

## EXAM I – September 23, 2004

Name \_\_\_\_\_

WRITE YOUR NAME ON EACH EXAM PAGE NOW. THERE ARE 8 QUESTIONS AND 106 PERCENT TOTAL IN THIS EXAM.

Show clearly all work on these pages. *Use the proper number of significant figures and the correct units in all final answers.* You must show your calculations and/or reasoning, *including equations*, on a question to obtain any credit; no credit for answers appearing out of the blue. *Your work must be understandable at the time it is being graded to obtain any partial credit.*

You do not have to do the *final* arithmetic on a question unless you need to have a numerical value for the next part of a question, *as long as the answer is expressed in its final form and all algebraic manipulations have been made.* Very little will be subtracted for routine *arithmetic* errors, but all numerical answers must be shown to the proper number of significant figures. Programmable calculators must have all memory erased. A calculator may be used, but not shared with anyone else. Tables of data and other information that may be useful are appended to the back of the exam. Use the backs of the pages as scrap paper. Anything written on the *backs* of pages is totally irrelevant to the grading process.

Unless otherwise stated, assume all solutions are aqueous, density = 1.0000 g/mL; activity coefficients are unity (*i.e.*, activity = concentration); temperature,  $T = 298 \text{ K}$ ;  $K_w = 1.008 \times 10^{-14}$ .

QUESTION 1 \_\_\_\_\_ / 9

Question 7 \_\_\_\_\_ / 9

QUESTION 2 \_\_\_\_\_ / 12

Question 8 \_\_\_\_\_ / 8

QUESTION 3 \_\_\_\_\_ / 8

Question 9 \_\_\_\_\_ /

QUESTION 4 \_\_\_\_\_ / 19

Question 10 \_\_\_\_\_ /

QUESTION 5 \_\_\_\_\_ / 35

Question 11 \_\_\_\_\_ /

QUESTION 6 \_\_\_\_\_ / 6

TOTAL \_\_\_\_\_ / 106



3. (8 points) List two of the important characteristics of determinate or systematic error.
4. (19 Points) Currently, the element whose atomic mass is *least* well known is palladium, which is reported as 106.4 g/mol. This is because the relative abundances of the six stable, naturally occurring isotopes of Pd vary substantially from one source of Pd to another. The *most* well known atomic mass is that of fluorine, at 18.998403 g/mol, because F has only one stable isotope. Assuming that the values stated in this manner imply the conventional uncertainty or “error” of  $\pm 1$  in the least significant digit (and corresponds to a standard deviation), calculate:
- (a) (4 Points) The *absolute* uncertainty in the atomic mass for Pd.
- (b) (6 Points) The *relative* uncertainty in the atomic mass for F.
- (c) (9 Points) The *relative* uncertainty of the molar mass for PdF<sub>3</sub>.