CHAPTER 2
Modeling the Market Process: A Review of the Basics

TRUE-FALSE

1.   Producers' decisions are modeled through the demand function, and consumers' decisions are captured by the supply function.

        Answer: F

2.   Two characteristics of a private good are rivalry in consumption and excludability.

        Answer: T

3.   A change in price results in a shift in the demand curve.

        Answer: F

4.   The demand price represents the consumer's willingness to pay for the good.

        Answer: T

5.   Conventionally, the graph of demand uses the inverse form of the demand function, which is $P = f(Q_D)$.

        Answer: T

6.   Market demand for a private good is found by vertically summing individual demands.

        Answer: F

7.   The supply curve is positively sloped because marginal cost (MC) rises with output (Q).

        Answer: T

8.   If $Q_S = -10 + \frac{1}{2} P$, the slope of supply, when conventionally graphed, is $+\frac{1}{2}$.

        Answer: F

9.   Equilibrium price is the price level at which Q_D equals Q_S.

        Answer: T

10.   If the price level is such that quantity supplied exceeds quantity demanded, there is excess demand, or a shortage in the market.

        Answer: F

11. Cost-effectiveness requires that resources are allocated such that the additional benefits to society are equal to the additional costs.

   Answer: F

12. Assume that the marginal revenue associated with the 12th unit of output is $25 and the marginal cost is $14. As a result, the firm should produce more, because the marginal profit at that output level is greater than zero.

   Answer: T

13. When a profit-maximizing firm increases output to $Q = 50$, its $MR = \$100$ and $MC = \$124$, meaning that total profit falls by $24, so the firm should contract production.

   Answer: T

14. In perfect competition, the firm faces a perfectly inelastic demand.

   Answer: F

15. The demand faced by the perfectly competitive firm is perfectly elastic, meaning that price and marginal revenue are equal.

   Answer: T

16. If a market is perfectly competitive, allocative efficiency is achieved at the point where the profit-maximizing firm produces.

   Answer: T

17. If a firm maximizes output from a stock of available resources, it must be achieving allocative efficiency.

   Answer: F

18. Consumer surplus is the net gain to the firm measured as the excess of price over the marginal cost of production summed over all units sold.

   Answer: F

19. If a consumer is willing to pay more for a good than he/she actually must pay, he/she enjoys a gain for that unit of output known as consumer surplus.

   Answer: T

20. The sum of the change in consumer surplus plus the change in producer surplus is called deadweight loss to society.

   Answer: T

MULTIPLE CHOICE

1.   A competitive market is characterized by

a.   the absence of entry barriers
b.   many buyers with a single seller
c.   imperfect information
d.   a differentiated product

        Answer: a.

2.   If the market for a good or service is competitive,

a.   there are many independent buyers and sellers
b.   buyers and sellers have no control over price
c.   there are no entry barriers
d.   all of the above

        Answer: d.

3.   Which of the following is NOT a characteristic of a private good?

a.   rivalry in consumption
b.   benefits of consumption are nonexcludable
c.   consumption of the good precludes consumption by another individual
d.   the benefits to a consumer of consuming the good are exclusive to that individual

        Answer: b.

4.   According to the theory of demand,
a.   a change in the consumer's income or wealth changes the entire demand relationship
b.   the consumer's willingness to pay is also called the demand price
c.   demand price measures the marginal benefit (*MB*) of consuming another unit of the good
d.   a change in product price changes quantity demanded
e.   all of the above

        Answer: e.

5.   Horizontal summing of individual demands yields

a.   the market demand for a private good
b.   the market supply of a private good
c.   the market demand for a public good
d.   the market supply of a public good

        Answer: a.

6.	If the demand for recycled plastic is specified as $Q_D = 100 - 2.5P$, the slope of demand, as conventionally graphed, is

a.	−2.5	b.	−0.4	c.	+100	d.	none of the above

Answer:	b.

7.	If market demand for solar panels is specified as $Q_D = 100 - 2.5P$, the vertical intercept of demand, as conventionally graphed, is

a.	+100	b.	−100	c.	−2.5	d.	+40

Answer:	d.

8.	If supply in the market for air filters is specified as $Q_S = 24 + 3P$, then, when conventionally graphed,

a.	the vertical intercept is +24
b.	the slope of the supply curve is +3
c.	the horizontal intercept is +3
d.	none of the above

Answer:	d.

9.	According to the Law of Supply,

a.	price and quantity supplied are positively related, *c.p.*
b.	firms produce less output as the price of the product rises, *ceteris paribus*
c.	marginal cost rises as the firm contracts production
d.	there is an inverse relationship between output and price, holding all else constant

Answer:	a.

10.	The supply curve is positively sloped because

a.	profit levels always rise with output
b.	*MC* rises as *Q* rises, so firms must charge a higher *P* as *Q* increases
c.	as *Q* increases, *TC* rises proportionately faster than *Q*, so price must rise with output
d.	none of the above
e.	both b. and c. are correct

Answer:	e.

11. Market supply for a private good is found by

a. vertically summing all market prices for a given quantity
b. horizontally summing the quantity decisions of producers at each and every price
c. adding the price-quantity pairs for all units sold
d. none of the above

Answer: b.

12. Suppose that in the market for bottled water, the market supply is $Q_S = 14 + 20P$ and the market demand is $Q_D = 74 - 10P$, then equilibrium price is

a. $2   b. $54   c. $6   d. none of the above

Answer: a.

13. Assume that in the market for bottled water, the market supply is $Q_S = 14 + 20P$ and the market demand is $Q_D = 74 - 10P$. This means that the equilibrium quantity is

a. 2   b. 54   c. 6   d. none of the above

Answer: b.

14. Assume that the market demand for organic tomatoes is modeled as $Q_D = 104 - 2P$ and market supply is $Q_S = 20 + 4P$. If the actual price is set at $20 per pound, there is a
_____ of _____ units of the good.

a. surplus;   36   c. shortage;   10
b. surplus;   26   d. none of the above

Answer: a.

15. Allocative efficiency in a market means that resources are appropriated such that

a. the additional social benefits outweigh the additional social costs
b. the additional social benefits outweigh the additional private benefits
c. the marginal social benefits are equal to the marginal social costs
d. the marginal social benefits are greater than the marginal social costs

Answer: c.

16. Marginal revenue is defined as

a. the accumulated revenue associated with production
b. $\Delta TR/\Delta Q$

c. the change in profit associated with another unit of output produced

d. $\Delta TC/\Delta Q$

Answer: b.

17. Marginal cost is defined as

a. $\Delta Q/\Delta TC$ b. TC/Q c. $\Delta TC/\Delta Q$ d. Q/TC

Answer: c.

18. If a firm is maximizing profit, it produces at the point where

a. $MR > MC$ b. $MR = MC$ c. $TR > TC$ d. $TR = TC$

Answer: b.

19. If a perfectly competitive firm is a profit-maximizer, it produces where

a. $MR > MC$ b. $P > MR$ c. $P = MC$ d. $TR = TC$

Answer: c.

20. If a firm is producing at an output level such that the MR is $550 and the MC is $780,

a. the firm incurs a total loss of $230
b. the firm should contract production because marginal profit is less than zero
c. $M\pi$ is +$230
d. the firm should expand its output level because its total revenue is rising by $550

Answer: b.

21. Suppose that a company produces at a point where its MR is $430 and its MC is $105, this implies that

a. the firm earns a total profit of $325 at that output level
b. the firm's total costs are rising faster than its total revenue
c. the firm's total profit is rising, suggesting that the firm should expand production
d. each unit of output generates an average profit of $325

Answer: c.

22. If a firm makes production decisions such that it achieves maximum output from a fixed stock of resources, this means that this firm is
a. achieving allocative efficiency   c. earning a normal profit
b. earning a positive economic profit   d. technically efficient

Answer: d.

23. If demand for clean water is specified as $P = 140 - 2Q$, and the market price is $40, then consumer surplus at that price level is

a. $2500   b. $3000   c. $1600   d. $50

Answer: a.

24. Suppose that a producer's supply curve is estimated to be $P = 15 + 3Q$ and that the product is sold at $P = $45. At this price level, the firm's producer surplus is

a. $2250   b. $150   c. $300   d. $10

Answer: b.

25. The deadweight loss associated with a policy change is measured as

a.   the maximum value of consumer surplus
b.   the sum of consumer surplus and producer surplus associated with the new policy
c.   the excess of producer surplus over consumer surplus
d.   the sum of Δ consumer surplus plus Δ producer surplus associated with the new policy

Answer: d.

SHORT PROBLEMS

1. Consider the market for a Procter and Gamble biodegradable detergent. Suppose that market demand is $Q_D = 120 - 3P$, and market supply is $Q_S = -50 + 2P$, where P is the price per case and Q is the quantity in thousands per week.

a. Find equilibrium quantity and price.

b. What is the value of consumer surplus (*CS*) and producer surplus (*PS*) at equilibrium?

c. If each case of detergent were sold at $30, determine the amount of the shortage or surplus that would result.

Solution

1a. Equilibrium price for the bio-degradable detergent occurs at the point where $Q_D = Q_S$. Therefore, set the demand and supply equations equal to one another and solve as follows:

|			
Equilibrium:	Q_D	$=$	Q_S
Substituting:	$120 - 3P$	$=$	$-50 + 2P$
Solving:	$5P$	$=$	170
	P_E	$=$	$34 per case

Substituting P_E into either equation gives equilibrium output, Q_E:

$$Q_E = 120 - 3(34) = 18 \text{ thousand cases}$$

or: $\qquad Q_E = -50 + 2(34) = 18 \text{ thousand cases}$

b. *CS* is calculated as the area of the triangle between demand and the market price, and *PS* is the area of the triangle between supply and the market price. Sketching a graph makes the calculation more apparent, as shown below. Note that when labeling vertical intercepts for the supply and demand equations, it is easier to first write each equation in inverse form, i.e., $P = f(Q)$. In this case, the inverse demand equation is $P = 40 - \frac{1}{3}Q_D$ and the inverse supply equation is $P = 25 + \frac{1}{2} Q_S$.

See graph below.
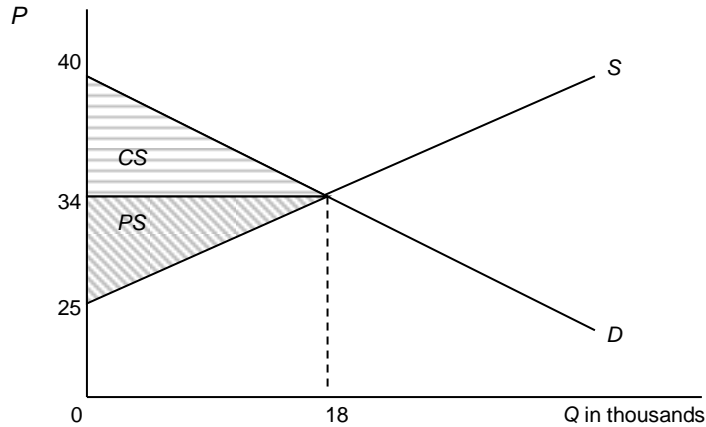
Now, it's a simple matter to calculate the areas of each triangle.

$$CS = \tfrac{1}{2} * base * height = \tfrac{1}{2} * 18 * 6 = \$54 \text{ thousand}$$

$$PS = \tfrac{1}{2} * base * height = \tfrac{1}{2} * 18 * 9 = \$81 \text{ thousand}$$

c.   If each case of detergent were sold at \$30, the quantity demanded would be $Q_D = 120 - 3(30) = 30$ thousand cases, while the quantity supplied would be $Q_S = -50 + 2(30) = 10$. Since Q_D exceeds Q_S, there is a shortage equal to $Q_D - Q_S = 30 - 10 = 20$ thousand cases of detergent. *(Be able to illustrate this graphically.)*

2.   In the competitive market for organic corn, market demand is $\boldsymbol{Q_D = 340 - 2P}$ and market supply is $\boldsymbol{Q_S = 100 + 4P}$, where P is the price per bushel, and Q is market output in thousands of bushels. Each individual farmer faces a marginal cost function of $\boldsymbol{MC = 10 + 3q}$, where q is the single farmer's output level in thousands.

a.   What is the equation for the demand (which is also MR) faced by the individual farmer?

b.   Based on your answer to part (a), find the profit-maximizing output level for each farmer.

c.   At an output level of 8 thousand bushels, explain in terms of both marginal profit and total profit why the individual farmer should expand production.

Solution

2a.   The individual competitive farm must accept the market-determined price of organic corn as given. This is the equilibrium or market-clearing price found where $Q_D = Q_S$ for the entire market, as shown below.

$$Q_D \quad = \quad Q_S$$

Substituting: $\quad 340 - 2P \quad = \quad 100 + 4P$

Solving: $\quad\quad\quad 6P \quad = \quad 240$, or $P = \$40$ per bushel.

Since the competitive firm has no control over price, it faces a horizontal demand curve at the \$40 price, so the equation for demand (and MR) it faces is simply $P = MR = \$40$.

b. The profit-maximizing output level for each farmer is found where $MR = MC$. Find the result as follows:

$$MR \quad = \quad MC$$

Substituting: $\quad 40 \quad = \quad 10 + 3q$

Solving: $\quad\quad 3q \quad = \quad 30$, or $q = 10$ thousand bushels

c. At an output level of 8 thousand bushels, the farm's $MR = \$40$, but its $MC = 10 + 3(8) = \$34$. At this point, the farmer's _marginal_ profit ($M\pi$), which equals $MR - MC$, is \$6, which means that if the farm produces the 8000th bushel of organic corn, its _total_ profit would rise by \$6.

CASE STUDY

CASE 2.1:   THE MARKET FOR RECYCLED NEWSPRINT

The amount of trash generated in the United States has risen from 88.1 million tons in 1960 to 243.0 million tons in 2009. Of this tonnage, approximately 28.2 percent is paper and paperboard. In a logical move, many communities established paper recycling programs in the 1980s. The first step was to encourage individuals and firms to bring paper wastes to collection centers. According to EPA data, as shown in the accompanying table, this recovery stage has met with some success.

Types of Paper Waste	Percent Recovered			
	1980	1990	2000	2009
Containers and packaging	16.1	26.0	38.1	47.8
Newspaper	27.3	38.0	59.0	88.1
Books	8.3*	10.3	19.4	33.3
Magazines	---	10.6	31.8	53.8
Office papers	21.8	26.5	55.1	74.2

*The 8.3 in 1980 represents books *and* magazines, which were reported in the aggregate prior to 1990.

Although these data suggest that society responded responsibly, they belie a very real problem. Many communities failed to recognize the need to create a market for recovered materials. This was precisely the problem that arose during the late 1980s and continued into the 1990s. The result was insufficient demand for recovered newspapers, and the excess supply sent the price of used newsprint plummeting.

To correct the problem, it was necessary to stimulate market demand. Virtually all levels of government took an active role. A number of state governments passed laws requiring newspapers to be partly printed on recycled paper. At the federal level, President Clinton signed Executive Order 12873, calling for all printing and writing paper to contain at least 20 percent recovered paper. (This amount was subsequently raised to 30 percent in Executive Order 13101.) The EPA established clearinghouses and hotlines to bring together suppliers and demanders of recyclables. Added influences were the thriving domestic economy and the rising demand of developing nations, whose growth required new sources of paper inputs.

Taken together, market demand eventually swamped existing supplies, and in 1995, there was a shortage of recycled newsprint. Just as predicted by economic theory, the shortage placed upward pressure on price, which rose to between $100 and $200 per ton. The boom in the market was temporary, however. By 1996, excess supplies and falling demand drove prices back to the $20 per ton level of the early 1990s.

Such volatility is characteristic of this market and continues through the present day. As a case in point, assume that the market demand for recycled newsprint in 2011 is $Q_D = 200 - 2P$ and that market supply is $Q_S = -150 + 5P$, where P is the price per ton and Q is the quantity in thousands of tons per year.

1. Based on these equations, determine the equilibrium quantity (Q_E) and price (P_E) of recycled newsprint.

2. Graphically illustrate the recycled newsprint market based on the supply and demand equations given. Provide numerical labels, including the values derived in Question 1.

3. Suppose that as a consequence of market changes, the selling price of recycled newspaper is $35 per ton. At this price level, is the market in an equilibrium, shortage, or surplus condition? Be sure to support with specific values.

4. Based on the market condition you determined in Question 3, what do you expect will happen to the price of recycled newsprint?

Sources: U.S. EPA, Office of Solid Waste (December 2010), Table 1, p. 36; Table 16, p. 82; Reidy (July 24, 1996); "Newspaper Recycling Booming," (July 11, 1995).

Solution

1. Equilibrium price for the recycled newsprint occurs where $Q_D = Q_S$. Therefore, set the demand and supply equations equal to one another and solve as follows:

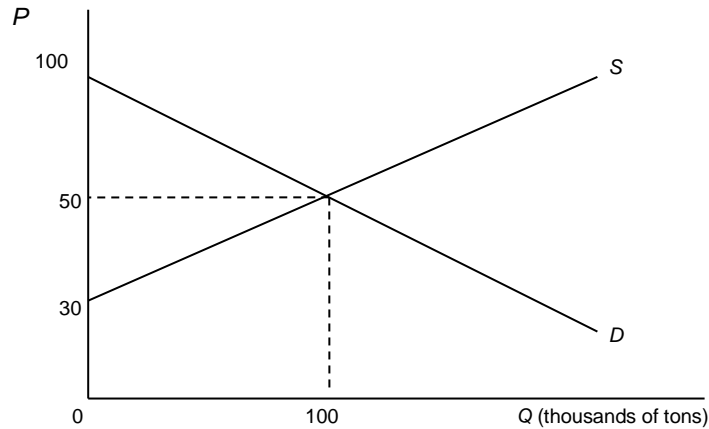 | | | | |
    |---|---|---|---|
    | Equilibrium: | Q_D | $=$ | Q_S |
    | Substituting: | $200 - 2P$ | $=$ | $-150 + 5P$ |
    | Solving: | $7P$ | $=$ | 350 |
    | | P_E | $=$ | $50 per ton |

    Substituting P_E into either equation gives equilibrium output, Q_E:

    $$Q_E = 200 - 2(50) = 100 \text{ thousand tons per year}$$

    or: $$Q_E = -150 + 5(50) = 100 \text{ thousand tons per year}$$

2.   The graph of this market is as follows:

3.   If the market price per ton of recycled newsprint is \$35, the quantity demanded would be Q_D = 200 − 2(35) = 130 thousand tons, while the quantity supplied would be Q_S = −150 + 5(35) = 25 thousand tons. Since Q_D exceeds Q_S, there is a shortage equal to Q_D− Q_S = 130 − 25 = 105 thousand tons. *(Be able to illustrate this graphically.)*

4.   Because a market price of \$35 per ton produces a shortage in the recycled newsprint market, we would expect upward pressure on the price per ton.

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