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### Chapter 4 Practice Worksheet: Periodic Trends

1) Write electron configurations of the following ions:

a)  $K^+$  (long hand notation):

b)  $F^-$  (long hand):

c)  $Ni^{2+}$  (short hand):

d)  $Zn^{2+}$  (short hand):

e)  $Br^-$  (short hand):

f)  $Cu^{2+}$  (short hand):

g)  $Ag^+$  (short hand):

2) Draw orbital diagrams (for valence electrons only) for the following ions:

a)  $K^+$

b)  $Br^-$

c)  $Ni^{2+}$

d)  $Zn^{2+}$

3) Define the following terms: **atomic radius**. Describe the periodic trend for atomic radius.

4) Define  $Z_{\text{eff}}$  (effective nuclear charge). How does this property affect radii of atoms as you move from left to right in a period? Does it affect atomic radius as you move down a group?

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5) Arrange the following atoms in order of **increasing** radius: N, Sb, P, Bi, As. Explain your answer in terms of the atomic number of the elements and/or their valence electron configuration.

6) Define the phrase **isoelectronic series**. Describe how sizes of ions change as you move from the most positively charged ion to the most negatively charged ion in an isoelectronic series.

7) Arrange the following ions in order of **increasing** radius:  $F^-$ ,  $Na^+$ ,  $O^{2-}$ ,  $Mg^{2+}$ ,  $N^{3-}$ . Is this an isoelectronic series?

8) Define **ionization energy**.

9) Write the chemical equation that corresponds to the ionization energy of iodine.

10) On the periodic table below, use arrows to show the general trends in ionization energy and atomic radius among the elements. Indicate which elements have the highest and lowest ionization energy. Also indicate the largest and smallest elements.

1 H																	2 He
3 Li	4 Be											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 Rf	105 Ha	106 Sg	107 Ns	108 Hs	109 Mt	110	111	112	(113)	(114)	(115)	(116)	(117)	(118)

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11) Which has higher ionization energy, Li or Na? Explain your reasoning in terms of the electronic configurations of each. Check the values to make sure you are correct.

12) Which has higher ionization energy, Al or Cl? Explain your reasoning in terms of the electronic configurations of each. Check the values to make sure you are correct.

13) Which has higher first ionization energy, N or O? Explain your reasoning in terms of the electronic configurations of each. Check the values to make sure you are correct.

14) Which has higher first ionization energy, Be or B? Explain your reasoning in terms of the electronic configurations of each. Check the values to make sure you are correct.

15) A new element is discovered which has the following ionization energies:

IE <sub>1</sub>	127 kJ/mol
IE <sub>2</sub>	287 kJ/mol
IE <sub>3</sub>	625 kJ/mol
IE <sub>4</sub>	2651 kJ/mol
IE <sub>5</sub>	3540 kJ/mol

Which group do you suppose this new element belongs in?