2.6 Coal and iron

The progress of the Industrial Revolution was assisted by the increased use of coal, a more efficient fuel than wood and charcoal. Also, improvements in the production of iron and steel resulted in metals that were stronger and cheaper to produce, and could be applied to a wider variety of uses.

Coalmining
Coal is a much more efficient fuel than wood; that is, a given weight of coal will burn for longer and provide greater heat than a similar weight of wood. Britain had a very rich supply of coal, but traditional coalmining practice allowed only the extraction of coal from shallow bell pits (see Source 1). This meant that coal was not widely available and was therefore more expensive than wood. Deep-pit mining could not be pursued because of the amount of water that would flood the shafts. Pumping out surplus water from mines with the use of steam-driven pumps (see spread 2.4) made coal more readily available and cheaper to mine. This coal could be used as fuel for the steam engines that would come into more widespread use as the Industrial Revolution progressed.

Developments in iron production
Methods of producing iron had been known throughout Europe since ancient times. To produce iron that could be used for tools, weapons and other implements, iron ore extracted from the ground had to have various impurities removed. This was achieved by a process known as smelting, in which heat was applied to the ore in a blast furnace. For centuries the source of heat for English blast furnaces had been charcoal, obtained by the heating and partial burning of wood. The product of the blast furnaces was known as pig iron.

Did you know?

Pig iron was so called because of the method of casting molten iron from blast furnaces into moulds. These moulds were laid in a row in a bed of sand, and fed the molten iron from a common channel. The process was said to resemble a litter of piglets being fed by a mother sow, and so the iron at this stage was called ‘pig iron’.

Burning coke in blast furnaces
The growth in coal production meant that coal became more widely available for use in the smelting process, but impurities in the coal tended to contaminate the iron, compromising its quality. During the seventeenth century methods of burning out the impurities in coal to produce coke were improved. In 1709 Abraham Darby developed a blast furnace that burned coke to produce iron of a superior quality. The use of coke also allowed the construction of larger blast furnaces capable of producing greater quantities of pig iron.
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Henry Cort and ‘puddling’

While pig iron had many uses, it could be brittle because of the presence of carbon. In 1783 Henry Cort developed a method of reducing the carbon content of pig iron through a process known as ‘puddling’. This resulted in a product that was stronger and could be bent, rolled or cast into many different shapes. High-quality iron could now be used for making machinery, boilers for steam-driven engines, and a huge variety of tools and implements, as well as bridges and the framework for buildings.

As iron production methods improved, quantities increased, and large-scale production made good-quality iron cheaper. By 1850 Britain was producing more than seventy times as much iron as it had in 1760.

### British pig iron production, 1760–1850

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
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<tbody>
<tr>
<td>1760</td>
<td>30,000</td>
</tr>
<tr>
<td>1785</td>
<td>50,000</td>
</tr>
<tr>
<td>1796</td>
<td>125,000</td>
</tr>
<tr>
<td>1806</td>
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<tr>
<td>1823</td>
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<tr>
<td>1830</td>
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<tr>
<td>1840</td>
<td>1,400,000</td>
</tr>
<tr>
<td>1850</td>
<td>2,200,000</td>
</tr>
</tbody>
</table>


### Analysis and Use of Sources

1. Explain how the method of mining depicted in Source 1 limited the use of coal before the eighteenth century.
2. The Iron Bridge, shown in Source 2, was opened in the 1780s. Explain why such a bridge would not have been practical before this time.

### Explanation and Communication

3. Explain why deep-pit mining became possible during the eighteenth century.
4. What had been the traditional source of heat for English blast furnaces?
5. Identify the problem that Abraham Darby was able to solve, and explain his solution.
6. In what way did Henry Cort improve the production of iron?

### Perspectives and Interpretations

7. In what ways do you think the figures in Source 3 suggest that a revolutionary change occurred in Britain between 1750 and 1850?

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**Source 2** The Iron Bridge in Shropshire, England, built by the grandson of Abraham Darby, is an example of late eighteenth-century iron construction.

**Source 3** British pig iron production, 1760–1850

bell pit a traditional form of coalmining in which a shaft is dug down to a seam of coal and then excavated outwards, with the coal raised to the surface using a winch and buckets

blast furnace a type of furnace into which air is forced to raise the temperature sufficiently to carry out the smelting of iron ore

coke a type of fuel produced by using heat to remove impurities such as coal gas and tar from coal

pig iron the initial product resulting from the smelting of iron ore in a blast furnace