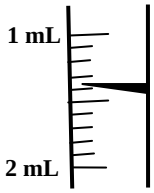
Chem 151 Drilling Question Set #7
Significant Figures
(Answer Key)

1. All values obtained in lab must be reported in correct number of significant figures, which is the number of digits known exactly plus one guessing digit at the end. Results of computations also should be rounded to correct number of significant figures.

Examples:

- The analytical balances in our lab weigh to ±0.0001 g. The mass of all objects weighed on these balances should be recorded in 4 decimal places.
- The volume of solution delivered by a Brinkman dispenser set in the figure below should be recorded as 1.36 mL, where the last digit is a guessing digit.
- The uncertainty of a 10-mL volumetric flask is ±0.02 mL. The volume of solution held in the flask should be recorded as 10.00 mL.



2. Counting Number of Significant Figures

a. 0.012003 ***(5 SF)***

b. 123.0 ***(4 SF)***

c. 12300 ***(3 SF)***

d. 12300. grams ***(5 SF)***

e. 123 atoms ***(infinite number of SF)***

> ***1. Start counting with the first non-zero digit.***
> ***2. Zeros between numbers are significant.***
> ***3. Zeros to the right of a number with a decimal are significant.***
> ***4. Zeros to the right of a number that has no decimal are not significant.***
> ***5. An integer has infinite number of significant figures.***

3. Rounding

Round the following to 3 significant figures:

f. 1.23499 ***(1.23)***

g. 1.2350 ***(1.24)***

h. 1.205 ***(1.20)***

i. 1.24501 ***(1.25)***

j. 0.20661 ***(0.207)***

k. 0.09504 ***(0.0950)***

> **Box 2**
> ***1. If the first discarded digit is < 5, the remaining digits are left as it is.***
> ***2. If the first discarded digit is > 5, the remaining digits are rounded up.***
> ***3. If the first discarded digit is = 5 followed by nonzero digits, the remaining digits are rounded up.***
> ***4. If the first discarded digit is = 5 followed by zeros, round it up if the number before the 5 is an odd number; round it down if the number before is an even number or a zero.***

4. Addition and Subtraction

l. 1.2345 + 123.45 ***= 124.68***

m. 1.2345 + 0.0045 ***= 1.2390***

> ***Box 3***
> ***In addition/subtract, the number of decimal places (NOT number of significant figures) in the answer should be same as the one with the fewest number of decimal places.***

5. Multiplication and Division

n. 1.2345 x 1.23 ***= 1.52***

o. 1.2345 x 0.0012 ***= 0.0015***

> ***Box 4***
> ***In multiplication/division, the answer should have the same number of significant figures as the one that has the fewest number of SF.***

p. The mass of one electron is 0.0005486 amu. What is the mass of 5 electrons?

0.005486 amu/electron x 5 electrons = 0.002743 amu (4 SF in the answer because 5 electrons is an integer.)

q. How many moles of potassium iodide in 5 mL of 0.222 M KI solution?

0.222 mol/L x 0.005 L = 0.001 mol (1 SF in the answer because 5 mL has 1 SF)

6. In multi-step computations, you should keep track of the number of SF (and number of decimal places) in every step. You should keep at least one extra SF in the calculation process and round the answer to the correct number of SF. ***(Note that the uncertain digit is in purple font color. An extra SF is kept in the calculation process and the answer is rounded to the correct number of SF.)***

r. (21.4 – 20.634 + 11.22) x 8.375 = (0.77 + 11.22) x 8.375 ***(Keep an extra SF in process)***
= 11.99 x 8.375 = 100. ***(Round to 3 SF in answer)***

s. (21.4 – 20.634) x 8.375 = 6.415 rounded to 1 SF to become 6
(the answer is rounded to 1 SF because 21.4 – 20.634 = 0.8)

t. $\frac{0.123\times11.27}{2.0-1.4}+3.024=5$ ***(the answer is rounded to 1 SF because 2.0 – 1.4 = 0.6)***

u. $\frac{0.123\times11.27}{22.0-1.4}+3.024=$ 0.06729 + 3.024 = 3.091 ***(The number that has the fewest number of decimal places is 3.024. Thus, the answer is rounded to 3 decimal places.)***

7. Common Logarithm

a. log (1.63×10^3) = ***3.212***

b. log (1.63×10^4) = ***4.212***

c. log (1.63×10^{23}) = ***23.212***

d. Antilog(1.63) = ***4.3×10^1***

e. Antilog(4.63) = ***4.3×10^4***

f. Antilog(23.63) = ***4.3×10^{23}***

Box 5

1. ***The number of digits after the decimal in a common logarithm has the same number of SF as the original number.***
2. ***The number of SF in an antilogarithm number is same as the number of digits after the decimal in the original number.***

More Exercise

Calculate the following and report your answers in correct number of significant figures.

8. Jill weighs an empty weigh-boat and records its mass as 0.5422 g. She added some $AlCl_3$ crystals on the weigh-boat and record the combined mass is 0.5622 g. What is the mass of $AlCl_3$ in the weigh-boat?

Mass of $AlCl_3$ = 0.5622 g – 0.5422 g = 0.0200 g (Answer should be in 4 decimal places.)

9. If Jill dissolves the $AlCl_3$ in Question 1 in water in a 10-mL volumetric flask, what is the molarity of Al^{3+} ions in solution? What is the molarity of Cl^- ions in solution?

Moles of $AlCl_3$ = $\dfrac{0.0200\ g}{133.34\ g/mol} = 0.000150\ mol$

Moles of Al^{3+} = 0.000150 mol; Moles of Cl^- = 0.000450 mol

$[Al^{3+}]$ = $\dfrac{0.000150\ mol}{0.01000\ L} = 0.0150\ M$ ***$[Cl^-]$ =*** $\dfrac{0.000450\ mol}{0.01000\ L} = 0.0450\ M$

10. 10 mL of 0.2 M $AgNO_3$ solution is added to the solution in Question 2. How many grams of silver chloride precipitate can be obtained?

Moles of Ag^+ added = 0.2 mol/L x 0.010 L = 0.002 mol

Since there are only 0.000450 moles of Cl^- ions, 0.000450 moles of AgCl ppt. can be obtained. (In here, the mole of Cl^- is the limiting reagent; Ag^+ is the excess reagent. The number of SF of the product should go along with the number of SF of the limiting reagent, which is 3 SF in here.)

Grams of AgCl obtained = (0.000450 mol)(143.32 g/mol) = 0.0645 g