

The Elements and Electronic Structure Lab

Chem Honors

Prelab: Read the lab and identify as many elements as possible before the day of the lab.

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. **Be careful—there are some incorrect elements included in the lab to match some incorrect identifications.** Answering the questions may require you to view an image or video, or to 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(s) and stick together. Do not split up the work. It is important that everyone see each element. Make sure you get to all the elements and answer those questions that must be done in the lab. Element images and videos are in the Google Folder <http://bit.ly/3aYsVAv>.

Write-Up: Once you have answered all the questions, neatly complete all of the information and answers on the final chart, which you will hand in (do NOT turn in the procedure/questions pages). **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). Be sure your name and your lab partner(s) are filled in.

Questions: (Some questions refer you to a textbook. It is NOT your textbook. The textbook is the Merrill Chemistry text. The needed pages are in the linked Google Folder.)

- 1) Identify the element whose neutral atoms have an electron configuration ending with $5p^5$.
 - a) Watch the video for this element. What is the color of the solid crystals?
 - b) In the video, a tube containing this element is gently heated over a Bunsen burner. What is the color of the vapor formed?
 - c) In this demo, the *solid* crystals turned directly into a *gas*. What is the name of this phase change?
- 2) One element on display is dull yellow in color. Find it and identify it.
 - a) Is this element a metal or a nonmetal?
 - b) State one property that supports your designation in question 2a.
 - c) What is the symbol (with charge) of the *ion* of this element that exists in stable ionic compounds?
 - d) Is this ion larger or smaller than the neutral atom of this element?
- 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 5.00 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. Watch the video in which I put one piece of this metal into a test tube partially filled with water.
 - a) When the metal was put into water, it reacted with the water and 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 indicates that the gas is flammable. The gas is flammable because it reacts with the O_2 in the air. Write the balanced chemical equation for this gas reacting with O_2 (*what is the product?*).
 - c) Now, write the balanced chemical equation for the formation of the gas.
Hint: The metal reacts with water to form the gas and $Ca(OH)_2$

- 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 in the form of pellets, chunks, powder, sheet or foil?
 - What is this element's density? (*Look it up by clicking on the element on www.ptable.com and then clicking on its name in the properties box to the left.*)
 - What does one make if one adds this element to iron, carbon and chromium? (*p.310 of Merrill*)
- 6) Find the transition metal in the lab which has only 7 electrons in its d orbitals. Identify it.
- List 2 beneficial uses of this element. (*Use the pictorial periodic table.*)
- 7) Mystery Element Z is a metalloid with outermost electrons in the 5th main energy level and 3 unpaired electrons. Identify Mystery Element Z.
- Watch the video for Mystery Element Z. Does Mystery Element Z “look” metallic?
 - Does the Mystery Element Z have a lower or higher resistance to current than silicon?
 - 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*)
- 8) Mystery Gas X is a Noble Gas in period 4.
- Report its color in its normal, unexcited state with no electricity flowing through it (*video*).
 - Report its color in its excited state, when an electric current is run through it. (*video*)
 - At what temperature would this gas turn into a liquid? (*Hint: Look up element in ptable.com and note its melting point and its boiling point. The answer is one of these. State the correct answer and explain your reasoning in one short phrase.*)
- 9) What element has an electron configuration of [Ar] 4s²3d⁴? 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 p. 257*)
 - In order for a neutral atom of this element to form an ion with this maximum charge, which electrons must be lost? Be specific. (*Think—look at the electron configuration.*)
 - What gems get their color from ions of this element? (*See Merrill p. 291*)
- 10) Find elements with atomic numbers of 13, 30 and 50. Identify all three.
- Which of these three is the most abundant in the earth's crust? Record its abundance. (*see Merrill Appendix A*)
 - The symbol of which of these three elements comes from Latin? What is its Latin name? (*see ptable.com*)
 - Which of these three has the largest molar mass? Record its molar mass.
 - Which of these three is the densest? Record its density in g/cm³. (*See ptable.com.*)
 - Which of these three ends with a d¹⁰ electron?
- 11) Find the element in Group 14/IVA that is the only nonmetal.
- When was this element discovered? (*See ptable.com*)
 - 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 (*hint: flask is open*)?
 - 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 p.282*)
- 13) This element has just three electrons in its 4th energy level. Find it.
- Is this element a metal, metalloid, or nonmetal?
 - Watch video. What is the state (solid, liquid or gas) of this element at room temperature?
 - What happens to the element when placed in the warm water? Why? (*Look it up on 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.com 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 and explain why not (in only a few words)?
- 14) This element is the product of β^- decay of Pb-209. It was formerly thought to be stable but now known to have a $\frac{1}{2}$ -life of 1.9×10^{19} years. Find it.
- What form is on display here (pellets, chunks, powder, sheet or foil)?
 - The age of the earth is about 4.5×10^9 years. Approximately how many $\frac{1}{2}$ -lives have passed? (*You will need to use the $\frac{1}{2}$ -life time equation*)
 - What is this element’s density? (*see ptable.com*)
 - What would be the mass of 25.0 cm^3 of this element? (*You must show calculation in chart.*)

DANGER CORNER!!! #15-#17 Find the image. **Your element choices for these questions are only those elements available in the box.** The elements are stored in small quantities in little sample vials because the chemicals are dangerous if allowed into the air.

- 15) Find the element in the danger corner in Group 1/IA, 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.*)
- 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 p. 282-283.*)
 - Why is this allotrope of the element so dangerous? (*Merrill 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?

Do not fill in these charts until you have answered all questions on the previous lab sheets. Once ready, completely fill in these charts according to my directions. Only answers written in these charts will be graded. For any calculations, all work must be shown with units on every number and answers must have proper significant figures.

#	Element name	Symbol	Atomic Number	Electron Configuration (Noble gas notation)	# of valence e ⁻	Answers to the Questions
1						a) b) c)
2						a) b) c) d)
3						a) b)
4						a) b) c)
5						a) b) c)
6						a)
7						a) b) c) d) e)
8						a) b) c)
9						a) b) c) d) e)

#	Element name	Symbol	Atomic Number	Electron Configuration (Noble gas notation)	# of valence e ⁻	Answers to the Questions
10						a) b) c) d) e)
11						a) b)
12						a) b) c) d) e)
13						a) b) c) d) e)
14						a) b) c) d)
15						a) b) c) d) e)
16						a) b) c)
17						a) b) c)