Chemistry 145
Exam 1A, October 1, 1996
Dr. Van Bramer NAME_____

Bone Pile:

1 metric ton = 1000 kg	? °C = (5 °C/9 °F)(°F - 32 °F)
1 troy oz = 31.1035 g	0 K = -273.15 °C
1 mile = 5280 ft	e = $1.6021773 \times 10^{-19}$ C

1. Carbon has two common isotopes ^{12}C and ^{13}C. ^{12}C has a relative abundance 98.892% and one atom has an exact mass of 12.0000 u. ^{13}C has a relative abundance of 1.108% and one atom has an exact mass of 13.0034 u.
   a. (3 pts) How many protons, neutrons and electrons in an atom of ^{12}C?

   b. (3 pts) How many protons, neutrons and electrons in an atom of ^{13}C?

   c. (4 pts) What is the average atomic mass of carbon in gram $mole^{-1}$?

2. (5 pts) Sketch a diagram of the experiment that JJ Thomson used to determine the mass to charge ratio of an electron. Briefly describe how the experiment worked.

3. I was recently in New York City where a street vendor offered to sell me a "genuine" platinum coin. After taking the coin back to the lab, I get out a graduated cylinder. The mass of the cylinder is 120.4367 g. I add water at 25 °C to the 25.0 mL mark. Then I weigh the cylinder on a balance and the mass is 145.3643 g. Then I add the coin. The volume now reads 27.3 mL and the mass of the cylinder is 169.5143 g.

Material	Density (g/cm^3)	Cost ($ per metric ton)
Aluminum	2.702	1381.50
Copper	8.96	1994.00
Gold	19.32	12,207,621
Platinum	21.45	12,365,160
Tin	7.30	6060.00
Nickel	8.90	7211.00
Lead	11.34	1002.00
Silver	10.5	157689
Water	0.99707	0

a. (5 pts) Based on the information in the table, is the coin platinum?

b. (2 pts) If it is not platinum, which of these metals could the coin be?

c. (5 pts) Calculate the cost of the coin if it was platinum?

d. (5 pts) If the coin is not platinum, how much did the street vendor make from the transaction?

4. (6 pts) Give the symbol, atomic mass, and charge for an atom using the notation $^{1}H^{1+}$ with the following:

   a. 108 protons, 156 neutrons, 106 electrons

   b. 35 protons, 46 neutrons, 36 electrons

5. 1 mole of an element with 23 protons combines with 5 moles of an element with 17 protons.

   a. (2 pts) Write the chemical formula for this compound.

   b. (2 pts) Write the name for this compound.

   c. (5 pts) Determine the percent atomic composition for each element in this compound.

6. (12 pts) Name the following compounds and determine the mass of 45.1 nmole of the compound

a. Li_2SO_4

b. $Mg(NO_2)_3$

c. Cr_2O_3

d. CF_4

7. (15 pts) Write the formula for the following compounds and determine the number of moles present in 92.36 mg of the compound.

a. Iron (III) Oxide

b. Sodium dihydrogen phosphate

c. Potassium carbonate

d. Acetic acid

e. Nitric acid

8. Give two examples for each of the following
   a. (2 pts) An alkali metal

   b. (2 pts) A halogen

   c. (4 pts) An ionic compound (name and formula)

   d. (4 pts) A covalent compound (name and formula)

9. (3 pts) Convert the following into seconds
   a. 4.417 Ms

   b. 51.8 μs

   c. 50.86 ps

10. (5 pts) Light travels a distance of 29.98 cm in 1 ns. What is the speed of light in miles per hour?

11. One of the compounds discussed in my seminar last night was pamoic acid. The empirical formula for pamoic acid is $C_{11}H_8O_2$. The molecular mass is 344.37 g $mole^{-1}$.

a. (2 pts) What is the molecular formula?

b. (2 pts) 20.4 mg of pamoic acid was used for the NMR spectra discussed in the seminar. I How many pamoic acid molecules is this?

c. (2 pts) How many hydrogen atoms were used for the NMR spectra?

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1. Carbon has two common isotopes ^{12}C and ^{13}C. ^{12}C has a relative abundance 98.892% and one atom has an exact mass of 12.0000 u. ^{13}C has a relative abundance of 1.108% and one atom has an exact mass of 13.0034 u.
   a. (3 pts) How many protons, neutrons and electrons in an atom of ^{12}C?

   b. (3 pts) How many protons, neutrons and electrons in an atom of ^{13}C?

   c. (4 pts) What is the average atomic mass of carbon in gram $mole^{-1}$?

2. (5 pts) Sketch a diagram of the experiment that JJ Thomson used to determine the mass to charge ratio of an electron. Briefly describe how the experiment worked.

3. I was recently in New York City where a street vendor offered to sell me a "genuine" platinum coin. After taking the coin back to the lab, I get out a graduated cylinder. The mass of the cylinder is 120.4367 g. I add water at 25 °C to the 35.0 mL mark. Then I weigh the cylinder on a balance and the mass is 155.3344 g. Then I add the coin. The volume now reads 36.3 mL and the mass of the cylinder is 166.9042 g.

Material	Density (g/cm^3)	Cost ($ per metric ton)
Aluminum	2.702	1381.50
Copper	8.96	1994.00
Gold	19.32	12,207,621
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Nickel	8.90	7211.00
Lead	11.34	1002.00
Silver	10.5	157689
Water	0.99707	0

a. (5 pts) Based on the information in the table, is the coin platinum?

b. (2 pts) If it is not platinum, which of these metals could the coin be?

c. (5 pts) Calculate the cost of the coin if it was platinum?

d. (5 pts) Based upon what metal the coin could be made of, if I paid $200 for the coin, how much did the street vendor make (or loose) from the transaction?

4. (6 pts) Give the symbol, atomic mass, and charge for an atom using the notation $^{1}H^{1+}$ with the following:

   a. 108 protons, 156 neutrons, 105 electrons

   b. 35 protons, 44 neutrons, 36 electrons

5. 1 mole of an element with 24 protons combines with 3 moles of an element with 9 protons.

   a. (2 pts) Write the chemical formula for this compound.

   b. (2 pts) Write the name for this compound.

   c. (5 pts) Determine the percent atomic composition for each element in this compound.

6. (12 pts) Name the following compounds and determine the mass of 55.1 nmole of the compound

a. Li_2SO_4

b. $Mg(NO_2)_3$

c. Cr_2O_3

d. CF_4

7. (15 pts) Write the formula for the following compounds and determine the number of moles present in 94.36 mg of the compound.

a. Iron (III) Oxide

b. Sodium dihydrogen phosphate

c. Potassium carbonate

d. Acetic acid

e. Nitric acid

8. Give two examples for each of the following
   a. (2 pts) An alkali metal

   b. (2 pts) A halogen

   c. (4 pts) An ionic compound (name and formula)

   d. (4 pts) A covalent compound (name and formula)

9. (3 pts) Convert the following into seconds
   a. 6.417 Ms

   b. 53.8 μs

   c. 30.86 ps

10. (5 pts) Light travels a distance of 29.98 cm in 1 ns. What is the speed of light in miles per hour?

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a. (2 pts) What is the molecular formula?

b. (2 pts) 21.4 mg of pamoic acid was used for the NMR spectra discussed in the seminar. I How many pamoic acid molecules is this?

c. (2 pts) How many hydrogen atoms were used for the NMR spectra?