



TEKS 5B, 5D, 7A, 11A, 12C, 12D, 13A, 13B, 14A, 14B, 27A, 27D, 28B

What You Will Learn...

Main Ideas

1. The invention of new machines in Great Britain led to the beginning of the Industrial Revolution.
2. The development of new machines and processes brought the Industrial Revolution to the United States.
3. Despite a slow start in manufacturing, the United States made rapid improvements during the War of 1812.

The Big Idea

The Industrial Revolution transformed the way goods were produced in the United States.

Key Terms and People

Industrial Revolution, *p. 385*
textiles, *p. 385*

Richard Arkwright, *p. 385*

Samuel Slater, *p. 386*

technology, *p. 387*

Eli Whitney, *p. 387*

interchangeable parts, *p. 387*

mass production, *p. 387*



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TAKING NOTES

Use the graphic organizer online to list the key contributors to the Industrial Revolution and their inventions.

The Industrial Revolution in America

If YOU were there...

You live in a small Pennsylvania town in the 1780s. Your father is a blacksmith, but you earn money for the family, too. You raise sheep and spin their wool into yarn. Your sisters knit the yarn into warm wool gloves and mittens. You sell your products to merchants in the city. But now you hear that someone has invented machines that can spin thread and make cloth.

Would you still be able to earn the same amount of money for your family? Why?

BUILDING BACKGROUND In the early 1700s making goods depended on the hard work of humans and animals. It had been that way for hundreds of years. Then new technology brought a change so radical that it is called a revolution. It began in Great Britain and soon spread to the United States.

The Industrial Revolution

At the beginning of the 1700s, the majority of people in Europe and the United States were farmers. They made most of what they needed by hand. For example, female family members usually made clothing. First, they used a spinning wheel to spin raw materials, such as cotton or wool, into thread. Then they used a hand loom to weave the thread into cloth.

Some families produced extra cloth to sell to merchants, who sold it for a profit. In towns, a few skilled workers made goods by hand in their own shops. These workers included blacksmiths, carpenters, and shoemakers. Their ways of life had stayed the same for generations.

A Need for Change

By the mid-1700s, however, changes in Great Britain led to a greater demand for manufactured goods. As agriculture and roads

Textile Mill and Water Frame

CONNECT TO SCIENCE AND TECHNOLOGY

A water frame adapts the power of flowing water into energy that moves wheels and gears through a system of belts. These wheels and gears then move parts of machines such as looms and spinning wheels.

1 Flowing water from a river turned the waterwheel. The giant wheel turned smaller gears connected to belts. 2 These belts moved parts of the machinery in the mill.

5 After the thread was spun, it moved to the loom to be woven into cloth. Workers called spoolers watched the looms and made sure that the spools of thread were kept straight.

4 Then the raw cotton was spun into thread on a spinning frame.

3 A machine for cleaning the raw cotton was the first step.

ANALYSIS SKILL

ANALYZING VISUALS

What provided the power for the machines in the mill?

improved, cities and populations grew. Overseas trade also expanded. Traditional manufacturing methods did not produce enough goods to meet everyone's needs.

People began creating ways to use machines to make things more **efficient**. These developments led to the **Industrial Revolution**, a period of rapid growth in using machines for manufacturing and production that began in the mid-1700s.

Textile Industry

The first important breakthrough of the Industrial Revolution took place in how **textiles, or cloth items**, were made. Before the Industrial Revolution, spinning thread took much more time than making cloth. Several workers were needed to spin enough thread to supply a single weaver.

In 1769 Englishman **Richard Arkwright** invented a large spinning machine called a water frame. The water frame could produce dozens of cotton threads at the same time. It lowered the cost of cotton cloth and increased the speed of textile production.

The water frame used flowing water as its source of power. Merchants began to build large textile mills, or factories, near rivers and streams. The mills were filled with spinning machines. Merchants began hiring people to work in the mills.

Additional improvements also speeded up the spinning process. Britain soon had the world's most productive textile manufacturing industry.

ACADEMIC VOCABULARY

efficient
productive and not wasteful

READING CHECK Drawing Conclusions How did machines speed up textile manufacturing?

New Machines and Processes

New machines encouraged the rise of new processes in business and manufacturing. As the machines used to make products became more efficient, the processes involved changed dramatically.

Slater and His Secrets

The new textile machines allowed Great Britain to produce cloth more quickly and inexpensively than other countries could. To protect British industry, the British Parliament had made it illegal for skilled mechanics or machine plans to leave the country. Disguised as a farmer, **Samuel Slater**, a skilled British mechanic, immigrated to the United States after carefully memorizing the designs of textile mill machines. Soon after arriving, he sent a letter to Moses Brown, who owned a textile business in New England. Slater claimed he could improve the way textiles were manufactured in the United States.

Brown had one of his workers test Slater's knowledge of machinery. Slater passed. Brown's son, Smith Brown, and son-in-law, William Almy, formed a partnership with Slater. In 1793 they opened their

first mill in Pawtucket, Rhode Island. The production of cotton thread by American machines had begun. Slater ran the mill and the machinery. He was confident that his new machines would work well.

“If I do not make as good yarn as they do in England, I will have nothing for my services, but will throw the whole of what I have attempted over the bridge.”

—Samuel Slater, quoted in *The Ingenious Yankees*, by Joseph and Francis Gies

Slater's machines worked, and the Pawtucket mill became a success. Slater's wife also invented a new cotton thread for sewing. In 1798 Slater formed his own company to build a mill. By the time he died in 1835, he owned all or part of 13 textile mills.

Other Americans began building textile mills. Most were located in the Northeast. In New England in particular, merchants had the money to invest in new mills. More important, this region had many rivers and streams that provided a reliable supply of power. Fewer mills were built in the South, partly because investors in the South concentrated on expanding agriculture. There, agriculture was seen as an easier way to make money.

Elements of Mass Production

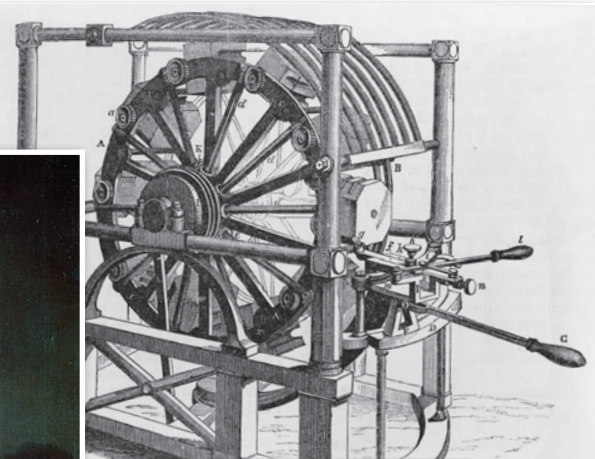
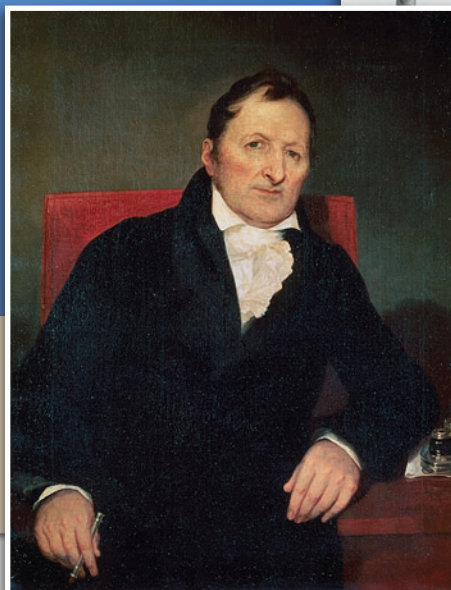
CONNECT TO ECONOMICS

Mass-production techniques allow manufacturers to efficiently create more goods for the marketplace. Mass production requires the use of interchangeable parts, machine tools, and the division of labor.

Why are interchangeable parts important?

Interchangeable Parts

Eli Whitney developed the idea of using interchangeable parts. Interchangeable, or identical, parts are needed so each part does not have to be custom-made by hand.



Machine Tools

Machine tools like this one make parts that are identical and therefore interchangeable.

A Manufacturing Breakthrough

Despite these great changes, most manufacturing was still done by hand. In the late 1790s the U.S. government worried about a possible war with France, so it wanted more muskets for the army. Skilled workers made the parts for each weapon by hand. No two parts were exactly alike, and carefully fitting all the pieces together took much time and skill.

As a result, American gun makers could not produce the muskets quickly enough to satisfy the government's demand. Factories needed better **technology**, the tools used to produce items or to do work.

In 1798 inventor **Eli Whitney** tried to address some of these problems. Whitney gave officials a proposal for mass-producing guns for the U.S. government using water-powered machinery. Whitney explained the benefits of his ideas.

“I am persuaded that machinery moved by water [and] adapted to this business would greatly reduce the labor and facilitate [ease] the manufacture of this article.”

—Eli Whitney, quoted in *Technology in America*, edited by Carroll W. Pursell

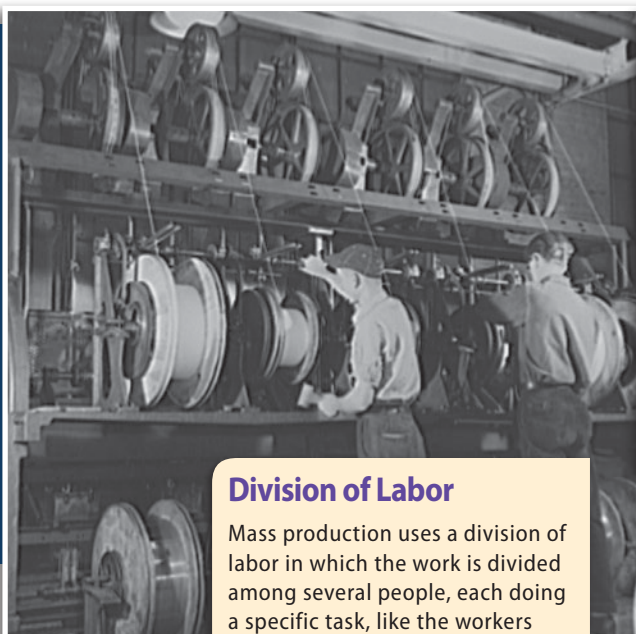
Whitney also came up with the idea of using **interchangeable parts**—parts of a machine that are identical. Using interchangeable parts made machines easier to assemble and broken parts easier to replace. Whitney promised to build 10,000 muskets in two years. The federal government gave him money to build his factory, and in 1801 Whitney was called to Washington, D.C., to give a demonstration.

Whitney stood before President John Adams and his secretary of war. He had an assortment of parts for 10 guns. He then randomly chose parts and quickly assembled them into muskets. To the audience's amazement, he repeated the process several times.

Whitney's Influence

Whitney had proven that American inventors could improve upon the new British technology. Machines that produced matching parts soon became standard in industry. Interchangeable parts sped up **mass production**, the efficient production of large numbers of identical goods.

READING CHECK Summarizing How did Eli Whitney influence American manufacturing?



Division of Labor

Mass production uses a division of labor in which the work is divided among several people, each doing a specific task, like the workers shown here.



Mass-Produced Goods

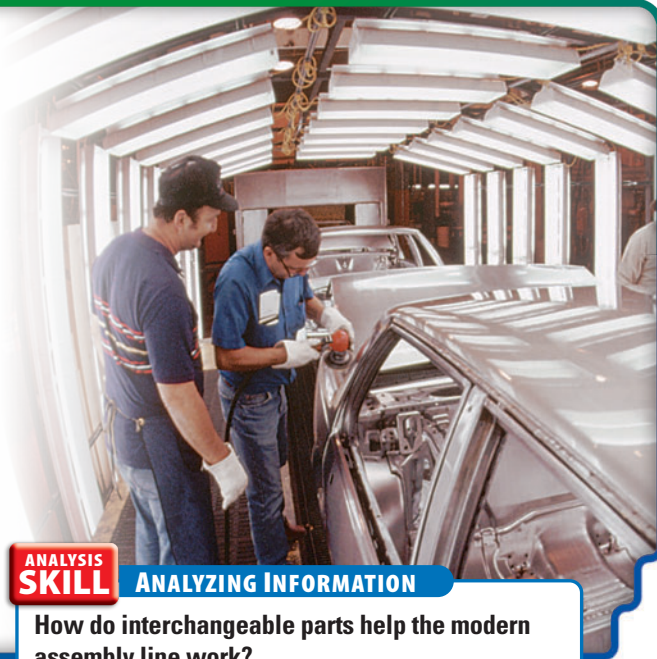
The end result is goods that have been mass-produced. These techniques were used to build items such as these firearms.

Modern Manufacturing

The word manufacture comes from Latin words that mean “to make by hand.” Yet in modern manufacturing, machines—not human hands—do most of the work.

A key feature of modern manufacturing is the assembly line. An assembly line is a long conveyer belt. As the product moves along the belt, or “down the line,” workers assemble it. Often, the workers use machines to help them. On a growing number of assembly lines, there are no workers at all: the product is assembled by computer-controlled robots.

Although a far cry from Eli Whitney’s factory, modern factories use the same elements of mass production that Whitney did more than 200 years ago.



ANALYSIS SKILL

ANALYZING INFORMATION

How do interchangeable parts help the modern assembly line work?

Manufacturing Grows Slowly

Despite the hard work of people such as Samuel Slater and Eli Whitney, manufacturing in the United States grew slowly. Many businesspeople were eager to make their fortune in the new capitalist economy, free from the restrictive British policies of the colonial era, but there were several reasons it was difficult. In 1810 Secretary of the Treasury Albert Gallatin suggested some reasons why there were so few factories in the United States.

“[The reasons include] . . . the superior attractions of agricultural pursuits [farming], . . . the abundance of land compared with the population, the high price of labor, and the want [lack] of sufficient capital [investment].”

—Albert Gallatin, quoted in *Who Built America?*
by Bruce Levine et al.

Gallatin and others believed that few people would choose to work in a factory if they could own their own farm instead. In Great Britain, on the other hand, land was more scarce and more expensive than in the United States. As a result, fewer people were able to own farms. British factory workers

generally were willing to work for lower wages than factory workers in the United States were.

Because British manufacturers had plenty of factory workers with technical skills, they could produce large amounts of goods less expensively than most American businesses could. As a result, they could charge lower prices for the goods. Lower British prices made it difficult for many American manufacturers to compete with British companies. This situation in turn discouraged American investors from spending the money needed to build new factories and machinery. The new free market economy had not yet reached a balance between the needs of workers, business owners, and consumers that would result in a growing economy. As a result, only a few industries had found a place in the American economy. These included cotton goods, flour milling, weapons, and iron production.

These circumstances began to change around the time of the War of 1812. Since the 1790s, wars between European powers had interfered with U.S. trade. American customers were no longer able to get all the manufactured goods they were used to buying from

British and European manufacturers. Then, during the War of 1812, British ships blockaded eastern seaports, preventing foreign ships from delivering goods. Americans began to buy the items they needed from American manufacturers instead of from foreign suppliers. As profits for American factories grew, manufacturers began to spend more money expanding their factories. State banks and private investors began to lend money to manufacturers for their businesses.

At the same time, many Americans began to realize that the United States had been relying too heavily on foreign goods. If the United States could not meet its own needs, it might be weak and open to attack. Former president Thomas Jefferson, who had once opposed manufacturing, changed his mind. He, too, realized that the United States was too dependent on imports.

“To be independent for the comforts of life we must fabricate [make] them ourselves. We must now place the manufacturer by the side of the agriculturalist [farmer].”

—Thomas Jefferson, from *The Writings of Thomas Jefferson*, edited by P. L. Ford

In February 1815, New Yorkers celebrated the end of the War of 1812 and the return of free trade. The streets were decorated and filled with merchants whose ships were loaded with goods. “With Peace and Commerce, America Prospers,” declared one display. Eager businesspeople prepared to lead the United States into a period of industrial growth. They urged northern politicians to pass higher tariffs on foreign goods to protect American companies. Many southerners, however, feared that tariffs might harm their economy by making imported goods too expensive.

READING CHECK Analyzing How did the War of 1812 aid the growth of American manufacturing?

SUMMARY AND PREVIEW The Industrial Revolution started with the English textile industry but soon spread to the United States. In the next section you will learn about how factories changed the working lives of Americans.

THE IMPACT TODAY

American dependence on some foreign goods, such as oil, is still being debated today.

Section 1 Assessment

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ONLINE QUIZ

Reviewing Ideas, Terms, and People

- a. Identify** What was the first industry to begin to use machines to manufacture goods?

b. Predict In what ways might life for workers change as a result of the **Industrial Revolution**?
- a. Recall** In what part of the United States were most mills located? Why?

b. Draw Conclusions How did the ideas of **Samuel Slater** and **Eli Whitney** affect manufacturing in the United States?

c. Evaluate Whose contributions do you think were more important—Slater’s textile machines or Whitney’s **interchangeable parts**? Why?
- a. Identify** What event encouraged the growth of American manufacturing? Why?

b. Contrast Why was manufacturing in Great Britain in the early years more successful than that in the United States?

c. Analyze How would a higher tariff affect the economy of the North?

Critical Thinking

- 4. Drawing Conclusions** Review your notes on key inventions and improvements during the Industrial Revolution. Then copy the chart below and use it to show how each contribution affected manufacturing.

| Invention/improvement | Effect on Manufacturing |
|-----------------------|-------------------------|
| | |
| | |
| | |
| | |

FOCUS ON WRITING

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- 5. Noting Inventions** In your notebook, create a three-column chart. In the first column, list any inventions mentioned in this section. In the second column, identify the inventor. In the third column, describe the invention and its benefits.