## Self-Check Questions

[1](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idm9948688-solution).

Identify the following situations as an example of a negative or a positive externality:

1. You are a birder (bird watcher), and your neighbor has put up several birdhouses in the yard as well as planting trees and flowers that attract birds.
2. Your neighbor paints his house a hideous color.
3. Investments in private education raise your country’s standard of living.
4. Trash dumped upstream flows downstream right past your home.
5. Your roommate is a smoker, but you are a nonsmoker.

[2](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idp37271888-solution).

Identify whether the market supply curve will shift right or left or will stay the same for the following:

1. Firms in an industry are required to pay a fine for their carbon dioxide emissions.
2. Companies are sued for polluting the water in a river.
3. Power plants in a specific city are not required to address the impact of their air quality emissions.
4. Companies that use fracking to remove oil and gas from rock are required to clean up the damage.

[3](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idm7564448-solution).

For each of your answers to [Exercise 12.2](#fs-idp37271888), will equilibrium price rise or fall or stay the same?

[4](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idm11018080-solution).

[Table 12.5](#Table_12_04) provides the supply and demand conditions for a manufacturing firm. The third column represents a supply curve without accounting for the social cost of pollution. The fourth column represents the supply curve when the firm is required to account for the social cost of pollution. Identify the equilibrium before the social cost of production is included and after the social cost of production is included.

|  |  |  |  |
| --- | --- | --- | --- |
| Price | Quantity Demanded | Quantity Supplied without paying the cost of the pollution | Quantity Supplied after paying the cost of the pollution |
| $10 | 450 | 400 | 250 |
| $15 | 440 | 440 | 290 |
| $20 | 430 | 480 | 330 |
| $25 | 420 | 520 | 370 |
| $30 | 410 | 560 | 410 |

Table 12.5

[5](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idp49608800-solution).

Consider two approaches to reducing emissions of CO2 into the environment from manufacturing industries in the United States. In the first approach, the U.S. government makes it a policy to use only predetermined technologies. In the second approach, the U.S. government determines which technologies are cleaner and subsidizes their use. Of the two approaches, which is the command-and-control policy?

[6](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idp53675472-solution).

Classify the following pollution-control policies as command-and-control or market incentive based.

1. A state emissions tax on the quantity of carbon emitted by each firm.
2. The federal government requires domestic auto companies to improve car emissions by 2020.
3. The EPA sets national standards for water quality.
4. A city sells permits to firms that allow them to emit a specified quantity of pollution.
5. The federal government pays fishermen to preserve salmon.

[7](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idm47024320-solution).

An emissions tax on a quantity of emissions from a firm is not a command-and-control approach to reducing pollution. Why?

[8](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idp168952928-solution).

Four firms called Elm, Maple, Oak, and Cherry, produce wooden chairs. However, they also produce a great deal of garbage (a mixture of glue, varnish, sandpaper, and wood scraps). The first row of [Table 12.6](#Table_12_07) shows the total amount of garbage (in tons) that each firm currently produces. The other rows of the table show the cost of reducing garbage produced by the first five tons, the second five tons, and so on. First, calculate the cost of requiring each firm to reduce the weight of its garbage by one-fourth. Now, imagine that the government issues marketable permits for the current level of garbage, but the permits will shrink the weight of allowable garbage for each firm by one-fourth. What will be the result of this alternative approach to reducing pollution?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Elm** | **Maple** | **Oak** | **Cherry** |
| **Current production of garbage (in tons)** | **20** | **40** | **60** | **80** |
| **Cost of reducing garbage by first five tons** | $5,500 | $6,300 | $7,200 | $3,000 |
| **Cost of reducing garbage by second five tons** | $6,000 | $7,200 | $7,500 | $4,000 |
| **Cost of reducing garbage by third five tons** | $6,500 | $8,100 | $7,800 | $5,000 |
| **Cost of reducing garbage by fourth five tons** | $7,000 | $9,000 | $8,100 | $6,000 |
| **Cost of reducing garbage by fifth five tons** | $0 | $9,900 | $8,400 | $7,000 |

Table 12.6

[9](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idp114002128-solution).

The rows in [Table 12.7](#Table_12_09) show three market-oriented tools for reducing pollution. The columns of the table show three complaints about command-and-control regulation. Fill in the table by stating briefly how each market-oriented tool addresses each of the three concerns.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Incentives to Go Beyond | Flexibility about Where and How Pollution Will Be Reduced | Political Process Creates Loopholes and Exceptions |
| Pollution Charges |  |  |  |
| Marketable Permits |  |  |  |
| Property Rights |  |  |  |

Table 12.7

[10](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idm15713664-solution).

Suppose a city releases 16 million gallons of raw sewage into a nearby lake. [Table 12.8](#Table_12_10) shows the total costs of cleaning up the sewage to different levels, together with the total benefits of doing so. (Benefits include environmental, recreational, health, and industrial benefits.)

|  |  |  |
| --- | --- | --- |
|  | Total Cost (in thousands of dollars) | Total Benefits (in thousands of dollars) |
| 16 million gallons | Current situation | Current situation |
| 12 million gallons | 50 | 800 |
| 8 million gallons | 150 | 1300 |
| 4 million gallons | 500 | 1650 |
| 0 gallons | 1200 | 1900 |

Table 12.8

1. Using the information in [Table 12.8](#Table_12_10), calculate the marginal costs and marginal benefits of reducing sewage emissions for this city. See [Production, Costs and Industry Structure](http://openstax.org/books/principles-microeconomics-3e/pages/7-introduction-to-production-costs-and-industry-structure) if you need a refresher on how to calculate marginal costs.
2. What is the optimal level of sewage for this city?
3. Why not just pass a law that firms can emit zero sewage? After all, the total benefits of zero emissions exceed the total costs.

[11](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idp33211776-solution).

The state of Colorado requires oil and gas companies who use fracking techniques to return the land to its original condition after the oil and gas extractions. [Table 12.9](#Table_12_12) shows the total cost and total benefits (in dollars) of this policy.

|  |  |  |
| --- | --- | --- |
| Land Restored (in acres) | Total Cost | Total Benefit |
| 0 | $0 | $0 |
| 100 | $20 | $140 |
| 200 | $80 | $240 |
| 300 | $160 | $320 |
| 400 | $280 | $380 |

Table 12.9

1. Calculate the marginal cost and the marginal benefit at each quantity (acre) of land restored. See [Production, Costs and Industry Structure](http://openstax.org/books/principles-microeconomics-3e/pages/7-introduction-to-production-costs-and-industry-structure) if you need a refresher on how to calculate marginal costs and benefits.
2. If we apply marginal analysis, what is the optimal amount of land to be restored?

[12](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idp51747376-solution).

Consider the case of global environmental problems that spill across international borders as a prisoner’s dilemma of the sort studied in [Monopolistic Competition and Oligopoly](http://openstax.org/books/principles-microeconomics-3e/pages/10-introduction-to-monopolistic-competition-and-oligopoly). Say that there are two countries, A and B. Each country can choose whether to protect the environment, at a cost of 10, or not to protect it, at a cost of zero. If one country decides to protect the environment, there is a benefit of 16, but the benefit is divided equally between the two countries. If both countries decide to protect the environment, there is a benefit of 32, which is divided equally between the two countries.

1. In [Table 12.10](#Table_12_15), fill in the costs, benefits, and total payoffs to the countries of the following decisions. Explain why, without some international agreement, they are likely to end up with neither country acting to protect the environment.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | * **Country B** |  |
|  |  | * Protect | * Not Protect |
| * **Country A** | * Protect |  |  |
|  | * Not Protect |  |  |

* Table 12.10

[13](http://openstax.org/books/principles-microeconomics-3e/pages/chapter-12#fs-idm84125904-solution).

A country called Sherwood is very heavily covered with a forest of 50,000 trees. There are proposals to clear some of Sherwood’s forest and grow corn, but obtaining this additional economic output will have an environmental cost from reducing the number of trees. [Table 12.11](#Table_12_17) shows possible combinations of economic output and environmental protection.

|  |  |  |
| --- | --- | --- |
| *Combos* | Corn Bushels (thousands) | Number of Trees (thousands) |
| **P** | 9 | 5 |
| **Q** | 2 | 30 |
| **R** | 7 | 20 |
| **S** | 2 | 40 |
| **T** | 6 | 10 |

Table 12.11

1. Sketch a graph of a production possibility frontier with environmental quality on the horizontal axis, measured by the number of trees, and the quantity of economic output, measured in corn, on the vertical axis.
2. Which choices display productive efficiency? How can you tell?
3. Which choices show allocative efficiency? How can you tell?
4. In the choice between T and R, decide which one is better. Why?
5. In the choice between T and S, can you say which one is better, and why?
6. If you had to guess, which choice would you think is more likely to represent a command-and-control environmental policy and which choice is more likely to represent a market-oriented environmental policy, choice Q or S? Why?