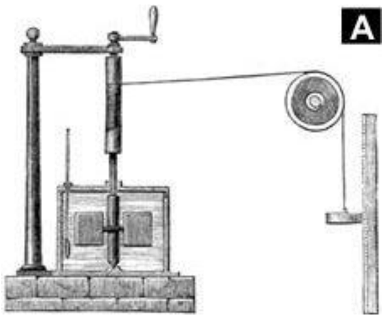
Labs Professors Fear



1. Exploding the Joule Experiment: Impulse Per Calorie

Professor Du-Ane Du

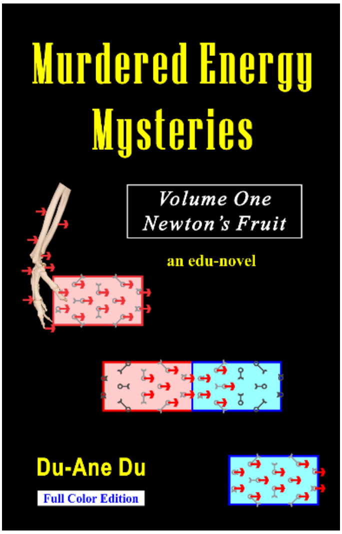
www.Wacky1301SCI.com, *"Looking at serious science, sideways!"*

An analysis of Joule's original "heat-is-work" experiment reveals that Joule used an equivalency speed of 1 ft/s, which means it was impossible for him to distinguish between joules of work-done and ρ of impulse-used. According to Joule's original data, 1 cal of heat is always equivalent to 4.958 ρ of impulse, 1 standard-linearized joule is equivalent to 1.185 ρ of impulse, and 1 Volt = 1.185 ρ/C.
—By Du-Ane Du, Author of *Murdered Energy Mysteries*, (Amazon, Kindle, ebook 2018, paperback 2021).

This is the first of three experiments on the relationship between impulse (momentum-transfer), calories, and electric joules. Experiment #1 is an analysis of Joule's original heat-is-work experiment. Experiment #2 is a sample mechanical-vs-electric heat experiment that can be repeated in a school or home lab. Electric-vs-magnetic force Experiment #3 can also be duplicated and verified in a school or home lab. As one would expect, Labs Professors Fear produce results that are eye-opening, revolutionary, and controversial. *They are a must-perform for every aspiring engineer and physicist.*

Labs Professors Fear #1: A detailed analysis of Joule's heat-is-work experiment was done by Mr. Du in Part 3, Chapter 2 of *Murdered Energy Mysteries*. This analysis will begin with an extensive excerpt of that dialogue, and will finish up with final observations and conclusions:

Excerpted from:



"Are there other conservation laws?" Tera queried.

"Yes," Proge said, "in 1783 and 1789, a scientist named Antoine Lavoisier proposed two new conservation laws. One was the law of conservation of mass, and the other was the conservation of heat-calories. These two laws became the foundation for the science of chemistry."

"Lavoisier proposed that *caloric* was a fluid-like substance that flowed from one object to another," Proge elaborated. "A hot object contained lots of caloric, and caloric flowed from a hot object to a cold object."

"Kind of like atomic momentum?" Hectii solicited. "In our rocket-fuel experiments, the atomic momentum moved to the surface of the rocket engine, then the momentum was transferred from one atom to another and allotted and distributed throughout the mass of the rocket."

"The transfer of momentum from one place to another is similar to a fluid behavior!" Pico said. "Good observation, Hectii."

"The original idea of caloric was that it was like a gas that had no mass," Proge said. "It was never connected to the idea of atomic momentum. In fact, the atomic theory didn't exist at the time."

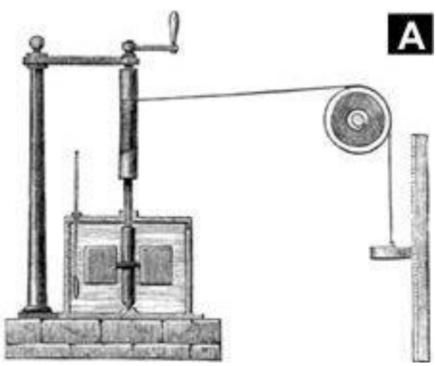
"Too bad," Hectii said disappointedly. "I liked the idea that calories are the same thing as heat-related atomic momentum. That way the conservation fact for momentum would be the same as the law of conservation of calories."

"But no one made that connection," Tera countered. "What came next?"

"In 1805 John Dalton proposed an idea called the modern atomic theory," Proge said. "Dalton theorized, all matter is composed of atoms, atoms are indestructible, and atoms bond in groups to make molecules."

"I wonder if molecular-momentum is similar to atomic-momentum?" Pico reflected.

Proge smiled knowingly. "One of Dalton's students was a man named James Prescott Joule. Joule did experiments with special mixer. As a weight dropped, the mixer stirred a container of water, and the water became warmer."



"It's a gravity motor!" Hectii said proudly. "That means heat is related to gravitational momentum!"

"How can you tell?" Pico said.

"Look at the right side of Joule's equipment," Hectii said. "Gravity gives downward momentum to the atoms in the weight, the weight forces the momentum into the atoms in the rope, the rope forwards the momentum to the atoms in the axel and mixer, and the mixer forces the momentum into the atoms of water."

“In other words,” Tera paraphrased. “The gravitational momentum in the falling weight is transferred to the atoms in the water, where it becomes atomic momentum—and that causes the temperature of the water to rise!”

“That means I was right,” Hectii said triumphantly. “Atomic momentum and heat-calories must be related!”

“Wouldn’t that depend on the equations they used?” Pico said. “Grandpa, did Joule time how long the mixer turned, or did he measure the distance that the weight fell? If he measured the distance, did he remember to use the square root equation for Gravitational Potential Distanced Impulse?”

Proge shook his head. “Joule was trying to prove that heat is a form of work. While he did time some of his experiments, for the most part, Joule measured the distance that the weight fell—and he didn’t use the square root equation.”

“Sound’s a lot like the work-done experiment we just did, lifting the bricks,” Tera said as she burst into song:

We -e -e -e -e
Work’d our impulse, Did it speedy,
Making speedy impul -l -l -l -l -l -lse,
‘Cause that’s what work-done is—!

“Wait, that’s my song,” Pico protested. “Grandpa, why was Joule trying to prove heat is a type of work or energy?”

“Joule’s experiments began years earlier, when he was a student,” Proge replied. “At the time, most scientists believed the movement of electricity from one place to another did not involve the movement of mass. That assumption meant electricity could not be a form of momentum, it had to be a form of energy. In fact, they called it, electric energy because they believed electricity did not involve mass.

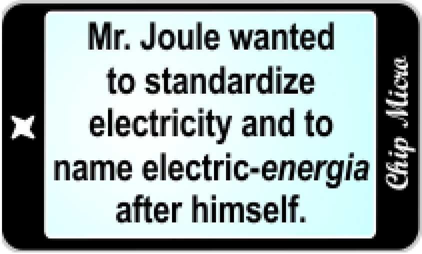
“Joule noticed that when a narrow wire is attached to a battery, the wire gets hot,” Proge extended. “So Joule developed the theory that electric energy and heat-calories were the same thing—because caloric and electricity both seemed to involve a fluid like substance that had no mass.”

“You’re saying, heat and electricity are related?” Hectii said.

“Yes,” Proge said. “The relationship between heat-calories and electron currents is well established. Both are linear behaviors, and both obey the rules of linear mathematics.

“During the early 1800’s, there was no single standard for measuring electricity,” Proge continued. “Therefore, Joule proposed that electron currents and heat-calories be standardized based on a type of copper-zinc battery invented by a man named Daniell. Joule further proposed that the standard unit of measure for standard linearized electric-energy be called a joule. [Basically, (1 volt)(1 amp)(1 sec) = (1 joule$_{[1.2]}$)].”

“Joule wanted to name electric energy after himself!” Tera shockingly said, between mouthfuls of cake. “That sounds very political.”



“Very,” Proge agreed. “Joule had a lot of political influence. But he needed more than just political influence to accomplish his goal. So, Joule developed the Heat-is-Work experiment hoping that he could prove his theory that heat-calories are also a type of mechanical work.”

“Joule thought heat-calories are a form of mechanical work?” Hectii said, exasperatedly. “But work-energy involves multi-parabolic kinetic-joules$_{[IC]}$ and work-done involves multi-linear work-joules$_{[IC]}$! In Joule’s experiment, the farther the weight falls, the faster work-energy accelerates. If you use a different height with each experiment, you’ll never find consistent results for how much work-energy is involved!”

“Wait,” Pico cautioned. “That also means every time Joule changed the design of his equipment, he would produce a different answer. At some point, he would find the combination of equipment that would produce the answer he was looking for."

"If at first you don't succeed," Tera said with a smirk, "then modify your equipment until you find the answer you want! I guess that's the beauty of multi-parabolic kinetic-joules[IC]—you can keep modifying the experiment until you '*prove*' your claim is '*plausible*'!"

"The closest answers Joule ever got involved an error of about 20%," Proge tactfully noted. "For decades, many chemists rejected Joule's theory that heat-equals-work. The biggest objection was probably the fact that the law of conservation of calories was well established by then, and there was no established conservation law for kinetic energy or work energy. Finally, in 1850 a scientist named Rudolf Clauses suggested that if chemists and physicists would accept a law of conservation of standard linearized H&E-joules[1.2], based on the behavior of electricity, then Joule's heat-is-energy theory could be merged with the heat-calorie theory."

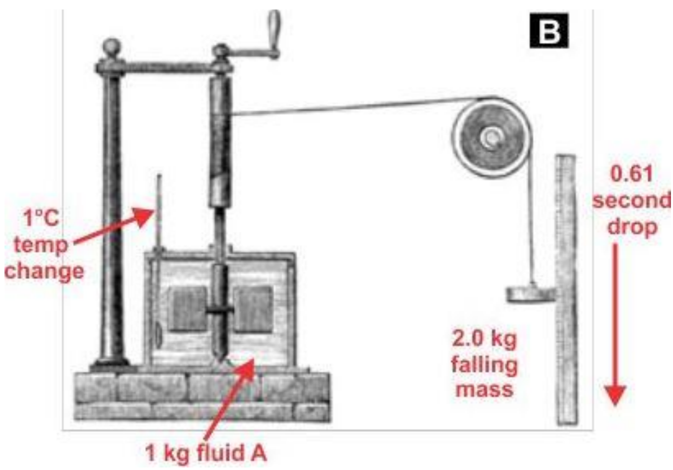
"I imagine that caused a lot of political conflicts," Pico said softly.

"It was a compromise," Proge said. "It was the century of standardization, and political compromises were being made all the time. Scientists eventually agreed to the [Heat &

Electric] H&E-joule[1.2] compromise, and teachers began creating equations and demonstrations that made it appear that mechanical energy can't be created or destroyed."

"Seriously?" Pico said, as a look of astonishment clouded her face. "They actually voted on it?"

"What about heat-related impulse [momentum transfer]?" Hectii courageously offered. "Here, Grandpa, look at the data I added to your picture:"



"This looks interesting," Tera said, leaning over Hectii's shoulder.

"This diagram shows a 2.0 kg mass being pulled down by gravity," Hectii said. "We've already learned that each second, the Earth's gravity gives 9.8 ρ of downward subatomic momentum to each kilogram of the falling mass. If there's no acceleration, the rope will force the new momentum into the mixer at a rate of (9.8)(2), or 19.6 momentums per second. In

0.61 s, the mixer will transfer (0.61)(9.8)(2) or 12 ρ of momentum into the atoms of the fluid."

"And the additional momentum caused the temperature of the fluid to go up 1.0 degree Celsius," Pico interpolated.

Symbols

$im\Delta\rho$ – impulse

10 ρ = 10 kgm/s

10 ρ = 10 N*s

5 N = ρ/s

"Now it looks like both heat and temperature are somehow related to the transfer of momentum from one object to another. That would make heat a type of impulse/momentum-transfer," Hectii said. "But James Prescott Joule and other scientists thought heat and temperature are related to molecular kinetic energy."

"It's too bad Joule didn't use a stopwatch during his experiments," Tera said regretfully.

"Actually, Joule did," Proge advanced. "In his most accurate published experiment, Joule used a clock to calculate the speed that the weight was falling. He designed the equipment so the weight fell at a constant speed of 1.0 foot per second, which was a common experimental speed at the time."

"Why did he want to know the speed that the weight fell?" Pico asked.

"Notice that Joule's experimental apparatus has a hand crank attached to the paddle that churned the water," Proge pointed out. "The weight only fell a few feet. Once Joule had a good estimate of the speed that the weight was falling, he cranked the paddle at the same speed."

"How long did he turn the crank?" Tera said.

"900 seconds," Proge said. "Since the speed was 1.0 foot per second, Joule multiplied the time by the speed to calculate a distance of 900 feet. He used this distance to calculate the number of foot-pounds of multi-linear work-done—"

"Grandpa!" Hectii said hurriedly. "If we know the speed, distance, and time, maybe we can do a reverse calculation!"

"A what?" Tera said, confused.

"Don't you understand? This version of the experiment involved a constant velocity, *not an acceleration!*" Hectii said, as she began keying information into her phone.

"We forgot all about Pico's fact #1 of work-impulse expansion," Pico commented.

"Great point," Hectii said. "Pico's fact #1 of work-impulse expansion tells us, multi-linear work-done is a scalar expansion of the amount of impulse used…"

"And the variable of scalar expansion is the average speed at which the work was done," Pico meticulously completed.

"Fabulous," Tera said, as her eyes widened with understanding. "We know the velocity that Joule used, and if we apply Pico's fact, then we can calculate the amount of impulse that Joule used."

"Exactly," Hectii said. She walked to the computer and began keying. "The question we're looking at is, does heat involve atomic momentum-transfer (im$\Delta\rho$)? It appears that Joule's heat-is-work experiment involved this equation:"

> (*mass of water*)(*joules/g*) = (F)(*distance*)
> appeared on the display.

"Which means?" Pico said.

"If this were a heat-is-impulse experiment," Hectii said, "then the equation would've been:"

> (*mass of water*)(ρ/*g*) = (F)(*time*)
> appeared on the display.

"But we don't know the mass of the water," Tera said regretfully. "We also don't know the mass of the falling weight, or the force—this is impossible!"

Proge lifted a brow encouragingly, "You don't always need every piece of information to solve a problem. Remember Pico's fact?"

Pico nodded as she quickly thumb-keyed information into her phone, "Pico's fact is the fastest way to convert joules$_{[IC]}$ of work-done into ρ of impulse. The formula is:"

$work\text{-}done_{[1/S]} = (speed)(im\Delta\rho)$

$im\Delta\rho = \frac{work\text{-}done}{speed}$

appeared on their displays.

“Grandpa, Joule’s experiment was all about the specific heat of water,” Hectii recalled. “You said his experiment produced an incorrect answer, was it higher or lower than the standard unit?”

“Joule was using English units,” Proge clarified. “He was looking for a measurement of 778 foot-pounds, but his experiment produced a value of 900 foot-pounds.”

“Which means his value was higher than the standard number,” Tera deduced. “Chip, what would that be in metric joules[IC]?”

“The calculations for the modern metric equivalent to Joule’s experiment would be:”

$Joule's\ experiment = (Goal)(\frac{[actual\text{-}distance]}{[desired\text{-}distance]})$

$Joule's\ experiment = (4.184\ J/cal)(900/778)$

Joule’s experiment = 4.840 J/cal

appeared on their displays.

“Joule’s experiment would have shown that 1.0 calorie is equal to 4.840 joules[1.2],” Hectii read. “In our Pico’s fact experiments, we found that, 1.0 J is the same thing as 1.0 ρ(m/s).”

"And to find the ρ of impulse involved," Pico said logically, "all we do is divide by the velocity."

"Grandpa said James Prescott Joule turned the crank at a velocity of 1.0 foot per second," Tera said. "What's the metric equivalent of 1.0 foot, Chip?"

"Does it matter?" Proge said, with a soft chuckle. "Think about it girls—if I'm not mistaken, you're about to discover a new Space-sci Sherlock's scientific fact."

"Think carefully, Sisters," Tera suggested warily.

"Grandpa said, Joule turned the crank at a speed of 1.0 foot per second," Pico said. "That's an old English unit. The other unit he mentioned was 778 foot-pounds."

"Grandpa, what does foot-pounds measure?" Tera said.

"Work-done and work energy, depending on the situation," Proge said. "What happens if you use English units in your Pico's law equation, Hectii?"

"I think it would look like this:"

$$im\Delta\rho = \frac{work\text{-}done}{velocity}$$

$$im\Delta\rho = \frac{778\ foot\text{-}pounds}{1\ ft/s}$$

$im\Delta\rho$ = 778 pound-seconds

appeared on their displays.

"Look at that," Pico exclaimed, "The numbers didn't change—only the units. Joule's experiment involved 778 foot-pounds, and it involved 778 pound-seconds. The numbers are identical!"

"It's an equivalency point!" Hectii said. "Grandpa is right, there should be a scientific fact hidden somewhere."

"Whenever the speed is 1 unit per second," Pico realized. "The numerical value of work-done and the numerical value for impulse-used are identical—but in a way, we already knew that."

"Joule was doing his experiment at the equivalency speed for the old English system of measurement," Tera said. "Does that mean we don't have to multiply or divide?"

"Precisely," Hectii affirmed.

"They're equivalent," Pico said, as she keyed the following into her phone:

> ***Joule's experiment =*** *4.840 J/cal ≈* ***4.840 ρ/cal***
>
> was written on their displays.

"That's an interesting fact, 1 calorie is equal to 4.840 ρ of impulse… but was that his real experimental value?" Tera challenged. "Grandpa said, Joule was trying to prove that the number was 4.184. Did all of Joule's experiments produce a value of 4.840?"

"Only one experiment produced that value," Proge stipulated. "James Prescott Joule tried thousands of experiments, and this was the only published experiment that came close to his target of 4.184."

"If 4.840 is his closest result, the other experiments must've produced results that were higher than 4.840," Pico postulated. "That means the real value must also be higher than 4.840—another interesting fact. But how much higher?"

"A good experimental error is 2 or 3%," Hectii said. "We could adjust it up some, knowing the other experiments were higher…"

"And make a range of plus or minus about 1%," Pico said, as her thumbs adeptly keyed. "That way we would be saying that the value is between 1, 3, maybe 4% higher than the value produced by Joule's experiment. How's this look:"

$1\ cal = (4.840\ \rho)(102.44\%)$

$\mathbf{1\ cal = 4.958 \pm 0.04\ \rho}$

was written on their displays.

"Marvelous job, girls, you found the scientific fact," Proge lauded. "I'm the proudest grandfather in history! This experiment by Joule was unique because he used a hand crank and a clock. The hand crank produced a constant force and a constant velocity. There was no acceleration during this particular experiment. Your conversion works because Joule used a fixed experimental velocity."

"And the math was easy because Joule used a speed of 1.0 foot per second—which is the work-to-impulse equivalency speed for English units," Pico said.

"We need to codify this fact," Tera nominated. "Let's call it **Joule's double-meaning fact of heat-impulse**."

"I love it," Pico said winningly.

"We'll begin by noting that Joule's most successful heat experiment didn't involve gravitational acceleration," Hectii said.

"Joule's best experimental results occurred when he turned a hand-crank with a force of 1.0 lb, a speed of 1.0 ft/s, for 900 seconds," Pico said.

"Because he used a clock!" Tera said. "By using a clock, Joule was actually measuring the amount of impulse needed to raise the temperature of the water."

"However," Pico said. "Because the speed was 1.0 ft/s, Joule multiplied his measurements by the speed to find a value he associated with multi-linear work-done."

"Look at this," Hectii said, holding her phone for all to see. "I calculated four conversion equalities that relate to Joule's double-meaning fact of heat-impulse:"

1 cal of heat = 4.958 ±0.04 ρ of heat-impulse

1 $J_{[1.2]}$ standardized heat = 1.185 ±0.009 ρ of heat-impulse

1 ρ of heat-impulse = 0.202 cal

1 Volt = 1.185 ρ/coulomb
was written on their displays.

OBSERVATIONS & CONCLUSIONS:

Probably one of the most important statements in the above dialogue is:

> *"Wait," Pico cautioned. "That also means every time Joule changed the design of his equipment, he would produce a different answer. At some point, he would find the combination of equipment that would produce the answer he was looking for."*

In truth, Joule's experiment failed to work thousands of times, and no scientist has ever been able to duplicate Joule's experimental results over a *range* of speeds/accelerations.

The reason Joule's experiment rarely worked, is because mechanical energy and work-done are speedy-impulse. In other words:

$$work\ done = (speed)(im\Delta\rho)$$

Joule turned the crank with a specific force, for a specific amount of time, then he multiplied by the speed. That's impulse times speed.

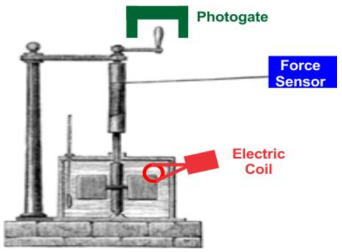
If Joule's equipment worked at a force of 1 pound and a speed of 2 ft/s, then the "joules per calorie" value would have been 8.4 J/cal instead of the accepted value of 4.2 J/cal.

Similarly, if Joule's equipment worked at a force of 1 pound and a speed of 0.5 m/s, then his experimental result would have been 2.1 J/cal. Every time the design changed, the results changed.

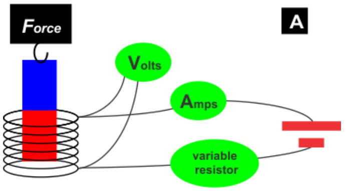
Joule was only able to publish one experiment that produced a result which had an experimental error less than 20%, and his experiment is not repeatable, due to the fact that he had to manipulate the equipment to get a result that was close to his goal.

Is the impulse/calorie data more accurate? Is the impulse version of the experiment repeatable? To discover more, explore:

Labs Professors Fear #2: a repeatable amplification of Joule's experiment that uses calories as the intermediate step in comparing mechanical heat and electric heat. (www.Wacky1301SCI.com)



Labs Professors Fear #3: a repeatable school-home experiment that uses the interaction of natural magnetism and a solenoid's electromagnetic field to calibrate voltage. (www.Wacky1301SCI.com)

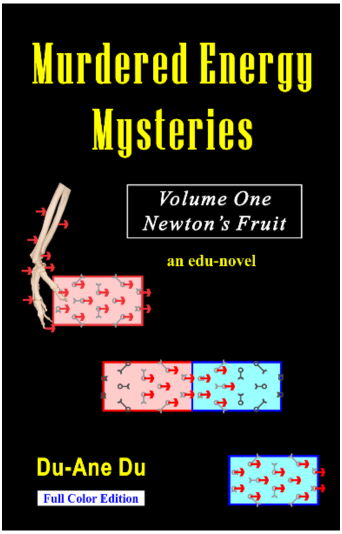


Conclusion: An analysis of Joule's original "heat-is-work" experiment reveals that Joule used an equivalency speed of 1 ft/s, which means that it was impossible for him to distinguish between joules of work-done and ρ of impulse-used. According to Joule's original data, 1 cal of heat is always equivalent to 4.958 ρ of impulse, 1 standard-linearized joule is equivalent to 1.185 ρ, and 1 Volt = 1.185 ρ/C (ρ/C is a type of pressure, like N/m^2, or ρ/mol).

* * *

Murdered Energy Mysteries seeks to increase understanding of the various forms of momentum and momentum transfer, as well as the various forms of energy and energy transfer. The lack of understanding on the part of the scientific community is substantial, and more research needs to be done.

—Du-Ane Du, author of the edu-novel *Murdered Energy Mysteries* (Amazon, Kindle, e-book 2018, paperback 2021.)



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