



James Joule

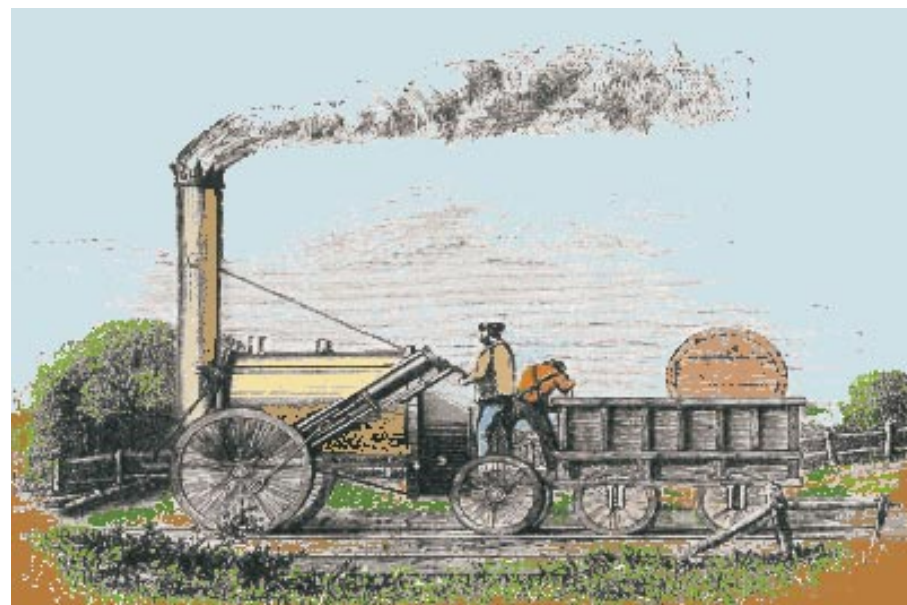
1818-1889

James Joule, a British physicist, established that the various forms of energy - mechanical, electrical and heat - are basically the same, and can be changed one into another. This is *the law of conservation of energy*.

Joule was born in December 1818 and lived in Manchester, a busy industrial town. He was the second of the five children of Benjamin and Alice Prescott Joule. The family inherited a brewery. James later wrote that he was 'in poor health' between the ages of five and twelve. He had a spinal weakness, and was under treatment by a bonesetter, who really was a horse doctor but sometime treated the 'royalty'. James and his brother Benjamin were not sent to school, but received education at home under private tutors. They used to be constant companions. Once, the brothers went down to a field not far from home to watch the first trains running on the Liverpool to Manchester Railway. This event influenced the boys and probably formed their future thoughts.

From 1834 to 1837 the two brothers were privately taught elementary mathematics, some physics and chemistry, by John Dalton, the noted English chemist. Joule's pioneering experiments, which began in his nineteenth year, were carried out in laboratories he had equipped at his own expense in his house and in the brewery. While he carried out some of his researches at the brewery he also was actively engaged in running the business, until it was sold.

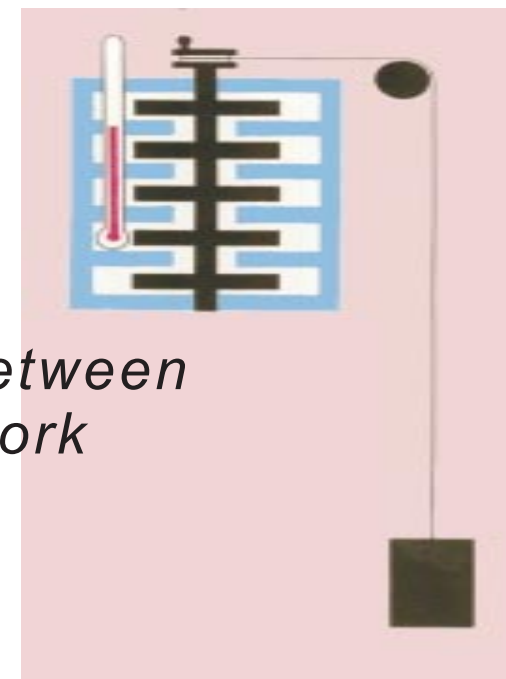
In his first experiments he began to construct electric motors. The first two motors were not a success, but the third was much better. With this motor he carried out a series of experiments and finally showed how the motor performed when driven by a different number of voltaic cells and different currents.



*The brothers saw
the first trains
on the Liverpool
to Manchester
Railway*



*Joule showed
the relation between
mechanical work
and heat*



In 1840, he published the statement that the amount of heat per second that developed in a wire carrying a current is proportional to the electric resistance of the wire and square of the current.

In 1843, Joule announced his determination of the amount of work required to produce a unit of heat. He used many increasingly accurate methods of obtaining this. The first was by measuring the rise in temperature, the current and the mechanical work resulting from the rotation of a small electromagnet in the water between the poles of a magnet.

Joule married Amelia Grimes of Liverpool in 1847, but she died in 1854. He spent the rest of his life with his two children in the neighborhood of Manchester.

In 1852, Joule and W. Thomson (later Lord Kelvin) discovered that when gas is expanded, without performing external work, its temperature falls. This famous result is named the **Joule-Kelvin effect**. Later, this effect was used to construct refrigerators.

Joule spent all his money on his research and finally had to ask for contributions from scientific bodies.

After the acceptance by the scientific world of his experimental investigations he was elected to The Royal Society. His last observation was concerned with the atmospheric consequences of the eruption of the Krakatau volcano. He died, after a long illness in 1889.

His name was given to the energy unit '*the joule*'.