

**Chemistry 215**  
**Spring 1999**  
**The Final**

Name .....

**TABLE 4-2** Values of  $t$  for Various Levels of Probability

Degrees of Freedom	Factor for Confidence Interval			
	80%	90%	95%	99%
1	3.08	6.31	12.7	63.7
2	2.89	2.92	4.30	9.92
3	2.64	2.35	3.18	5.84
4	2.53	2.13	2.78	4.60
5	2.48	2.02	2.57	4.03
6	2.44	1.94	2.45	3.71
7	2.42	1.90	2.36	3.50
8	2.40	1.86	2.31	3.36
9	2.38	1.83	2.26	3.25
10	2.37	1.81	2.23	3.17
11	2.36	1.80	2.20	3.11
12	2.36	1.78	2.18	3.06
13	2.35	1.77	2.16	3.01
14	2.34	1.76	2.14	2.98
$\infty$	1.29	1.64	1.96	2.58

[1] Joe Critic wants to compare two kinds of light bulbs, one made in Lebanon and the other in Germany. The local variety is much cheaper but Joe's Uncle assured him they don't last as long as the German ones. Joe tests a set of each and finds the following:

German bulbs (4 tested):  
 lasted for 860, 790, 841, 810h  
 before burning out.

Lebanese bulbs (5 tested):  
 900, 880, 750, 795, 830 h

Determine, at the 95% confidence level, whether Joe's Uncle was right.  
 Are there any other observations you can make comparing the German to the Lebanese bulbs?

20 pts

*Joe's Uncle*

*Joe's Uncle*

[2] Suppose I have a solution of copper nitrate that is approximately 0.01M in copper. Describe in detail **THREE** ways I could determine the copper concentration accurately. Include a description of the apparatus, any equations and a description of the method.

45 pts

[3] Consider 50 mL weak diprotic acid,  $H_2A$ .  $pK_{a1}=5$  and  $pK_{a2}=8$ , concentration 0.1M. Calculate the pH after the addition of the following quantities of 0.05M NaOH  
0 mL, 5 mL, 100 mL, 150 mL, 250 mL.

20 pts

[4] Sketch voltage vs. time and current vs. time curves for controlled-potential and controlled-current reduction of ox in aqueous solution. Label all axes.

20 pts

[5] A 2.0 mL aliquot of a solution that contains 3.8 ppm iron III is treated with an excess of KSCN and diluted to 50 mL. What is the absorbance of the resulting solution at 580 nm in a 2.5 cm cell? Molar absorptivity of the Fe/SCN complex at 580 nm is  $7 \times 10^3$

20 pts

[6] Sketch a photomultiplier tube (PMT). Describe how it works. To what region of the spectrum is it most sensitive?

20 pts

[7] Sketch a hollow cathode lamp. Why is it a good source of light for atomic absorption spectroscopy? What source would you use for visible and what for UV molecular absorption spectroscopy.

20 pts

[8] Using a sketch of a chromatogram with two retained species, A and B, show how you would determine the following parameters:

- capacity factors for A and B
- plate height,  $H$ , for A and B
- selectivity factor for A and B
- resolution for A and B

20 pts