

tpo_6_passage_1

In Britain one of the most dramatic changes of the Industrial Revolution was the harnessing of power. Until the reign of George ?(1760-1820), available sources of power for work and travel had not increased since the Middle Ages. There were three sources of power: animal or human muscles; the wind, operating on sail or windmill; and running water. "Only the last of these was suited at all to the continuous operating of machines, and although waterpower abounded in Lancashire and Scotland and ran grain mills as well as textile mills, it had one great disadvantage: streams flowed where nature intended them to, and water-driven factories had to be located on their banks whether or not the location was desirable for other reasons. " Furthermore, even the most reliable waterpower varied with the seasons and disappeared in a drought. The new age of machinery, in short, could not have been born without a new source of both movable and constant power. The source had long been known but not "exploited". Early in the eighteenth century, a pump had come into use in which expanding steam raised a piston in a cylinder, and atmospheric pressure brought it down again when the steam condensed inside the cylinder to form a vacuum. This ""atmospheric engine"," invented by Thomas Savery and vastly improved by his partner, Thomas Newcomen, embodied revolutionary principles, but it was so slow and wasteful of fuel that it could not be employed outside the coal mines for which it had been designed. In the 1760s, James Watt perfected a separate condenser for the steam, so that the cylinder did not have to be cooled at every stroke; then he devised a way to make the piston turn a wheel and thus convert reciprocating (back and forth) motion into rotary motion. He thereby transformed an inefficient pump of limited use into a steam engine of a thousand uses. The final step came when steam was introduced into the cylinder to drive the piston backward as well as forward, thereby increasing the speed of the engine and cutting its fuel consumption. Watt's steam engine soon showed what it could do. It liberated industry from dependence on running water. The engine eliminated water in the mines by driving efficient pumps, which made possible deeper and deeper mining. The ready availability of coal inspired William Murdoch during the 1790s to develop the first new form of nighttime illumination to be discovered in a millennium and a half. Coal gas rivaled smoky oil lamps and flickering candles, and early in the new century, well-to-do Londoners "grew accustomed to" gaslit houses and even streets. Iron manufacturers, which had starved for fuel while depending on charcoal, also benefited from ever-increasing supplies of coal: blast furnaces with steam-powered bellows turned out more iron and steel for the new machinery. Steam became the motive force of the Industrial Revolution as coal and iron ore were the raw materials. By 1800 more than a thousand steam engines were in use in the British Isles, and Britain "retained" a virtual monopoly on steam engine production until the 1830s. Steam power did not merely spin cotton and roll iron; early in the new century, it also multiplied ten times over the amount of paper that a single worker could produce in a day. At the same time, operators of the first printing presses run by steam rather than by hand found it possible to produce a thousand pages in an hour rather than thirty. Steam also promised to eliminate a transportation problem not fully solved by either canal boats or turnpikes. Boats could carry heavy weights, but canals could not cross hilly terrain; turnpikes could cross the hills, but the roadbeds could not stand up under great weights. These problems needed still another solution, and the ingredients for it lay close at hand. In some industrial regions, heavily laden

wagons, with flanged wheels, were being hauled by horses along metal rails; and the stationary steam engine was puffing in the factory and mine. Another generation passed before inventors succeeded in combining these ingredients, by putting the engine on wheels and the wheels on the rails, so as to provide a machine to take the place of the horse. Thus the railroad age sprang from what had already happened in the eighteenth century.

question 1

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information .

A Running water was the best power source for factories since it could keep machines operating continuously, but since it was abundant only in Lancashire and Scotland, most mills and factories that were located elsewhere could not be water driven.

B The disadvantage of using waterpower is that streams do not necessarily flow in places that are the most suitable for factories, which explains why so many water-powered grain and textile mills were located in undesirable places.

C Since machines could be operated continuously only where running water was abundant, grain and textile mills, as well as other factories, tended to be located only in Lancashire and Scotland.

D Running water was the only source of power that was suitable for the continuous operation of machines, but to make use of it, factories had to be located where the water was, regardless of whether such locations made sense otherwise.

question 2

It can be inferred from paragraph 1 that before the reign of George III there were no sources of power that

A were movable

B were widely available

C did not disappear during certain seasons of the year

D could provide continuous power

question 3

Which of the following best describes the relation of paragraph 2 to paragraph 1?

A Paragraph 2 shows how the problem discussed in paragraph 1 arose.

B Paragraph 2 explains how the problem presented in paragraph 1 came to be solved.

C Paragraph 2 provides a more technical discussion of the problem introduced in paragraph 1.

D Paragraph 2 shows why the problem discussed in paragraph 1 was especially important to solve.

question 4

According to paragraph 2, the "atmospheric engine" was slow because

A it had been designed to be used in coal mines

B the cylinder had to cool between each stroke

C it made use of expanding steam to raise the piston in its cylinder

D it could be operated only when a large supply of fuel was available

question 5

According to paragraph 2, Watt's steam engine differed from earlier steam engines in each of the following ways EXCEPT:

A It used steam to move a piston in a cylinder.

B It worked with greater speed.

C It was more efficient in its use of fuel.

D It could be used in many different ways.

question 6

In paragraph 3, the author mentions William Murdoch's invention of a new form of nighttime illumination in order to

A indicate one of the important developments made possible by the introduction of Watt's steam engine

B make the point that Watt's steam engine was not the only invention of importance to the Industrial Revolution

C illustrate how important coal was as a raw material for the Industrial Revolution

D provide an example of another eighteenth-century invention that used steam as a power source

question 7

According to paragraph 4, which of the following statements about steam engines is true?

A They were used for the production of paper but not for printing.

B By 1800, significant numbers of them were produced outside of Britain.

C They were used in factories before they were used to power trains.

D They were used in the construction of canals and turnpikes.

question 8

According to paragraph 4, providing a machine to take the place of the horse involved combining which two previously separate ingredients?

A Turnpikes and canals

B Stationary steam engines and wagons with flanged wheels

C Metal rails in roadbeds and wagons capable of carrying heavy loads

D Canal boats and heavily laden wagons

question 9

Look at the four squares [] that indicate where the following sentence could be added to the passage. Where would the sentence best fit?

In Britain one of the most dramatic changes of the Industrial Revolution was the harnessing of power. Until the reign of George ?(1760-1820), available sources of power for work and travel had not increased since the Middle Ages. There were three sources of power: animal or human muscles; the wind, operating on sail or windmill; and running water. "Only the last of these was suited at all to the continuous operating of machines, and although waterpower abounded in Lancashire and Scotland and ran grain mills as well as textile mills, it had one great disadvantage: streams flowed where nature intended them to, and water-driven factories had to be located on their banks whether or not the location was desirable for other reasons. " Furthermore, even the most reliable waterpower varied with the seasons and disappeared in a drought. The new age of machinery, in short, could not have been born without a new source of both movable and constant power. The source had long been known but not "exploited". Early in the eighteenth century, a pump had come into use in which expanding steam raised a piston in a cylinder, and atmospheric pressure brought it down again when the steam condensed inside the cylinder to form a vacuum. This ""atmospheric engine"," invented by Thomas Savery and vastly improved by his partner, Thomas Newcomen, embodied revolutionary principles, but it was so slow and wasteful of fuel that it could not be employed outside the coal mines for which it had been designed. In the 1760s, James Watt perfected a separate condenser for the steam, so that the cylinder did not have to be cooled at every stroke; then he devised a way to make the piston turn a wheel and thus convert reciprocating (back and forth) motion into rotary motion. He thereby transformed an inefficient pump of limited use into a steam engine of a thousand uses. The final step came when steam was introduced into the cylinder to drive the piston backward as well as forward, thereby increasing the speed of the engine and cutting its fuel consumption. [] Watt's steam engine soon showed what it could do. [] It liberated industry from dependence on running water. [] The engine eliminated water in the mines by driving efficient pumps, which made possible deeper and deeper mining. [] The ready availability of coal inspired William Murdoch during the 1790s to develop the first new form of nighttime illumination to be discovered in a millennium and a half. Coal gas rivaled smoky oil lamps and flickering candles, and early in the new century, well-to-do Londoners "grew accustomed to" gaslit houses and even streets. Iron manufacturers, which had starved for fuel while depending on charcoal, also benefited from ever-increasing supplies of coal: blast furnaces with steam-powered bellows turned out more iron and steel for the new machinery. Steam became the motive force of the Industrial Revolution as coal and iron ore were the raw materials. By 1800 more than a thousand steam engines were in use in the British Isles, and Britain "retained" a virtual monopoly on steam engine production until the 1830s. Steam power did not merely spin cotton and roll iron; early in the new century, it also multiplied ten times over the amount of paper that a single worker could produce in a day. At the same time, operators of the first printing presses run by steam rather than by hand found it possible to produce a thousand pages in an hour rather than thirty. Steam also promised to eliminate a transportation problem not fully solved by either canal boats or turnpikes. Boats could carry heavy weights, but canals could not cross hilly terrain; turnpikes could cross the hills, but the roadbeds could not stand up under great weights. These problems needed still another solution, and the ingredients for it lay close at hand. In some industrial regions, heavily laden

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question 10

Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

- A. In the early eighteenth century, Savery and Newcomen discovered that expanding steam could be used to raise a piston in a cylinder.
- B. Watt' s steam engine played a leading role in greatly increasing industrial production of all kinds.
- C. Until the 1830s, Britain was the world' s major producer of steam engines.
- D. In the mid-1700s James Watt transformed an inefficient steam pump into a fast, flexible, fuel-efficient engine.
- E. In the 1790s William Murdoch developed a new way of lighting houses and streets using coal gas.
- F. The availability of steam engines was a major factor in the development of railroads, which solved a major transportation problem.