would expect the compound to be ionic or molec- in character.

nent M is a shiny and highly reactive metal (melt- point 63°C), and element X is a highly reactive metal (melting point −7.2°C). They react to form mpound with the empirical formula MX, a color- , brittle white solid that melts at 734°C. When dis- ed in water or when in the molten state, the sub- ce conducts electricity. When chlorine gas is bled through an aqueous solution containing MX, ddish-brown liquid appears and Cl^- ions are ned. From these observations, identify M and X. u may need to consult a handbook of chemistry for melting-point values.)

ch each of the elements on the right with its de- ption on the left:

A dark-red liquid	Calcium (Ca)
A colorless gas that burns in oxygen gas	Gold (Au)
	Hydrogen (H_2)
A reactive metal that attacks water	Argon (Ar)
	Bromine (Br_2)
A shiny metal that is used in jewelry	
An inert gas	

nge the following species in isoelectronic pairs: Ar, S^{2-}, Ne, Zn, Cs^+, N^{3-}, As^{3+}, N, Xe.

which of the following are the species written in easing order by size of radius? (a) Be, Mg, Ba, N^{3-}, O^{2-}, F^-, (c) Tl^{3+}, Tl^{2+}, Tl^+.

ch of the following properties show a clear peri- variation? (a) first ionization energy, (b) molar s of the elements, (c) number of isotopes of an el- nt, (d) atomic radius.

en carbon dioxide is bubbled through a clear ium hydroxide solution, the solution appears dy. Write an equation for the reaction and explain this reaction illustrates that CO_2 is an acidic de.

are given four substances: a fuming red liquid, a metallic-looking solid, a pale-yellow gas, and a ow-green gas that attacks glass. You are told that e substances are the first four members of Group the halogens. Name each one.

each pair of elements listed below, give three prop- es that show their chemical similarity: (a) sodium potassium and (b) chlorine and bromine.

ne the element that forms compounds, under ap- priate conditions, with every other element in the iodic table except He, Ne, and Ar.

ain why the first electron affinity of sulfur is J/mol but the second electron affinity is J/mol.

Li^+ ion and the He atom have two 1*s* electrons Which of the two species is larger? Explain.

⊛⊛⊛ 8.91 Predict the products of the following oxides with water: Na_2O, BaO, CO_2, N_2O_5, P_4O_{10}, SO_3. Write an equation for each of the reactions. Specify whether the oxides are acidic, basic, or amphoteric.

⊛⊛ **8.92** Write the formulas and names of the oxides of the second-period elements (Li to N). Identify the oxides as acidic, basic, or amphoteric.

⊛⊛⊛ 8.93 State whether each of the following elements is a gas, a liquid, or a solid under atmospheric conditions. Also state whether it exists in the elemental form as atoms, as molecules, or as a three-dimensional network: Mg, Cl, Si, Kr, O, I, Hg, Br.

⊛⊛ **8.94** What factors account for the unique nature of hydrogen?

⊛⊛ 8.95 The air in a manned spacecraft or submarine needs to be purified of exhaled carbon dioxide. Write equations for the reactions between carbon dioxide and (a) lithium oxide (Li_2O), (b) sodium peroxide (Na_2O_2), and (c) potassium superoxide (KO_2).

⊛⊛ **8.96** The formula for calculating the energies of an electron in a hydrogenlike ion is given in Problem 8.57. This equation cannot be applied to many-electron atoms. One way to modify it for the more complex atoms is to replace Z with $(Z - \sigma)$, where Z is the atomic number and σ is a positive dimensionless quantity called the shielding constant. Consider the helium atom as an example. The physical significance of σ is that it represents the extent of shielding that the two 1*s* electrons exert on each other. Thus, the quantity $(Z - \sigma)$ is appropriately called the "effective nuclear charge." Calculate the value of σ if the first ionization energy of helium is 3.94×10^{-18} J per atom. (Ignore the minus sign in the given equation in your calculation.)

⊛ 8.97 Why do noble gases have negative electron affinity values?

⊛⊛ **8.98** The atomic radius of K is 216 pm and that of K^+ is 133 pm. Calculate the percent decrease in volume that occurs when $K(g)$ is converted to $K^+(g)$. [The volume of a sphere is $(\frac{4}{3})\pi r^3$, where r is the radius of the sphere.]

⊛⊛ 8.99 The atomic radius of F is 72 pm and that of F^- is 136 pm. Calculate the percent increase in volume that occurs when $F(g)$ is converted to $F^-(g)$. (See Problem 8.98 for the volume of a sphere.)

⊛⊛ **8.100** A technique called photoelectron spectroscopy is used to measure the ionization energy of atoms. A sample is irradiated with UV light, and electrons are ejected from the valence shell. The kinetic energies of the ejected electrons are measured. Because the energy of the UV photon and the kinetic energy of the ejected electron are known, we can write

$$h\nu = \text{IE} + \tfrac{1}{2}mu^2$$

8.71, 8.72, 8.73, 8.74, 8.75, 8.76, 8.77, 8.78, 8.79, 8.80, 8.81, 8.83, 8.84, 8.85, 8.86, 8.87, 8.88, 8.91, 8.92, 8.93, 8.94, 8.95,