Table 1. Element abundances in the solar photosphere and in meteorites.

Element	Photosphere[a]	Meteorites	Photosphere–meteorite difference	Element	Photosphere[a]	Meteorites	Photosphere–meteorite difference
1 H	12.00	–	–	42 Mo	1.92 ± 0.05	1.97 ± 0.02	−0.05
2 He	$[10.93 \pm 0.004]$	–	–	44 Ru	1.84 ± 0.07	1.83 ± 0.04	+0.01
3 Li	1.10 ± 0.10	3.31 ± 0.04	−2.21	45 Rh	1.12 ± 0.12	1.10 ± 0.04	+0.02
4 Be	1.40 ± 0.09	1.42 ± 0.04	−0.02	46 Pd	1.69 ± 0.04	1.70 ± 0.04	−0.01
5 B	(2.55 ± 0.30)	2.79 ± 0.05	−0.24	47 Ag	(0.94 ± 0.25)	1.24 ± 0.04	−0.30
6 C	8.52 ± 0.06	–	–	48 Cd	1.77 ± 0.11	1.76 ± 0.04	+0.01
7 N	7.92 ± 0.06	–	–	49 In	(1.66 ± 0.15)	0.82 ± 0.04	+0.84
8 O	8.83 ± 0.06	–	–	50 Sn	2.0 ± 0.3	2.14 ± 0.04	−0.14
9 F	$[4.56 \pm 0.30]$	4.48 ± 0.06	+0.08	51 Sb	1.0 ± 0.3	1.03 ± 0.07	−0.03
10 Ne	$[8.08 \pm 0.06]$	–	–	52 Te	–	2.24 ± 0.04	–
11 Na	6.33 ± 0.03	6.32 ± 0.02	+0.01	53 I	–	1.51 ± 0.08	–
12 Mg	7.58 ± 0.05	7.58 ± 0.01	+0.00	54 Xe	–	2.17 ± 0.08	–
13 Al	6.47 ± 0.07	6.49 ± 0.01	−0.02	55 Cs	–	1.13 ± 0.02	–
14 Si	7.55 ± 0.05	7.56 ± 0.01	−0.01	56 Ba	2.13 ± 0.05	2.22 ± 0.02	−0.09
15 P	5.45 ± 0.04	5.56 ± 0.06	−0.11	57 La	1.17 ± 0.07	1.22 ± 0.02	−0.05
16 S	7.33 ± 0.11	7.20 ± 0.06	+0.13	58 Ce	1.58 ± 0.09	1.63 ± 0.02	−0.05
17 Cl	$[5.50 \pm 0.30]$	5.28 ± 0.06	+0.22	59 Pr	0.71 ± 0.08	0.80 ± 0.02	−0.09
18 Ar	$[6.40 \pm 0.06]$	–	–	60 Nd	1.50 ± 0.06	1.49 ± 0.02	+0.01
19 K	5.12 ± 0.13	5.13 ± 0.02	−0.01	62 Sm	1.01 ± 0.06	0.98 ± 0.02	+0.03
20 Ca	6.36 ± 0.02	6.35 ± 0.01	+0.01	63 Eu	0.51 ± 0.08	0.55 ± 0.02	−0.04
21 Sc	3.17 ± 0.10	3.10 ± 0.01	+0.07	64 Gd	1.12 ± 0.04	1.09 ± 0.02	+0.03
22 Ti	5.02 ± 0.06	4.94 ± 0.02	+0.08	65 Tb	(-0.1 ± 0.3)	0.35 ± 0.02	−0.45
23 V	4.00 ± 0.02	4.02 ± 0.02	−0.02	66 Dy	1.14 ± 0.08	1.17 ± 0.02	−0.03
24 Cr	5.67 ± 0.03	5.69 ± 0.01	−0.02	67 Ho	(0.26 ± 0.16)	0.51 ± 0.02	−0.25
25 Mn	5.39 ± 0.03	5.53 ± 0.01	−0.14	68 Er	0.93 ± 0.06	0.97 ± 0.02	−0.04
26 Fe	7.50 ± 0.05	7.50 ± 0.01	+0.00	69 Tm	(0.00 ± 0.15)	0.15 ± 0.02	−0.15
27 Co	4.92 ± 0.04	4.91 ± 0.01	+0.01	70 Yb	1.08 ± 0.15	0.96 ± 0.02	+0.12
28 Ni	6.25 ± 0.04	6.25 ± 0.01	+0.00	71 Lu	0.06 ± 0.10	0.13 ± 0.02	−0.07
29 Cu	4.21 ± 0.04	4.29 ± 0.04	−0.08	72 Hf	0.88 ± 0.08	0.75 ± 0.02	+0.13
30 Zn	4.60 ± 0.08	4.67 ± 0.04	−0.07	73 Ta	–	-0.13 ± 0.02	–
31 Ga	2.88 ± 0.10	3.13 ± 0.02	−0.25	74 W	(1.11 ± 0.15)	0.69 ± 0.03	+0.42
32 Ge	3.41 ± 0.14	3.63 ± 0.04	−0.22	75 Re	–	0.28 ± 0.03	–
33 As	–	2.37 ± 0.02	–	76 Os	1.45 ± 0.10	1.39 ± 0.02	+0.06
34 Se	–	3.41 ± 0.03	–	77 Ir	1.35 ± 0.10	1.37 ± 0.02	−0.02
35 Br	–	2.63 ± 0.04	–	78 Pt	1.8 ± 0.3	1.69 ± 0.04	+0.11
36 Kr	–	3.31 ± 0.08	–	79 Au	(1.01 ± 0.15)	0.85 ± 0.04	+0.16
37 Rb	2.60 ± 0.15	2.41 ± 0.02	+0.19	80 Hg	–	1.13 ± 0.08	–
38 Sr	2.97 ± 0.07	2.92 ± 0.02	+0.05	81 Tl	(0.9 ± 0.2)	0.83 ± 0.04	+0.07
39 Y	2.24 ± 0.03	2.23 ± 0.02	+0.01	82 Pb	1.95 ± 0.08	2.06 ± 0.04	−0.11
40 Zr	2.60 ± 0.02	2.61 ± 0.02	−0.01	83 Bi	–	0.71 ± 0.04	–
41 Nb	1.42 ± 0.06	1.40 ± 0.02	+0.02	90 Th	–	0.09 ± 0.02	–
				92 U	(<-0.47)	-0.50 ± 0.04	–

Abundances are given in the logarithmic scale usually adopted by astronomers $A_{el} = \log N_{el}/N_H + 12.0$, where N_{el} is the abundance by number. By definition the abundance of hydrogen is exactly $A_H = 12.0$.
[a] Values between square brackets are not derived from the photosphere, but from sunspots, solar corona and solar wind particles. Values between parentheses are less accurate results.

the largest number of data. Actually, 65 elements, out of 83 stable elements, are present in the photospheric spectrum; other sources of solar abundances only concern a limited number of elements. The photosphere, just above the convection zone, is a well-mixed region whereas the outer solar layers show a very heterogeneous and changing structure. Furthermore, it is also the layer that was studied quite a long time before the other layers for an obvious reason: the solar photospheric spectrum has been recorded for quite a long time with high resolution and high signal-to-noise ratio. For all these reasons, photospheric abundances are adopted as a reference for all the other solar (and stellar) data.

Solar photospheric abundances

The basic data for deriving photospheric abundances are from the photospheric spectrum. Solar photospheric spectra with very high resolution and very high signal-to-noise ratio, obtained from the ground and from space, are now available for quite a large wavelength range, from the ultraviolet to the far infrared.

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