

# 5 • What Do Atoms Look Like?

## RECOGNIZING TRENDS 1

In each group of atoms, circle the atom with the...

largest atomic radius

Li	Be
Na	Mg

largest ionization energy

C	N
Al	Si

smallest atomic radius

S	Cl
Se	Br

smallest ionization energy

Cl	Ar
Br	Kr

Iodine, I, would have properties most like:

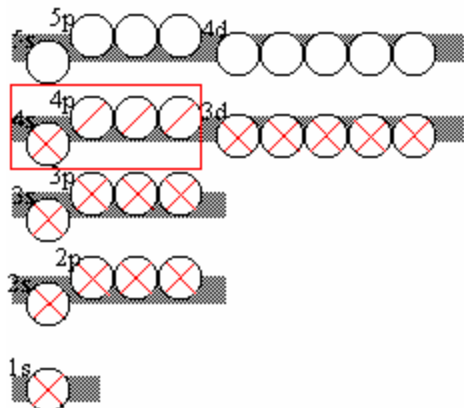
- N, nitrogen
- Cl, chlorine**
- Te, tellurium
- Xe, xenon

				N			
						Cl	
					Te	I	Xe

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## VALENCE ELECTRONS 2

Draw the orbital diagram for **As** (Z=33)  
Draw a box around the **valence electrons**.



For each element below, write in the number of **valence electrons** that it has:

H 1							He 2
Li 1	Be 2	B 3	C 4	N 5	O 6	F 7	Ne 8
Na 1	Mg 2	Al 3	Si 4	P 5	S 6	Cl 7	Ar 8

Which orbital(s) are farthest from the nucleus? 4s & 4p

Which orbital(s) are highest energy? 4p

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### FAMILY QUESTIONS 3

Use the following KEY to answer these questions (more than one answer may be correct):

H = hydrogen AM = alkali metals AEM = alkaline earth metals HALO = halogens NG = noble gases

- |   |  |
|---|--|
| <u>AEM</u> 1. Form 2+ ions                    | <u>NG</u> 6. Highest ionization energies         |
| <u>H &amp; Halo</u> 2. All are diatomic       | <u>AM</u> 7. Lowest ionization energies          |
| <u>NG</u> 3. Have full valence orbitals       | <u>HALO</u> 8. Gain 1 electron when forming ions |
| <u>AM</u> 4. React quickly with water         | <u>H</u> 9. Family only has one member           |
| <u>HALO</u> 5. Form 1- ions ( <b>also H</b> ) | <u>HALO</u> 10. Members include (s), (l), & (g)  |

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### METALS, NONMETALS & SEMIMETALS 4

Use the following KEY to answer these questions:

M = metals

NM = nonmetals

S = semimetals

- |  |  |
|--|--|
| <u>M</u> 1. Shiny and ductile            | <u>NM</u> 6. Argon, Ar, is an example    |
| <u>NM</u> 2. Poor conductors             | <u>S</u> 7. Also called semiconductors   |
| <u>M</u> 3. Magnesium, Mg, is an example | <u>S</u> 8. Silicon, Si, is an example   |
| <u>NM</u> 4. Brittle                     | <u>M</u> 9. Good conductors              |
| <u>S</u> 5. Arsenic, As, is an example   | <u>NM</u> 10. Hydrogen, H, is an example |

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### SIZES OF ATOMS & IONS 5

For each pair, circle the LARGER one (size, not mass):

- |              |                       |               |                       |
|--------------|-----------------------|---------------|-----------------------|
| 1. <b>N</b>  | F                     | 6. Ne         | <b>Ar</b>             |
| 2. <b>Mg</b> | Mg <sup>2+</sup>      | 7. Br         | <b>Br<sup>-</sup></b> |
| 3. <b>K</b>  | Ca                    | 8. <b>Si</b>  | O                     |
| 4. O         | <b>O<sup>2-</sup></b> | 9. <b>Al</b>  | Al <sup>3+</sup>      |
| 5. <b>S</b>  | Ar                    | 10. <b>Na</b> | F                     |

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### ELECTRONS OF IONS 6

Complete the following tables:

	O <sup>2-</sup>	F <sup>-</sup>	Ne	Na <sup>+</sup>	Mg <sup>2+</sup>
# protons	<b>8</b>	<b>9</b>	<i>10</i>	<b>11</b>	<b>12</b>
# electrons	<b>10</b>	<b>10</b>	<i>10</i>	<b>10</b>	<b>10</b>

	S <sup>2-</sup>	Cl <sup>-</sup>	Ar	K <sup>+</sup>	Ca <sup>2+</sup>
# protons	<b>16</b>	<b>17</b>	<i>18</i>	<b>19</b>	<b>20</b>
# electrons	<b>18</b>	<b>18</b>	<i>18</i>	<b>18</b>	<b>18</b>

Al<sup>3+</sup> has the same number of electrons as the noble gas, **Neon (10 electrons)**

I<sup>-</sup> has the same number of electrons as the noble gas, **Xenon (54 electrons)**

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### PERIODIC PUZZLERS 7

The following elements belong together in families as grouped below. Use the clues to fill in the chart.

**AQ, MB, GNC**

1		18
	2	G
	M	C
	B	N

13	14	15	16	17	18
			A		C
			Q		N

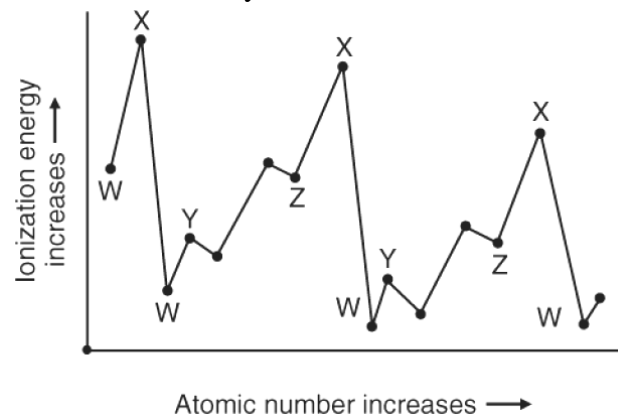
**Clues:**

1. A is the second most abundant gas in the atmosphere.
2. G has the highest ionization energy of any atom.
3. M forms 2+ ions.
4. N is the largest member of its group.
5. B has a greater atomic radius than M.

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### IONIZATION ENERGIES 8

This is a graph of the ionization energies for the first 20 elements by atomic number.



Use the information on this chart to determine which families are W, X, and Y:

	1	2	13	14	15	16	17	18
1	H 131	Ionization Energy						He 237
2	Li 52	Be 90	B 80	C 109	N 140	O 131	F 168	Ne 208
3	Na 49	Mg 74	Al 58	Si 79	P 106	S 100	Cl 126	Ar 152
4	K 42	Ca 59						

- W is the Alkali Metals family.  
 X is the Noble Gases family.  
 Y is the Alkali Earth Metals family.

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### THE SUBATOMIC PARTICLES 9

Use the following KEY to answer these questions (more than one answer may apply):

P = protons

N = neutrons

E = electrons

- |                         |                                      |                         |  |
|-------------------------|--------------------------------------|-------------------------|--|
| <u><b>P &amp; N</b></u> | 1. Most of the mass of the atom      | <u><b>P &amp; N</b></u> | 6. Size of a softball in a 6-mile atom |
| <u><b>P</b></u>         | 2. 1+ charge                         | <u><b>E</b></u>         | 7. 1/2000 <sup>th</sup> amu            |
| <u><b>P &amp; N</b></u> | 3. Mass of 1 amu                     | <u><b>N</b></u>         | 8. No charge                           |
| <u><b>P &amp; N</b></u> | 4. Makes up the nucleus              | <u><b>E</b></u>         | 9. Found outside the nucleus           |
| <u><b>E</b></u>         | 5. Determines the radius of the atom | <u><b>E</b></u>         | 10. Charge of 1-                       |