit subsidy, the marginal private cost schedule drops by $2 at every unit of output. Hence to produce 650 units of output, the new marginal private cost becomes $6. This equals the marginal private benefit of 650 units, so the (new) equilibrium price is $6 and the quantity produced is the efficient amount, or 650 units.

17. b This answer summarizes the “bottom line” results about how externalities affect efficiency.

18. a Subsidies are a solution to the problem posed by an external benefit.

19. d Once a patent is granted, the holder becomes the monopoly owner of the resource. Monopolies create inefficiency by setting the price higher than the competitive level and this inefficiency is a cost of issuing a patent.

20. b New discoveries often may be used by many people, which is an externality from the point of view of the discoverer.

**Answers to Short Answer Problems**

1. The equilibrium quantity is 60 tons of lead, determined by the intersection of the demand and supply curves. The efficient quantity is 50 tons of lead, determined by the intersection of the marginal social benefit and marginal social cost curves. The deadweight loss is the triangle illustrated in Figure 18.6.

![Figure 18.6](image-url)

The area of the triangle is \(\frac{1}{2}(\text{base})(\text{height})\). The base is 10 tons of lead. The height is $2 per ton of lead, the difference between the marginal social cost of another ton of lead and the marginal benefit from another ton. So the deadweight loss is equal to \(\frac{1}{2}(10\ \text{tons})($2\ per\ \text{ton}) = $10\ million.\)

2. a. Farmer Mark will erect the fence. Doing so costs him $250 a year, but it saves him the $350 Justin would otherwise eat.

b. Farmer Dave will erect the fence. If he did not do so, Justin would eat $350 worth of corn, and Mark would bill Dave for the corn. Thus erecting the fence costs Dave $250 a year, but saves him $350.

c. These answers illustrate the Coase theorem. Erecting the fence is efficient because the cost to society of the fence, $250, is less than the benefit to society of the fence, $350 saved by preventing the pig from eating the corn. As the Coase theorem points out, regardless of whether Dave or Mark is given the property right, the fence is erected and Justin dines on valueless garbage rather than valuable corn.

3. The existence of external costs means that producers do not take into account all costs when deciding how much to produce. If a tax is levied that is exactly the amount of the external cost, the cost is no longer external. As a result, the producer takes it into account and so is induced to produce the efficient quantity.
4. a. The total amount of pollution is 10 units, 5 remaining units from factory A and 5 remaining units from factory B. The total cost of achieving this level of pollution is $750, the cost of $250 incurred by factory A plus the cost of $500 incurred by factory B.

b. The total amount of pollution (again) is 10 units, comprising no pollution from factory A and 10 units from factory B. The total cost of attaining this level of pollution is $500, all incurred by factory A.

c. From a social standpoint, having factory A decrease its pollution by 10 units and factory B do nothing is the most efficient because it has the lowest total social cost, $500 versus $750 for an equal reduction at each factory. Eliminating the 10 units of pollution by having only A cut back has inflicted the lowest possible total cost on society, which is a desirable outcome.

d. Factory A will sell its permits to factory B. This transaction will occur because decreasing its pollution is less expensive for factory A than it is for factory B. In particular, the price of a permit for a unit of pollution will range between $50 and $100. For any price greater than $50, factory A is willing to sell its permits and reduce its pollution because this transaction is profitable: The cost to A is $50 per unit of pollution eliminated but, as long as the price exceeds $50, factory A profits. Factory B is willing to buy permits for any price less than $100 because buying permits at this price reduces B’s costs. For each permit that B can buy, it saves $100 by not having to decrease its pollution. As long as the price of a permit is less than $100, buying the permits reduces B’s costs.

e. With marketable permits only factory A decreases its pollution. Factory B does not lower its pollution but instead buys permits from factory A. With marketable permits we obtain, as in part (c), the socially desirable outcome: Factory A decreases its pollution and factory B does not.

5. The economic argument is that education generates external benefits. In particular, when individuals are educated, society at large receives benefits beyond the private benefits that accrue to those choosing how much education to obtain. The presence of the external benefit means that in the absence of government intervention, the private sector would provide too little education for efficiency. Hence to attain efficiency in the market for education, the government provides below-cost education at public colleges and universities.

6. Figure 18.7 shows the market for chicken pox vaccine. Because there are no external costs, the marginal social cost curve equals the marginal private cost. This curve is labeled \( MC = MSC \) in the figure. It also is the private supply curve. However, the presence of the external benefit means that the marginal social benefit \( (MSB) \) curve lies right of the marginal private benefit curve, which is the same as the private demand curve (labeled \( MB = D \)). The vertical distance between the curves equals the marginal externality; that is, it is the additional (external) benefit to society over and above the benefit to the consumer. In the absence of government intervention, \( Q_0 \) is produced but the efficient amount is \( Q_1 \). To move this market closer to the efficient level of output, the government might subsidize production. This policy could take the form of paying producers to produce more vaccine. The aim is to shift the private supply curve rightward so that it intersects the private demand at output \( Q_1 \), the efficient amount, and price \( S \). Alternatively, the government might buy \( Q_1 \) worth of doses and then resell them to consumers below cost at price \( S \), the price necessary to induce consumers to buy \( Q_1 \) doses.
7. a. In an unregulated market, the equilibrium price and quantity are determined by the intersection of the marginal private benefit and cost curves because these are the market’s demand and supply curves, respectively. Thus the equilibrium price is $300, and the equilibrium quantity is 3 students.

b. Because there are no external costs, the efficient quantity is determined by the intersection of the marginal private cost and marginal social benefit curves. This result implies that efficiency is attained at a quantity of 5 students attending college.

c. Igor wants 5 students to attend his new university, I.O.U. Five students will attend only when the tuition is $100.

d. When 5 students attend the university, the marginal cost of the 5th student is $400. By charging the student only $100 in tuition, Igor apparently is losing money on this student. However, the loss is only apparent: Five students are the efficient level of education because the total marginal social benefit from the 5th student is $400, which equals the marginal cost of educating this student.

You’re the Teacher

1. “I agree with you that pollution is bad, but clearly to totally eliminate it isn’t optimal because it would cost way too much. Think about it this way: Society could get rid of all air pollution by outlawing all cars, all trains, all planes, shutting down all factories, and eliminating all cows. (Cows produce methane you know.) But, come on, you know we won’t do this and we don’t want to do it. The reason is immediate: It’s just too expensive.

“Sure, we’d like less pollution, but the cost to get to zero pollution is prohibitive — a whole lot more than the benefit! So, anyone that says ‘Zero pollution is best’ hasn’t thought through the issue. In fact, some pollution is good. We get to drive rather than walk, we get to have pizza delivered rather than doing without, we get to air condition our homes rather than perspire, and we get to heat our homes rather than freeze.”
1. An example of an activity with an external cost is
   a. planting flowers around a house.
   b. playing a CD very loud in an apartment.
   c. watching a movie in a theater.
   d. reading a textbook.
2. If a good has an external benefit, a market left unregulated will produce
   a. more than the efficient amount.
   b. the efficient amount.
   c. less than the efficient amount.
   d. an amount that may be more than, less than, or equal to the efficient amount depending on how large the external benefit is relative to the private benefit.
3. The relationship between marginal private cost (MC), marginal external cost, and marginal social cost (MSC) is
   a. $MC = MSC + \text{marginal external cost}$.
   b. marginal external cost $= MC + MSC$.
   c. $MSC = MC + \text{marginal external cost}$.
   d. None of the above answers is correct.
4. If production of a good creates an external cost, to move the economy closer to efficiency the government might
   a. subsidize production of the good.
   b. tax consumption of the good.
   c. remove the offending property right.
   d. None of the above actions move the economy closer to efficiency.
5. Resource use definitely is efficient when production is at the level such that marginal
   a. external cost equals marginal external benefit.
   b. private cost equals marginal private benefit.
   c. social cost equals marginal social benefit.
   d. external cost is zero and marginal external benefit is as large as possible.
6. Potential solutions to the negative production externality created by pollution include
   a. subsidizing the production of the good or using emissions charges.
   b. taxing the production of the good or using marketable permits.
   c. using marketable permits or issuing patents or copyrights.
   d. public provision by the government or using vouchers.
7. When a student makes a decision about how much schooling to acquire, the student considers only the
   a. private marginal benefits and private marginal costs.
   b. social marginal benefits and social marginal costs.
   c. marginal external benefits and marginal external costs.
   d. private marginal benefits and social marginal costs.
8. The private marginal benefit from a good is less than the social marginal benefit but the private marginal cost of the good equals the social marginal cost. As a result, the good _____ external benefits and ____ external costs.
   a. has; has
   b. has; has no
   c. has no; has
   d. has no; has no
9. To offset the externality from knowledge, governments use all of the following EXCEPT
   a. patents.
   b. copyrights.
   c. below-cost provision.
   d. taxes.
10. An external cost of a good is
    a. its total cost minus its consumer surplus.
    b. its total cost minus producer surplus.
    c. its total cost minus total surplus.
    d. any cost it imposes on people who do not buy it.

The answers for this Chapter Quiz are on page 368