Appendix I-1: Starting with Safety: An Introduction for an Academic Chemistry Laboratory

Multiple Choice Questions/**1ApxI-1**
Essay Section/**4ApxI-1**
Answer Key/**6ApxI-1**

MULTIPLE CHOICE QUESTIONS

1. To dilute 50 ml of concentrated (18M) sulfuric acid to 100 ml of 9M sulfuric acid you should:
   a. Put 50 ml of concentrated sulfuric acid in a 100ml volumetric flask and add water to the mark.
   b. Put 50 ml of water in a 100-ml volumetric flask and add concentrated sulfuric acid to the mark.
   c. Put about 25 ml of water in a 100-ml volumetric flask; add 50-ml of concentrated sulfuric acid and then water up to the mark.

2. The fume hood is the place to: (Multiple Answers)
   a. Use a Bunsen burner to fire polish glass tubing.
   b. Pour volatile chemicals from a stock bottle.
   c. Recrystallize using acetone (major ingredient in fingernail polish remover).
   d. Filter an aqueous mixture.

3. To put out clothing fires you should: (Multiple Answers)
   a. Run to blow out the flames.
   b. Stop, drop, and roll.
   c. Wrap yourself in a fire blanket.
   d. Step under the safety shower and pull the handle. **best**

4. When lighting a Bunsen burner:
   a. First light the match, then turn on the gas.
   b. First turn on the gas, then light the match.
   c. Either a or b.

5. The following are appropriate to wear in the lab: (Multiple Answers)
   a. Rings and watches
   b. Contact lenses
   c. Sandals
   d. Safety goggles

6. When heating test tubes in a flame: (Multiple Answers)
   a. Position the test tube upright directly under the flame.
   b. Position the test tube at an angle away from people.
   c. Move the test tube back and forth.
   d. Aim the test tube at your neighbor.

7. Before using glassware for any procedure:
   a. It should be free of stars and cracks.
   b. It should be dried in an oven.
   c. It should be triple rinsed with distilled water.
   d. It should be rinsed with acetone.

8. To insert glass tubing into rubber stoppers: (Multiple Answers)
   a. Use a glass tubing inserter.
   b. If no tubing inserter is available use glycerin to lubricate the tubing.
   c. Use mineral oil to lubricate the tubing.
   d. Place your palm behind the stopper to keep the tubing from going in too far.
   e. Use toweling to hold lubricated glass tubing as it is being inserted.
   f. Ask for help from the instructor or stockroom attendant.

9. To measure out 3 ml of an aqueous solution from a 4-liter bottle:
   a. Pour directly into a 10-ml graduated cylinder.
   b. First pour some of the solution into a 50-ml beaker to carry it to your desk.
   c. Use a funnel to pour into the graduated cylinder from the 4-liter bottle.

10. In order to balance a centrifuge properly:
   a. Opposing centrifuge tubes must contain the same volume.
   b. Opposing centrifuge tubes must be of equal mass.

11. When pouring from a reagent bottle (like nitric acid): (Multiple Answers)
   a. Put your hand over the label when pouring.
   b. Lay the glass stopper on the bench.
   c. Examine and clean drips from the outside of the bottle.
   d. Use appropriate gloves.

12. How should you heat a round bottom flask containing hexane? (Multiple Answers)
   a. Using a steam bath.
   b. Using a Bunsen burner.
   c. Using a heating mantle.

13. When heating volatile liquids you should: (Multiple Answers)
   a. Have your materials in the hood.
   b. Use a condenser to trap vapors.
   c. Stopper the flask to avoid vapors in the lab.

14. If you get chemicals in your eyes you should: (Multiple Answers)
    a. Hit yourself on the head for not wearing your safety goggles.
    b. Get under the safety shower.
    c. Use the eyewash fountain holding eyes open for 15 minutes.
    d. Remove inserted contact lenses.

15. If you spill a beaker of corrosive chemical down the front of your clothing you should:
    a. Rush to the bathroom to remove your clothes.
    b. Step under the safety shower and wash with your clothes on.
    c. Step under the safety shower and quickly remove contaminated clothing while washing.

16. To put out a hexane fire in a beaker you should: (Multiple Answers)
    a. Pour water into the beaker.
    b. Put a watch glass over the beaker.
    c. Remove the ignition source.
    d. Use the fire extinguisher in the lab.

17. Mercury spills should be cleaned up using: (Multiple Answers)
    a. A vacuum cleaner.
    b. A mercury sponge.
    c. Pennies to form a copper amalgam with the mercury.
    d. Elemental sulfur to bond with the mercury and make it less volatile.
    e. The mercury clean-up kit from the stockroom.

18. To reach a bottle of chemicals which is over your head you should:
    a. Stand on your lab stool.
    b. Use a step stool.
    c. Climb onto your lab partners shoulders.
    d. Stand on a lower shelf or crawl onto the lab bench.

19. When offered a choice you should use:
    a. A mercury thermometer.
    b. A non-mercury thermometer.

20. To draw liquid into a pipette you should:
    a. Use a pipette bulb.
    b. Use your mouth.
    c. Pour the liquid into the top using a funnel.

ESSAY SECTION (Supervisor may only assign some of these questions.)

1. Explain what is likely to happen when a volatile organic liquid is placed into an open beaker and heated with a Bunsen burner. Explain what is likely to happen when a volatile organic liquid is placed into a stoppered flask and heated with a Bunsen burner. Suggest safer alternatives for heating a volatile organic liquid.

2. Why is it unwise to return unused chemicals to their reagent bottles? Suggest better alternatives for dealing with unused chemicals, considering both safety and economy.

3. Explain why laboratory personnel favor the use of alcohol thermometers in the laboratory rather than mercury thermometers.

4. Draw a picture of a glass tubing inserter and explain how it works.

5. Describe the type of clothing, personal attire, and safety equipment that should be worn by students working in a chemical laboratory.

6. How would you deal with a fire in a wastebasket next to your work bench?

7. Identify three high priority safety concerns when diluting concentrated sulfuric acid.

ANSWER KEY

1. C — Answer A will cause spattering. Answer B gives incorrect concentration.
2. B, C
3. B, C, D — Answer A is very dangerous as it fans flame and may result in inhalation of flame.
4. A
5. B, D — Answer B is acceptable if chemical goggles are worn and prior approval is provided by instructor/supervisor.
6. B, C
7. A
8. A, B, E, F — Answer C (mineral oil) does not work as well as glycerin and isn't water-soluble.
9. B
10. B
11. C, D
12. A, C — Answer B will ignite the hexane.
13. A, B — Answer C will result in potentially dangerous pressure buildup.
14. C, D
15. C
16. B, C, D
17. B, D, E — Answer A will make fine droplets of mercury vapor airborne.
18. B
19. B
20. A