FLINN SCIENTIFIC

Name_____

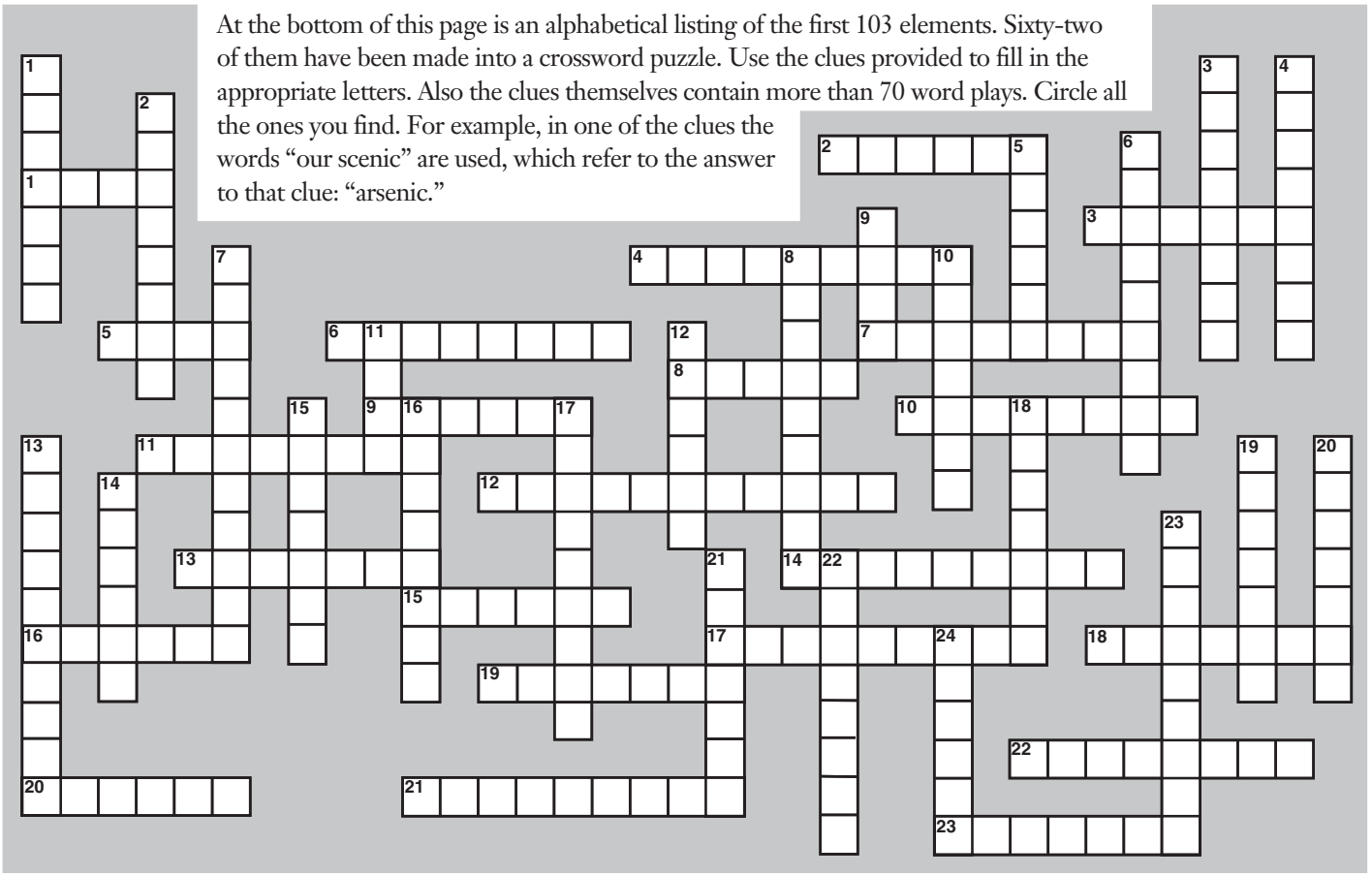
Activity 1. Fill in the missing information.

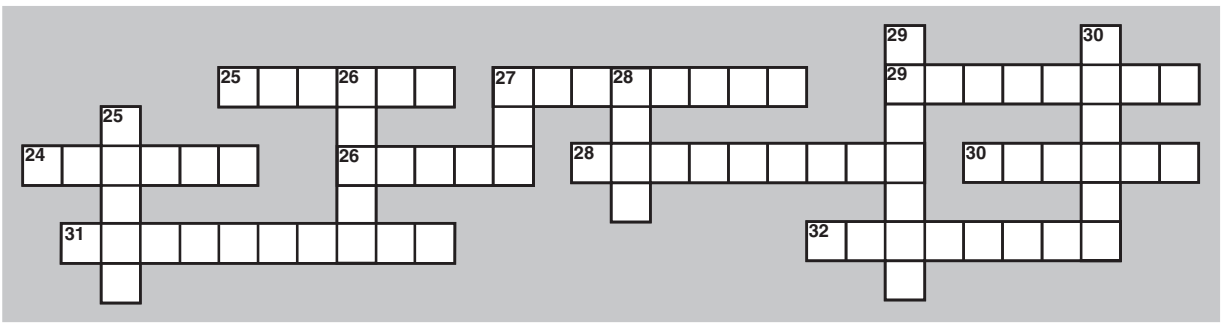
Use the Periodic Table provided to fill in the missing information.

Symbol	Name	Atomic Number
	Lithium	
Sn		
		16
	Hydrogen	
Lr		
		35
	Argon	
Sr		
		55
	Neon	
Se		
		2
Fe		
	Gold	
		42
Cf		
	Magnesium	
		22
	Silicon	
O		
	Uranium	
		17
	Sodium	

Activity 2. The Ultimate Element Crossword Puzzle

At the bottom of this page is an alphabetical listing of the first 103 elements. Sixty-two of them have been made into a crossword puzzle. Use the clues provided to fill in the appropriate letters. Also the clues themselves contain more than 70 word plays. Circle all the ones you find. For example, in one of the clues the words "our scenic" are used, which refer to the answer to that clue: "arsenic."





actinium
aluminum
americium
antimony
argon
arsenic
astatine
barium
berkelium
beryllium
bismuth
boron
bromine
cadmium
calcium
californium
carbon
cerium
cesium
chlorine
chromium
cobalt
copper
curium
dysprosium
einsteinium
erbium
europium
fermium
fluorine
francium
gadolinium
gallium
germanium
gold
hafnium
helium
holmium
hydrogen
indium
iodine
iridium
iron
krypton
lanthanum
lawrencium
lead
lithium
lutetium
magnesium
manganese
mendelevium
mercury
molybdenum
neodymium
neon
neptunium
nickel
niobium
nitrogen
nobelium
osmium
oxygen
palladium
phosphorus
platinum
plutonium
polonium
potassium
praseodymium
promethium
protactinium
radium
radon
rhenium
rhodium
rubidium
ruthenium
samarium
scandium
selenium
silicon
silver
sodium
strontium
sulfur
tantalum
technetium
tellurium
terbium
thallium
thorium
thulium
tin
titanium
tungsten
uranium
vanadium
xenon
ytterbium
yttrium
zinc
zirconium

Across

1. In batteries, stained glass windows and old paint; but not in pencils as some might lead you to believe. Also known for its density, malleability (and toxicity).
2. Matches, acid rain and a chigger repellent (and often associated with eternal damnation), so far as we know, its molecules are square dance–shaped.
3. Pipes, wires and Ms. Liberty's skin, whether you're a seasoned cop or a brand new rookie, a penny's worth isn't what it used to be.
4. In bananas, salt subs and Special K® cereal, this alkali metal is also used in lavender fireworks.
5. Anyone can see that, despite its total disregard for others, this member of the noble gas family has a bright future in advertising—I'd put money on it!
6. In fertilizers, explosives and cryogenics, we come in contact with this gas more than any other. Long ago, at night, Trojan men would breathe in a mixture containing 80% of this gas before going into battle!
7. Crystals of its salts are known for their crisp colors. This metal puts the shine on your car bumper.
8. Used in strobe lamps, this "stranger" may be a member of the royal family, but recently he has been seen on dates with such commoners as F and O!
9. Used as an alloy in ballpoint pens, nearly twice as dense as lead (if Dorothy's house were made of this metal, she never would have gone anywhere!), the strong odor given off by this metal is a result of its highly toxic oxide!
10. Not for sale at Arby's, this alkali is a real go-getter in vacuum tubes and is known for its ruby-colored flame.
11. Greenish yellow in color, used in bleach, drinking water, PVC pipes (that's logical) or in WWI as the world's first war gas.
12. This relatively recent addition to the table does not occur naturally; it was discovered in the all-burnt-up debris analyzed from the first H-bomb explosion (the energy of which was equal to the mass lost times the speed of light squared).
13. Make your silly list of pros and cons: Bill Gates, Cinderella and some top-notch super models all owe their good fortune to this metalloid.
14. Used in flares, flashbulbs and magnificent incendiary bombs, but also in mag wheels and M.O.M.
15. This shiny nonmetal gives off purple vapors; at blood donor centers, this goes on before the needle goes in, and in Ohio, diner and restaurant owners add it to their salt.
16. Without this noble lightweight, the Goodyear Company would never have gotten off the ground and scuba divers would really be hurting (and doctors might be unable to heal them).
17. One of the most reactive rare earth metals, (seriously) and often used in lighter flints and carbon-arc lamps, but using this toxic element in Heinz® steak sauce would not be a good plan (the number of protons has little to do with an element's uses!).
18. Its orange-red spectral line is how the modern-day meter is defined, and—not to sound cryptic—but its fictitious ore is the Achilles' heel for the Man of Steel.
19. Highly toxic, as are its compounds including its oxide, which has the distinct odor of garlic. Also used in transistors; think about that as you drive along our scenic highways listening to your radio!
20. When the Lone Ranger photographs his horse's fillings in the mirror, he must wonder why this #1 metal (in terms of electrical and heat conductivity) is still considered second best by most athletes.
21. An alloying agent in steel and active ingredient in poison ivy lotion, its silicate may be cubic, but it won't last forever.
22. Originally thrown away as a "fool's silver," now considered more valuable than gold, especially by recording artists (and DJs who spin their "platters").
23. Lighten up! Today this low density metal is used in batteries, tomorrow it may be used in the matter–antimatter chamber of the U.S.S. Enterprise!
24. Although this alkaline earth metal is very toxic, doctors often ask patients to drink a nice thick shake of its sulfate (and he rarely ends up having to bury them).
25. Has your car been acting up? You may want to check the antifreeze or oil or gasoline or vinyl seat covers... or yourself!
26. This great-great-great-granddaughter of U-238 is a dense, noble and silent killer, but do not be afraid. On the other hand, you may want to sleep with your windows open.
27. WOW! This wondrous worldly stone must weigh a ton (hence the Swedish name), but this weak wire filament is so light!
28. This most deadly poison was used in the Apollo program to power equipment on the lunar surface. Critical mass of this fissionable isotope can blast you to the outer limits of the solar system!
29. This group V metalloid is quite versatile—from tracer bullets to fireproofing to infrared detection. Not that I'm against cash or anything, but I should just pay off my ex-wife with this valuable stuff each month.
30. One of the most metallic metals, named for its sky blue spectral lines. Atomic clocks using this element are accurate to 5 sec in 300 years... or 1 sec in 60 years (that's easy math).
31. Just ten protons short of a full deck, welders know this steel-strengthening transition metal as "Molly B. Denim."
32. Albeit the most abundant metal in the Earth's crust, yet it is so difficult to extract from its ore that this shiny lightweight used to be more valuable than gold. Now everyone (even all you minimum wage earners) treat it like trash!

Down

1. It must have taken some gall in 1871 for Mendeleev to predict the existence of this low-melting metal. Then, four years later "eka-aluminum" was discovered by a Gallic chemist.
2. You're number one in our books and in the universe for that matter, the ultimate fuel and building block, but don't try to hide your genuinely explosive nature: Two of the worst aviation accidents in U.S. history resulted from your reaction with oxygen.
3. One might think that Fr, Ge and Sc might somehow be alloyed together to make this metal, but no, it's an element by itself, with an atomic mass of 151.96.
4. This pale yellow gas is considered the most reactive of all the elements. Even water will ignite in its presence. And after 70 years of continuous work, chemists were finally able to isolate this element (I bet that made them smile).
5. Used for years in self-luminous paint for glow-in-the-dark clock faces and in radiological treatment for cancer. One atom of this alkaline earth metal has as many protons as there are keys on a piano!
6. Its name is derived from the Greek *neos*, meaning "new" and *didymos*, meaning "twin," because for years no one could separate it from its next-door neighbor on the periodic table.
7. Named after the long-bearded Russian himself (who was not an MD, but without whom there would be no periodic table). Like all transuranium elements, #101 is synthesized (not found in nature) and has no stable isotopes.
8. Similar in nature to the other alkaline earth metals (which together make up a pretty strong team in terms of their reactivity). Salts of this metal are used in flares and fireworks, producing a beautiful crimson color.
9. Has more applications than you might think—from solders to makeup to printer's ink; paints, plastics and fencing (chain-link) and yes, of course, the kitchen ___.
10. The only metal that is a liquid at ordinary temperatures (ordinary for Earth, that is, not on a hotter planet!), nicknamed "quicksilver," used in thermometers, barometers and electrical switches, very dense, also very toxic (hard to imagine a more curious metal).
11. Some might consider it ironic that the same metal that's used in car bodies and Ferris wheels is also used to fortify our breakfast cereal. The most abundant and important metal on Earth, it's in our blood to treasure it.
12. To metals and nonmetals alike, this element bonds like epoxy—generally in a very exothermic manner (i.e., it makes things burn), but, oh, what trouble we would be in without these atoms (both the pairs down here and the trios up there).
13. Discovered in 1669 by Brandt who prepared it from urine (but that's not how it got its symbol!). This nonmetal is used in matches, fertilizers and detergents.
14. This transition metal is especially known for the deep blue color its salts produce when added to glass and ceramics (as produced by the Goblin Porcelain Co., Baltimore, MD, for example).
15. Ubiquitous and unusual, named after the 7th rock from the sun, one pound of this nuclear fuel source is equivalent to 1,500 tons of coal—you have to respect that!
16. The black form of this nonmetal conducts elec-tricity better when light is shined upon it, so it is used in Xerox toner. Thus, without this element you can cancel any immediate plans to photocopy this page!
17. Man can easily survive (and so can woman) without Ag or Au, but take away this trace dietary mineral and you are imminent risk of a vitamin B deficiency!
18. Irredeemably the most corrosion-resistant metal, #77 was alloyed with Pt to make the standard meter bar of Paris.
19. Why is this metal used in magnets, low melting alloys and pink antidiarrheal medication? I make it my business to know!
20. This halogen is a liquid at room temperature, and though its symbol may remind you of the cold, its compounds serve as flameproofing agents!
21. Dairy farmers see milking machines as quick extractors of this alkaline earth metal, but I bet the cows see them differently!
22. Nothing is as effective as stating the obvious, but with less than one ounce of this halogen existing on the Earth, this element isn't really where it's at!
23. Being lightweight with a high melting point, this group II metal is an ideal hardening agent in alloys. Originally, chemists tested for this element by its sweet taste, but its high toxicity makes this not such a brilliant idea!
24. Used in nichrome wire, alnico magnets, stainless steel barnacle scrapers(!) and as a catalyst for hydrogenating vegetable oil—the kind you might buy at the local five and dime.
25. A rather inactive gas, this royal family member makes up nearly 1% of our atmosphere. It is used as the inert gas in lightbulbs (when N and O are gone, the filament lasts a lot longer!)
26. Hamlet's soliloquy pondered whether or not this metalloid was diatomic! The nitride of this element can be as hard as diamond and can be used for drill bits (talk about boring!).
27. Snips can cut this metal into tiny pieces, used for solders (and soldiers) and coated onto steel cans (for beans, tennis balls, etc.) to prevent corrosion.
28. "HEY YOU! Come back here with my first place medal!" This king of metals is so malleable that a single ounce can be beaten out into a 300 ft^2 sheet 1,000 times thinner than paper and so inert that jewelry dating back to ancient times still looks as good as new.
29. This close relative of Zn is used with nickel to make Nicad rechargeable batteries. It is famous for its yellow paint pigment, but it is very toxic and is one of the many poisons found in cigarette smoke.
30. Naturally, this most abundant alkali metal is used in soaps, glass and pretzels. Most carbonated drinks, however, report having very low levels of this element—which seems so dumb when you think about it.

Activity 3. Comparing the Reactivity of Two Alkaline Earth Metals

Data Table

Observations	Mg + HCl	Ca + HCl
What do you see?		
What do you hear?		
Temperature (°C)		

Post-Lab Analysis and Questions

1. Which Group II metal did you find to be more reactive, Mg or Ca?

2. Study the position of the two elements on your periodic table. Write a general statement about period and reactivity.

3. Use the periodic table to predict which Group II element would be the most reactive, Be, Sr, or Ba based on your observations in this activity.

4. In this lab, the *ionization* (or dissolving) reaction of two different metals in acid was observed. When ionization occurs, the solid metal loses electrons to form the aqueous metal cation (positive ion). For example:

$$Mg(s) \rightarrow Mg^{2+}(aq) + 2e^- \text{ and } Ca(s) \rightarrow Ca^{2+}(aq) + 2e^-$$

The energy needed to cause this ionization to occur is called the *ionization energy* of the compound. The higher the ionization energy, the harder it is to lose electrons. Based on this information, which metal do you predict would have a higher ionization energy? Explain why.

5. How would tearing the magnesium ribbon into smaller pieces affect the reaction rate? Why?

6. List at least two other factors (besides particle size) that may affect the rate of the reaction.

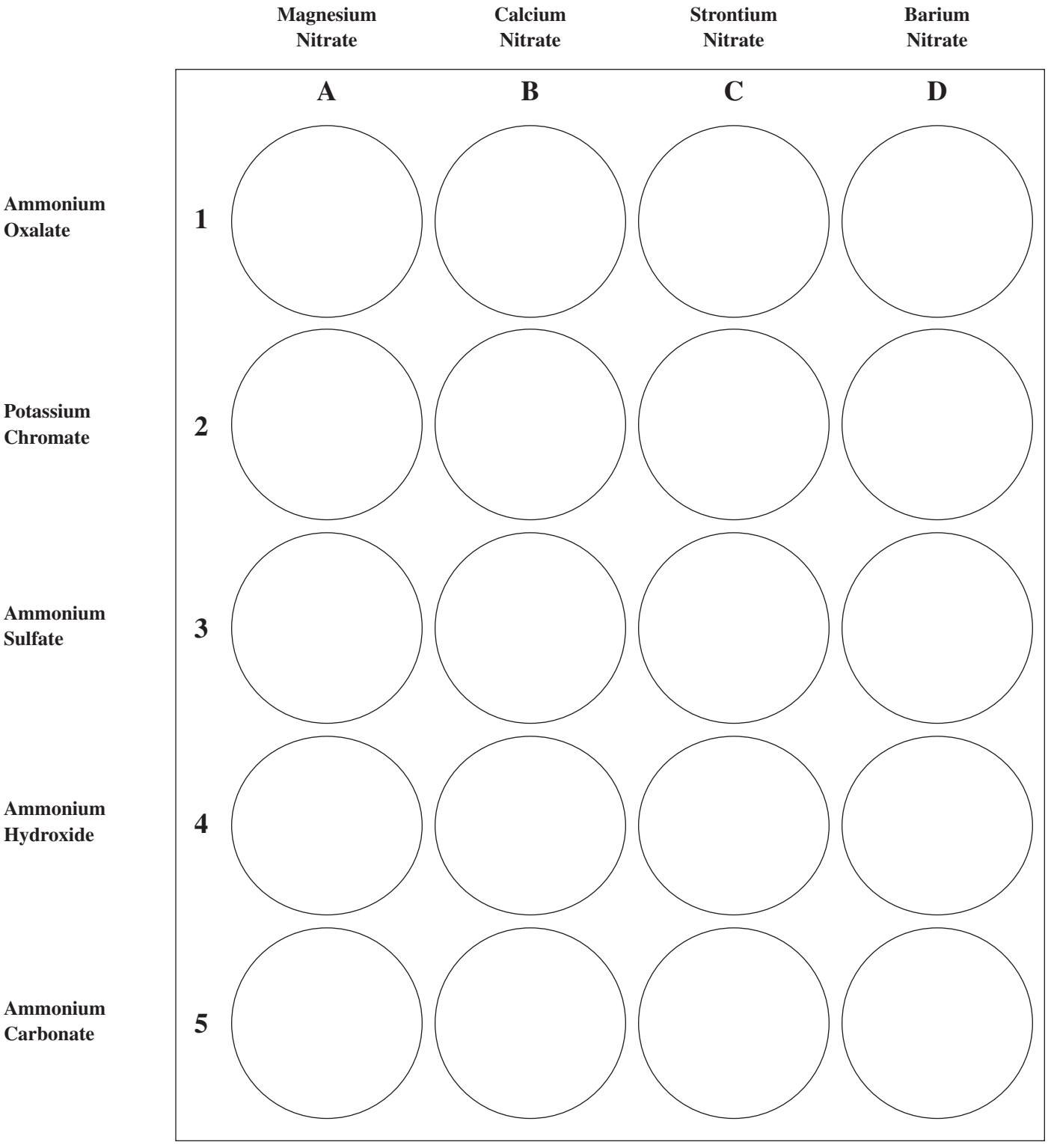
7. Write the balanced chemical equation for the reaction of magnesium with hydrochloric acid.

8. Write the balanced chemical equation for the reaction of calcium with hydrochloric acid.

Activity 4. Analyzing the Solubility of Group II Metals

Results

Record observations in the circles in the figure below. List any colors formed. If any solid precipitates form, use the abbreviation PPT. If no reaction at all occurs, use NR. Note: Be sure to make careful observations since the reactions with aqueous ammonium hydroxide may be quite difficult to see.



Post-Lab Analysis and Questions

1. A color change or the formation of a precipitate is an indication that a reaction has occurred. Which Group II metal (Mg, Ca, Sr, or Ba) showed a reaction with the most compounds?

2. Which Group II metal was the least reactive?

3. List the four Group II metals in increasing order from least reactive to most reactive.

   _____

   _____

   _____

   _____

4. Compare this order to the position on the periodic table and write a general statement regarding reactivity and position in a group.

Extension Questions (optional)

5. On a separate sheet of paper:

   a. Write a balanced equation for each reaction that occurred.

   b. Write a net ionic equation for each reaction. (Use a solubility chart to determine the formula of the solid precipitate.)

   Examples:

   Full equation

   $$Ba(NO_3)_2(aq) + (NH_4)_2CO_3(aq) \rightarrow NH_4NO_3(aq) + BaCO_3(s)$$

   Net ionic equation

   $$Ba^{2+}(aq) + CO_3^{2-}(aq) \rightarrow BaCO_3(s)$$

   c. Would sodium carbonate give the same or different reactivity as ammonium carbonate in this activity? (See the example equation provided.) Explain.