Properties8_Key.eps (or .pdf): Format of properties8.dat 03 April 2014

This inscrutable format evolved over nearly 15 years, and is naively read in by the FORTRAN code (fetchpro8.for) using unforgiving fixed format. It is explained in detail in properties8.common.

The basic materials list and coefficients for calculating the density correction are from in R. M. Sternheimer, M. J. Berger, and S. M. Seltzer, Atomic Data and Nuclear Data Tables **30**, 261-271 (1984). Compositions may be found in Int. J. Appl. Radiat. Isot. **35**, 665(1984). Also see D. E. Groom, N. V. Mokhov and S. I. Striganov, Atomic Data and Nuclear Data Tables **78**, 183-356 (2001). Updated densities, new materials, and additional properties have been added as required and requested.

Typical entries for an element and a compound:

```
-------------------------------------------------------------------------------
   9 Fluor  7  18.9984032000   5  0.47372 1.5803E-03 1.5803E-03 D  1  1  5 E
F   fluorine_gas
fluorine gas (F%2#)
     115.0  10.9653   1.8433   4.4096  0.11083   3.2962     0.00
         9  1.000000  1.000000
Melting point                  -219.62
Boiling point                  -188.12
Index ref (n-1)                195.
Note: This stuff is really, really noxious. It is a pale greenish yellow gas, and forms
      tightly bound compounds. Note that I mark a continuation line by 5 blanks at the start.
-------------------------------------------------------------------------------
 113 Ba-F2  5  -1.0000000000      0.42207 4.8900E+00 4.8930E+00 S  2  2  3 I
     barium_fluoride
barium fluoride (BaF%2#)
     375.9   5.4122  -0.0098   3.3871  0.15991   2.8867     0.00
         9  2.000000  0.216720
        56  1.000021  0.783280
Melting point (C)              1368.
Boiling point (C)              2260.
Index of ref                   1.4744       CRC2006 10-246
-------------------------------------------------------------------------------
12345678911234567892123456789312345678941234567895123456789612345678971234567898
```

Wrap to 150 columns OK

Separator line

Examples of first line:

```
   9 Fluor  7  18.9984032000   5  0.47372 1.5803E-03 1.5803E-03 D  1  1  5 E
 113 Ba-F2  5  -1.0000000000   5  0.42207 4.8900E+00 4.8930E+00 S  2  2  3 I
```

- Sternheimer index (now extended). Invisible but used by code.
- Truncated Sternheimer label (not used)
- Significant figures in atomic weight if element
- Atomic weight if element
- Error in last place
- $\langle Z/A \rangle$
- Sternheimer's density
- Corrected density
- S(olid), L(iquid), G(as), D(iatomic gas)
- Elements in material
- Number of optional lines
- Atoms of element 1
- Material type: E(lement), R(adioactive element), I(norganic compound), O(rganic compound), P(olymer), M(ixture), B(iological, for dosimetry)

Second line: fname. String () to be affixed to ().html, muB_().*, muE_(),* where * = ps, pdf, dat

```
hydrogen_H_gas
Barium_fluoride
```

Third line: Title. "%2#" means "subscript 2", to be interpreted appropriately for \TeX and for html.

```
hydrogen (gas) (H%2#)
Barium fluoride (BaF%2#)
```

← Name and formula

Fourth line: Mean excitation energy and Sternheimer density effect coefficients at Sternheimer's density. If $\bar{C} = 0$ the code will construct the coefficients, but with less resulting accuracy for the density correction than if they are obtained from the ancient papers.

```
     375.9   5.4122  -0.0098   3.3871  0.15991   2.8867     0.00
     175.3   0.0      0.0000   0.0000  0.0       0.0000     0.00
```

$I_{\rm eff}$ (in eV)	$\bar{C}$	x_0	x_1	a	k	δ_0	in Sternheimer
effIeV	Cbar	x0	x1	aa	sk	dlt0	in properties5.common

Line for each constitutent element: Number fraction is historical; calculated from *A*, *Z*, and weight fraction as a check. A modern *A* table was used, so small departures from integers occur. In the second example, $I_{\rm eff}$ is given (**as it must be**) but the others are 0.

```
         9  1.000000  0.216720
        56  2.000021  0.783280
```

Z	Number fraction	Weight fraction

Optional lines for select properties: Code treats col 1:5 as key. More properties can be added as needed. Not case sensitive.

```
Melting point (C)              1368.      Barium fluoride
Boiling point (C)              2260.         Barium fluoride BP from Rubber Bible
Index of ref                   1.56       George added barium fluoride index
12345678911234567892123456789312345678941234567895123456789612345678971234567898
```

Property: (A25) Code looks at 1:5 **Value:** F20 or E20 format **Comment:** Field starting in col 46 is not read; can be useful for records or labels.

Optional lines for notes: A150 format. Recognized as note if col 1:5 is 'Note:' or ' '. Not case sensitive. Example for polypropylene:

```
Note: Chem formula wrong in Sternheimer. <i>I</i> and density effect constants
      for polyethylene are scaled with density and used for these calculations.
12345678911234567892123456789312345678941234567895123456789612345678971234567898
```

WARNING: Read-in code (fetchpro8.for) learns the number of constituent elements and number of extra property lines from the first line. If these are incorrect, civilization as we know it will end.