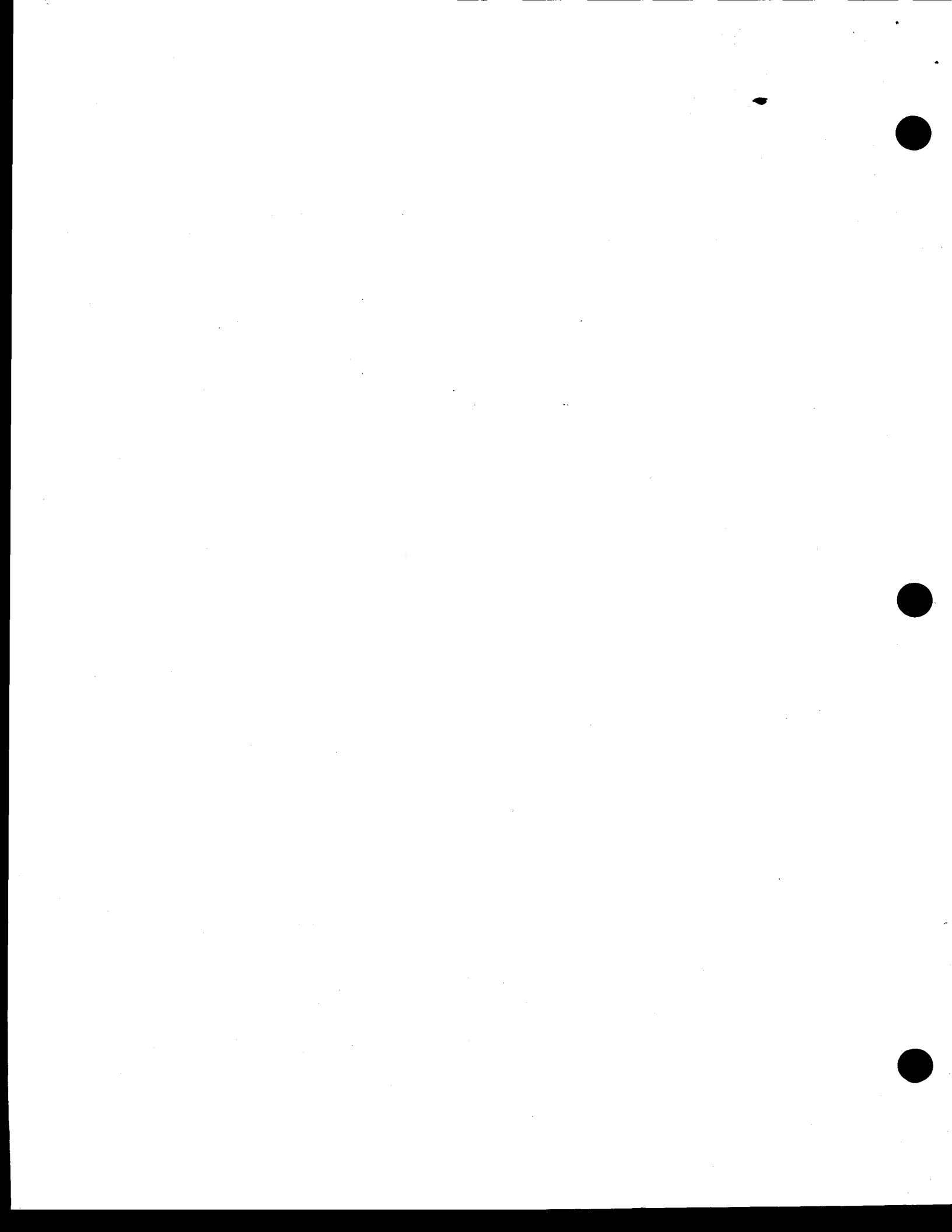


**Basic Information  
And  
Study Skills  
Packet  
2010-11**





# Illinois State Board of Education

Jesse Ruiz, Board Chair  
Dr. Christopher Koch, State Superintendent

Gov. Rod Blagojevich

ECS | CeRTS | IWAS | FRIS Inquiry | Teachers | Students | Administrators | Student Assessment | IL Learning Standards | Programs | Forms | Glossary

## Illinois Learning Standards Science

The *Illinois Learning Standards for Science* were developed using the 1985 State Goals for Science, the National Science Education Standards, various other state and national works, and local education standards contributed by team members.

### Applications of Learning

Through Applications of Learning, students demonstrate and deepen their understanding of basic knowledge and skills

### Solving Problems

Recognize and investigate problems; formulate and propose solutions supported by reason and evidence.

### Communicating

Express and interpret information and ideas.

### Using Technology

Use appropriate instruments, electronic equipment, computers and networks to access information, process ideas and communicate results.

### Working on Teams

Learn and contribute productively as individuals and as members of groups.

The practical application of science requires both individual and group efforts. Individuals bring unique insight and focus to the work of inquiry and problem solving. Working in groups, scientists pose questions, share hypotheses, divide their experimental efforts, and share data and results. Science students have the opportunity to work both ways—as individuals and as members of teams organized to conduct complex investigations and solve problems.

### Making Connections

Recognize and apply connections of important information and ideas within and among learning areas.

From: <http://206.166.105.35/ils/science/standards.htm>



# STUDENT FACT SHEET

NAME: \_\_\_\_\_

CIRCLE ONE: Fr So Jr Sr

PARENTS'/GUARDIANS' NAMES \_\_\_\_\_  
(please include last names if different than yours)

HOME PHONE: \_\_\_\_\_

	Science Course including level (i.e.honors, reg)	Grade for 1 <sup>st</sup> /2 <sup>nd</sup> semester (estimate if forgot)	Math Course including level (i.e.honors, reg)	Grade for 1 <sup>st</sup> /2 <sup>nd</sup> semester (estimate if forgot)
Freshman Year				
Sophomore Year				
Junior year				

1. What profession are you planning on entering?
2. Do you have a part-time job? If so, where and how many hours do you work per week?
3. What extra-curricular activities are you planning on participating in this year?
4. Please list at least one academic strength and one academic weakness below. Also include other things you would like me to know about you such as family information, medical information or hobbies or anything else.
  - a.
  - b.
  - c.
  - d.
5. What is your goal for this school year?



# Find Someone Who???

## Directions:

1. Ask people different questions until you find a person that fits one of the squares.
2. When you find a person who can answer YES to a square, ask his/her name and write it in the square.
3. Each person can only sign one space.

The winner will be the one with the most signatures when time is called.

**Good Luck!!!**

Has two vowels in his/her first name	Was born outside of Illinois	Likes spinach	Has traveled outside the country	Has a dog
Enjoys fishing	Has a swimming pool	Has more than 5 letters in his/her first name	Is wearing contacts	Plays a musical instrument
Likes soap operas	Has been on radio or TV	Knows how to type	Has pierced ears	Has a brother and a sister
Has a computer at home	Has a cat	Is wearing shoelaces	Has a birthday in September	Lives in a two-story house
Is wearing a dress or skirt	Likes to jog	Has a 3-syllable last name	Is wearing braces	Plays a sport



# Flinn Scientific's Student Safety Contract

## PURPOSE

Science is a hands-on laboratory class. You will be doing many laboratory activities which require the use of hazardous chemicals. Safety in the science classroom is the #1 priority for students, teachers, and parents. To ensure a safe science classroom, a list of rules has been developed and provided to you in this student safety contract. These rules must be followed at all times. Two copies of the contract are provided. One copy must be signed by both you and a parent or guardian before you can participate in the laboratory. The second copy is to be kept in your science notebook as a constant reminder of the safety rules.

## GENERAL RULES

1. Conduct yourself in a responsible manner at all times in the laboratory.
2. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ask the instructor before proceeding.
3. Never work alone. No student may work in the laboratory without an instructor present.
4. When first entering a science room, do not touch any equipment, chemicals, or other materials in the laboratory area until you are instructed to do so.
5. Do not eat food, drink beverages, or chew gum in the laboratory. Do not use laboratory glassware as containers for food or beverages.
6. Perform only those experiments authorized by the instructor. Never do anything in the laboratory that is not called for in the laboratory procedures or by your instructor. Carefully follow all instructions, both written and oral. Unauthorized experiments are prohibited.
7. Be prepared for your work in the laboratory. Read all procedures thoroughly before entering the laboratory.
8. Never fool around in the laboratory. Horseplay, practical jokes, and pranks are dangerous and prohibited.
9. Observe good housekeeping practices. Work areas should be kept clean and tidy at all times. Bring only your laboratory instructions, worksheets, and/or reports to the work area. Other materials (books, purses, backpacks, etc.) should be stored in the classroom area.
10. Keep aisles clear. Push your chair under the desk when not in use.

11. Know the locations and operating procedures of all safety equipment including the first aid kit, eyewash station, safety shower, fire extinguisher, and fire blanket. Know where the fire alarm and the exits are located.
12. Always work in a well-ventilated area. Use the fume hood when working with volatile substances or poisonous vapors. Never place your head into the fume hood.
13. Be alert and proceed with caution at all times in the laboratory. Notify the instructor immediately of any unsafe conditions you observe.
14. Dispose of all chemical waste properly. Never mix chemicals in sink drains. Sinks are to be used only for water and those solutions designated by the instructor. Solid chemicals, metals, matches, filter paper, and all other insoluble materials are to be disposed of in the proper waste containers, not in the sink. Check the label of all waste containers twice before adding your chemical waste to the container.
15. Labels and equipment instructions must be read carefully before use. Set up and use the prescribed apparatus as directed in the laboratory instructions or by your instructor.
16. Keep hands away from face, eyes, mouth and body while using chemicals or preserved specimens. Wash your hands with soap and water after performing all experiments. Clean all work surfaces and apparatus at the end of the experiment. Return all equipment clean and in working order to the proper storage area.
17. Experiments must be personally monitored at all times. You will be assigned a laboratory station at which to work. Do not wander around the room, distract other students, or interfere with the laboratory experiments of others.
18. Students are never permitted in the science storage rooms or preparation areas unless given specific permission by their instructor.
19. Know what to do if there is a fire drill during a laboratory period; containers must be closed, gas valves turned off, fume hoods turned off, and any electrical equipment turned off.
20. Handle all living organisms used in a laboratory activity in a humane manner. Preserved biological materials are to be treated with respect and disposed of properly.

21. When using knives and other sharp instruments, always carry with tips and points pointing down and away. Always cut away from your body. Never try to catch falling sharp instruments. Grasp sharp instruments only by the handles.
22. If you have a medical condition (e.g., allergies, pregnancy, etc.), check with your physician prior to working in lab.

## CLOTHING

23. Any time chemicals, heat, or glassware are used, students will wear laboratory goggles. There will be no exceptions to this rule!
24. Contact lenses should not be worn in the laboratory unless you have permission from your instructor.
25. Dress properly during a laboratory activity. Long hair, dangling jewelry, and loose or baggy clothing are a hazard in the laboratory. Long hair must be tied back and dangling jewelry and loose or baggy clothing must be secured. Shoes must completely cover the foot. No sandals allowed.
26. Lab aprons have been provided for your use and should be worn during laboratory activities.

## ACCIDENTS AND INJURIES

27. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the instructor immediately, no matter how trivial it may appear.
28. If you or your lab partner are hurt, immediately yell out "Code one. Code one" to get the instructor's attention.
29. If a chemical splashes in your eye(s) or on your skin, immediately flush with running water from the eyewash station or safety shower for at least 20 minutes. Notify the instructor immediately.
30. When mercury thermometers are broken, mercury must not be touched. Notify the instructor immediately.

## HANDLING CHEMICALS

31. All chemicals in the laboratory are to be considered dangerous. Do not touch, taste, or smell any chemicals unless specifically instructed to do so. The proper technique for smelling chemical fumes will be demonstrated to you.
32. Check the label on chemical bottles twice before removing any of the contents. Take only as much chemical as you need.
33. Never return unused chemicals to their original containers.

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# Flinn Scientific's Student Safety Contract

34. Never use mouth suction to fill a pipet. Use a rubber bulb or pipet pump.
35. When transferring reagents from one container to another, hold the containers away from your body.
36. Acids must be handled with extreme care. You will be shown the proper method for diluting strong acids. Always add acid to water, swirl or stir the solution and be careful of the heat produced, particularly with sulfuric acid.
37. Handle flammable hazardous liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.
38. Never remove chemicals or other materials from the laboratory area.
39. Take great care when transporting acids and other chemicals from one part of the laboratory to another. Hold them securely and walk carefully.

## HANDLING GLASSWARE AND EQUIPMENT

40. Carry glass tubing, especially long pieces, in a vertical position to minimize the likelihood of breakage and injury.
41. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Place broken or waste glassware in the designated glass disposal container.
42. Inserting and removing glass tubing from rubber stoppers can be dangerous. Always lubricate glassware (tubing, thistle tubes, thermometers, etc.) before attempting to insert it in a stopper. Always protect your hands with towels or cotton gloves when inserting glass tubing into, or removing it from, a rubber stopper. If a piece of glassware becomes "frozen" in a stopper, take it to your instructor for removal.
43. Fill wash bottles only with distilled water and use only as intended, e.g., rinsing glassware and equipment, or adding water to a container.
44. When removing an electrical plug from its socket, grasp the plug, not the electrical cord. Hands must be completely dry before touching an electrical switch, plug, or outlet.
45. Examine glassware before each use. Never use chipped or cracked glassware. Never use dirty glassware.
46. Report damaged electrical equipment immediately. Look for things such as frayed cords, exposed wires, and loose

connections. Do not use damaged electrical equipment.

47. If you do not understand how to use a piece of equipment, ask the instructor for help.
48. Do not immerse hot glassware in cold water; it may shatter.

## HEATING SUBSTANCES

49. Exercise extreme caution when using a gas burner. Take care that hair, clothing and hands are a safe distance from the flame at all times. Do not put any substance into the flame unless specifically instructed to do so. Never reach over an exposed flame. Light gas (or alcohol) burners only as instructed by the teacher.
50. Never leave a lit burner unattended. Never leave anything that is being heated or is visibly reacting unattended. Always turn the burner or hot plate off when not in use.
51. You will be instructed in the proper method of heating and boiling liquids in test tubes. Do not point the open end of a test tube being heated at yourself or anyone else.
52. Heated metals and glass remain very hot for a long time. They should be set aside to cool and picked up with caution. Use tongs or heat-protective gloves if necessary.
53. Never look into a container that is being heated.
54. Do not place hot apparatus directly on the laboratory desk. Always use an insulating pad. Allow plenty of time for hot apparatus to cool before touching it.
55. When bending glass, allow time for the glass to cool before further handling. Hot and cold glass have the same visual appearance. Determine if an object is hot by bringing the back of your hand close to it prior to grasping it.

## QUESTIONS

56. Do you wear contact lenses?  
 YES  NO
  57. Are you color blind?  
 YES  NO
  58. Do you have allergies?  
 YES  NO
- If so, list specific allergies \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## AGREEMENT

I, \_\_\_\_\_, (student's name) have read and agree to follow all of the safety rules set forth in this contract. I realize that I must obey these rules to insure my own safety, and that of my fellow students and instructors. I will cooperate to the fullest extent with my instructor and fellow students to maintain a safe lab environment. I will also closely follow the oral and written instructions provided by the instructor. I am aware that any violation of this safety contract that results in unsafe conduct in the laboratory or misbehavior on my part, may result in being removed from the laboratory, detention, receiving a failing grade, and/or dismissal from the course.

\_\_\_\_\_  
Student Signature

\_\_\_\_\_  
Date

Dear Parent or Guardian:

We feel that you should be informed regarding the school's effort to create and maintain a safe science classroom/laboratory environment.

With the cooperation of the instructors, parents, and students, a safety instruction program can eliminate, prevent, and correct possible hazards.

You should be aware of the safety instructions your son/daughter will receive before engaging in any laboratory work. Please read the list of safety rules above. No student will be permitted to perform laboratory activities unless this contract is signed by both the student and parent/guardian and is on file with the teacher.

Your signature on this contract indicates that you have read this Student Safety Contract, are aware of the measures taken to insure the safety of your son/daughter in the science laboratory, and will instruct your son/daughter to uphold his/her agreement to follow these rules and procedures in the laboratory.

\_\_\_\_\_  
Parent/Guardian Signature

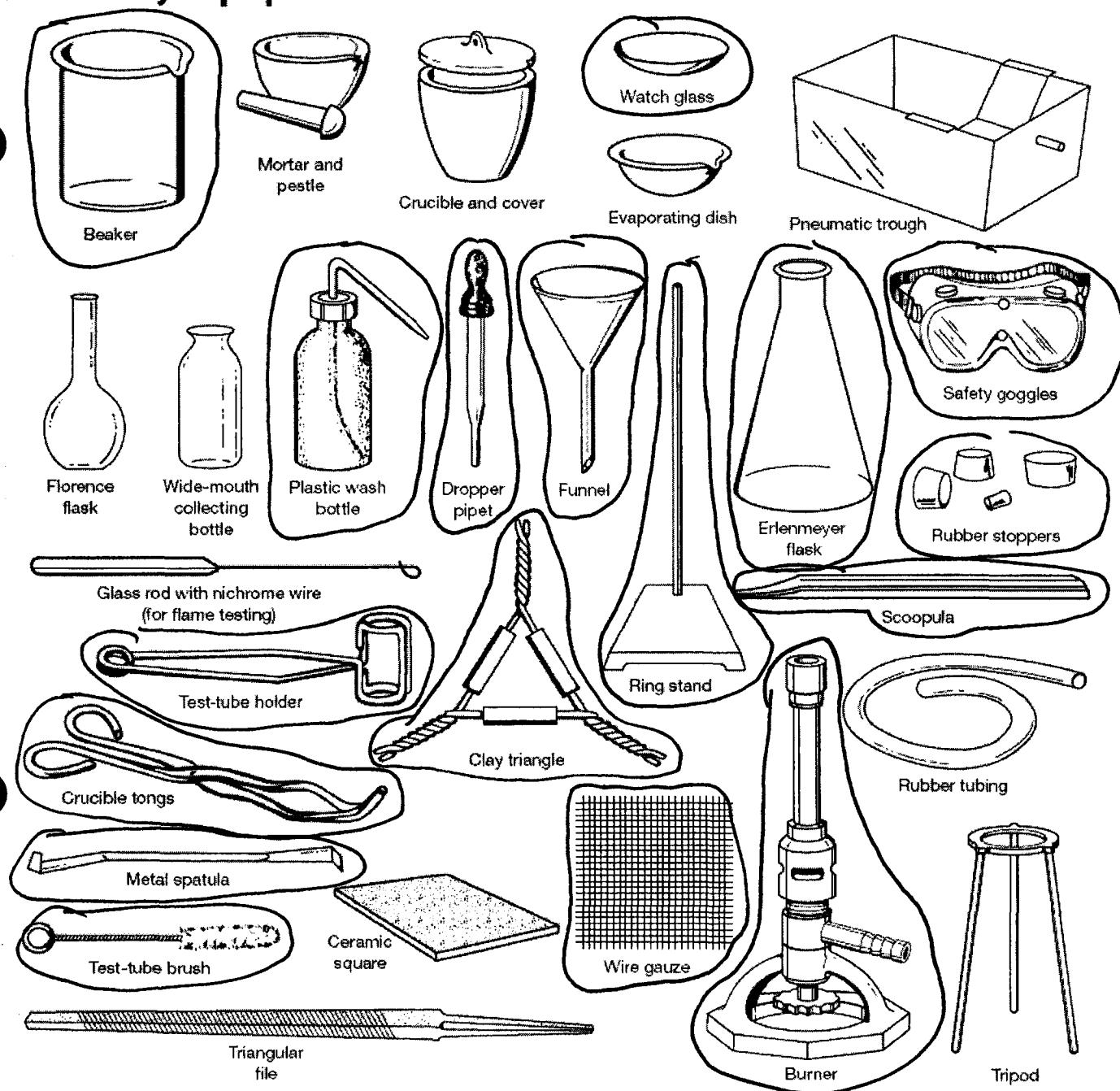
\_\_\_\_\_  
Date

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# Laboratory Equipment



**Beaker:** glass or plastic; common sizes are 50 mL, 100 mL, 250 mL, 400 mL; glass beakers may be heated.

**Buret:** glass; common sizes are 25 mL and 50 mL; used to measure volumes of solutions in titrations.

**Ceramic square:** used under hot apparatus or glassware.

**Clamps:** the following types of clamps may be fastened to support apparatus: buret/test-tube clamp, clamp holder, double buret clamp, ring clamp, 3-pronged jaw clamp.

**Clay triangle:** wire frame with porcelain supports; used to support a crucible.

**Condenser:** glass; used in distillation procedures.

**Crucible and cover:** porcelain; used to heat small amounts of solid substances at high temperatures.

**Crucible tongs:** iron or nickel; used to pick up and hold small items.

**Dropper pipet:** glass tip with rubber bulb; used to transfer small volumes of liquid.

**Erlenmeyer flask:** glass; common sizes are 100 mL, 250 mL; may be heated; used in titrations.

**Evaporating dish:** porcelain; used to contain small volumes of liquid being evaporated.

**Florence flask:** glass; common sizes are 125 mL, 250 mL, 500 mL; may be heated; used in making and for storing solutions.

**Forceps:** metal; used to hold or pick up small objects.

**Funnel:** glass or plastic; common size holds 12.5-cm diameter filter paper.

**Gas burner:** constructed of metal; connected to a gas supply with rubber tubing; used to heat chemicals (dry or in solution) in beakers, test tubes, and crucibles.

**Gas collecting tube:** glass; marked in mL intervals; used to measure gas volumes.

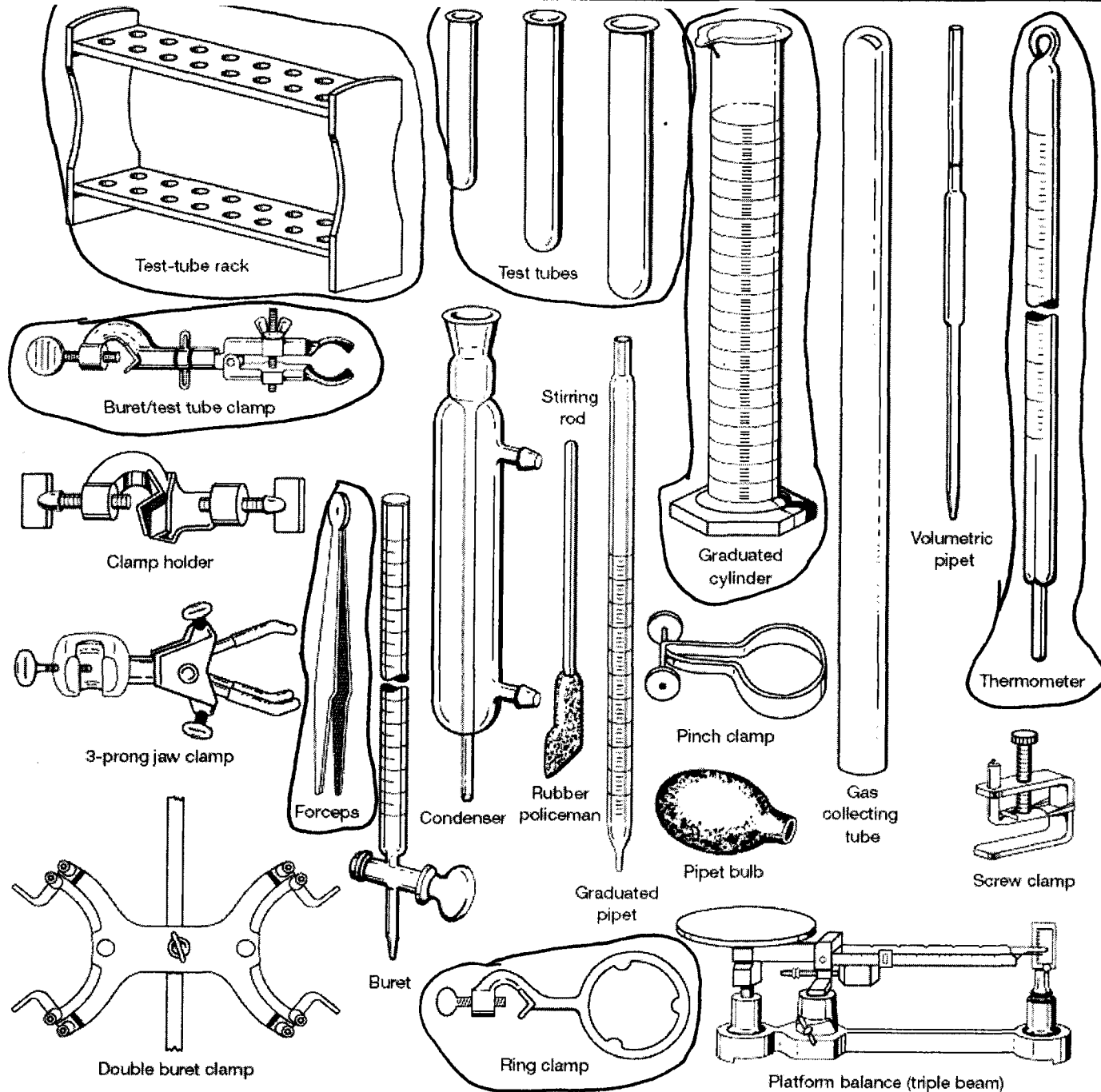
**Glass rod with nichrome wire:** used in flame tests.

**Graduated cylinder:** glass or plastic; common sizes are 10 mL, 50 mL, 100 mL; used to measure approximate volumes; must not be heated.

**Graduated pipet:** glass; common sizes are 10 mL, 25 mL; used to measure solution volumes; less accurate than a volumetric pipet.

**Mortar and pestle:** porcelain; may be used to grind crystals and lumpy chemicals to a powder.

**Pipet bulb:** rubber; used in filling a pipet with a solution; a pipet must never be filled by mouth.



**Plastic wash bottle:** flexible plastic; squeeze sides to dispense water.

**Platform balance:** also known as a triple-beam balance.

**Pneumatic trough:** galvanized container with shelf; used in experiments where a gas is collected.

**Ring stand:** metal rod fixed upright in a heavy metal base; has many uses as a support.

**Rubber stoppers:** several sizes.

**Rubber tubing:** used to connect apparatus to transfer liquids or gases.

**Safety goggles:** plastic; must be worn at all times while working in the laboratory.

**Screw clamp, pinch clamp:** metal; used to block off rubber tubing.

**Spatula, scoopula:** metal or porcelain; used to transfer solid chemicals; the scoopula has a larger capacity.

**Stirring rod and rubber policeman:** glass with rubber sleeve; used to stir, assist in pouring liquids, and for removing precipitates from a container.

**Test-tube brush:** bristles with wire handle; used to scrub small-diameter glassware.

**Test-tube holder:** spring metal; used to hold test tubes or glass tubing.

**Test-tube rack:** wood or plastic; holds test tubes in a vertical position.

**Test tubes:** glass; common sizes small (13 mm × 100 mm), medium (20 mm × 150 mm), large (25 × 200 mm); may be heated.

**Thermometer:** non-mercury; common range  $-10^{\circ}\text{C}$  to  $110^{\circ}\text{C}$ .

**Triangular file:** metal; used to scratch glass tubing prior to breaking to desired length.

**Tripod:** iron; used to support containers of chemicals above the flame of a burner.

**Volumetric pipet:** glass; common sizes are 10 mL, 25 mL; used to measure solution volumes accurately; must not be heated.

**Watch glass:** glass; used to cover an evaporating dish or beaker.

**Wide-mouth bottle:** glass; used with pneumatic trough.

**Wire gauze:** used to spread the heat of a burner flame.

TASK 1: Place a checkmark next to all of the following skills that you feel are important for successful cooperative group work.

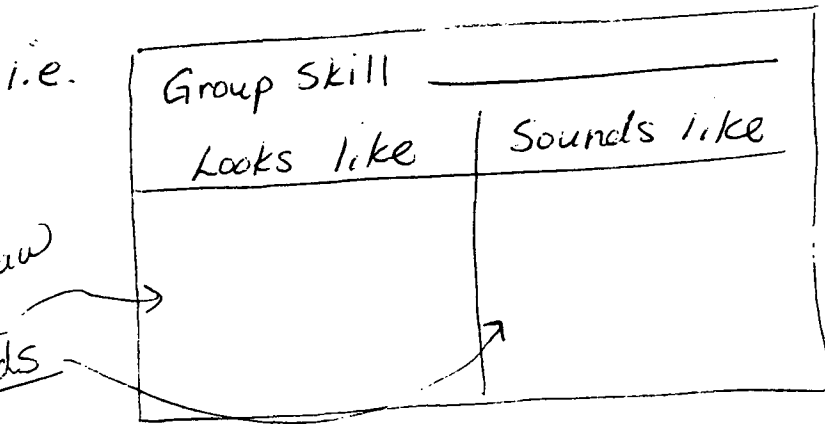
- \_\_\_\_\_ moving desks into place
- \_\_\_\_\_ sitting face-to-face
- \_\_\_\_\_ talking in quiet voices
- \_\_\_\_\_ distributing materials
- \_\_\_\_\_ staying on task
- \_\_\_\_\_ sharing materials
- \_\_\_\_\_ monitoring time
- \_\_\_\_\_ active listening
- \_\_\_\_\_ contributing ideas
- \_\_\_\_\_ taking turns
- \_\_\_\_\_ praising others
- \_\_\_\_\_ using "I" messages rather than "you"
- \_\_\_\_\_ encouraging participation from others
- \_\_\_\_\_ showing appreciation and empathy
- \_\_\_\_\_ checking for understanding
- \_\_\_\_\_ asking questions
- \_\_\_\_\_ asking for explanations
- \_\_\_\_\_ criticizing ideas, not the person
- \_\_\_\_\_ disagreeing in an agreeable way
- \_\_\_\_\_ Joking to relieve the tension
- \_\_\_\_\_ paraphrasing
- \_\_\_\_\_ inviting others to talk
- \_\_\_\_\_ summarizing
- \_\_\_\_\_ challenging ideas
- \_\_\_\_\_ taking different perspectives
- \_\_\_\_\_ generating alternative ideas
- \_\_\_\_\_ others \_\_\_\_\_

**TASK 2:** From the skills that you checked select the eight that are most important and rank them in order from greatest to least important.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**TASK 3:** With your team reach a consensus on the top four skills and be prepared to share your results with the class.

**TASK 4:** Create a T-chart on poster paper from one of the above skills (the teacher will assign it)



insert/draw  
pictures  
and words

2eval.doc

Evaluate each group member with an A,B,C,D,F.

Group Skills							
Actively involved							
Interacts with group members							
Actively listens							
Efficient use of time							
Functions positively							
Carries out job or role							

COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





# Chemistry Lab Format

**Title** - Brief description of the lab.

**Purpose** - This explains WHY you are doing the lab and describes what you are intending to discover, prove or find out.

**Background information** - This includes any definitions, chemical equations or other novel information pertinent to the lab.

**Safety** - includes all basic safety - goggles / closed toe shoes / aprons as needed and all other safety from the particular lab.

**Procedure** - This is a step by step procedure of what you will do in the lab. **The first step, whether stated or not, is to put on safety equipment - goggles, etc. The last steps, whether stated or not are always: Dispose of waste as directed by teacher, Clean-up by washing and returning all materials, and Wash hands.** Sometimes changes will be made on the day of the lab. Be sure to include any discussed changes.

**Data Table** - This is where any data collected in the lab is recorded. CALCULATED values should not be included in a data table. If a lab requires you to generate your own data table, the best way to determine what data needs to be collected is to reread the procedure. Each time it says to "record" there should be an entry in the data table. Organize the information that needs to be collected in a clear, concise format. Make sure that all data collected is accurate based on measuring tool.

**Calculations** - Many labs have a separate CALCULATIONS section. Show all work, remembering all rules for significant figures and units.

**Questions** - At the end of most lab, there will be a series of questions. These questions must be answered IN COMPLETE SENTENCES as part of the report. The answers to these questions often times lead you to part of the conclusion of the lab.

**Conclusion** - This is a paragraph that states what was discovered in the lab as it relates to the purpose. You must include the following information:

- Restate the purpose
- Use the PASSIVE voice, i.e. tell me what was done, but NOT who did it. (EX: don't write "Our unknown sample #4 was magnesium." INSTEAD write, "Unknown Sample #4 was determined to be magnesium.")
- Give a VERY brief synopsis of the procedure used. This should be no more than 2-3 sentences. DO NOT REPEAT ENTIRE PROCEDURE! This will cause you to lose points!
- Use your data and/or calculations and/or answers to the questions to draw a conclusion from the data/observations **as it relates to the purpose!** NOTE: Only use the data or calculations that directly relate to the purpose. DO NOT REPEAT ALL DATA!
- State any NON-HUMAN sources of error that may have affected your results. NON-HUMAN sources of error are errors due to a design flaw in the lab. By changing the design of the lab, accuracy and/or precision should be increased. You should explain how these errors would have specifically altered your results found in the lab. Human sources of error (i.e. spilling a beaker, misreading a thermometer) are NOT ACCEPTABLE and will cause you to LOSE POINTS!!!!



# The Periodic Table of the Elements

1 <b>H</b> Hydrogen 1.00794	2 <b>He</b> Helium 4.003	3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012182	5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.0107	7 <b>N</b> Nitrogen 14.00674	8 <b>O</b> Oxygen 15.99994	9 <b>F</b> Fluorine 18.9984032	10 <b>Ne</b> Neon 20.1797	11 <b>Na</b> Sodium 22.989770	12 <b>Mg</b> Magnesium 24.3050	13 <b>Al</b> Aluminum 26.981538	14 <b>Si</b> Silicon 28.0855	15 <b>P</b> Phosphorus 30.973761	16 <b>S</b> Sulfur 32.066	17 <b>Cl</b> Chlorine 35.4527	18 <b>Ar</b> Argon 39.948	19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.955910	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938049	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933200	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.39	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.61	33 <b>As</b> Arsenic 74.92160	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.80	37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.90585	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.94	43 <b>Tc</b> Technetium (98)	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.90550	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.60	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.29	55 <b>Cs</b> Cesium 132.90545	56 <b>Ba</b> Barium 137.327	57 <b>La</b> Lanthanum 138.9055	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.9479	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.217	78 <b>Pt</b> Platinum 195.078	79 <b>Au</b> Gold 196.96655	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.3833	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.98038	84 <b>Po</b> Polonium (209)	85 <b>At</b> Astatine (210)	86 <b>Rn</b> Radon (222)	87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium (226)	89 <b>Ac</b> Actinium (227)	104 <b>Rf</b> Rutherfordium (261)	105 <b>Db</b> Dubnium (262)	106 <b>Sg</b> Seaborgium (263)	107 <b>Bh</b> Bohrium (262)	108 <b>Hs</b> Hassium (265)	109 <b>Mt</b> Meitnerium (266)	110 <b>Ds</b> Darmstadtium (269)	111 <b>Rg</b> Roentgenium (272)	112 <b>Cn</b> Copernicium (277)	113 <b>Nh</b> Nihonium (283)	114 <b>Fl</b> Flerovium (284)	115 <b>Mc</b> Moscovium (285)	116 <b>Lv</b> Livermorium (286)	117 <b>Ts</b> Tennessine (287)	118 <b>Og</b> Oganesson (288)	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.90765	60 <b>Nd</b> Neodymium 144.24	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.92534	66 <b>Dy</b> Dysprosium 162.50	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.26	69 <b>Tm</b> Thulium 168.93421	70 <b>Yb</b> Ytterbium 173.04	71 <b>Lu</b> Lutetium 174.967	90 <b>Th</b> Thorium 232.0381	91 <b>Pa</b> Protactinium 231.035888	92 <b>U</b> Uranium 238.0289	93 <b>Np</b> Neptunium (237)	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (262)
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COMMON POLYATOMIC IONS						
+1	Ammonium	$\text{NH}_4^{+1}$	+2	Dimercury	$\text{Hg}_2^{2+}$	
-1	Acetate	$\text{CH}_3\text{COO}^{-1}$ or $\text{C}_2\text{H}_3\text{O}_2^{-1}$	-2	Carbonate	$\text{CO}_3^{2-}$	
	Bromate	$\text{BrO}_3^{-1}$		Chromate	$\text{CrO}_4^{2-}$	
	Chlorate	$\text{ClO}_3^{-1}$		Dichromate	$\text{Cr}_2\text{O}_7^{2-}$	
	Chlorite	$\text{ClO}_2^{-1}$		Hydrogen phosphate	$\text{HPO}_4^{2-}$	
	Cyanide	$\text{CN}^{-1}$		Oxalate	$\text{C}_2\text{O}_4^{2-}$	
	Dihydrogen phosphate	$\text{H}_2\text{PO}_4^{-1}$		Peroxide	$\text{O}_2^{2-}$	
	Hydrogen carbonate (bicarbonate)	$\text{HCO}_3^{-1}$		Sulfate	$\text{SO}_4^{2-}$	
	Hydrogen sulfate	$\text{HSO}_4^{-1}$		Sulfite	$\text{SO}_3^{2-}$	
	Hydroxide	$\text{OH}^{-1}$		-3	Arsenate	$\text{AsO}_4^{3-}$
	Hypochlorite	$\text{ClO}^{-1}$			Phosphate	$\text{PO}_4^{3-}$
	Nitrate	$\text{NO}_3^{-1}$				
	Nitrite	$\text{NO}_2^{-1}$				
	Perchlorate	$\text{ClO}_4^{-1}$				
	Permanganate	$\text{MnO}_4^{-1}$				

—Figure 61.6—

**Problem-Solving Strategies Wheel**

