

**Procedure:** On this sheet there are a series of clues that allow you to identify the elements that are found in the lab. Once you use the clue to figure out what element you are looking for, go find the element somewhere in the lab and answer all questions concerning that element. Answering the questions may require you to observe, do a small experiment, or refer to a textbook or other resource. You may do the clues in any order you wish to avoid crowds. Just write down all answers right on the lab handout as you go. **(Do not write any answers in the final chart yet!!)** I expect that you will work cooperatively with your lab partner and stick together. Do not split up the work. It is important that everyone sees each element. Make sure you get to all the elements and answer those questions that must be done in the lab.

**Write-Up:** Once you have answered all the questions, make a final copy of answers by neatly completing the final chart. **Only answers written in the chart will be graded.** If a question involves a calculation, you must show all steps of the calculation in the CHART (Units, Sig figs)

**Questions:** (Some questions refer you to a text book. It is NOT your text book. The text book is the Merrill Chemistry text. There are many copies of this text book in the classroom.)

- 1) Identify the element whose neutral atoms have an electron configuration ending with  $5p^5$ .
  - a) What is the color of the solid crystals?
  - b) As a demo, your teacher will put one tiny flake into a test tube and gently heat over a Bunsen burner. What is the color of the vapor forming?
  - c) In this demo, the solid crystals turned directly into a gas. What is the name of this type of phase change?
  
- 2) One element on display today is bright yellow in color. Locate it and identify it.
  - a) What is the symbol (with charge) of the ion of this element that exists in stable ionic compounds?
  - b) Is this ion larger or smaller than the neutral atom of this element?
  - c) Is this element a metal or a nonmetal?
  - d) What property can you observe by looking at the sample that supports your designation in the previous question (2c)?
  
- 3) One element on display today has a “last electron” configuration of  $6p^2$ . Identify it.
  - a) One mole of this element is on display with one mole of another element. Which element has a larger molar mass—this one or the other?
  - b) How many moles would be in 5.0 g of this element? (*You must show calculation in chart.*)
  
- 4) One element on display has a molar mass of 40.08 g/mole. Identify it and then locate it. Put one piece of this metal into a test tube partially filled with water (1/4 full is plenty). Allow the metal to react for a minute or so-- keep your finger over test tube opening to collect the gas produced in the reaction. (*Wait until the test tube starts to get warm or the reaction is occurring well*). Light a wooden splint. When ready, remove your finger from the test tube opening and quickly hold the lit splint over the opening. **CLEANUP:** Pour water waste into beaker labeled, “Waste.” Rinse out test tube with some water. Put test tube back in test tube rack. Put used splints into “used splint” beaker.
  - a) When the metal was put into water, bubbles formed. Thus, a gas was produced. What happened when this gas was tested with the lit splint?
  - b) The result of the lit splint test suggests that the gas is flammable. The gas is flammable because it reacts with the oxygen in the air. Write the balanced chemical equation for this gas reacting with oxygen.
  - c) Now, write the balanced chemical equation for the formation of the gas.

*Hint: The metal reacts with water to form the gas and  $\text{Ca}(\text{OH})_2$*

- 5) One particular isotope of this element has a mass number of 64 and has 36 neutrons. Identify the element.
- Is the sample on display today in the form of pellets, chunks, powder, sheet or foil?
  - What is this element's density? (*Look in Appendix A of black Merrill Chemistry text book*)
  - What does one make if one adds this element to iron, carbon and chromium? (*p.310 of Merrill text*)
- 6) Find the transition metal in the lab which has 7 electrons in its d orbitals. Identify it.
- List 2 beneficial uses of this element.  
*Use the pictorial periodic table on the bulletin board at the front of the room.*
- 7) Mystery element Z is a metalloid with outermost electrons in the 5th main energy level and 3 unpaired electrons. Identify mystery element Z.
- Does mystery element Z "look" metallic?
  - Does the mystery element have a lower or higher resistance to current than silicon?  
*NOTE: To measure resistance, use the meter provided. The meter is set to read in ohms,  $\Omega$ , which is a unit of resistance. Don't worry if the readings jump around. Just get a good enough reading to answer the question. Make sure to notice if the value is in  $\Omega$ , k $\Omega$ , or M $\Omega$ .)*
  - Thus, which element conducts electricity better-- mystery element Z or silicon?  
*HINT: If an element has high resistance to current this means current does not flow well.*
  - Silicon is also a metalloid. Thus, it should have properties of both metals and nonmetals. List one property of silicon that is metal-like and one that is nonmetal-like.
  - What property of silicon makes it possible for it to be used in transistors, solar cells and computer chips? (See p.281 in Merrill text)
- 8) Mystery gas X is a noble gas in period 4. (This element is in a hood labeled, "Mystery Gas X.")
- Report its color in its normal state with no electricity flowing through it.
  - Report its color when an electric current is run through it. (*BE CAREFUL! Just turn the machine on and off. Don't touch the tube.*)
  - At what temperature would this gas turn into a liquid? (*Hint: Look up element in Appendix A of text and note its melting point and its boiling point. The answer is one of these. Explain your reasoning in one short phrase.*)
- 9) What element has an electron configuration of  $[\text{Ar}] 4s^2 3d^4$ ? Find it.
- What type of metal is this (alkali, alkaline earth or transition)?
  - What metallic property can easily be seen for this element?
  - What is this element's maximum oxidation number or charge? (*See Merrill text p. 257*)
  - In order for a neutral atom of this element to form an ion with this maximum charge, which electrons must be lost? (*Think—look at the electron configuration.*)
  - What gems get their color from ions of this element? (*See Merrill text p.291*)
- 10) Find elements with atomic numbers of 13, 30 and 50. Identify all three.
- Which of these three is the shiniest element? (*Observe*)
  - Which of these three is the most bendable? (*Observe carefully. Do not rip the metals!!!*)
  - Which of these three has the largest molar mass?
  - Which of these three is the densest? (*See appendix A of Merrill text.*)
  - Which of these three ends with a  $d^{10}$  electron?
- 11) Find the element in Group IV that is the only nonmetal.
- What is the percent abundance of this element in the earth's crust? (*See appendix A in Merrill text*)
  - What are the two crystal forms (allotropes) of this element? (*See p. 403 in Merrill text.*)

- 12) Find the open flask labeled as “Mystery Gas Y,” which is the predominant gas in the open flask.
- What is the common name for the mixture of gases in the flask?
  - What is the percentage of Mystery Gas Y in the flask? (*See p. 458 in Merrill text*)
  - What substances, other than Mystery Gas Y, are in the flask? (*See p. 458. List all 7 other substances.*)
  - What is the chemical formula for Mystery Gas Y? (*See Merrill text p.282*)
  - Give the names or chemical formulas for three common compounds which contain atoms of Mystery Gas Y. (*See Merrill text p.282*)
- 13) This element has just three electrons in its 4<sup>th</sup> energy level.
- Is this element a metal, metalloid, or nonmetal?
  - What is the state (solid, liquid or gas) of this sample of the element at room temperature?
  - Place the *sealed vial* into the warm water bath. What happens to the element when placed in the warm water? Why? (*Look it up by clicking on the element on [www.ptable.com](http://www.ptable.com)*)
  - What is the predominant use of this element? What compound of this element is made from the element two to its right? (*See ptable again.*)
  - There are only 2 elements that are liquids at room temperature, Hg & Br. We are not allowed to work with Hg. Watch the video on Hg at [https://youtu.be/oL0M\\_6bfzkU](https://youtu.be/oL0M_6bfzkU) and explain why not (in only a few words)?
- 14) This element is the product of  $\beta^-$  decay of Pb-209. It was formerly thought to be stable but now known to have a  $\frac{1}{2}$ -life of  $1.9 \times 10^{19}$  years.
- What form is on display here (pellets, chunks, powder, sheet or foil)?
  - The age of the earth is about  $4.5 \times 10^9$  years. Approximately how many  $\frac{1}{2}$ -lives have passed?
  - What is this element’s density? (*see appendix A of Merrill text*)
  - What would be the mass of 25 mL of this element? (*You must show calculation in chart.*)

**DANGER CORNER!!! #15-#17** Go to the designated area. **Your element choices for these questions are only those elements available in the box.** The little bottles are fragile and the chemicals are dangerous if allowed into the air. For the small bottles stored in the foam, remove one bottle at a time carefully from the foam, observe and place back in the foam. DO NOT OPEN any jars or touch any elements except those listed below!

- 15) Find the element in the danger corner in Group I, period 3.
- What family is this element in?
  - How many electrons must this element lose to achieve a noble gas electron configuration?
  - What is the charge of an ion of this element in a stable ionic compound?
  - Is the ion larger or smaller than the neutral atom?
  - Why is this element stored in oil? (*See p.138 in Merrill text.*)
- 16) Find the **nonmetal** in the danger corner which has 3 unpaired electrons in the third energy level.
- What is its color?
  - Which allotrope of this element is the most dangerous? (*See Merrill text p. 282-283.*)
  - Why is this allotrope of the element so dangerous? (*use Merrill text again*)
- 17) One of these danger corner elements is an orange liquid. Identify it.
- Look up this element in a dictionary. Its name was derived from a Greek word. What is this Greek word and what does this Greek word mean?
  - How many unpaired electrons does a neutral atom of this element have?
  - What is the name of this element’s chemical family?





