Solutions and Spectroscopy PreLab Worksheet

The following items deal with safety issues in the Solutions and Spectroscopy experiment. (Select all that apply.)

(a) Which hazards are associated with copper(II) sulfate?

- ☐ flammable
- ☐ carcinogenic
- ☐ corrosive
- ☐ toxic
- ☐ irritant

(b) What actions should you take if you spill copper(II) sulfate solution on yourself?

- ☐ Flush the affected area with water.
- ☐ Dry the area with paper towels, but avoid getting it wet.
- ☐ Neutralize it with a solution of sodium bicarbonate.
- ☐ Neutralize it with a solution of sodium bisulfite.

(c) What clothing is appropriate for the laboratory?

- ☐ a shirt that covers the shoulders (has sleeves)
- ☐ pants that extend to the ankles
- ☐ sandals
- ☐ shirt and pants that overlap 6”
- ☐ shoes that cover heels and toes
- ☐ shorts
- ☐ tank tops without sleeves

This question deals with waste disposal in the Solutions and Spectroscopy experiment.

What should be done to waste solutions containing copper ion? (Select all that apply.)

- ☐ flushed down the sink.
- ☐ disposed of in the bottle for waste copper ion once the work is complete.
- ☐ No waste will be generated in this experiment.
- ☐ returned to the bottle containing 0.5 M copper sulfate solution.
- ☐ dumped in a beaker labeled ”waste copper” on one’s bench during the experiment.

The following questions deal with making solutions and using volumetric glassware. (You should review the information on Volumetric Glassware in the Lab Equipment section of your lab manual and the Instructional Videos "Using a Volumetric Flask" and "Pipetting Techniques".)

(a) What are the standard ways to make a solution of known concentration? (Select all that apply.)

- ☐ diluting a known volume of stock solution into a known volume of liquid
- ☐ dissolving a known volume of solid into a known mass of liquid
- ☐ dissolving a weighed amount (known mass) of solid into a known volume of liquid
- ☐ dissolving a weighed amount (known mass) of stock solution into a known volume of liquid

(b) Volumetric flasks are built _____ a known volume of liquid to an accuracy of about _____% of the flask's capacity.

(c) Most pipettes are built _____ a known volume of liquid.

(d) Volumes obtained with volumetric flasks, pipettes, and burets are recorded to the nearest _____ mL.

The following questions deal with copper(II) sulfate.

(a) In part B of this experiment, you will use copper(II) sulfate pentahydrate. What is the molar mass of this compound?

(b) How much of this compound must be weighed to make 300.0 mL of a 0.15 M solution?

(c) How many mL of the 0.15 M solution should be diluted to prepare 300.0 mL of a 0.05 M solution?

The following items deal with spectroscopy and Beer's Law
$A = \varepsilon\ l\ c$.

(a) Define the terms in the formula:$A = \varepsilon\ l\ c$. (Enter your answers using the letter of the correct definition.)

A. pathlength of light through the cell
B. concentration, in mol/L, of the stock solution from which the sample was made
C. absorbance measured by the spectrometer
D. molar absorptivity, a constant unique to that substance at that wavelength
E. the wavelength of the light being used for the measurement
F. concentration, in mol/L, of the sample solution being measured

a) definition of l

b) definition of c

c) definition of ε

d) definition of A

(b) Data has been collected to show that at a given wavelength in a 1 cm pathlength cell, Beer's Law for the absorbance of Co^{2+} is linear. If a 0.135 M solution of Co^{2+} has an absorbance of 0.350, what is the concentration of a solution with an absorbance of 0.470?

(c) In this experiment, a calibration curve, often called a Beer's Law plot, will be made. (Please read "Plotting a Calibration Curve" in the Good Laboratory Practices section of your lab manual and review the following link on graphing in Excel (http://www.ncsu.edu/chemistry/resource/excel/excel.html) to answer the question below.)

A calibration curve should have which of the following attributes?

- ☐ Absorbance is plotted on the x-axis.
- ☐ Concentration is plotted on the x-axis.
- ☐ Concentration is plotted on the y-axis.
- ☐ Absorbance is plotted on the y-axis.
- ☐ In a hand-plotted graph, individual lines should be drawn between adjacent points.
- ☐ The command for getting an equation is "Add Trendline" in Microsoft Excel.
- ☐ The x- and y-axes should be labeled with units as well as quantities.