

HOMEWORK #1 Solution

Due Jan 22, 2008

2.1 Atomic mass is the mass of an individual atom, whereas atomic weight is the average (weighted) of the atomic masses of an atom's naturally occurring isotopes.

2.7 The K^+ ion is just a potassium atom that has lost one electron; therefore, it has an electron configuration the same as argon (Figure 2.6).

The I^- ion is a iodine atom that has acquired one extra electron; therefore, it has an electron configuration the same as xenon.

2.8 Each of the elements in Group VIIA has five p electrons.

2.10 (a) The $4f$ subshell is being filled for the rare earth series of elements.

(b) The $5f$ subshell is being filled for the actinide series of elements.

3d, 4p, 5s, 5p, and 5d

Periodic Table of the Elements

1 H																	2 He
3 Li	4 Be	<ul style="list-style-type: none"> ■ hydrogen ■ poor metals ■ alkali metals ■ nonmetals ■ alkali earth metals ■ noble gases ■ transition metals ■ rare earth metals 										5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Unq	105 Unp	106 Unh	107 Uns	108 Uno	109 Une	110 Unn								

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

2.12 (a) Differentiation of Equation 2.11 yields

$$\frac{dE_N}{dr} = \frac{A}{r^{(1+1)}} - \frac{nB}{r^{(n+1)}} = 0$$

(b) Now, solving for $r (= r_0)$

$$\frac{A}{r_0^2} = \frac{nB}{r_0^{(n+1)}}$$

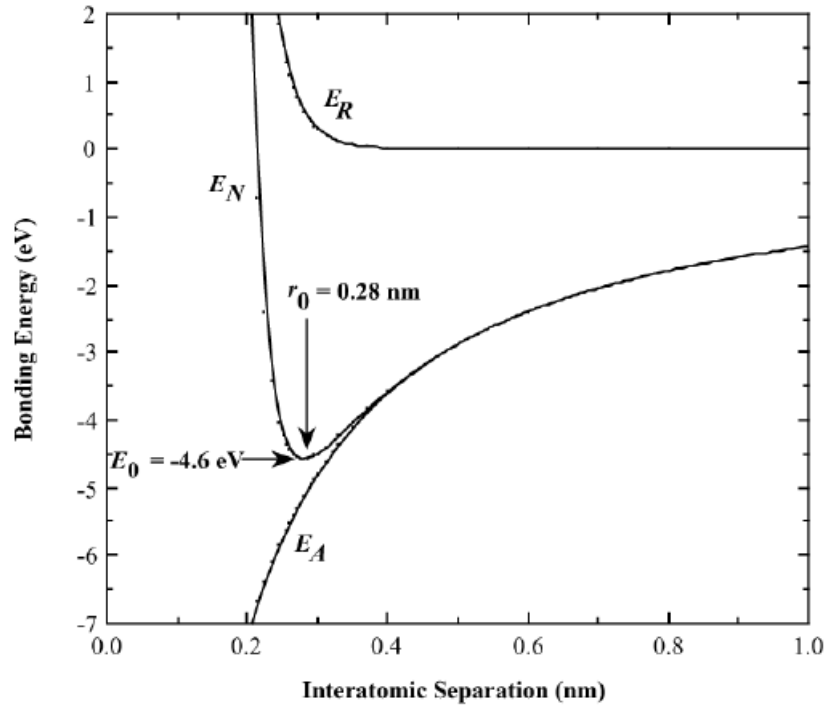
or

$$r_0 = \left(\frac{A}{nB} \right)^{1/(1-n)}$$

(c) Substitution for r_0 into Equation 2.11 and solving for $E (= E_0)$

$$\begin{aligned} E_0 &= -\frac{A}{r_0} + \frac{B}{r_0^n} \\ &= -\frac{A}{\left(\frac{A}{nB} \right)^{1/(1-n)}} + \frac{B}{\left(\frac{A}{nB} \right)^{n/(1-n)}} \end{aligned}$$

2.13 (a) Curves of E_A , E_R , and E_N are shown on the plot below.



(b) From this plot

$$r_0 = 0.28 \text{ nm}$$

$$E_0 = -4.6 \text{ eV}$$

(c) From Equation 2.11 for E_N

$$A = 1.436$$

$$B = 5.86 \times 10^{-6}$$

$$n = 9$$

Thus,

$$r_0 = \left(\frac{A}{nB} \right)^{1/(1-n)}$$

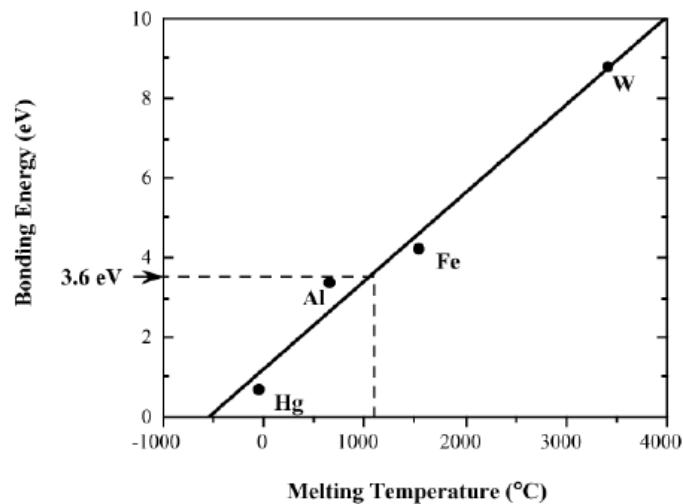
$$\left[\frac{1.436}{(9)(5.86 \times 10^{-6})} \right]^{1/(1-9)} = 0.279 \text{ nm}$$

and

$$E_0 = - \frac{1.436}{\left[\frac{1.436}{(9)(5.86 \times 10^{-6})} \right]^{1/(1-9)}} + \frac{5.86 \times 10^{-6}}{\left[\frac{1.436}{(9)(5.86 \times 10^{-6})} \right]^{9/(1-9)}}$$

$$= -4.57 \text{ eV}$$

2.18 Below is plotted the bonding energy versus melting temperature for these four metals. From this plot, the bonding energy for copper (melting temperature of 1084°C) should be approximately 3.6 eV. The experimental value is 3.5 eV.



(b) This value of the density is greater than the measured density. The reason for this discrepancy is that the ionic radii in Table 3.4, used for this computation, were for a coordination number of six, when, in fact, the coordination number of both Cs^+ and Cl^- is eight. The ionic radii should be slightly greater, leading to a larger V_C value, and a lower density.

2.20 For brass, the bonding is metallic since it is a metal alloy.

For rubber, the bonding is covalent with some van der Waals. (Rubber is composed primarily of carbon and hydrogen atoms.)

For BaS, the bonding is predominantly ionic (but with some covalent character) on the basis of the relative positions of Ba and S in the periodic table.

For solid xenon, the bonding is van der Waals since xenon is an inert gas.

For bronze, the bonding is metallic since it is a metal alloy (composed of copper and tin).

For nylon, the bonding is covalent with perhaps some van der Waals. (Nylon is composed primarily of carbon and hydrogen.)

For AlP the bonding is predominantly covalent (but with some ionic character) on the basis of the relative positions of Al and P in the periodic table.