WESTERN CONNECTICUT STATE UNIVERSITY

DEPARTMENT of CHEMISTRY

EVERYDAY CHEMISTRY LABORATORY MANUAL

2020-2021

Western Connecticut State University

Chemistry Department

Laboratory Safety and Work Rules

1) Be prepared! Read your laboratory exercise beforehand. Know what possible problems may arise. If in doubt, ask your instructor.
2) In case of accident or fire notify the instructor immediately!
3) Know where the safety equipment (shower, eye washes, extinguishers, emergency phone, etc.) are located. Know how to use them.
4) Proper use of glassware and equipment will be demonstrated. Do not force connections. Follow instructions. If in doubt, ask your instructor.
5) You must wear EYE PROTECTIVE DEVICES designated by the department. Do not wear contact lens to lab.
6) Do not smoke, eat, drink, or/horseplay in the laboratories.
7) Never work alone! Do not attempt unauthorized experiments. Consult with your instructor, if in doubt as to what to do.
8) Do not taste or/smell laboratory chemicals unless so instructed. Avoid skin contact of chemicals. Wash hands frequently, especially before leaving the laboratory.
9) Be neat! Report all spills to your instructor for instructions on proper cleanup. Wash your work area, and clean up, etc., before leaving laboratory. Check out with your instructor.
10) You must wear "closed toe" shoes. Long hair should be contained (fire hazard). Avoid loose, readily flammable clothing. Lab coats, aprons, gloves, etc., are recommended.
11) Do not aim boiling liquids at your neighbor. Watch your neighbors! Work "defensively" and cooperatively.
12) Do not use broken glassware, equipment, etc. Check with your instructor.
13) Discard all wastes as directed in cans, hood, waste bottles, sinks, etc. Wash away with copious water. If in doubt, check with your instructor. Follow instructions!
14) Read all reagent bottle labels. Check concentration as well as identify. Do not contaminate reagents. Do not pipette by mouth. Follow instructions.
15) Use hood for flammable or/noxious substances.
16) Be careful of open flames, electrical hazards, radiation exposure, flammables, toxic materials, gases, mercury, etc. Do not inhale noxious gases.
17) Do not weigh chemicals directly on metal balance surfaces. Be neat.
18) Do not assume the responsibilities of an instructor. Bring all problems requiring first aid to the instructor. Be prepared for emergency treatment of accidents, however. If faint, lie down. Do not rub burns (thermal or chemical); wash with copious water. Never rub your eyes – use eye wash. If clothing catches fire, do not inhale flame – use showers, fire blanket, or roll on the floor.
19) If in doubt, consult with your instructor – ALWAYS!
20) Always be safety conscious – of yourself and everyone else!

EVERYDAY CHEMISTRY
ALCHEMY

1. INTRODUCTION.

The age of alchemy spanned from approximately 300 B.C.E. to 1600 A.D. The alchemists' practice of a combination of sorcery, religion, medicine and chemistry formed the foundation of modern chemical science. The alchemists developed their interpretation of the ideas of Aristotle and other Greek philosophers into an experimental endeavor which centered around two main themes: transform or transmute base metals (e.g., lead, tin, copper) into gold and prepare the "elixir of life," which could cure all sickness and bestow immortality upon people.

Alchemy was important to the extent that many devices and experimental techniques were invented which are still used in the modern chemical laboratory. Among these are evaporation, distillation, crystallization, filtration, alloying, along with flasks, retorts and ovens. Alchemists also carried the notion of the unity of matter into modern thinking; they also discovered several elements and were the early pharmacists.

The present experiment is designed to introduce you to some basic laboratory techniques and apparatus through exploration of the alchemical principle of transmutation of base metals into gold.

2. SAFETY.

In this experiment, you may use the Bunsen burner and a hot plate as well as zinc powder, which when embedded into paper, can cause the paper to combust. Proper precautions should be followed (your instructors will note the specific items) and, of course, *eye protection worn at all times*!

3. PROCEDURES.

1. Bring to the laboratory three (3) clean (shiny) pennies. If the pennies are not clean, use sandpaper or steel wool to brighten them.

2. Keep one penny aside as a control, against which the other pennies can be compared after they are treated.

3. Set up an evaporating dish on a hot plate as described by your instructor.

4. Put four pennies (2 for each student) into the evaporating dish. Sprinkle a small amount of powdered zinc (Zn) onto the surface of the pennies. Try to cover most of the surface of the coins. Add aqueous 3.0 M zinc chloride to a level that just covers the pennies.

5. Heat carefully on the hot plate. Move the pennies with tongs so that all surfaces contact the reagents. Do not allow the mixture to reach boiling temperature. Be prepared to remove the evaporating dish from the hot plate with the tongs (grip the dish with the tongs securely so you don't drop the dish and its contents!) if boiling begins. You should heat the mixture for about five minutes, until you note a uniform change from the original copper color of the pennies.

6. Remove the pennies with tweezers or tongs and rinse them under running water. Remove any excess zinc that has adhered to the surfaces (you can use a paper towel or your fingers for this; do not discard the paper towels in the garbage – there is a beaker of water for this).

7. When the evaporating dish has cooled, pour the remaining zinc and liquid into the designated waste container. Clean the evaporating dish and the tongs or tweezers with water.

8. Treat two of the "silver" pennies as follows. Grasp one of them around its edges with tongs, and gently wave the coin over the flame of a Bunsen burner. Do not hold the penny directly in the flame. If you are feeling flush, you can take another (non-treated) penny and heat it directly in the burner flame.

4. DISCUSSION QUESTIONS.

In the DISCUSSION section of your report, address the following points.

[1] Do you believe that you really made silver (Ag) and gold (Au)? Justify your answer in terms of your experimental observations and general experience.

[2] Probably none of you would believe you made real gold coins during the Alchemy lab – but the pennies did look like gold after flamed. Based on what you know (search online if you need), which of the following experiments you could do to check if the gold coins you made were real gold? Select all correct methods, and explain each choice briefly.

(a) Measure the density of the lab gold coins and compare with the density values of the real gold (which is known, what is the value?)

(b) Heat the coin in a strong flame to see if it melts. The hottest Bunsen flame has a temperature around 700 ^{o}C. Look up the melting points of gold, zinc and copper to answer this question.

(c) Taste the coin and see if it tastes like real gold

(d) Treat the coins with nitric acid (nitric acids would "eat"-up most metals but not gold) and see if it would be corroded.

(e) Compare the color of the coins with a piece of real gold.

[3] If you were an alchemist in the middle ages, would you have a tendency to believe that you transmuted copper? Please explain you answer.

[4] State the definition of a science. Is alchemy a science? Discuss some area or discipline popular today that people treat as science but which doesn't adhere to the basic definition.

[5] What lessons can you take from the principles addressed in this experiment in application to everyday situations?

[6] During the Alchemy Lab, you made BRASS from copper on the pennies and zinc – zinc atoms deposited on the surface of copper when you heated the pennies covered in zinc dust and zinc chloride solution. Based on this, judge if brass is a mixture or a pure substance. Briefly explain why.