Plant Science
Laboratory Techniques Study Guide
3/3/03

The lab techniques qualifying exam will cover the following:

1. General lab problems – See attached sheet.
2. Accuracy and precision – define and explain. Include formulas for determining accuracy and precision.
3. Resolution, detection limit, working range.
4. List and discuss the Basic Elements of a Lab Procedure. (Listed below)
5. Discuss the following lab methods using Basic Elements of a Lab Procedure listed below:
    a. Acid / base titration.
    b. Nitrate analysis by Ion selective electrode.
    c. Potassium or sodium analysis by atomic emission spectrophotometry.
    d. Calcium analysis by at atomic absorption spectrophotometry.
    e. Bioassay using 2,4 D on rye grass and tomatoes.
    f. Phosphate or iron analysis using UV/Vis spectrophotometry .
    g. Chromatography – discuss one type of chromatography i.e. paper, HPLC, GC etc.
    h. Kjeldahl – digestion and distillation.

Basic Elements of a Lab procedure

When discussing a Lab procedure the following areas should be covered:

1. What is the analyte and the matrix?

2. What is the principle of the analysis?

3. What instrumentation is used? Diagram and principle of instrument.

4. What are the general types of interference for this procedure? Give specific examples.

5. What chemical equations explain the principle of the analysis?

6. What math calculations and graphs are used in the procedure?

7. *What is the resolution, accuracy, working range, and detection limit of the procedure?

8. *How does this method compare with other methods in terms of what is listed above.

9. What are the safety concerns for this procedure. Chemical hazards etc.

10. *Is this an approved procedure? by whom

11. How are samples prepared?

12.* What is the cost and time involved in this procedure?

*You won't have to discuss these elements on the Qualifying Exam for specific methods e.g. nitrate analysis by ion selective electrode.

Sample Lab Tech Problems for Qualifying Exam

1. How much $CaCl_2$ would you weigh out to make 4 liter of a 2.5 molar solution?

2. How many moles of $CdCO_3$ are in 300 ml of a 7.5 molar solution?

4. How many moles of sodium are present in a 3 liters of a 1.5 molar sodium sulfate solution. (Na_2SO_4)

5. Explain how to make a .25 Molar $BaCl_2$ solution.

6. If you have 2 moles of NaCl, how many grams do you have?

7. If you have 50 grams of $CuCl_2$, how many moles do you have?

8. What is the molecular wt of $FeCl_2$.

9. How many liters of a .6 molar KCl solution would you need so that you had 7 moles of KCl?

10. What is the molecular Wt of $ZnCl_2$?

11. Convert 400 ppm Na_2CO_3 to Molarity.

12. How many moles of Calcium are present in 2000ml of a 400 ppm $CaCl_2$ solution?

13. A 2.5% NaCl solution is how many ppm NaCl?

Data
41,42,39,43,37

14. What is the standard deviation of the above data?

15. What is the standard deviation of the mean of the above data?

16. What is the coefficient of variation of the above data?

17. What is the accuracy of the above data if the true value is 40.

18. What is the Normality of a 200 ppm $MgCl_2$ solution?

19. What is the dilution factor of a .75 gram sample that was extracted with 225 ml of water?

20. What is the pH of a .00001 Normal HCl solution?

21. How much of a 2000 ppm solution would you pipette to make 100 ml of a 250 ppm solution?

22. Convert .365 ppm HF to Normality.

23. If the absorbance for 15 ppm PO_4-P is .200, what would you expect the absorbance for 3 ppm PO_4-P? (This was done on a Spectrophotometer.)

24. What is the dilution factor of a 1.5 gram alfalfa sample that was extracted with 150 ml of water?

25. If the solution in question 24 has a concentration of 15 ppm Na, what is the concentration of Na in the alfalfa?

26. What dilution factor would you use to determine the Na content of brine? Brine has a Na content between 10 - 25%. The working range of the Atomic absorption spectrophotometer for sodium is 1-20 ppm.

27. What is the resolution in ppm PO4-p of a spectrophotometer that gives a reading of .200 absorbance units for 20 ppm PO4-P? The resolution of the instrument is .001 absorbance units.

28. What would be the detection limit for PO_4-P in question 27?

29. How much K_3PO_4 would you weigh out to obtain 2 liter of a 2000 ppm K solution?