

AP Chemistry Unit 1: Introduction & Stoichiometry Test Review

- I. Review all material in your summer assignment packet.
- II. Know the scientists and their contributions to chemistry from the scientists assignment. You will have to write about them--not all of them but several. You do NOT need to know dates.
- III. Solve Problems like the following

1) Aspirin ($C_9H_8O_4$) is produced by the reaction of salicylic acid ($C_7H_6O_3$) and acetic anhydride ($C_4H_6O_3$).

$$C_7H_6O_3(s) + C_4H_6O_3(l) \rightarrow C_9H_8O_4(s) + CH_3CO_2H(aq)$$

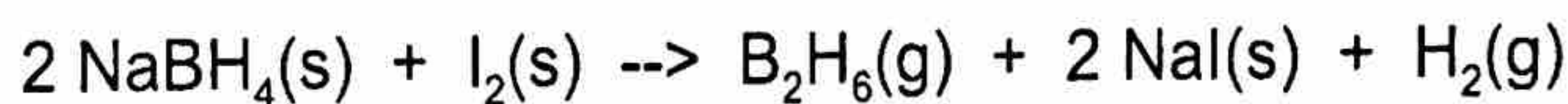
aspirin

If you mix 100. g of each of the reactants, what is the maximum mass of aspirin that can be obtained?

100. g $C_7H_6O_3$		1 mol		1 mol aspirin		180.154 g	= 130. g aspirin
		138.118 g		1 mol		1 mol	

100. g $C_4H_6O_3$		1 mol		1 mol aspirin		180.154 g	= 176 g aspirin
		102.088 g		1 mol		1 mol	

2) Diborane, B_2H_6 , is a valuable compound in the synthesis of new organic compounds. One of several ways this boron compound can be made is by the reaction



Suppose you use 1.203 g of $NaBH_4$ with an excess of iodine and obtain 0.295 g of B_2H_6 . What is the percent yield of B_2H_6 ?

1.203 g $NaBH_4$		1 mol		1 mol B_2H_6		27.668 g	= .4402 g B_2H_6
		37.8032 g $NaBH_4$		2 mol		1 mol	

$\frac{.295 g}{.4402 g} \times 100 = 67.0\%$

3) ~~2b~~ If copper metal is a mixture two isotopes, Cu-63, mass = 62.9298 u and Cu-65, mass = 64.9278 u. The molar mass of copper is 64.546 g/mole. Calculate the % abundances of the two isotopes of copper. Show your work.

$$62.9298(x) + 64.9278(1-x) = 64.546$$

$$62.9298x + 64.9278 - 64.9278x = 64.546$$

$$-1.998x = -0.3818$$

$$x = 0.1912$$

$$x = 19.12\%$$

Cu-63 = 19.12%
Cu-65 = 80.88%

4) Menthol, from the *oil of mint*, has a characteristic cool taste. The compound contains only C, H, and O. If 95.6 mg of menthol burns completely in O_2 , and gives 269 mg of CO_2 and 110 mg of H_2O , what is the empirical formula of menthol?

269 mg CO_2		1 mol CO_2		1 mol C		12.01 g C	= .0734 g C
		44.01 g CO_2		1 mol CO_2		1 mol C	
110 mg H_2O		1 mol H_2O		2 mol H		1.008 g H	= .0123 g H
		18.016 g H_2O		1 mol H_2O		1 mol H	

$\frac{.0734 g C}{12.01 g C} = .00611 = 9.87 = 10$
 $\frac{.0123 g H}{1.008 g H} = 0.0122 = 19.7 = 20$

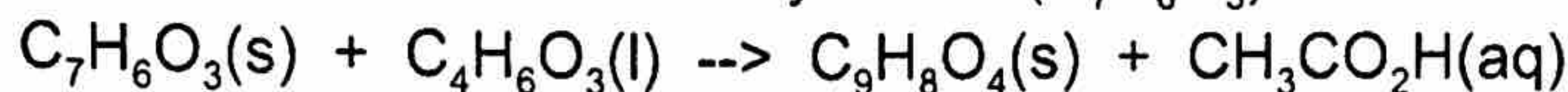
$\frac{.0099 g O}{16.00 g O} = .000619 = 1$

C₁₀H₂₀O

Key
P Chemistry Unit 1: Introduction & Stoichiometry Test Review

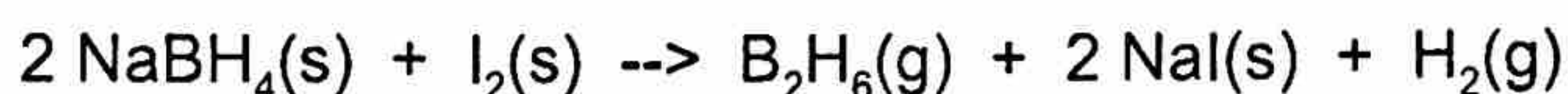
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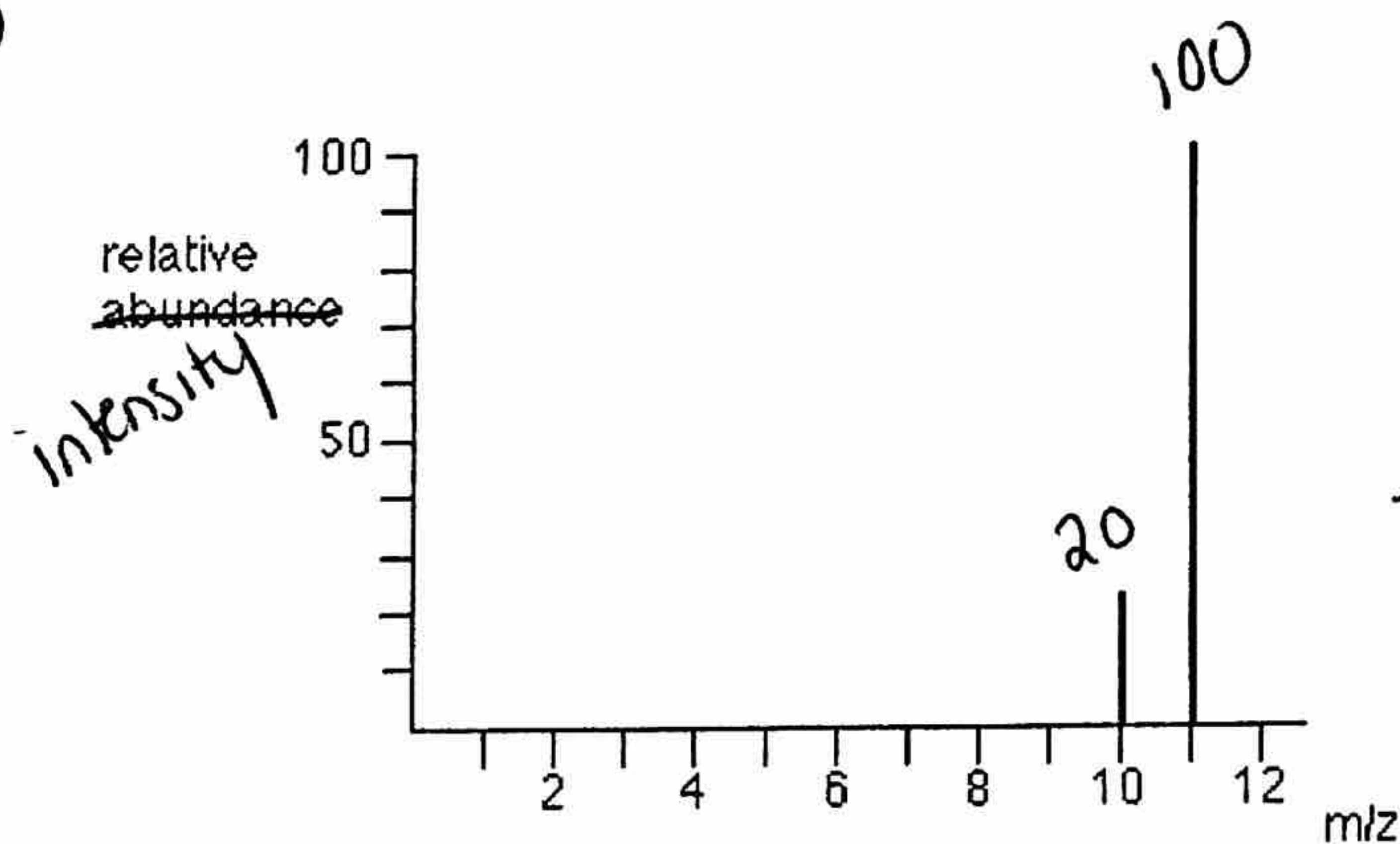
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5) Calculate the atomic mass & identify the element for each graph below:

a)



$$\frac{20}{120} \times 100 = 16.7\%$$

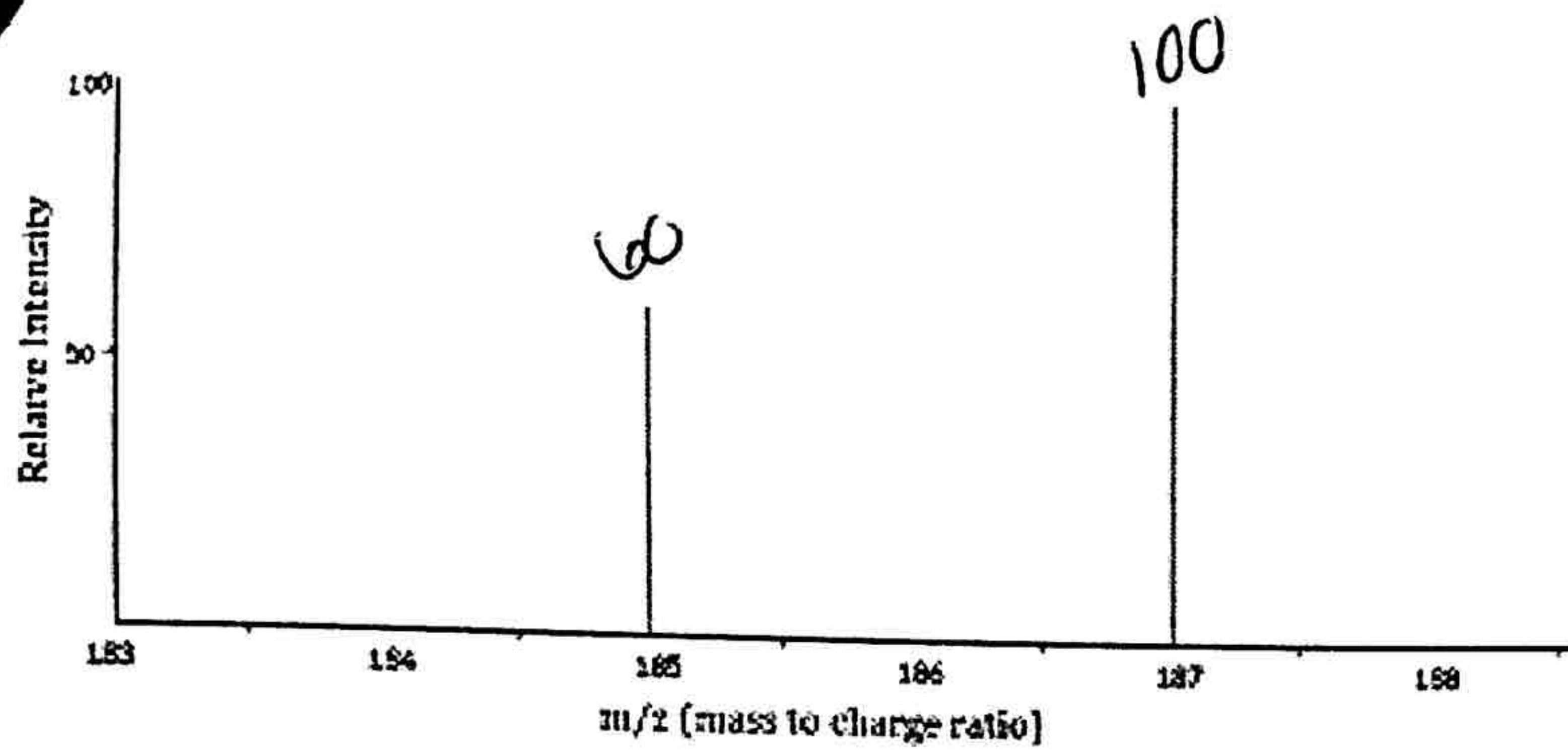
$$\frac{100}{120} \times 100 = 83.3\%$$

$$10 \times (.167) + (11 \times .833)$$

$$= 10.833 \text{ amu}$$

B

b)

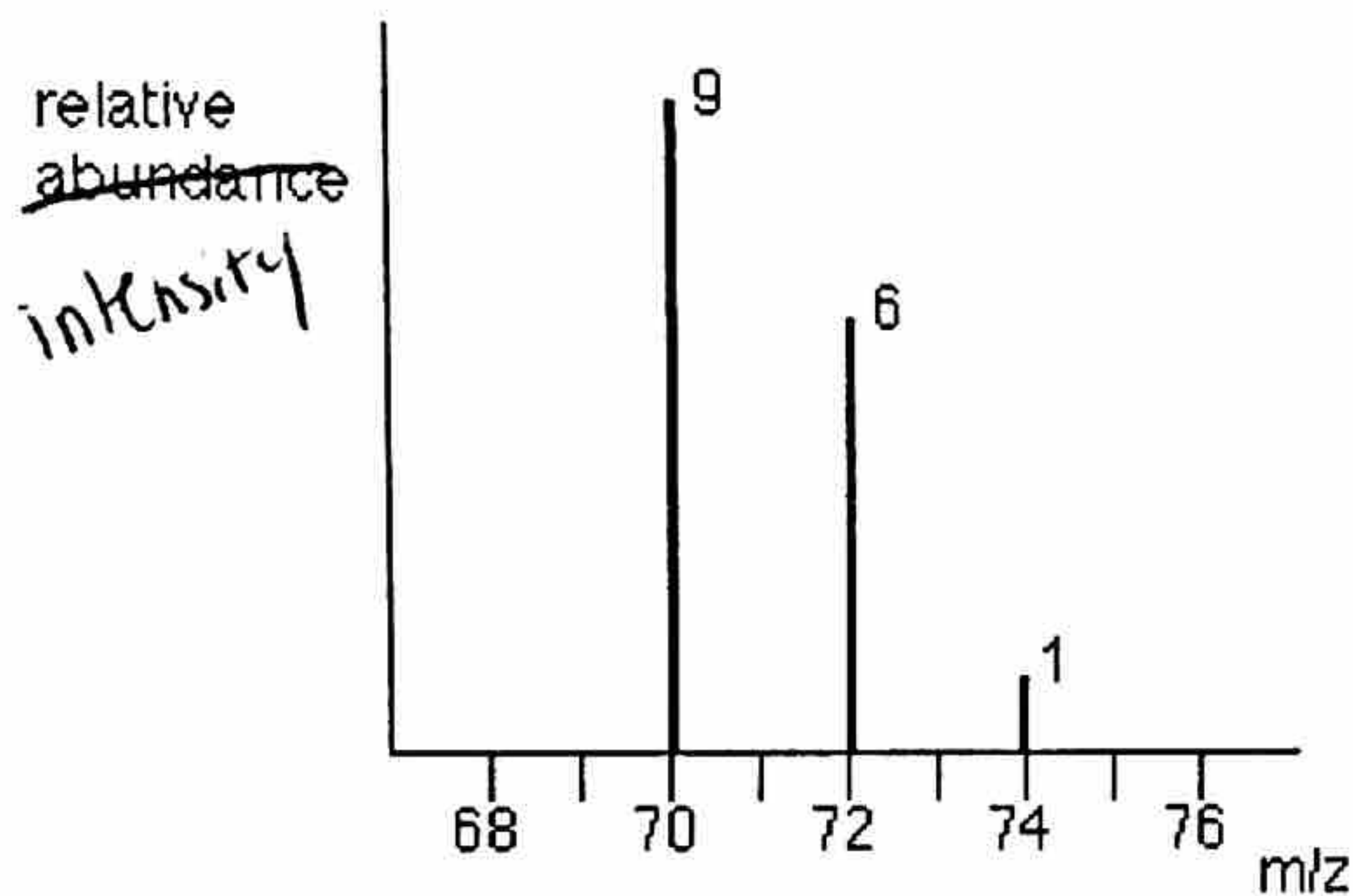


$$\frac{60}{160} \times 100 = 37.5$$

$$\frac{100}{160} \times 100 = 62.5\%$$

$$(185 \times 0.375) + (187 \times 0.625) = 186.25 \text{ amu Re}$$

c)



$$\frac{9}{16} \times 100 = 56.25$$

$$\frac{6}{16} \times 100 = 37.5$$

$$\frac{1}{16} \times 100 = 6.25$$

$$(70 \times 0.5625) + (72 \times 0.375) + (74 \times 0.0625) = 71 \text{ amu}$$

Ga

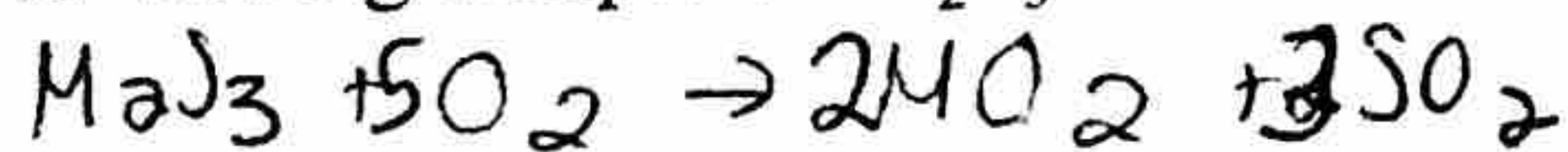
6) a) Draw a mass spectrometry graph for the following data:

Mass	50	52	53	54
% Abundance	4.3	83.8	9.5	2.4

b) Calculate the atomic mass & identify the element.

$$(50 \times 0.043) + (52 \times 0.838) + (53 \times 0.095) + (54 \times 0.024) = 52.057 \text{ amu Cr}$$

7) A 4.000 g sample of M_2S_3 is converted to MO_2 and loses 0.277 g. What is the atomic weight of M?



8) For the reaction below, when 0.5000 g of XI_3 reacts completely, 0.2360 g of XCl_3 is obtained. Calculate the atomic weight of element X and identify it.



$$7) \frac{4.000g \text{ } M_2S_3}{2x + 96.18g \text{ } M_2S_3} = \frac{2 \text{ mol } MO_2}{1 \text{ mol } M_2S_3} = \frac{x + 32 \text{ } MO_2}{1 \text{ mol } MO_2} = 3.723g \text{ } MO_2$$

$$\frac{8(x+32)}{2x+96.18} = 3.723$$

$$8x + 256 = 7.446x + 358.08$$

$$0.554x = 102.08$$

$$x = \frac{102.08}{0.554}$$

$$x = 184.3 \text{ g/mol}$$

$$8) \frac{5000 \text{ g XI}_3}{x + 380.73 \text{ g}} \cdot \frac{1 \text{ mol XI}_3}{2 \text{ mol XCl}_3} = \frac{x + 106.35}{1 \text{ mol XCl}_3} = 0.2360 \text{ g}$$

$$\frac{5000(x + 106.35)}{(x + 380.73)} = 0.2360$$

$$5000x + 531.75 = 0.2360x + 89.8523$$

$$0.264x = 36.6773$$

$$x = 138.9 \text{ g/mol La}$$