PARK EAST HIGH SCHOOL
Purpose, Preparation, Pride

Name: _____ Date: _____

Directions:
1. Complete all the questions that follow on separate pieces of paper.
2. Indicate what page # you are completing before your answers. You must write the question and the answers.

Part 1 of 4

The Beginnings of Industrialization

MAIN IDEA	WHY IT MATTERS NOW	TERMS & NAMES
SCIENCE AND TECHNOLOGY The Industrial Revolution started in England and soon spread to other countries.	The changes that began in Britain paved the way for modern industrial societies.	• Industrial Revolution • enclosure • crop rotation • industrialization • factors of production • factory • entrepreneur

SETTING THE STAGE In the United States, France, and Latin America, political revolutions brought in new governments. A different type of revolution now transformed the way people worked. The **Industrial Revolution** refers to the greatly increased output of machine-made goods that began in England in the middle 1700s. Before the Industrial Revolution, people wove textiles by hand. Then, machines began to do this and other jobs. Soon the Industrial Revolution spread from England to Continental Europe and North America.

In short, the Industrial Revolution is the major change from goods made at home by hand to goods made by machine in a factory.

Industrial Revolution Begins in Britain

In 1700, small farms covered England's landscape. Wealthy landowners, however, began buying up much of the land that village farmers had once worked. The large landowners dramatically improved farming methods. These innovations amounted to an agricultural revolution.

The Agricultural Revolution Paves the Way After buying up the land of village farmers, wealthy landowners enclosed their land with fences or hedges. The increase in their landholdings enabled them to cultivate larger fields. Within these larger fields, called **enclosures**, landowners experimented with more productive seeding and harvesting methods to boost crop yields. The enclosure movement had two important results. First, landowners tried new agricultural methods. Second, large landowners forced small farmers to become tenant farmers or to give up farming and move to the cities.

Jethro Tull was one of the first of these scientific farmers. He saw that the usual way of sowing seed by scattering it across the ground was wasteful. Many seeds failed to take root. He solved this problem with an invention called the seed drill in about 1701. It allowed farmers to sow seeds in well-spaced rows at specific depths. A larger share of the seeds took root, boosting crop yields.

Rotating Crops The process of **crop rotation** proved to be one of the best developments by the scientific farmers. The process improved upon older methods of crop rotation, such as the medieval three-field system discussed in Chapter 14. One year, for example, a farmer might plant a field with wheat, which exhausted soil nutrients. The next year he planted a root crop, such as turnips, to restore nutrients. This might be followed in turn by barley and then clover.



▶ An English farmer plants his fields in the early 1700s using a seed drill.

Livestock breeders improved their methods too. In the 1700s, for example, Robert Bakewell increased his mutton (sheep meat) output by allowing only his best sheep to breed. Other farmers followed Bakewell's lead. Between 1700 and 1786, the average weight for lambs climbed from 18 to 50 pounds. As food supplies increased and living conditions improved, England's population mushroomed. An increasing population boosted the demand for food and goods such as cloth. As farmers lost their land to large enclosed farms, many became factory workers. A

Why the Industrial Revolution Began in England In addition to a large population of workers, the small island country had extensive natural resources. **Industrialization**, which is the process of developing machine production of goods, required such resources. These natural resources included

- water power and coal to fuel the new machines
- iron ore to construct machines, tools, and buildings
- rivers for inland transportation
- harbors from which merchant ships set sail

In addition to its natural resources, Britain had an expanding economy to support industrialization. Businesspeople invested in the manufacture of new inventions. Britain's highly developed banking system also contributed to the country's industrialization. People were encouraged by the availability of bank loans to invest in new machinery and expand their operations. Growing overseas trade, economic prosperity, and a climate of progress led to the increased demand for goods.

Britain's political stability gave the country a tremendous advantage over its neighbors. Though Britain took part in many wars during the 1700s, none occurred on British soil. Their military successes gave the British a positive attitude. Parliament also passed laws to help encourage and protect business ventures. Other countries had some of these advantages. But Britain had all the **factors of production**, the resources needed to produce goods and services that the Industrial Revolution required. They included land, labor, and capital (or wealth).

Inventions Spur Industrialization

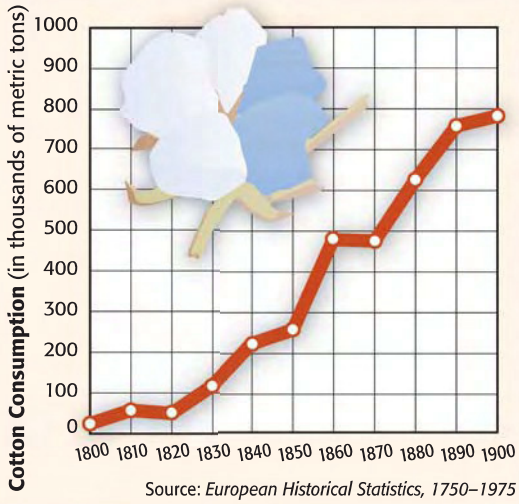
In an explosion of creativity, inventions now revolutionized industry. Britain's textile industry clothed the world in wool, linen, and cotton. This industry was the first to be transformed. Cloth merchants boosted their profits by speeding up the process by which spinners and weavers made cloth.

Changes in the Textile Industry As you will learn in the feature on textile technology on page 719, by 1800, several major inventions had modernized the cotton industry. One invention led to another. In 1733, a machinist named John Kay made a shuttle that sped back and forth on wheels. This flying shuttle, a boat-shaped piece

Textiles Industrialize First

The Industrial Revolution that began in Britain was spurred by a revolution in technology. It started in the textile industry, where inventions in the late 1700s transformed the manufacture of cloth. The demand for clothing in Britain had greatly increased as a result of the population boom caused by the agricultural revolution. These developments, in turn, had an impact worldwide. For example, the consumption of cotton rose dramatically in Britain (see graph at right). This cotton came from plantations in the American South, where cotton production skyrocketed from 1820 to 1860 in response to demand from English textile mills.

British Cotton Consumption, 1800–1900



Source: *European Historical Statistics, 1750–1975*

▶ John Kay's flying shuttle (below) speedily carried threads of yarn back and forth when the weaver pulled a handle on the loom. The flying shuttle greatly increased the productivity of weavers.





▲ Flying shuttle

Patterns of Interaction

Technology Transforms an Age: The Industrial and Electronic Revolutions

Inventions in the textile industry started in Britain and brought about the Industrial Revolution. This revolution soon spread to other countries. The process of industrialization is still spreading around the world, especially in developing countries. A similar technological revolution is occurring in electronics today, transforming the distribution of information around the world.

Complete This Section

Connect *to* Today

1. **Synthesizing** How might the technological innovation and industrialization that took place in the textile industry during the Industrial Revolution have provided a model for other industries?

See Skillbuilder Handbook, Page R21.

2. **Recognizing Effects** Research the textile industry today to learn how it has been affected by new technology, including computerization. Prepare a two-paragraph summary on the effects of the new technology.

History *in* Depth



Inventions in America

In the United States, American inventors worked at making railroad travel more comfortable, inventing adjustable upholstered seats. They also revolutionized agriculture, manufacturing, and communications:

1831 Cyrus McCormick's reaper boosted American wheat production.

1837 Samuel F. B. Morse, a New England painter, first sent electrical signals over a telegraph.

1851 I. M. Singer improved the sewing machine by inventing a foot treadle (see photograph).

1876 Scottish-born inventor Alexander Graham Bell patented the telephone.

INTEGRATED TECHNOLOGY

INTERNET ACTIVITY Create a photo exhibit on American inventions of the 19th century. Include the name of the inventor and the date with each photograph. Go to **classzone.com** for your research.

of wood to which yarn was attached, doubled the work a weaver could do in a day. Because spinners could not keep up with these speedy weavers, a cash prize attracted contestants to produce a better spinning machine. Around 1764, a textile worker named James Hargreaves invented a spinning wheel he named after his daughter. His spinning jenny allowed one spinner to work eight threads at a time.

At first, textile workers operated the flying shuttle and the spinning jenny by hand. Then, Richard Arkwright invented the water frame in 1769. This machine used the waterpower from rapid streams to drive spinning wheels. In 1779, Samuel Crompton combined features of the spinning jenny and the water frame to produce the spinning mule. The spinning mule made thread that was stronger, finer, and more consistent than earlier spinning machines. Run by waterpower, Edmund Cartwright's power loom sped up weaving after its invention in 1787. B

MAIN IDEA

Summarizing

B What inventions transformed the textile industry?

The water frame, the spinning mule, and the power loom were bulky and expensive machines. They took the work of spinning and weaving out of the house. Wealthy textile merchants set up the machines in large buildings called **factories**. Factories needed waterpower, so the first ones were built near rivers and streams:

PRIMARY SOURCE

A great number of streams . . . furnish water-power adequate to turn many hundred mills: they afford the element of water, indispensable for scouring, bleaching, printing, dyeing, and other processes of manufacture: and when collected in their larger channels, or employed to feed canals, they supply a superior inland navigation, so important for the transit of raw materials and merchandise.

EDWARD BAINS, *The History of Cotton Manufacture in Great Britain* (1835)

England's cotton came from plantations in the American South in the 1790s. Removing seeds from the raw cotton by hand was hard work. In 1793, an American inventor named Eli Whitney invented a machine to speed the chore. His cotton gin multiplied the amount of cotton that could be cleaned. American cotton production skyrocketed from 1.5 million pounds in 1790 to 85 million pounds in 1810.

Improvements in Transportation

Progress in the textile industry spurred other industrial improvements. The first such development, the steam engine, stemmed from the search for a cheap, convenient source of power. As early as 1705, coal miners were using steam-powered pumps to remove water from deep mine shafts. But this early model of a steam engine gobbled great quantities of fuel, making it expensive to run.

Watt's Steam Engine James Watt, a mathematical instrument maker at the University of Glasgow in Scotland, thought about the problem for two years. In 1765, Watt figured out a way to make the steam engine work faster and more efficiently while burning less fuel. In 1774, Watt joined with a businessman named Matthew Boulton. Boulton was an **entrepreneur** (AHN•truh•pruh•NUR), a person who organizes, manages, and takes on the risks of a business. He paid Watt a salary and encouraged him to build better engines.

Water Transportation Steam could also propel boats. An American inventor named Robert Fulton ordered a steam engine from Boulton and Watt. He built a steamboat called the *Clermont*, which made its first successful trip in 1807. The *Clermont* later ferried passengers up and down New York's Hudson River.

In England, water transportation improved with the creation of a network of canals, or human-made waterways. By the mid-1800s, 4,250 miles of inland channels slashed the cost of transporting both raw materials and finished goods.

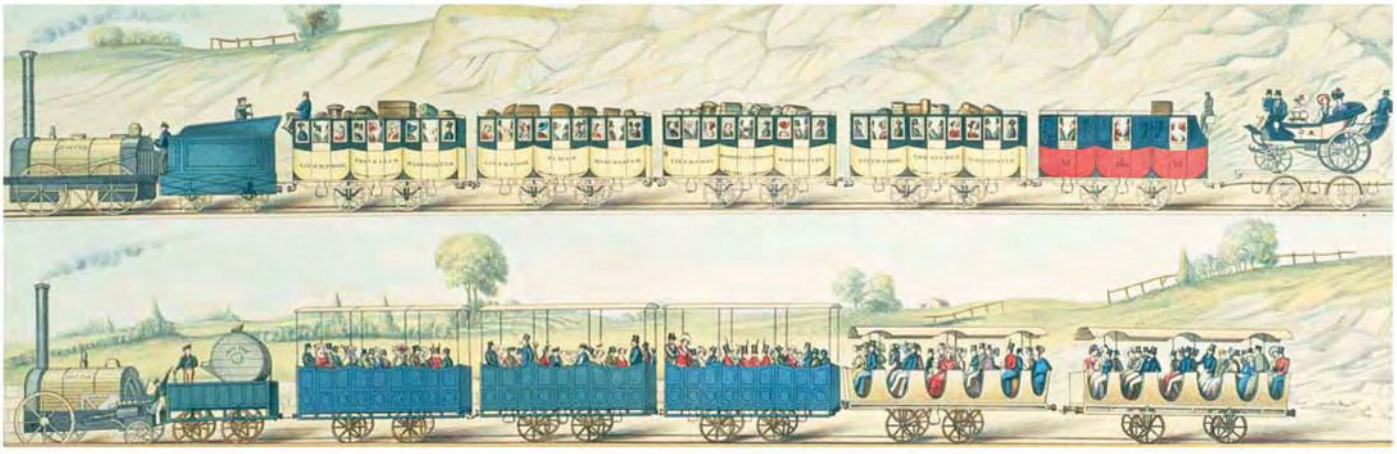
Road Transportation British roads improved, too, thanks largely to the efforts of John McAdam, a Scottish engineer. Working in the early 1800s, McAdam equipped road beds with a layer of large stones for drainage. On top, he placed a carefully smoothed layer of crushed rock. Even in rainy weather heavy wagons could travel over the new "macadam" roads without sinking in mud.

Private investors formed companies that built roads and then operated them for profit. People called the new roads turnpikes because travelers had to stop at tollgates (turnstiles or turnpikes) to pay tolls before traveling farther.

The Railway Age Begins

Steam-driven machinery powered English factories in the late 1700s. A steam engine on wheels—the railroad locomotive—drove English industry after 1820.

Steam-Driven Locomotives In 1804, an English engineer named Richard Trevithick won a bet of several thousand dollars. He did this by hauling ten tons of iron over nearly ten miles of track in a steam-driven locomotive. Other British engineers soon built improved versions of Trevithick's locomotive. One of these early



▼ First-class passengers on the Liverpool-Manchester Railway in the 1830s rode in covered cars; all others, in open cars.



▲ George Stephenson's *Rocket*

railroad engineers was George Stephenson. He had gained a solid reputation by building some 20 engines for mine operators in northern England. In 1821, Stephenson began work on the world's first railroad line. It was to run 27 miles from the Yorkshire coal fields to the port of Stockton on the North Sea. In 1825, the railroad opened. It used four locomotives that Stephenson had designed and built.

The Liverpool-Manchester Railroad News of this success quickly spread throughout Britain. The entrepreneurs of northern England wanted a railroad line to connect the port of Liverpool with the inland city of Manchester. The track was laid. In 1829, trials were held to choose the best locomotive for use on the new line. Five engines entered the competition. None could compare with the *Rocket*, designed by Stephenson and his son.

Smoke poured from the *Rocket*'s tall smokestack, and its two pistons pumped to and fro as they drove the front wheels. The locomotive hauled a 13-ton load at an unheard-of speed—more than 24 miles per hour. The Liverpool-Manchester Railway opened officially in 1830. It was an immediate success.

Railroads Revolutionize Life in Britain The invention and perfection of the locomotive had at least four major effects. First, railroads spurred industrial growth by giving manufacturers a cheap way to transport materials and finished products. Second, the railroad boom created hundreds of thousands of new jobs for both railroad workers and miners. These miners provided iron for the tracks and coal for the steam engines. Third, the railroads boosted England's agricultural and fishing industries, which could transport their products to distant cities.

Finally, by making travel easier, railroads encouraged country people to take distant city jobs. Also, railroads lured city dwellers to resorts in the countryside. Like a locomotive racing across the country, the Industrial Revolution brought rapid and unsettling changes to people's lives. C

MAIN IDEA

Synthesizing

C How did improvements in transportation promote industrialization in Britain?

SECTION 1 ASSESSMENT

TERMS & NAMES **1.** For each term or name, write a sentence explaining its significance.

• Industrial Revolution • enclosure • crop rotation • industrialization • factors of production • factory • entrepreneur

MAIN IDEAS

3. What were four factors that contributed to industrialization in Britain?

4. How did rising population help the Industrial Revolution?

5. What American invention aided the British textile industry?

CRITICAL THINKING & WRITING

6. EVALUATING Was the revolution in agriculture necessary to the Industrial Revolution? Explain.

7. MAKING INFERENCES What effect did entrepreneurs have upon the Industrial Revolution?

8. FORMING AND SUPPORTING OPINIONS Do you agree or disagree with the statement that the steam engine was the greatest invention of the Industrial Revolution? Why?

9. WRITING ACTIVITY SCIENCE AND TECHNOLOGY Write a **letter,** as a British government official during the Industrial Revolution, to an official in a nonindustrial nation explaining how the railroad has changed Britain.