

CHEM 101-080 Fall 2004
Problem-Solving Session 1
September 13, 2004

1. Without doing the calculation, determine the precision (uncertainty) of each sum and the number of significant figures in each product. (Sec. 1-1)

A	B	C	Precision of A + B + C	Sig. Figs. in A x B x C
2.5	0.20	1.625	± 0.1	2
3500	12.5	24	± 100	2
153	0.24	32.667	± 1	2
24010	0.658	1.29	± 10	3
24001	6552	40	± 10	1
24001	6552	40.	± 1	2

2. Calculate the following sums $A + B + C$. Report each the value of each function before and after rounding to the proper number of significant figures. Report also the precision (uncertainty) of each result. (Sec. 1-2)

A	B	C	Function	Result		Precision
				(before rounding)	(after rounding)	
1.235	0.032	65.3278	A + B + C	66.5948	66.595	± 0.001
			A + B - C	-64.0608	-64.061	± 0.001
			(A x B) + C	0.040 + C	65.368	± 0.001
			A + (B x C)	A + 2.1	3.3	± 0.1
			(A / B) + C	39 + C	104	± 1
			A + (B / C)	A + 0.00049	1.235	± 0.001
			A x B x C	2.58175	2.6	± 0.1
			A / (B x C)	0.59077	0.59	± 0.01

3. Report the value of each function before and after rounding to the proper number of significant figures. (Sec. 1-3)

A	B	C	Function	Result	Precision
6.84×10^{-4}	1.286×10^{-6}	4.30×10^{10}	A + B + C	4.30×10^{10}	$\pm 10^8$
			A - B - C	-4.30×10^{10}	$\pm 10^8$
			A x B x C	3.78×10^1	± 0.1
			A / (B x C)	1.24×10^{-8}	$\pm 10^{-10}$

4. Convert each of the numbers to the specified units. Write each solution on the board. (Sec. 1-5)

Group	Convert	From	To	Result
1	1.25×10^{-4}	feet	mm	0.0381
2	2.24	km	mi	2.11
3	4500	ml	l	4.5
4	4500	l	ml	4500000
5	5.25	lb	kg	2.38
6	8	oz	g	227
7	180000	sec	days	2.08
8	180000	nsec	msec	0.18

Solutions:

$$1.25 \times 10^{-4} \text{ ft} \times \frac{12 \text{ in}}{\text{ft}} \times \frac{2.54 \text{ cm}}{\text{in}} \times \frac{10 \text{ mm}}{\text{cm}} = 381 \times 10^{-4} \rightarrow 0.0381 \text{ mm}$$

$$2.24 \text{ km} \times \frac{\text{mi}}{1.609 \text{ km}} = 2.1114 \rightarrow 2.11 \text{ mi}$$

$$4500 \text{ ml} \times \frac{\text{l}}{1000 \text{ ml}} = 4.5 \text{ l}$$

$$4500 \text{ l} \times \frac{1000 \text{ ml}}{\text{l}} = 4.5 \times 10^6 \text{ ml}$$

$$5.25 \text{ lb} \times \frac{\text{kg}}{2.205 \text{ lb}} = 2.38 \text{ kg}$$

$$8 \text{ oz} \times \frac{\text{lb}}{16 \text{ oz}} \times \frac{\text{kg}}{2.205 \text{ lb}} \times \frac{1000 \text{ g}}{\text{kg}} = 227 \text{ g}$$

$$180000 \text{ sec} \times \frac{\text{min}}{60 \text{ sec}} \times \frac{\text{hr}}{60 \text{ min}} \times \frac{\text{day}}{24 \text{ hr}} = 2.08 \text{ days}$$

$$180000 \text{ nsec} \times \frac{\text{msec}}{1000 \text{ nsec}} \times \frac{\text{msec}}{1000 \text{ msec}} = 0.18 \text{ msec}$$

5. Solve each of the following problems. Write the solution on the board. (Chapter 2)

Group	Problem #	Result
1	2-27	28.9 kg
2	2-33	2.51 ml
3	2-40	13.35 lbs
4	2-53	Lead floats & Gold sinks
5	2-58	35.1%
6	2-67	(a) P, (b) P & K, (c) P, (d) P
7	2-78	1.40 °C
8	2-99	0.242 cal/g°C

6. How many protons, neutrons, and electrons are in each of these isotopes? (Sec. 3-6)

Isotope	Protons	Neutrons	Electrons	Isotope	Protons	Neutrons	Electrons
Group 1				Group 5			
¹³ O	8	5	8	⁸² Y	39	43	39
¹⁴ O	8	6	8	⁸⁷ Y	39	48	39
²⁰ O	8	12	8	⁹⁶ Y	39	57	39
Group 2				Group 6			
²⁸ P	15	13	15	¹⁰² Ag	47	55	47
³² P	15	17	15	¹⁰⁷ Ag	47	60	47
³⁴ P	15	19	15	¹⁰⁹ Ag	47	62	47
Group 3				Group 7			
³⁵ Ar	18	17	18	¹⁰⁶ In	49	57	49
³⁸ Ar	18	20	18	¹⁰⁸ In	49	59	49
⁴² Ar	18	24	18	¹¹³ In	49	64	49
Group 4				Group 8			
⁶⁴ Zn	30	34	30	¹¹⁴ Sn	50	64	50
⁶⁹ Zn	30	39	30	¹¹⁸ Sn	50	68	50
⁷² Zn	30	42	30	¹²⁴ Sn	50	74	50

7. How many protons and electrons are in each of these ions? (Sec. 3-6)

Ion	Protons	Electrons	Ion	Protons	Electrons
Group 1			Group 5		
Zn ²⁺	30	28	Cr ⁶⁺	24	18
S ²⁻	16	18	Te ²⁻	52	54
NO ₃ ⁻	31	32	CO ₃ ²⁻	30	32
Group 2			Group 6		
Cs ⁺	55	54	Fe ²⁺	26	24
Se ²⁻	34	36	F ⁻	9	10
SO ₄ ²⁻	48	50	SO ₃ ²⁻	40	42
Group 3			Group 7		
V ⁵⁺	23	18	Ru ⁴⁺	44	40
Cl ⁻	17	18	Sc ³⁺	21	18
SO ₃ ²⁻	40	42	ClO ₄ ⁻	49	50
Group 4			Group 8		
Mn ²⁺	25	23	Rb ⁺	37	36
I ⁻	53	54	O ²⁻	8	10
NH ₄ ⁺	11	10	PH ₄ ⁺	19	18

8. Calculate the average atomic mass of the following elements from their isotopic mass and natural abundance. Your answer should be close to the corresponding value in the periodic table. (Sec. 3-6)

Element	Atomic No.	Isotope	Atomic mass of isotope*	% Abundance	Avg. atomic mass of element
Group 1					
Ga	31	⁶⁹ Ga	68.9257	60	69.7254
		⁷¹ Ga	70.9249	40	
Group 2					
Rb	37	⁸⁵ Rb	84.9117	72.17	85.4700
		⁸⁷ Rb	86.9178	27.83	
Group 3					
Ag	47	¹⁰⁷ Ag	106.90509	51.83	107.8683
		¹⁰⁹ Ag	108.9047	48.17	
Group 4					
In	49	¹¹³ In	112.9043	4.3	114.8181
		¹¹⁵ In	114.9041	95.7	
Group 5					
Sb	50	¹²¹ Sb	120.9038	57.3	121.7579
		¹²³ Sb	122.9041	42.7	

9. Solve each of the following problems. Write the solution on the board. (Chapter 3)

Group	Problem #	Result
1	3-76	Sulfur => CS ₂
2	3-28	(a) Ca(ClO) ₂ (b) Mg ₃ (PO ₄) ₂ (c) Cr ₂ (C ₂ O ₄) ₃
3	3-33	S ²⁻
4	3-41	p = e = 92; n = 142, 143, 146
5	3-55	Palladium
6	3-62	63.578 amu
7	3-74	Lead