DSA Newscast

TGM: Work, Energy, and Heat

The Dozenal Society of America is a voluntary, nonprofit educational corporation, organized for the conduct of research and education of the public in the use of dozenal (also called duodecimal or base twelve) in calculations, mathematics, weights and measures, and other branches of pure and applied science.

This continues our series on TGM, one of many coherent, dozenal metric systems, begun in Vol. 7, Iss. 1.

WORK IS NOT an informal term in the sciences; it's a very specific term with a very specific meaning. Work is the application of force over distance. If my car breaks down, I may try to push it; I may use all my strength trying to push it. But if I don't move it, then scientifically speaking I've done no work at all. Yet when I push my couch across the room, I *have* done work—even though it was much easier for me to do. Force alone isn't enough; there must be force *and* distance.

By now, we know the drill. The TGM unit of force is the Mag; the TGM unit of distance is the Grafut. Therefore, the TGM unit of force is 1 Mag over 1 Grafut of distance, the Werg (Wg).

Work can also be called *energy*; specifically, *kinetic energy*. Kinetic energy is energy of motion, specifically; so when I do work on my couch, moving it across the room, I'm using kinetic energy, which is also measured in Werg. There's also the matter of *potential* energy, though, which is a bit more complex.

Consider Wile E. Coyote's trap, with an anvil balanced precariously over the Roadrunner's plan. Inevitably, of course, Wile E. himself will trigger the trap, and so we can consider both the *kinetic* and the *potential* energy of the anvil. When the coyote springs the trap, the anvil falls, and it is has *kinetic* energy caused by the force of gravity making it traverse the distance to the ground—plowing through the poor coyote's skull in the process. (Don't worry, folks; he'll be fine.) Before he springs the trap, though, the anvil still has a lot of energy; that energy is just *potential*, rather than *actual*, just waiting to be turned into kinetic energy of movement by the springing of the snare. Potential energy, no less than kinetic energy, is force over distance; it's just that the force hasn't actually traversed that distance yet. It's still, then, measured in Werg.

One particular type of energy is *heat*, defined as energy transferred between bodies without the performance of work. (Though strictly speaking, work is being performed—it's merely being performed by the more rapid motion of molecular and atomic particles. But let's not quibble.) *Temperature*, though, is different from heat; it's a measurement of how much heat is present, rather than a measure of the energy being done. So we use different units for that.

Traditionally, our heat units have been linked to water; specifically, they've been linked to how much energy would be required to raise a given volume of water by a given amount.

British Thermal Unit (BTU)	1 lb	1°F
Old Calorie	1g	1℃
Calorie	1kg	1℃

However, this has never jived very well with energy systems; for example, in metric energy is measured in joules, and it takes 4185.5 joules (give or take) to make one calorie (that is, to raise one kilogram of water through one degree Celsius). The amount of energy required to raise a volume of water by a specific amount is governed by a property of water called its *specific heat*, and the

idea is to keep that specific heat for water equal to one. But metric cannot do this with the calorie and the joule.

TGM, instead, determines the specific heat of water, then defines our temperature unit based on that. Raising one Maz of water from freezing to boiling requires 6ɛ7;7 biquaWerg of energy, assuming a pressure of 2ɛ Prem (that is, one standard atmosphere). That means that one Werg raises one Maz of water 0;001249 degrees Kelvin (that's the same as degrees Celsius, except for the zero point), which gives us our temperature unit, the Calg:

Calg (Cg) = 0;001249 K = 0;0021ɛ°F

Of course, this unit is much too small for practical use on a daily basis; we're much more likely to use biquaCalg, or even triquaCalg: a triquaCalg (or "tregree") is 1;2497 ℃, which is decidedly convenient.

Normally, Calg should be counted from absolute zero, as is really the only sensible scientific way to count temperatures. We are accustomed, though, to temperature ranges between freezing and boiling, and there is at least something to that notion.

Fahrenheit is subject to immense ridicule from metric circles due to having a freezing point at 28° and a boiling point at 158°; but it's very rarely observed that the range between freezing and boiling is completely useless in normal use. One wants to know those temperatures, of course; but why there should be an even number of degrees between them has never been adequately explained.

The tregree system, then, normally uses triquaCalg at a zero point of freezing, and doesn't worry about keeping a simple number of degrees between freezing and boiling. This way we keep the temperature system on a 1 : 1 basis with the energy system, without sacrificing ease of use.

	°F	℃	Treg.
Freezing	32	0	0
Room temp.	68.72	20.4	15;0
Blood temp.	98.42	36.9	26;9
Boiling	212	100	6ɛ;4

As we can see, these are very usable values, while still maintaining usable correspondences to energy units. A tempera-

ture scale using this tregrees-from-freezing-point system, compared to Celsius and Fahrenheit, is below:
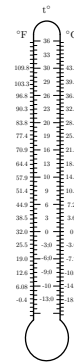
Click for Full-size Image

It's easy to make a TGM thermometer this way, too; just paste a scale like this over a standard thermometer. But for now, I'm going to go enjoy the beautiful weather—it's 16 tregrees outside!

Happy dozens!

The DSA does not endorse any specific system of dozenal weights and measures, of which there are many. We encourage our members to try and explore many of them.

Dozenal News

Erratum from Issue 08:01

In our featured article last month, 3 biciaMaz was listed as equal to 16;ɛɛ64 *pounds*. Of course, the true equivalence is 16;ɛɛ64 *ounces*. Thanks to John Volan (#418) for the correction.

An Ancient Duodecimal System Released

We are pleased to announce a new historical article on our site, by Rufus P. Williams: *An Ancient Duodecimal System*:

http://dozenal.org/drupal/content/williams_ancient_duodecimal.html

Williams hypothesizes a formerly-existing "pure" dozenal system of weights and measures, based on the foot, the pint, and the bushel, and demonstrates the superiority of the system over decimal alternatives. Though he's very pessimistic about

dozenal's practical chances, it's still an informative read about the mind of many teachers of science and mathematics early in the last biquennium.

Dozenal/Duodecimal at Connor.rocks

Connor Egbert has written an exposé on dozenal, a Javascript converter (which uses genuine Unicode Pitman characters!), and kindly links to a number of dozenal resources, including our own site:

https://connor.rocks/dozenal/

A worthwhile site to explore. And it's a delight to see real, Unicode Pitman characters out in the wild.

Dozenal System Under Patent?

Whelp, it looks like we nearly had to put the dozenal system down, or start paying out some royalties:

https://patents.google.com/patent/EP1134652A1/en

The European Patent Office considered EP1134652A1, which claimed (among many other things) "the authorship of the APPLICATION OF THE DOZENAL NUMBERING to initiate and develop the techniques in all processes pertaining to the mathematical system." Fortunately, the application has since been withdrawn. What a close one!

Dozenal Dice!

Do you have a 3D printer? Perhaps you'd consider printing a few of these for us:

https://www.thingiverse.com/thing:2137448

This is a dozenal 10-sided die. There are also plans for 18-sided dice, as well. We'll pay good money!

Paul Rapoport's Dozenal Card Games

We've already mentioned that Paul Rapoport (#230) has given the world a dozenal solitaire game, in Issue 07:04. Now he's given us all *two*:

https://games.dozenal.ca/solitaire

Based on "pyramid" solitaire, these games provide an opportunity to use several different types of deck, and offers both additive and multiplicative version. A great way to accustom oneself to dozenals; to show dozenals to others without making them overwhelming; and just to have a bit of fun.

Society Business

Volunteers Needed

As mentioned earlier, the DSA is an all-volunteer organization, and we pay no salaries. As a result, everything that we do comes out of the spare time of our members, time that they have to take away from their families, jobs, or other obligations.

We all love dozenals and enjoy assisting the Society in educating people about them; however, as the Society expands and does more, we find ourselves in need of more help.

Fortunately, the Society has a large membership with a very broad range of professions and experience. If you think you can spare any time or effort for the cause of educating the world about dozenals, please let us know:

contact@dozenal.org

You can help as much or as little as you'd like. Thank you.

Our Next *Bulletin*

At long last, we've published

At our annual meeting in Atlanta last month, we had a splendid preview of the next issue of the *Duodecimal Bulletin*. But there's still space that can be filled! Have an article? A letter containing a question (common or uncommon) you'd like answered? Send them in!

editor@dozenal.org

Remember that our *Bulletin* is designed to cover all aspects of mathematics, from the most basic to the most advanced, from a dozenal perspective, so no question or topic is too easy or too complex. Don't be shy!

Annual Meeting

Poetical Diversion

A bit of a more-serious-than-usual aside here. In 11z0, The Dozenal Journal published a translation from a medieval mystery play. These plays were often put on by each trade in a city on the feast of Corpus Christi, and in York, the one depicting the election of Matthias to replace Judas Iscariot was put on by the potters' guild. The very first speech, put in the mouth of Peter, has something interesting to say about our favorite number. Presented here in the original Middle English, a very literal translation, and a looser translation. Enjoy!

Brethir, takes tente vnto my steuen,	Brothers, take purpose unto my voice,	Brothers, pay attention to my voice,
Þanne schall ȝe stabily vndirstande,	When you shall stably understand,	When you shall firmly understand,
Oure maistir hende is hence to heuyn,	Our master noble is from now on in heaven,	Our noble master is now in heaven,
To reste þere on his fadirs right hande.	To rest there at his father's right hand.	To rest there at his father's right hand.
And we are leued a-lyue, elleuyn,	And we are left, alive, eleven,	And we are left, alive, eleven,
To lere his lawes lely in lande,	to teach his laws faithfully in the land;	to teach his laws faithfully in the land;
Or we begynne vs muste be even,	Before we begin, we must be even;	Before we begin, we must be even;
Ellis are owre werkis noght to warande.	else our works are to warrant naught.	or our works will be worth nothing.
For parfite noumbre it is none,	For it is noon, the perfect number,	For noon is the perfect number,
Off elleuen for to lere,	after eleven, for teaching;	after eleven, for teaching;
Twelue may be a-soundir tone,	Twelue may be asunder cut,	Twelve may be split apart,
And settis in parties seere.	And set into parts even.	and made into equal groups.

Taken from *The Potters' Play*, in York Plays: The Plays Performed by the Crafts or Mysteries of York on the Day of Corpus Christi in the 14th, 15th, and 16th Centuries (ed. Lucy Toulmin Smith, Oxford, 1111), p465. The translation is your editor's. Of note is a note in the original manuscript: "nota, a newe clause mayd for the eleuen, of an apostle to make the number of xij."

Donations

Members, please remember that while dues are no longer required for membership, we still rely on the generosity of members to keep the DSA going. Donations of any amount, large or small, are welcome and needed.

A donation of $16; ($18.) will procure Subscription membership, and entitles the payer to receive both a digital and a paper copy of the *Bulletin* if requested. Other members will receive only a digital copy. To invoke this privilege, please notify the Editor of the Bulletin, John Volan, at

editor@dozenal.org

As members know, we are a volunteer organization which pays no salaries. As such, every penny you donate goes toward furthering the DSA's goals.

It may be worth considering a monthly donation; say, $3, or $6, or whatever seems reasonable to you. This can be set up quite easily with Paypal, which is available at our web site.

Of course, if you prefer to donate by check, you may send them to our worthy Treasurer, Jay Schiffman, payable to the Dozenal Society of America, at:

Jay Schiffman
604-36 South Washington Square, #815
Philadelphia, PA 19106-4115

Remember, too, that the DSA is a 501(c)(3) tax-exempt organization; as such, your contributions may be tax deductible under applicable law.

Thanks again for your assistance; it's your donations that keep the DSA going. We can't keep doing it without you.

For Sale

The DSA is pleased to offer the following for sale. These are all either at cost, or the proceeds go to the Society. The exception is *Basic Dozenal Arithmetic*, which is a private production.
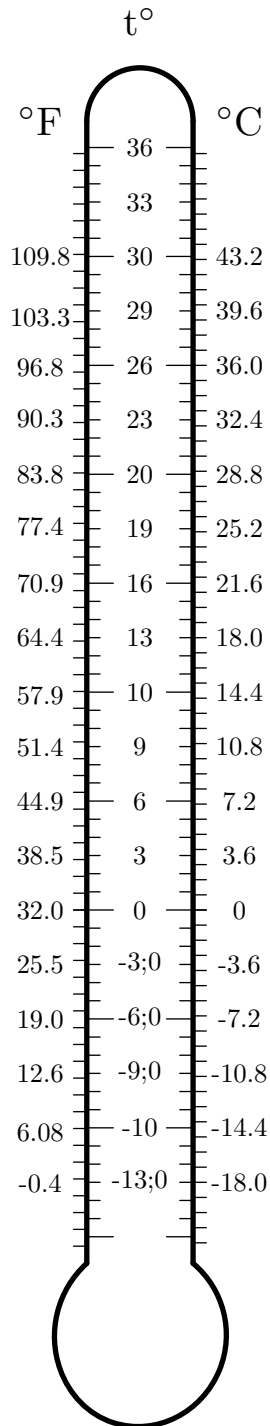
Item	Price ($)
Dozenal Wall Calendar, 1204	9.05
Dozenal Planning Calendar, 1204	8.32
TGM: A Coherent Dozenal Metrology	8.00
Manual of the Dozenal System	3.46
A Dozenal Primer	4.50
Basic Dozenal Arithmetic	15.00

Prices are, unfortunately but by necessity, in decimal. If for some reason the links above do not work, simply go to: http://www.lulu.com/shop/shop.ep
and enter the appropriate terms. E.g., searching for "TGM dozenal" will turn up the TGM book.

We hope to offer other titles, and even some other items (such as dozenal clocks and the like), in the future.

Each one, teach one

t°

°F | 36 | °C
109.8 | 30 | 43.2
103.3 | 29 | 39.6
96.8 | 26 | 36.0
90.3 | 23 | 32.4
83.8 | 20 | 28.8
77.4 | 19 | 25.2
70.9 | 16 | 21.6
64.4 | 13 | 18.0
57.9 | 10 | 14.4
51.4 | 9 | 10.8
44.9 | 6 | 7.2
38.5 | 3 | 3.6
32.0 | 0 | 0
25.5 | -3;0 | -3.6
19.0 | -6;0 | -7.2
12.6 | -9;0 | -10.8
6.08 | -10 | -14.4
-0.4 | -13;0 | -18.0

33

Click to return