Table 2.5

Electron affinities of the elements (kJ mol^{-1})[a]

Z	Element	Value	Z	Element	Value
1	H	72.775	34	$Se \longrightarrow Se^{1-}$	194.980
2	He	0		$Se^{1-} \longrightarrow Se^{2-}$	−410[b]
3	Li	59.63	35	Br	324.6
4	Be	0	36	Kr	0
5	B	26.7	37	Rb	46.887
6	C	153.89	38	Sr	0
7	$N \longrightarrow N^{1-}$	7	39	Y	29.6
	$N^{1-} \longrightarrow N^{2-}$	−673[b]	40	Zr	41.1
	$N^{2-} \longrightarrow N^{3-}$	−1070[b]	41	Nb	86.1
8	$O \longrightarrow O^{1-}$	140.986	42	Mo	71.9
	$O^{1-} \longrightarrow O^{2-}$	−744[b]	43	Tc	53
9	F	328.0	44	Ru	101.3
10	Ne	0	45	Rh	109.7
11	Na	52.871	46	Pd	53.7
12	Mg	0	47	Ag	125.6
13	Al	42.5	48	Cd	0
14	Si	133.6	49	In	28.9
15	$P \longrightarrow P^{1-}$	72.02	50	Sn	107.3[c]
	$P^{1-} \longrightarrow P^{2-}$	−468[b]	51	Sb	103.2
	$P^{2-} \longrightarrow P^{3-}$	−886[b]	52	Te	190.16
16	$S \longrightarrow S^{1-}$	200.42	53	I	295.18
	$S^{1-} \longrightarrow S^{2-}$	−456[b]	54	Xe	0
17	Cl	349.0	55	Cs	45.509
18	Ar	0	56	Ba	0
19	K	48.387	57	La	48
20	Ca	0	58−71	Ln	50
21	Sc	18.1	72	Hf	0
22	Ti	7.62	73	Ta	31.06
23	V	50.6	74	W	78.63
24	Cr	64.26	75	Re	14.47
25	Mn	0	76	Os	106.1
26	Fe	15.7	77	Ir	151.0
27	Co	63.7	78	Pt	205.3
28	Ni	111.5	79	Au	222.76
29	Cu	118.4	80	Hg	0
30	Zn	0	81	Tl	19.2
31	Ga	28.9	82	Pb	35.1
32	Ge	119.0[c]	83	Bi	91.2
33	$As \longrightarrow As^{1-}$	78	84	Po	183.3
	$As^{1-} \longrightarrow As^{2-}$	−435[b]	85	At	270.1
	$As^{2-} \longrightarrow As^{3-}$	−802[b]	86	Rn	0

[a] Unless otherwise noted, all values are from Hotop, H.; Lineberger, W. C. *J. Phys. Chem. Ref. Data* **1985**, *14*, 731.

[b] Pearson, R. G. *Inorg. Chem.* **1991**, 30, 2856–2858.

[c] Miller, T. M.; Miller, A. E. S.; Lineberger, W. C. *Phys. Rev. A* 1986, *33*, 3558–3559.

Table 2.6

Electron affinities of molecules[a]

Molecule	Experimental (kJ mol^{-1})[b]	Molecule	Experimental (kJ mol^{-1})[b]
CH_3	752	OCN	340
$C{\equiv}CH$	285	SiH_3	140
C_5H_5	165	PH_2	150
C_6H_5	100	PtF_5	630
$C_6H_5CH_2$	85	PtF_6	770
CN	365	SH	223
N_3	266	SO_2	107
NH_2	74	SO_3	160
NO	232	SCN	205
NO_2	220	SF_5	290
NO_3	375	SF_6	101
O_2	42	Cl_2	230
O_3	203	Br_2	240
OH	176	TeF_5	430
OCH_3	155	TeF_6	320
O-*t*-C_4H_9	184	I_2	240
O-*neo*-C_5H_{11}	183	WF_6	330
OC_6H_5	220	UF_2O_2	325
O_2H	104	UF_6	540

[a] Lias, S. G.; Bartmess, J. E.; Liebman, J. F.; Holmes, J. L.; Levin, R. D.; Mallard, W. G. *J. Phys. Chem. Ref. Data* **1988**, *17*, Supplement 1, 1-86.

[b] Uncertainty is approximately ±20 except for numbers given to three significant digits.

Problems

2.1 Calculate the r value in pm at which a radial node will appear for the 2s orbital of the hydrogen atom.

2.2 Which quantum numbers reveal information about the shape, energy, orientation, and size of orbitals?

2.3 How many orbitals are possible for $n = 4$? Which of these may be described as *gerade*?

2.4 How many radial nodes do 3s, 4p, 3d and 5f orbitals exhibit? How many angular nodes?

2.5 Make a photocopy of Fig. 2.8. Draw two lines, one along the z axis, and one at a 45° angle away from the z axis. Along one of these lines measure the distance from the origin (nucleus) to each contour line and plot the value of the contour line at that distance (r). Do this for all contours on both lines. Compare your drawing with Fig. 2.4.

2.6 Determine the maximum number of electrons that can exist in a completely filled $n = 5$ level. Give four possible quantum numbers for a 5f electron of the hydrogen atom.

2.7 The signs of the unsquared wave functions are usually shown in plots of the squared functions. Why do you think this practice exists?

2.8 Sometimes 2p orbitals are drawn as shown below: