

# Chapter 11 PERFECT COMPETITION

## Key Concepts

### ■ Competition

**Perfect competition** is an industry with many firms, each selling an identical good; many buyers; no restrictions on entry into the industry; no advantage for existing firms over new firms; and sellers and buyers are well informed about prices.

Perfect competition occurs when the minimum efficient scale of a firm is small relative to demand. The minimum efficient scale of a firm is the smallest quantity of output at which the long-run average total cost is at its lowest level.

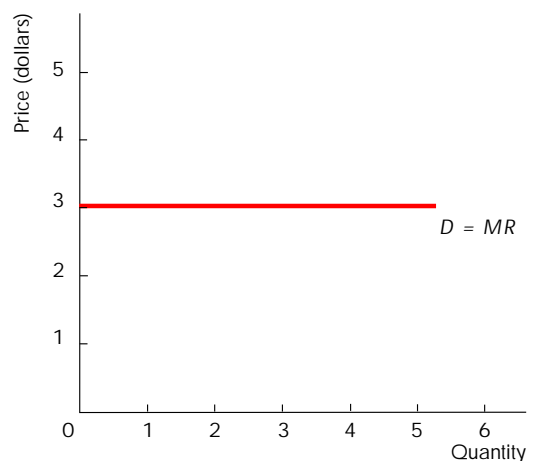
- ◆ Each perfectly competitive firm is a **price taker**, that is, it cannot affect the price of the good.
- ◆ The *market* demand curve slopes downward. But each *firm* faces a horizontal — perfectly elastic — demand curve at the going price. Such a demand curve is illustrated in Figure 11.1.

Economic profit equals total revenue minus total opportunity cost. Part of the opportunity cost is a normal profit, the return the firm's entrepreneur can obtain in an alternative business. **Total revenue** equals the price of the output times the number sold,  $TR = P \times q$ , with  $P$  the price and  $q$  the amount the firm produces.

- ◆ **Marginal revenue,  $MR$** , equals the change in total revenue from a one-unit increase in the quantity sold. In terms of a formula,  $MR = (\Delta TR)/\Delta q$ .
- ◆ In perfect competition  $P = MR$ . So, as illustrated in Figure 11.1, a perfectly competitive firm's  $MR$  curve is the same as its demand curve and both are horizontal at the market-determined price.

FIGURE 11.1

Perfectly Competitive Firm's Demand Curve



### ■ The Firm's Decisions in Perfect Competition

In the short run, each firm must decide:

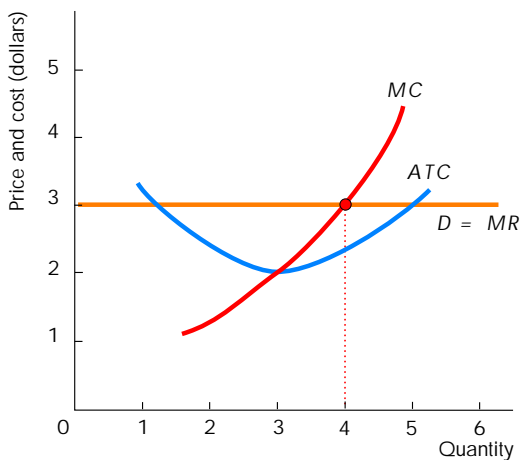
- ◆ whether to produce or to shut down.
- ◆ if it produces, how much to produce.

In the long run, the firm must decide:

- ◆ whether to change its plant size.
- ◆ whether to enter or exit an industry.

To maximize its profit in the short run, the firm produces the quantity of output at which  $MR = MC$ . This result is illustrated in Figure 11.2 (on the next page), where the firm maximizes its profit by producing 4 units. In Figure 11.2, the price of the product is \$3, the (given) price.

FIGURE 11.2

**A Perfectly Competitive Firm's Output**

Maximizing profit by setting  $MR = MC$  is an example of marginal analysis: As long as  $MR > MC$ , producing an extra unit of output adds to the firm's total profit.

In the short run, perfectly competitive firms can make an economic profit, a normal profit, or an economic loss:

- ◆  $P > ATC$  — the firm earns an economic profit. (This case is illustrated in Figure 11.2.)
- ◆  $P = ATC$  — the firm earns a normal profit and zero economic profit. (The firm breaks even.)
- ◆  $P < ATC$  — the firm incurs an economic loss.

A firm incurring economic losses must decide whether to shut down temporarily:

- ◆ If  $P > AVC$ , the firm continues to produce.
- ◆ If  $P < AVC$ , the firm shuts down temporarily. The **shutdown point** is the output and price for which total revenue just equals total variable cost and is reached when  $P$  equals the minimum  $AVC$ .

A perfectly competitive firm's supply curve is its  $MC$  curve above the minimum  $AVC$ . The **short-run industry supply curve** shows the quantity supplied by the industry at each price when the number of firms and their plant size is fixed. The short-run industry supply curve is the sum of the amounts supplied by each firm.

### ■ Output, Price, and Profit in Perfect Competition

The equilibrium market price and industry equilibrium level of output are determined by the industry demand

and supply curves. The number of firms in the industry, and their size, is fixed in the short run. In the long run, the number of firms in the industry, and their size can adjust.

Changes in the market demand affect the price and thereby the firms' profits. The presence of an economic profit means that as time passes new firms enter the industry; the presence of an economic loss means that eventually some existing firms exit. When firms earn a normal profit, there is no incentive to enter or exit.

- ◆ Economic profits bring entry by new firms. The industry supply curve shifts rightward and reduces the market price. The fall in price reduces economic profit and decreases the incentive to enter the industry. New firms enter until it is no longer possible to earn an economic profit.
- ◆ Economic losses lead to exit by existing firms, which shifts the industry supply curve leftward. The price rises, and the higher price reduces economic losses. Firms exit until no firms incur an economic loss.

Firms change their plant size if it increases their profits.

FIGURE 11.3

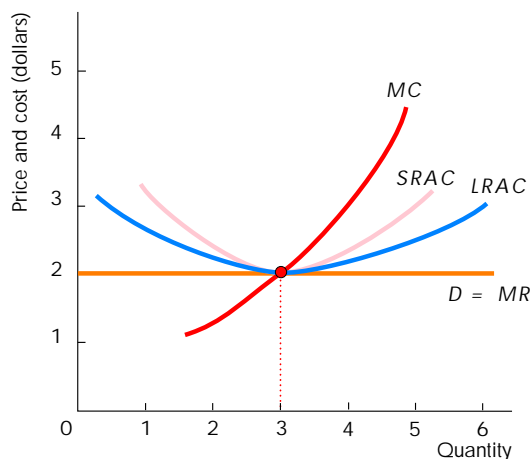
**Long-Run Equilibrium**

Figure 11.3 illustrates a firm in long-run competitive equilibrium. Three conditions are satisfied:

- ◆  $MR (= P) = MC$  — the firm maximizes its profits.
- ◆  $P =$  minimum short-run average cost ( $SRAC$ ) — the firm's economic profit is zero.
- ◆  $P =$  minimum  $LRAC$  — the firm's plant size cannot be changed in order to increase its profits.

### ■ Changing Tastes and Advancing Technology

A permanent decrease in demand leads to adjustments:

- ◆ The price falls. Each firm reduces its output, so the industry output decreases.
- ◆ Firms incur economic losses, so some exit the industry. Exit shifts the industry supply curve leftward, so the price rises and industry quantity decreases.
- ◆ The price eventually rises to eliminate economic losses. At this point, firms no longer exit and long-run equilibrium is established.

If there are **external economies**, factors beyond the control of an individual firm that lower its costs as the industry output expands, a decrease in demand means that the long-run equilibrium market price is higher than the initial price before the decrease in demand. If there are **external diseconomies**, factors beyond the control of an individual firm that raise its costs as industry output increases, the long-run equilibrium price is lower than the initial price. The **long-run industry supply curve** shows how the quantity supplied by an industry varies with changes in the market price after all adjustments have been made.

Technological change also creates adjustments:

- ◆ New technology lowers firms' costs and increases their supply. The industry supply curve shifts rightward, lowering the market price and increasing industry output.
- ◆ Firms that do not adopt the new technology incur economic losses and exit the industry.
- ◆ All firms, in the long run, use the new technology and earn only a normal profit.

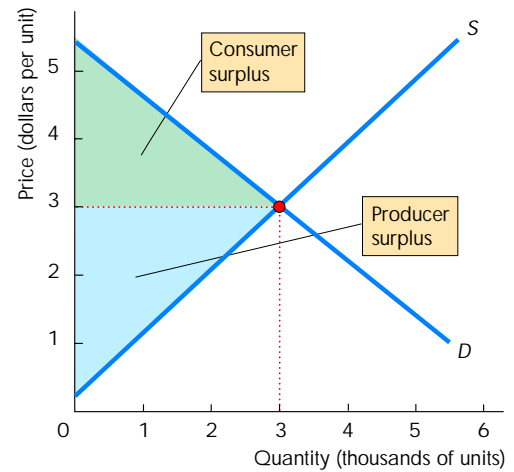
### ■ Competition and Efficiency

Resources are used efficiently when we produce the goods and services valued most highly. When resources are used efficiently, no one can be made better off without making someone else worse off.

- ◆ Consumers' demands reflect their efforts to get the most value from their incomes. The demand curve is consumers' marginal benefit curve.
- ◆ Producers' supplies reflect the firms' efforts to maximize their profits. The supply curve is producers' marginal cost curve.

If there are no **external benefits** (benefits that accrue to people other than the buyer of the good) and no **exter-**

FIGURE 11.4  
The Efficient Level of Output



**nal costs** (costs not borne by the producer of the good or service) perfect competition is efficient. Figure 11.4 shows an efficient use of resources. The production of 3,000 units sets the quantity demanded equal to the quantity supplied and so sets the marginal benefit equal to the marginal cost.

The presence of external costs or benefits, monopoly, or public goods, can lead to inefficiency.

## Helpful Hints

1. **WHY STUDY PERFECT COMPETITION?** Although perfectly competitive markets are rare in the real world, there are three important reasons for developing a thorough understanding of their behavior. First, many markets closely *approximate* perfect competition. This chapter gives direct and useful insights into the behavior of these markets. Second, the theory of perfect competition allows us to isolate the effects of competitive forces that are at work in all markets, even in those that do not match the assumptions of perfect competition. Third, the perfectly competitive model serves as a useful benchmark for evaluating the efficiency of different market structures.
2. **THE PROFIT MAXIMIZATION RULE,  $MR = MC$ :** Profit maximization requires producing where  $MR = MC$ , which might seem odd. Producing where  $MR > MC$  might seem more reasonable be-

cause this situation apparently implies that the business is making a profit. However, this line of thought is wrong.

A firm maximizes its *total* profit. To meet this objective, the firm produces any unit of output for which the revenue from the unit exceeds the cost of producing the unit. Why? If the revenue from the unit (the marginal revenue,  $MR$ ) is greater than the cost of producing it (the marginal cost,  $MC$ ) the unit adds to the firm's *total* profit. Some units add more to the profit — those with  $MR$  much greater than  $MC$  — and others add less — those with  $MR$  only slightly larger than  $MC$  — but as long as producing the unit of output adds to the total profit, the firm produces it. Comparing the additional revenue from a unit to its additional costs (using marginal analysis) shows that the firm passes up profit if it produced so that  $MR > MC$ . Only by producing the quantity that sets  $MR = MC$  does the firm not forego some profit, so only at this level of output does the firm maximize its total profit.

3. **WHY OPERATE WITH ZERO ECONOMIC PROFIT?** Why does a firm continue to operate even though its economic profit is zero? The key to this result rests in the definition of cost. Recall that the company's total costs are all its *opportunity* costs, which include both explicit and implicit costs. Among the implicit costs is the normal profit, the return the owners can earn on the average in an alternative business. When total revenue equals total cost, so that there is zero economic profit, the owners are earning the same profit they could obtain elsewhere. At this point, the firm earns a "normal profit." As the phrase implies, a normal profit is one that could normally be earned in any other industry. Even though the economic profit is zero, by earning a normal profit the firm is earning just as much profit as it could anywhere else and its owners therefore are content to continue producing in the same industry.

## Questions

### ■ True/False and Explain

#### Competition

- In a perfectly competitive industry many firms produce very similar but slightly different products.
  - The minimum efficient scale of a firm is the smallest level of output at which the long-run average total cost is at its minimum.
  - In a perfectly competitive industry, no single firm can significantly affect the price of the good.
  - The market demand curve in a perfectly competitive industry is horizontal.
  - A perfectly competitive firm must decide what price to charge for its goods.
- The Firm's Decisions in Perfect Competition**
- If it does not shut down, to maximize its profit a perfectly competitive firm produces the level of output that sets  $MR = MC$ .
  - If  $P > ATC$ , the firm is incurring an economic loss.
  - If the price is below a firm's minimum  $ATC$ , it immediately shuts down.
  - A perfectly competitive firm's supply curve shows the quantities of output supplied at alternative prices as long as the firm earns an economic profit.
  - A perfectly competitive firm's supply curve is its  $ATC$  curve.
- Output, Price, and Profit in Perfect Competition**
- A perfectly competitive firm can earn an economic profit, a normal profit, or incur an economic loss in the short run.
  - A perfectly competitive firm can earn an economic profit, a normal profit, or incur an economic loss in the long run.
  - Firms exit an industry whenever they cannot earn an economic profit.
  - A firm making zero economic profit makes no profit at all.
  - In the long run, a perfectly competitive firm produces at the minimum  $LRAC$ .
- Changing Tastes and Advancing Technology**
- In the short run, a permanent increase in demand results in firms earning an economic profit.
  - In the long run, a permanent increase in demand results in firms earning an economic profit.
  - In a perfectly competitive industry with external diseconomies, a change in demand always results in a higher price.

19. New technology raises firms' costs and so causes all firms to incur an economic loss in the short run.

**Competition and Efficiency**

- 20. Efficient use of resource occurs when making someone better off must make someone else worse off.
- 21. The total gains from trade equal the sum of consumer surplus plus producer surplus.
- 22. Perfect competition always results in an efficient use of resources.

**Multiple Choice**

**Competition**

- 1. Which of the following is NOT a characteristic of a perfectly competitive industry?
  - a. A downward-sloping market demand curve.
  - b. A perfectly elastic demand for each firm.
  - c. Each firm decides its quantity of output.
  - d. Each firm produces a good slightly different from that of its competitors.
- 2. Of the following, which is a perfect competitor?
  - a. AT&T, one of the three major providers of long distance telephone service in the United States.
  - b. The company that provides your local cable TV service.
  - c. A tomato grower living in Florida.
  - d. DeBeers, the provider of more than 80 percent of the rough diamonds in the world.

Use Table 11.1 for the next question.

**TABLE 11.1**  
**Multiple Choice Question 3**

Quantity	Price (dollars)
100	5.00
101	5.00

- 3. Using Table 11.1, what is the marginal revenue from selling 101 units of output rather than 100?
  - a. \$5
  - b. \$500
  - c. \$505
  - d. \$0

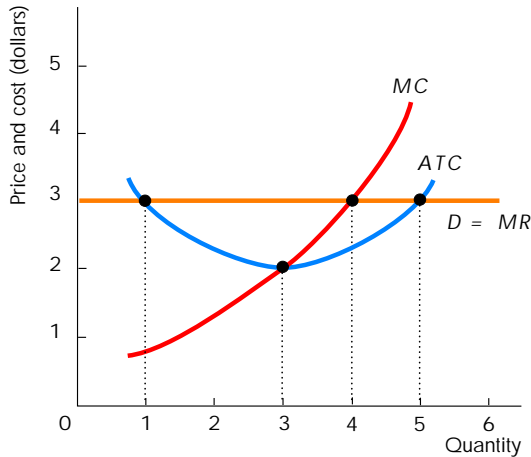
- 4. For a perfectly competitive firm,  $MR$  always equals
  - a.  $ATC$ .
  - b.  $P$ .
  - c.  $AVC$ .
  - d. none of the above because  $MR$  is not always equal to the same thing.

**The Firm's Decisions in Perfect Competition**

- 5. Paul runs a shop that sells printers. Paul's business is a perfect competitor and can sell each printer for a price of \$500. The marginal cost of selling one printer a day is \$300, the marginal cost of selling a second printer is \$400, and the marginal cost of selling a third printer is \$550. To maximize his profit, Paul should sell
  - a. one printer a day.
  - b. two printers a day.
  - c. three printers a day.
  - d. more than three printers a day.
- 6. Which of the following is necessarily true when a perfectly competitive firm is in short-run equilibrium?
  - a.  $MR = MC$ .
  - b.  $P = \text{minimum } LRAC$ .
  - c.  $P = ATC$ .
  - d. All of the above are true at short-run equilibrium.
- 7. The wage rate a firm must pay rises, so its marginal costs rise. But its demand curve does not change. As a result, the firm \_\_\_\_ the amount it produces and \_\_\_\_ its price.
  - a. decreases; raises
  - b. increases; lowers
  - c. decreases; does not change
  - d. increases; raises
- 8. In the short run, a perfectly competitive firm can
  - a. earn an economic profit.
  - b. earn a normal profit.
  - c. incur an economic loss.
  - d. All of the above answers are possible.
- 9. A perfectly competitive firm is definitely suffering an economic loss when
  - a.  $MR < MC$ .
  - b.  $P > ATC$ .
  - c.  $P < ATC$ .
  - d.  $P > AVC$ .

FIGURE 11.5

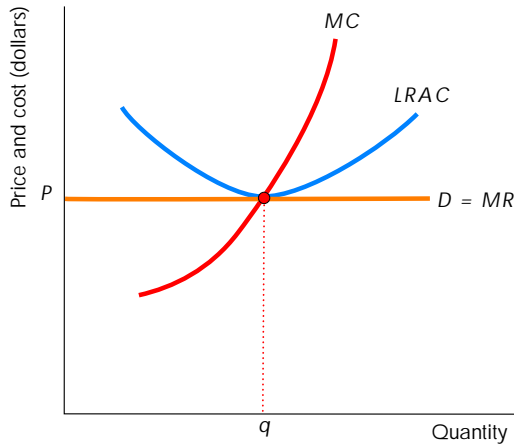
## Multiple Choice Questions 10 and 11



10. The firm illustrated in Figure 11.5 will produce how much output?
- 1 unit
  - 3 units
  - 4 units
  - 5 units
11. The firm illustrated in Figure 11.5 is
- earning an economic profit.
  - earning a normal profit.
  - incurring an economic loss.
  - in long-run equilibrium.
12. If a perfectly competitive firm is incurring an economic loss, it
- always shuts down immediately.
  - continues to operate until either the price rises or its costs fall so that it no longer has an economic loss.
  - shuts down if  $P > AVC$ .
  - shuts down if  $P < AVC$ .
13. For prices below the minimum average variable cost, a perfectly competitive firm's supply curve is
- horizontal at the market price.
  - vertical at zero output.
  - the same as its marginal cost curve.
  - the same as its average variable cost curve.
14. The short-run industry supply curve is
- the sum of the quantities supplied by all the firms.
  - undefined because the number of firms is constant in the short run.
  - vertical at the total level of output being produced by all firms.
  - horizontal at the current market price.
- Output, Price, and Profit in Perfect Competition**
15. In the short run, which of the following is FALSE?
- Perfectly competitive firms can possibly earn an economic profit.
  - The number of firms is fixed.
  - To maximize its profit, a perfectly competitive firm produces enough output so that  $MR = MC$ .
  - Perfectly competitive firms always produce at the minimum  $ATC$ .
16. When will new firms want to enter an industry?
- When  $MR = MC$  for the existing firms in the industry.
  - Any time the price of the good has risen.
  - When the new firms can earn economic profits.
  - When there are external economies.
17. Suppose that firms in a perfectly competitive industry are earning economic profits. Over time,
- other firms enter the industry so that the price rises and economic profits fall.
  - some firms leave the industry so that both the price and economic profits rise.
  - other firms enter the industry so that both price and economic profits fall.
  - nothing happens because there are no incentives for change.
18. In the long run, a perfectly competitive firm can
- earn an economic profit.
  - earn a normal profit.
  - incur an economic loss.
  - All of the above are possible.

FIGURE 11.6

**Multiple Choice Question 19**



19. In Figure 11.6, the firm is producing  $q$ . Producing  $q$ 
  - a. cannot be the long-run equilibrium because the firm is not maximizing its profit.
  - b. cannot be the long-run equilibrium because the firm is earning an economic profit.
  - c. cannot be the long-run equilibrium because the firm is incurring an economic loss.
  - d. is the long-run equilibrium.
20. Which of the following is true when a perfectly competitive firm is in long-run equilibrium?
  - a.  $MR = MC$ .
  - b.  $P = \text{minimum } LRAC$ .
  - c.  $P = ATC$ .
  - d. All of the above conditions are true.

**Changing Tastes and Advancing Technology**

21. If demand for a good decreases permanently, in the short run the price
  - a. falls and each firm produces more output to make up for the lower price.
  - b. falls and, as long as the price remains above the firms' average variable cost, each firm produces less output.
  - c. does not change, but some firms shut down because less is demanded.
  - d. does not change because each firm produces less output.

22. If firms in an industry are incurring an economic loss, then as some exit, the price \_\_\_\_ and the surviving firms' economic losses \_\_\_\_\_.
  - a. rises; do not change
  - b. rises; become smaller
  - c. falls; become larger
  - d. falls; become smaller
23. The term "external economies" refers to the
  - a. case in which the firm's marginal cost curve slopes downward as more output is produced.
  - b. situation in which the firm's average total cost curve shifts upward as more output is produced.
  - c. fact that a firm's average total cost curve has a negative slope at low levels of output.
  - d. situation in which an increase in an industry's output lowers the costs of the firms in the industry.
24. In a market with no external economies nor external diseconomies, following a decrease in demand, the price falls more in the \_\_\_\_ and the quantity decreases more in the \_\_\_\_\_.
  - a. short run; short run
  - b. short run; long run
  - c. long run; short run
  - d. long run; long run
25. If there are external diseconomies in an industry, after a permanent increase in demand, in the long run the price
  - a. is higher than initially.
  - b. is the same as initially.
  - c. is lower than initially.
  - d. might be higher or lower, depending on whether the firms are earning economic profits.
26. New technology in an industry means that
  - a. all firms in the industry permanently earn economic profits regardless of whether they adopt the technology.
  - b. firms that adopt the new technology permanently earn economic profits.
  - c. firms that do not adopt the new technology permanently earn economic profits.
  - d. firms that adopt the new technology temporarily earn economic profits.

### Competition and Efficiency

27. Which of the following is NOT necessary for a perfectly competitive industry to be efficient?
- The presence of external benefits.
  - Firms are economically efficient.
  - The sum of consumer surplus plus producer surplus is as large as possible.
  - All of the above answers are necessary for an industry to be efficient.
28. Resource use is efficient when
- the goods and services produced are those that are most highly valued.
  - it is impossible to make someone better off without making someone else worse off.
  - production is such that marginal benefit equals marginal cost.
  - All of the above answers are correct.
29. Which of the following statements is true?
- If there are no external benefits, a competitive market is cannot use its resources efficiently.
  - Resource use is efficient when marginal benefit exceeds marginal cost by as much as possible.
  - In a perfectly competitive market, at the efficient level of output the price equals consumers' marginal benefit and producers' marginal cost.
  - All of the above are all true statements.
30. Which of the following is NOT an obstacle to efficiency?
- External benefits or external costs.
  - Monopoly.
  - Competition.
  - Public goods.

### Short Answer Problems

- Why will a firm in a perfectly competitive industry choose not to charge a price either above or below the equilibrium price?
- Rudy runs a rutabaga farm. Rudy relishes the idea of maximizing his profit, so he must decide how many acres to farm. He receives a price of \$2,000 per ton of rutabagas grown. Table 11.2 shows Rudy's total cost and total revenue for different amounts of tons grown.
  - Based on Table 11.2, how many tons of rutabagas should Rudy farm? What is his total economic profit?

TABLE 11.2

**Rudy's Total Cost and Revenue**

Quantity (tons)	Total cost (dollars)	Total revenue (dollars)
1	1,000	2,000
2	2,500	4,000
3	5,000	6,000
4	8,500	8,000
5	13,000	10,000
6	18,500	12,000

- Complete Table 11.3, which gives Rudy's marginal cost and marginal revenue schedules. Note that both marginal costs and marginal revenues relate to changes in production, so they are located between the quantities of tons grown. That is, the first marginal cost and marginal revenue figures apply to the cost and revenue of changing from 1 ton grown to 2 tons.

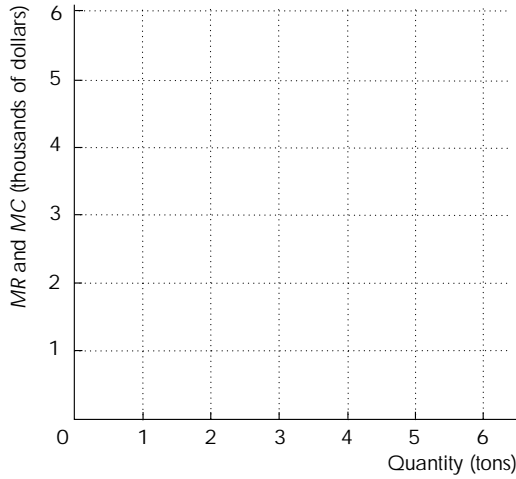
TABLE 11.3

**Rudy's Marginal Cost and Revenue**

Quantity (tons)	Marginal cost (dollars)	Marginal revenue (dollars)
1	—	—
2	—	—
3	—	—
4	—	—
5	—	—
6	—	—

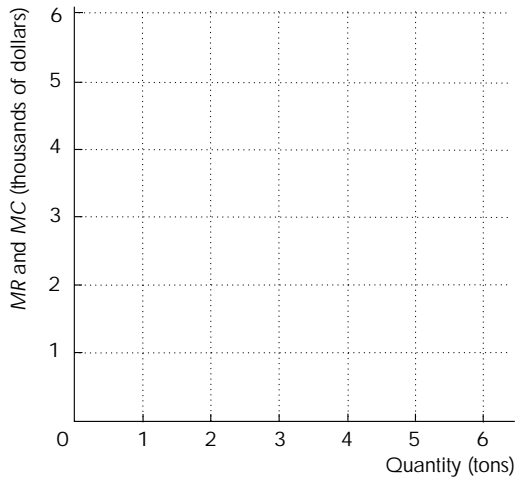
- Based on Table 11.3, in Figure 11.7 (on the next page), draw Rudy's marginal cost and marginal revenue curves.
- Based on Table 11.3 and Figure 11.6, how many tons should Rudy grow? Why?
- Are your answers to parts (a) and (d) different?

**FIGURE 11.7**  
**Rudy's *MC* and *MR***



3. a. More people decide that they like french fried rutabagas. As a result, the revenue from growing rutabagas rises to \$4,000 a ton. Rudy's costs do not change from those in Table 11.2. Draw Rudy's new *MC* and *MR* curves in Figure 11.8.
- b. How does Rudy respond to the rise in the price of a rutabaga?
- c. If all rutabaga farmers have the same cost schedule as Rudy's, does your answer in part (b) represent the long-run equilibrium? Why?

**FIGURE 11.8**  
**Rudy's New *MC* and *MR***



**TABLE 11.4**  
**Samantha's Sweater Shop**

Quantity (sweaters sold per day)	Total variable cost (dollars)	Total cost (dollars)
1	40	100
2	60	120
3	90	150
4	130	190
5	180	240
6	240	300

**TABLE 11.5**  
**Samantha's Average and Marginal Costs**

Quantity (sweaters sold per day)	Average variable cost (dollars)	Average total cost (dollars)	Marginal cost (dollars)
1	—	—	—
2	—	—	—
3	—	—	—
4	—	—	—
5	—	—	—
6	—	—	—

4. a. Table 11.4 presents total costs at Samantha's Sweater Shop, a perfectly competitive firm. Use these cost figures to complete Table 11.5.
- b. In Figure 11.9 draw Samantha's *MC* curve.

**FIGURE 11.9**  
**Samantha's *MC* Curve and Supply Curve**

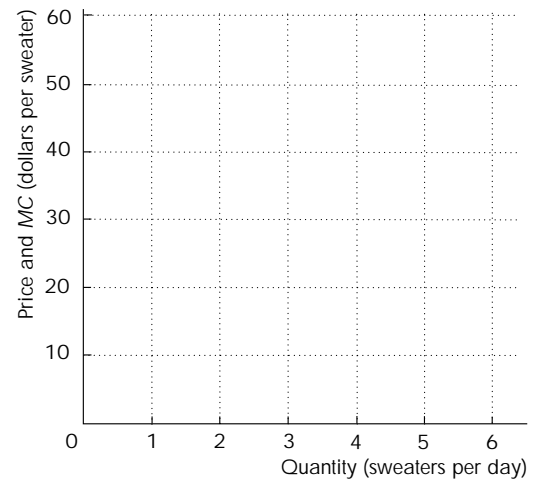


TABLE 11.6

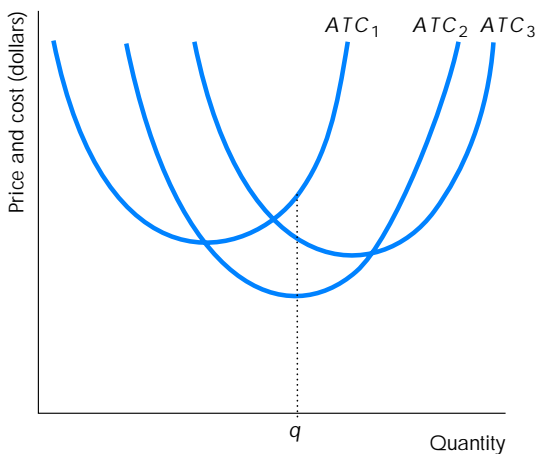
## Samantha's Supply Curve

Price (dollars per sweater)	Quantity (sweaters per day)
25	—
35	—
45	—
55	—

- c. Use the costs from Table 11.5 and the graph in Figure 11.9 to determine Samantha's supply schedule in Table 11.6.
- d. Draw Samantha's supply curve in Figure 11.9.
5. a. Draw a diagram illustrating the case of a perfectly competitive firm that is earning an economic profit. In the diagram, show the amount of the economic profit.
- b. In a diagram, show the case of a perfectly competitive firm that is earning only a normal profit, that is, it is not incurring an economic loss nor making an economic profit.
- c. Draw a diagram to illustrate the case of a perfectly competitive firm that is incurring an economic loss but is continuing to operate. Be sure to include the  $AVC$  curve. Show the amount of the economic loss.

FIGURE 11.10

## Short Answer Problem 6



6. A firm can use three levels of capital. Figure 11.10 shows the  $ATC$  curves for each level;  $ATC_1$  uses

the least amount of capital,  $ATC_2$  the next least, and  $ATC_3$  the most. For these three amounts of capital, carefully draw the firm's  $LRAC$ .

The level of output indicated by  $q$  can be produced by using all three levels of capital. In the long run, which amount of capital will the firm use to produce this level of output?

7. A perfectly competitive industry is at long-run equilibrium. Then there is a permanent decrease in demand for the industry's good. The industry has no external economies or diseconomies. How does the industry adjust to its new long-run equilibrium? Be sure to discuss what happens to the companies' profits and the number of firms in the industry. Also draw two diagrams showing what happens to the price and quantity during the adjustment process.
8. Why will economic profits be zero at long-run equilibrium in a perfectly competitive industry? Be sure to mention the roles played by economic profits and losses.
9. Wheat farming is a perfectly competitive industry with no external costs nor external benefits. Draw a figure showing the wheat market and identify the amount wheat that uses resources efficiently.

### You're the Teacher

1. "I really don't get why a perfectly competitive firm wants to produce so that  $MR = MC$ . I mean, the goal of the firm is to earn the most profit possible. Why does it produce so that  $MR = MC$ ? I think that it ought to want to produce so that  $MR > MC$ ; that is, so that revenues exceed costs and it earns a profit." This student is making a fundamental error. Correct the student's analysis.
2. "You know, one thing that seems weird about this chapter is the claim that a business will operate even though it's losing money. I'd think that the moment a business started to incur an economic loss, unless there was some chance that the loss would be reversed in the future, the business would shut down." This student is right: A business operating even though it incurs an economic loss *does* seem weird. Can you explain why this situation happens?

## Answers

### ■ True/False Answers

#### Competition

1. **F** In a perfectly competitive industry, each of the many firms produces an identical product.
2. **T** The question gives the definition of the minimum efficient scale.
3. **T** Each firm is a price taker.
4. **F** The *firm's* demand curve is horizontal, but the *market* demand curve slopes downward.
5. **F** A perfectly competitive firm is a price taker, for instance, a wheat farmer who can charge only the going price for the wheat grown.

#### The Firm's Decisions in Perfect Competition

6. **T** Produce the level of output so that  $MR = MC$  is the rule followed to maximize profits.
7. **F** If  $P < ATC$ , the firm suffers an economic loss.
8. **F** If  $P < ATC$ , the firm suffers an economic loss but it continues to operate as long as  $P > AVC$ .
9. **F** The supply curve shows the amount that will be produced regardless of whether the firm earns an economic profit or not.
10. **F** The firm's supply curve is its  $MC$  curve above its  $AVC$  curve.

#### Output, Price, and Profit in Perfect Competition

11. **T** In the short run, depending on market demand and the firm's costs, a perfectly competitive firm can earn an economic profit, incur an economic loss, or earn a normal profit.
12. **F** In the long run, the process of entry and exit means that a perfectly competitive firm earns only a normal profit.
13. **F** Even if they do not earn an economic profit, firms remain in the industry as long as they earn a normal profit.
14. **F** A firm making zero economic profit earns a profit equal to what its owners would earn elsewhere in the best alternative business.
15. **T** In the long run, the overwhelming competition within a perfectly competitive industry forces each firm to produce as efficiently as possible.

#### Changing Tastes and Advancing Technology

16. **T** The increase in demand raises the price of the product, thereby allowing the firms producing it to earn an economic profit.
17. **F** The short-run economic profit from the increase in demand attracts new firms, and as the new firms produce more output, the price falls and the economic profit is eliminated.
18. **F** An increase in demand results in a higher price, but a decrease in demand results in a lower price.
19. **F** Firms that adopt the new technology lower their costs and earn a temporary economic profit.

#### Competition and Efficiency

20. **T** This statement conveys the general meaning of efficiency.
21. **T** Efficiency occurs when the total gains from trade are as large as possible.
22. **F** Perfect competition results in an efficient use of resources if there are no external benefits or external costs.

### ■ Multiple Choice

#### Competition

1. **d** In perfect competition, each firm produces a good identical to that of its competitors.
2. **c** The other possibilities describe industries with only a few firms, so they cannot be perfectly competitive firms.
3. **a**  $MR = (\Delta TR)/\Delta q$  so in this case  $MR = (\$505 - \$500)/(101 - 100) = \$5$ . More directly, for a perfectly competitive firm, marginal revenue equals price.
4. **b** Because a perfectly competitive firm can always sell another unit of output at the going market price, the market price is the firm's marginal revenue.

#### The Firm's Decisions in Perfect Competition

5. **b** The second printer adds \$100 to Paul's total profit, so it will be sold; however, the third printer would lower Paul's total profit by \$50, so it will not be sold.
6. **a** The condition  $MR = MC$  is necessary for the firm to be maximizing its profit.

7. **c** When the marginal costs rise, the  $MC$  curve shifts upward. In response, the firm decreases the amount it produces. The firm's demand curve did not change, which indicates that the (market) price is constant.
8. **d** In the short run, any type of profit or loss is possible, so that the firm might earn an economic profit, a normal profit, or incur an economic loss.
9. **c** When  $P < ATC$ , the firm incurs an economic loss.
10. **c** The firm produces the level of output so that  $MR = MC$ , 4 units of output.
11. **a** The price, \$3, exceeds the average total cost of producing 4 units of output, so the firm earns an economic profit.
12. **d** As long as  $P > AVC$ , the firm's losses are smaller if it operates than if it shuts down.
13. **b** At prices below the minimum average variable cost, the firm shuts down and produces zero.
14. **a** At any price, the quantity supplied by the industry equals the sum of the quantities that all the firms supply.

#### Output, Price, and Profit in Perfect Competition

15. **d** In the long run, perfectly competitive firms produce at the minimum  $ATC$ , but that is not necessarily the case in the short run.
16. **c** The possibility of earning an economic profit leads to entry into the industry.
17. **c** The entry of new firms lowers the price and economic profits, thereby driving the industry toward its long-run equilibrium.
18. **b** Free entry and exit into the industry mean that only a normal profit is possible in the long run.
19. **d** Figure 11.6 illustrates the long-run equilibrium for a perfectly competitive firm.
20. **d**  $MR = MC$  means that the firm is maximizing its profit;  $P = \text{minimum } LRAC$  occurs because competition forces firms to produce as efficiently as possible;  $P = ATC$  means that the firm is earning only a normal profit.

#### Changing Tastes and Advancing Technology

21. **b** When the price falls, each firm moves down its  $MC$  curve and produces less. This response — each firm producing less — accounts for the re-

duction in the quantity supplied along the market supply curve when the price falls.

22. **b** Firms continue to leave as long as they incur an economic loss, thereby driving the price higher and reducing the survivors' economic losses.
23. **d** Answer (d) defines external economies.
24. **b** In the short run, both the price and quantity fall, and firms incur an economic loss. The economic loss means that firms leave the industry and as the supply decreases, the price rises from its initial fall, but the amount of the industry output continues to decrease.
25. **a** The diseconomies mean that, as the industry expands its output, firms' costs rise. As a result, in the long run the price, which equals the (higher) average total cost, is higher than it was initially.
26. **d** New technology creates economic profits, giving firms the incentive to adopt the technology. The increased competition from these firms ultimately eliminates the economic profit.

#### Competition and Efficiency

27. **a** Presence of external benefits means that a perfectly competitive industry will not be efficient.
28. **d** All the answers correctly characterize an efficient use of resources.
29. **c** Efficiency is achieved when  $P = MB = MC$ .
30. **c** Competition increases the likelihood that a market uses resources efficiently because, as we see in the next chapter, the lack of competition usually leads to inefficiency.

#### Answers to Short Answer Problems

1. If a firm in a perfectly competitive industry charged a price even slightly higher than the going equilibrium market price, it would lose all of its sales. So, it will not charge a price above the equilibrium price. Because it can sell all it wants at the going price, the firm would not be able to increase its sales by lowering its price. So, the firm will not charge a price below the market price because such a lower price would decrease its total revenue and thereby decrease its profits.
2. a. Table 11.2 shows that Rudy's profit-maximizing quantity of rutabagas is 2 tons. Rudy's economic profit when growing 2 tons of rutabagas is \$1,500 (Rudy's total revenue of \$4,000 minus

his total cost of \$2,500). This amount exceeds his economic profit at any other level of production.

TABLE 11.7

Short Answer Problem 2 (b)

Quantity (tons)	Marginal cost (dollars)	Marginal revenue (dollars)
1	1,500	2,000
2	2,500	2,000
3	3,500	2,000
4	4,500	2,000
5	5,500	2,000
6		

- b. Table 11.7 shows the marginal cost and marginal revenue schedules. Marginal cost is defined as  $(\Delta TC)/\Delta q$ , with  $\Delta TC$  the change in total cost and  $\Delta q$  the change in quantity. The marginal cost from 1 to 2 tons grown equals  $(\$2,500 - \$1,000)/(2 - 1)$ , or \$1,500. Marginal revenue can be calculated two ways. First, for a perfectly competitive firm, marginal revenue equals price. Hence marginal revenue is \$2,000. Alternatively, the definition of marginal revenue is  $(\Delta TR)/\Delta q$ , where  $\Delta TR$  is the change in total revenue. Using this formula, the marginal revenue from 1 to 2 tons is  $(\$4,000 - \$2,000)/(2 - 1) = \$2,000$ .
- c. Figure 11.11 shows the *MC* and *MR* curves.
- d. Table 11.7 shows that Rudy should grow 2 tons of rutabagas. The marginal cost of increasing from 2 tons to 3 tons is \$2,500, which exceeds the marginal revenue of the increase. So increasing from 2 to 3 tons would reduce Rudy's profit. Similarly, Figure 11.11 shows that the marginal revenue and marginal cost curves intersect at 2 tons, also indicating that Rudy should grow 2 tons of rutabagas.
- e. The answers in parts (a) and (d) are the same: Rudy grows 2 tons of rutabagas. Note the important point that the analysis based on *marginal* revenue and cost, in part (d), gives the same answer as the analysis based on *total* revenue and cost, in part (a).

FIGURE 11.11  
Short Answer Problem 2 (c)

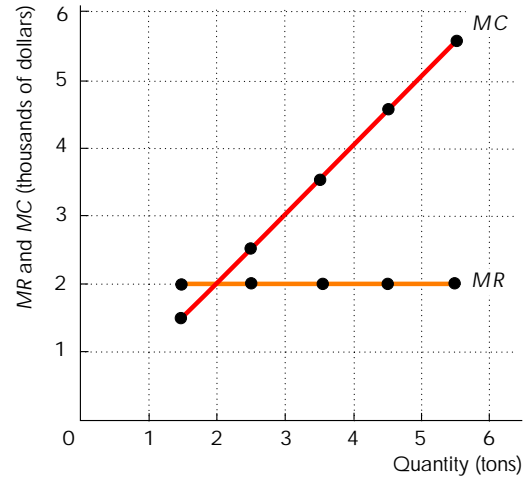
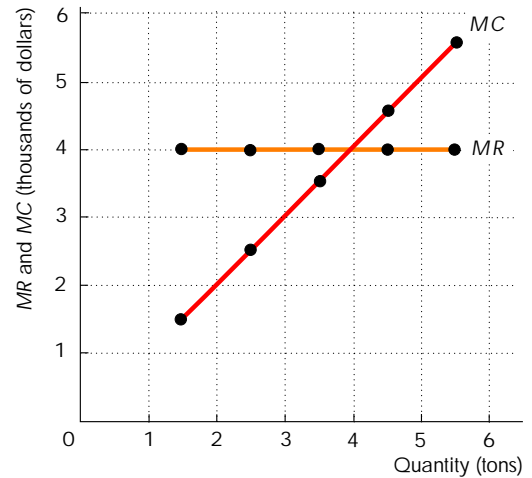


FIGURE 11.12  
Short Answer Problem 3 (a)



- 3. a. Figure 11.12 shows Rudy's new *MR* curve. The marginal cost curve does not change from before. Rudy's marginal revenue equals the price of a ton of rutabagas. The rise in the price to \$4,000 shifts Rudy's *MR* curve (which is the same as Rudy's demand curve) upward to \$4,000.
- b. As Figure 11.12 shows, with the higher price for a ton of rutabagas, Rudy increases the quantity of rutabagas he grows to 4 tons.
- c. The answer in part (b) cannot be the long-run equilibrium. When Rudy grows 4 tons of ruta-

bagas, his total revenue is \$16,000 and his total cost (from Table 11.2) is \$8,500. Rudy is earning an economic profit of \$7,500. The presence of an economic profit attracts new farmers to the rutabaga market. As new farmers begin to grow rutabagas, the market supply curve for these vegetables shifts rightward, lowering the price of a ton of rutabagas and eliminating some of the economic profit. New farmers continue to enter and the price of a rutabaga continues to fall as long as an economic profit exists. Only when the economic profit is entirely eliminated is the long-run equilibrium attained.

TABLE 11.8

Short Answer Problem 4 (a)

Quantity (sweaters sold per day)	Average variable cost (dollars)	Average total cost (dollars)	Marginal cost (dollars)
1	40.00	100.00	20.00
2	30.00	60.00	30.00
3	30.00	50.00	40.00
4	32.50	47.50	50.00
5	36.00	48.00	60.00
6	40.00	50.00	

4. a. Table 11.8 contains Samantha’s average costs and marginal cost. Average variable cost equals  $(TVC)/q$ , where  $TVC$  is total variable cost and  $q$  is quantity. Hence average variable cost when Samantha sells 3 sweaters a day is  $\$90/3$  or  $\$30$ . Average total cost is computed in a similar fashion, namely  $(TC)/q$ , with  $TC$  total cost. So for the sale of 3 sweaters per day, average total cost is  $\$150/3$  or  $\$50$ . Finally, marginal cost is  $(\Delta TC)/\Delta q$ . Hence the marginal cost of going from 2 to 3 sweaters sold per day is  $(\$150 - \$120)/(3 - 2)$  or  $\$30$ .
- b. Figure 11.13 shows the  $MC$  curve.
- c. Table 11.9 contains Samantha’s supply schedule. The supply curve is the same as her marginal cost curve above the average variable cost curve.

FIGURE 11.13  
Short Answer Problem 4 (b)

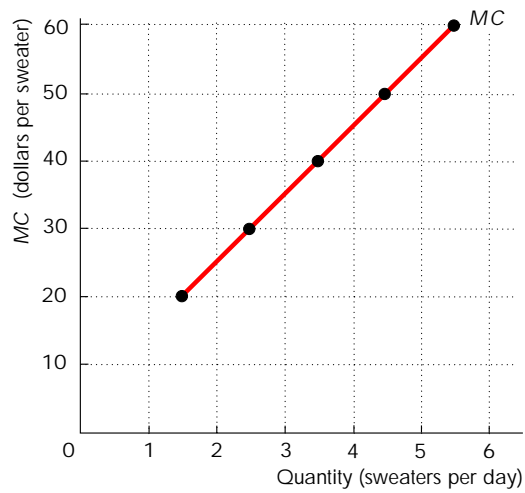


TABLE 11.9

Short Answer Problem 4 (c)

Price (dollars per sweater)	Quantity supplied (sweaters per day)
25	0
35	3
45	4
55	5

- So when the price of a sweater is \$25, Figure 11.13 shows that Samantha would supply 2 sweaters except for the fact that this price is below the average variable cost. Hence when the price is \$25, Samantha shuts down and does not supply any sweaters. At \$35, Figure 11.13 shows that Samantha supplies 3 sweaters. Because this price is above her average variable cost, Samantha supplies 3 sweaters. The rest of Samantha’s supply curve is obtained from Figure 11.13 in a similar manner.
- d. Figure 11.14 (on the next page) shows Samantha’s supply curve. At prices above \$30, that is, at prices above the minimum average variable cost, the supply curve is identical to Samantha’s marginal cost curve. For prices below \$30, Samantha supplies no sweaters.

FIGURE 11.14  
Short Answer Problem 4 (d)

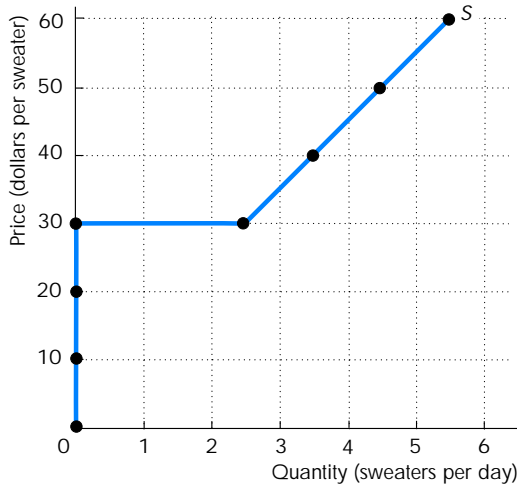


FIGURE 11.15  
Short Answer Problem 5 (a)

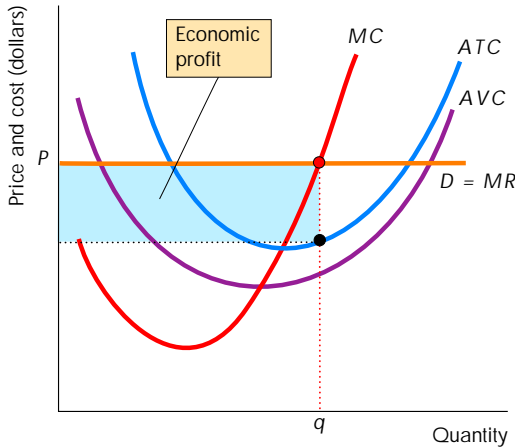


FIGURE 11.16  
Short Answer Problem 5 (b)

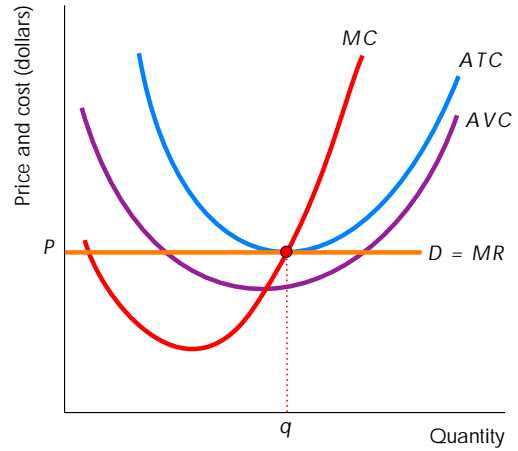
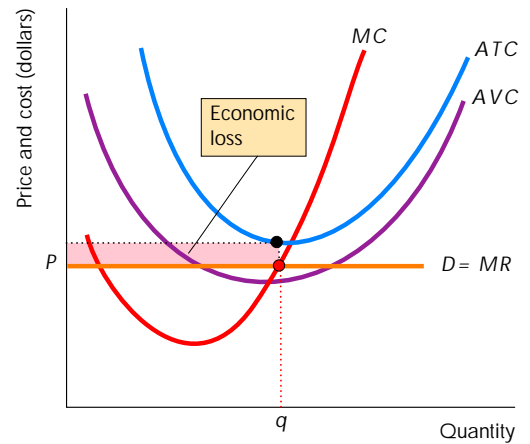
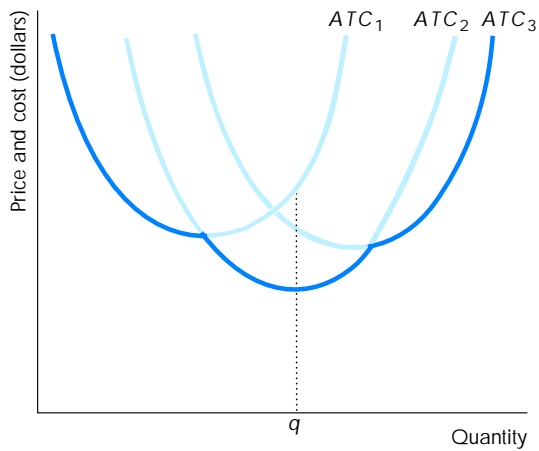


FIGURE 11.17  
Short Answer Problem 5 (c)



5. a. Figure 11.15 shows the case in which the firm earns an economic profit. To maximize its profit, the firm produces the level of output such that  $MR = MC$ . Because  $P > ATC$ , the firm is earning an economic profit, as shown in the figure.
- b. A perfectly competitive firm earning a normal profit is illustrated in Figure 11.16. To maximize its profit the firm produces  $q$ , the level of output that makes  $MR = MC$ . Because  $P = ATC$ , the firm is earning only a normal profit.
- c. Figure 11.17 illustrates the case of a firm that incurs an economic loss but continues to operate. The firm suffers an economic loss because, at the profit-maximizing (loss-minimizing) level of output  $q$ ,  $P < ATC$ . But the firm minimizes its loss by operating because  $P > AVC$ .

FIGURE 11.18  
Short Answer Problem 6



6. The dark line in Figure 11.18 is the  $LRAC$  curve. The dark line is constructed from the  $ATC$  curve that has the lowest average total cost for each level of output.

When producing  $q$ , in the long run the firm will use the middle amount of capital because  $ATC_2$  has the lowest average total cost for producing this level of output. The firm might need to adjust its capital stock to reach this amount. In the short run the firm might have, say, less than the middle amount of capital so that in the short run the business might have average total costs of  $ATC_1$ . Eventually, however, the firm will increase its capital stock to reach average total cost curve  $ATC_2$ .

7. In the short run, the decrease in demand means the price falls. In response to the fall in price, each firm produces less (some firms might even shut down if the price falls below their minimum average variable cost), so the market quantity also decreases. Figures 11.19 and 11.20 illustrate these changes: The price falls from  $P$  to  $P_{sr}$  and the quantity decreases from  $Q$  to  $Q_{sr}$  at (short-run) time  $T_{sr}$ .

In the initial situation, each business was earning zero economic profit. The fall in price now means that firms incur economic losses. Because the decrease in demand is permanent, these losses induce some firms to leave the industry. This exit shifts the market supply curve leftward, causing a rise in the market price. The rising price reduces the economic losses for the remaining firms. Firms continue to

FIGURE 11.19  
Short Answer Problem 7

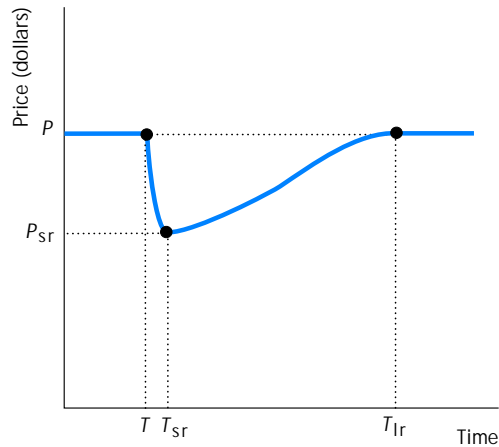
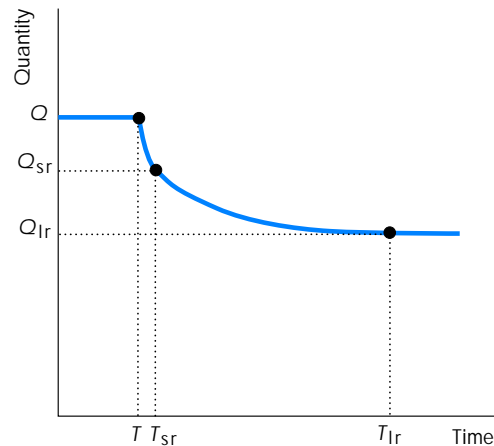


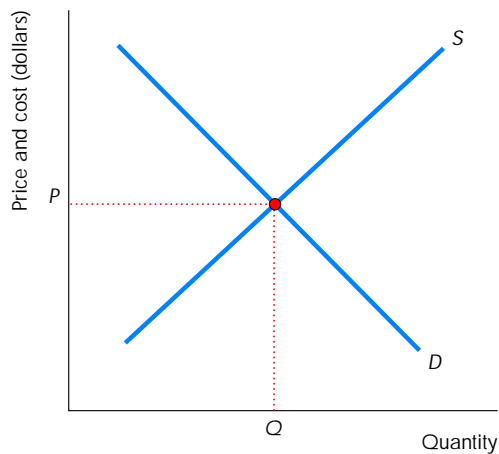
FIGURE 11.20  
Short Answer Problem 7



exit until the economic losses are totally eliminated. Costs have not been affected by the decrease in demand because there are no external economies or diseconomies. So the price must continue rising until, as shown in Figure 11.19, it reaches its original level in the new long-run equilibrium at time  $T_{lr}$ . At that time, each firm produces as much as it did originally. But as shown in Figure 11.20, the equilibrium quantity produced by the total industry is less than initially ( $Q$  versus  $Q_{lr}$ ) because the number of firms in the industry has decreased.

8. In a perfectly competitive industry, the existence of positive economic profits attract the entry of newcomers. Entry of new firms shifts the market supply curve rightward, causing the price to fall and firms' profits to decline. However, entry continues as long as there are positive economic profits. Similarly, the existence of economic losses result in firms exiting the industry. Exit shifts the market supply curve leftward, causing the price to rise and (surviving) firms' losses to decline. Exit continues as long as economic losses are being incurred. So only when economic profits and losses are zero, so that a normal profit is earned, is there no tendency for firms to enter or exit the industry. The industry is in long-run equilibrium only when economic profits are zero because economic profits or losses are the signals to enter or exit an industry.

FIGURE 11.21  
Short Answer Problem 9



9. Figure 11.21 shows the efficient quantity of wheat as  $Q$ . In the absence of external costs or benefits, it is a remarkable result that the efficient level is also the equilibrium level!

**You're the Teacher**

1. "Look, you're making just one mistake. It's an easy mistake to make, but it's a *big* one! The idea is that a firm wants to maximize its *total* profit. That is, it wants to maximize the difference between its total revenue and its total costs. You're confusing these terms with marginal revenue and marginal cost.

Remember that the word 'marginal' means 'additional'. So, marginal revenue means additional revenue, and marginal cost means additional cost. "Now, suppose that  $MR$  is larger than  $MC$ . For instance, suppose that a wheat farmer finds that the marginal revenue from growing an additional acre of wheat is \$5,000 and that the marginal cost of doing so is only \$3,000. Then, growing the additional acre of wheat adds more to the farmer's revenue than it adds to the cost, so this acre will add to the farmer's total profit. In particular, this acre adds \$2,000 (marginal revenue of \$5,000 minus marginal cost of \$3,000) to the farmer's total profit. The farmer will want to grow this additional acre of wheat.

"Next, suppose that the next acre still has a marginal revenue of \$5,000, but that it has a marginal cost of \$4,000.  $MR$  still is larger than  $MC$ , so this acre will continue to add to the farmer's total profit. It adds less (only \$1,000), but the key point is that it adds. So the farmer will plant this acre, too.

"Now look, I know that the added profit from the second acre isn't as much as the added profit from the first acre. But who cares? As long as the acre adds to the profit, the farmer, who wants to get the maximum possible total profit, will still grow the second acre of wheat. The deal is that as long as the acre adds to total profit, the farmer will grow more wheat. In other words, as long as  $MR > MC$ , the additional acre adds additional profit, so the farmer will put the acreage into production. Only when  $MR = MC$  does the additional acre not add to profit. So the farmer simply stops adding acres when  $MR = MC$ ."

2. "At first thought, it does seem weird that a business would continue to produce even though it's losing money. I couldn't get the point, either, until I thought about it a bit. Here's the idea: Whenever the price of output falls below the break-even point (the minimum average total cost) but remains above the shutdown point (the minimum average variable cost), the firm continues to produce even though it's incurring an economic loss. The key here is that the firm's owner, when suffering an economic loss, wants to make the loss as small as possible.
- "If the owner shuts down, the firm still must pay its fixed costs. (Recall that fixed costs are independent of output; whether the firm produces 10 million units or 0 units, fixed costs remain the same.) So if

the owner shuts down, the total loss will equal the total fixed cost. The owner compares this loss to the loss incurred by operating. If the price exceeds the average variable cost, the owner loses less by operating the business. When  $P > AVC$ , the firm earns enough revenue to pay all its variable costs and have some revenue left over to cover part of its fixed costs. In this case, by operating the business, the owner loses less than the total amount of the fixed

costs. The loss is smaller than would be incurred by shutting down, so the owner will operate the business as long as  $P > AVC$ . But, if  $P < AVC$ , the loss from running the business exceeds the total fixed cost because the business's revenue isn't sufficient to cover all of the variable costs. Hence when the average variable costs exceed the price, the owner will close the business."

## Chapter Quiz

1. In perfect competition, the product of a single firm
  - a. has an infinite elasticity of demand.
  - b. is sold under many different brand names.
  - c. is unique to that firm and cannot be copied by others.
  - d. has many perfect complements.
2. A perfectly competitive firm faces a
  - a. downward sloping demand curve.
  - b. downward sloping marginal revenue curve.
  - c. horizontal marginal revenue curve.
  - d. downward sloping marginal cost curve.
3. In the case of a perfectly competitive firm, as the firm sells more output, the price of the product \_\_\_\_ and the marginal revenue \_\_\_\_\_.
  - a. falls; falls
  - b. falls; does not change
  - c. does not change; falls
  - d. does not change; does not change
4. When a perfectly competitive firm is making zero economic profit, the owner is
  - a. going to close the business in the long run.
  - b. incurring an accounting loss.
  - c. earning the same profit he or she could obtain elsewhere on the average.
  - d. will boost output to earn a larger profit.
5. Even though it is incurring an economic loss, it pays a firm to stay open if price is
  - a. above minimum average variable cost.
  - b. below minimum average variable cost.
  - c. above total variable cost.
  - d. below total variable cost.
6. A perfectly competitive firm is producing at the point where its marginal cost equals price. If the firm decreases its output, total revenue will \_\_\_\_ and total profit will \_\_\_\_\_.
  - a. rise; rise
  - b. rise; fall
  - c. fall; rise
  - d. fall; fall
7. The supply curve for a perfectly competitive firm is the same as its marginal cost curve
  - a. above the horizontal axis.
  - b. above the minimum average variable cost.
  - c. below the minimum average variable cost.
  - d. below the average total cost.
8. The industry supply curve is the sum of the
  - a. supply curves of all the firms.
  - b. average variable cost curves of all the firms.
  - c. average total cost curves of all the firms.
  - d. average fixed cost curves of all the firms.
9. In a perfectly competitive industry, a permanent increase in demand creates a temporary economic \_\_\_\_ and \_\_\_\_ by some firms.
  - a. profit; entry
  - b. profit; exit
  - c. loss; exit
  - d. loss; entry
10. A perfectly competitive firm \_\_\_\_ earn an economic profit in the short run and \_\_\_\_ earn an economic profit in the long run.
  - a. can; can
  - b. can; cannot
  - c. cannot; can
  - d. cannot; cannot

**The answers for this Chapter Quiz are on page 368**

