

OFF THE BEAT

What's the latest on the SI scene? Peta, exa, gray and becquerel

Reaction and comment are still coming in over the official SI (International System) of units we published in the Oct. 18 issue. There was nothing timely or newsworthy about the matter; the SI system has been in existence for some time, and, following the practices of scientific journals, most of the measurements we print in our news articles are in SI units. We'd been wanting to publish the tables of SI base units, derived units and multiples for several years for readers' information but never really had an excuse to. Professor Horn's letter to us provided the occasion. (In his defense, he didn't invent the SI system; some of our readers seem to be holding him personally accountable for perceived deficiencies in the system, which was established by international agreement.) The response shows that although measurement science is hardly a glamorous topic, the vocabulary of measurement does hold a fascination for many people, and it can be controversial. The loss of the abundantly clear "cycles per second" in favor of the murky "hertz" is one we too lament. But it is a battle long lost; "hertz" has been in standard use now for nearly a decade.

The purpose of all this is not to rehash the old, however, but to report something new. Yes, even official, standard terminologies do change, at least slightly.

At the 15th General Conference on Weights and Measures, meeting in Paris May 27 to June 3, two new prefixes for large numbers and two special names for SI radiology units were officially adopted. The October *DIMENSIONS*, the news magazine of the National Bureau of Standards, carries a report on the decisions.

The two new prefixes are *peta* (symbol P) for 10^{15} and *exa* (symbol E) for 10^{18} . *Peta* is pronounced as in *petal* and *exa* as in *Texas*. The small end of the prefix spectrum has long had its equivalent prefixes: *femto* (symbol f) for 10^{-15} and *atto* (symbol a) for 10^{-18} .

The two new prefixes are expected to simplify the handling of very large quantities. Conferees pointed out that they would encourage greater use of the SI unit of energy, the joule (symbol J), instead of non-SI units like the watt-hour (1 watt-hour = 3,600 J) for expressing large amounts of energy frequently necessary in discussing national and world energy demands. It was noted, for example, that the terajoule (10^{12} J) is often too small and therefore posed a stumbling block to the use of SI.

An example of use of the new prefixes:

The total amount of energy from hydroelectric, fossil-fuel, nuclear and geothermal sources currently delivered to consumers in the United States each day is estimated to be about 100 petajoules (in symbols: 100 PJ) or 0.1 exajoule (in symbols: 0.1 EJ). Thus, about 1 exajoule of energy is delivered every 10 days.

The SI radiology units given new names are those for activity and absorbed dose. The SI unit of activity of a radioactive source, equal to 1 disintegration or other nuclear transformation per second, is to be called the *becquerel* (symbol Bq). It is named in honor of Henri Becquerel, the French physicist who discovered radioactivity in 1896.

The *becquerel* replaces the previous symbol "s⁻¹" for the SI unit of activity, which, because of its negative exponent, was considered "inconvenient and consequently dangerous in most current applications, especially in hospitals." In conjunction with the new prefixes, the *becquerel*, conferees thought, should encourage users to replace *curie* (1 curie = 3.7×10^{10} Bq) with the SI unit when describing intense radioactive sources such as are used to sterilize foods.

The SI unit of absorbed dose, defined as 1 joule per kilogram, is to be called the *gray* (symbol Gy), in honor of Louis Harold Gray, the British radiobiologist whose studies laid the foundation for the use of ionization chambers in measuring absorbed dose. As an example, a patient receives 1 gray when ionizing radiation imparts one joule of energy to one kilogram of tissue.

"Use of the term *gray*," says the NBS article, "has advantages similar to those of the *becquerel*. It too eliminates the use of a symbol containing a negative exponent and, in addition, it avoids the potential danger that unsophisticated medical users might misinterpret the 'kilogram' in 'joules per kilogram' to refer to the total weight of the patient. Adoption of the term *gray* is expected to help the SI unit of absorbed dose displace the *rad* (1 rad = 0.01 joule per kilogram)."

In other metric news, the NBS's latest reference guide to metric vocabulary, in the same issue of *DIMENSIONS*, states: "Certain units which are not part of the SI are used so widely that it is impractical to abandon them. The units that are accepted for continued use in the United States with the International System are: minute, hour, day, degree, second, liter, metric ton."

There's still more. "In those cases where their usage is already well established, the use, for a limited time, of the following units is accepted, subject to future review: nautical mile, knot, angstrom, standard atmosphere, hectare, barn, bar, are, gal, curie, rontgen, rad."

So there you are, SI fans and critics, the latest on the measurement front. Stay tuned for further bulletins.

—Kendrick Frazier

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