Significant Figures & Scientific Notation

1. How many significant figures are there in the following numbers:
   a. 75.1         b. 7.510 \times 10^1        c. 0.03400      d. 125,000

2. Carry out the following calculations and express the answer using the correct number of significant figures. Use scientific notation as appropriate.
   a. 186.25 + 3.2
   b. 661/0.0021
   c. (44)(0.034) + (5.226)(2.2511)

3. What’s the point of significant figures anyway. Consider the following example from the world of finance. Let’s say you took $5,000 (or $5.000 \times 10^3$ to be precise) and invested it in the stock market instead of using it on tuition (this would not have been a bad idea for some students in this class, statistically speaking of course). If you bought Hitachi stock, which is very volatile right now, at its rolling year long low ($40.95) and sold at its 52 week high ($81.35), how much money would you have made? Now, if your broker lied to you and said that stocks prices were only recorded to two significant figures, you would have lost how much of that amount?

4. We often feel like the magnitudes of numbers we use in chemistry are beyond our comprehension (like $6.02 \times 10^{23}$). The money spent by the federal government is likewise often unfathomable, but we use words not scientific notation or prefixes to denote these values. What word does your congressman use in his budget request to indicate
   a. 10^6 or mega (M) dollars
   b. 10^9 or giga (G) dollars?

5. What are the values of the following federal government numbers in scientific notation?
   From the OMB (Office of Management and Budget):
   a. Federal Budget for 2004: $2,272 billion
   b. 2004 Federal Deficit: $475 billion
   c. Total, gross federal debt: $7,586 billion
   d. Debt held by the public: $4,473 billion
Dimensional Analysis

6. In the movie Raiders of the Lost Ark, Indiana Jones replaces a golden statue with a bag of sand of approximately the same size to compensate for its removal. Because the mass of the sand is very different from the mass of the statue it springs a trap and a big stone sphere rolls out to crush him. Let’s say that the statue had a volume of 1 Liter and it was made of pure gold (density = 19.3 g/mL). How many bags of sand should he have put on the pedestal to compensate for the statue? Assume the sand bags are also 1 Liter in volume and the density of sand is 2.3 g/mL.

Atomic Structure

7. Complete the following table.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Protons</th>
<th>Neutrons</th>
<th>Electrons</th>
<th>Net charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr^{2+}</td>
<td>30</td>
<td>34</td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>

8. If you look at the periodic table in your book you will find that sodium (Na) has an atomic mass of 22.98770 amu, whereas lead (Pb) has an atomic mass of 207.2 amu. Why does the atomic mass of sodium have so many more significant figures?

9. You are given a box containing exactly 100 atoms of a single isotope. First you weigh the atoms and find they have a total mass of $1.4 \times 10^{-20}$ g. Next you react them with a box of fluorine atoms and find that 200 atoms of fluorine are consumed in the reaction (and the product is a tiny white crystal). What is the chemical symbol for the isotope in question?

Naming Compounds

10. There are two binary compounds that can form when the elements gold and iodine are reacted: gold (I) iodide and gold (III) iodide.
   a. What is the empirical formula for gold (I) iodide?
   b. What is the empirical formula for gold (III) iodide?
   c. Are these compounds metallic, ionic or molecular?
   d. If you heat either of the above compounds they will decompose back to form iodine and gold. The iodine can then be washed away and you’re left with solid gold. If you were given a choice of taking 1.0 kg of gold (I) iodide or 2.0 kg of gold (III) iodide (and your plan was to decompose the compound and sell the gold for spending money), which would you take? If gold is worth $13 per gram how much money could you get by selling the gold?