
Andy Pearson

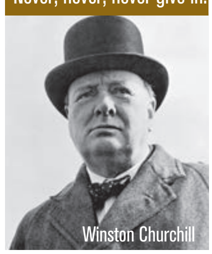
English, Irish and Scots

BY ANDY PEARSON, PH.D., C.ENG., MEMBER ASHRAE

Three pioneers of engineering science have been immortalized through the use of their names as units in the SI system, representing energy, temperature and power. They are James Joule, James Watt, and William Thomson (Lord Kelvin) and it is likely every practicing refrigeration engineer, designer, technician and mechanic uses at least one of their names every day of their working lives. They create an interesting weave in space-time.

Watt and Kelvin worked in the same cramped, old-fashioned and dingy university laboratories in Glasgow, Scotland, but were not contemporaries—Watt left Glasgow to settle in Birmingham, England, 50 years before Kelvin was born. Watt and Joule's lives overlap, but only by eight months, and Watt was nearly 83 when Joule was born. Kelvin and Joule, although separated by more than 200 miles, worked on the same mathematical and physical problems and had a strong friendship based on mutual respect and frequent letter-writing.

Never, never, never give in.


Winston Churchill

James Joule, the Englishman in this trio of famous names, was born in Salford, just southwest of Manchester, England, in 1818. His father owned a brewery and Joule was raised and educated to take over the business, being tutored by John Dalton who is famous for creating Dalton's law of partial pressures (also widely used by refrigeration technicians, whether they realize it or not). Joule developed a passion for science, particularly topics that affected his working life such as electricity, heat and power. He was a businessman and industrialist who pursued science as a hobby, and his wealthy background and successful brewery business provided the means to follow his amateur enthusiasms.

He created sophisticated scientific experiments that were completely at odds with the received wisdom of the establishment at the time and he claimed, for example, to be able to measure temperature to within 0.005°F (0.0028°C); an accuracy that would not be out of place in a modern, digital, science laboratory. The main goal of all his experimentation was to demonstrate that mechanical work could be converted to heat and to establish the conversion factor; the so-called "mechanical equivalent of heat." Although this seems normal to us, it was so far removed from scientific orthodoxy at the time that the first reading of his theories, at a meeting of the British Association for the Advancement of Science in 1843, was met with complete silence from the audience. He was 24 years old. Despite this setback he persevered with his experiments into electromagnetism and heat, presenting further papers to the British Association in 1845 and 1847. The latter meeting was attended by William Thomson, recently appointed as Professor of Natural Philosophy at Glasgow at the age of 23. Thomson was initially skeptical because Joule's ideas were so unlike conventional thinking, but he noted that Joule's theory helped explain some shortcomings of traditional caloric theory and over the next four years he convinced himself that Joule's reasoning was correct. Joule and Thomson started a series of experiments to validate Joule's theory. Their correspondence extended from 1852 to 1856, and Joule continued stirring and measuring for a further 20 years.

Joule was not the only one to develop these ideas; similar thinking surfaced at about the same time in Germany and Denmark, but above all others Joule stuck to his task, even in the face of stony opposition. He continually refined his techniques and measurements, perfecting his craft and homing in on the elusive value of equivalence. The number he was seeking was the amount of mechanical work, measured in foot-pounds, that was required to heat one pound of water from 60°F to 61°F (15.56°C to 16.11°C). When he died in 1889 his tombstone was inscribed with the value "772.55," this being, in his opinion, his most accurate assessment, achieved in 1878 after 35 years of testing. The fact that this is within one percent of the true value of 778.17 ft·lb/Btu (4,187 Nm to raise 1 kg by 1 K) is testament to Joule's precision, his patience and his eyesight. ■

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