Name_____ Class _____

Essay questions for final examination in chemistry. January, 2013.

I. (3 points) A gas is collected at a temperature of 290. K and a pressure of 150. kilopascals. The volume of the gas is found to be 24.0 mL. The gas is heated to a temperature of 580. K. What must the new pressure of the gas be, if its new volume is 192. mL ? (assume no gas leaks in or out of the container)

Write the equation that you will use to solve the problem. Solve the equation, and be sure to include correct units in your answer.

$$\frac{(150kPa)(24.0mL)}{290K} = \frac{(x)(192mL)}{580K} \qquad x = 37.5 \text{ kPa}$$

II. Draw dot structures for each of the following: (2 points each)

A. An aluminum atom.

B. nitrogen trichloride

C. BaO

D. CO_2

E. N_2

III. You are comparing the elements   Al, Cr,   Zn,   and Ga using information on table S and the Periodic table. (2 points each)

A. What **two** properties do these elements have in common, that distinguishes them from elements such as sulfur and phosphorous?

They are all metals, so they all have luster, are malleable, ductile, conduct electricity, react by losing electrons. Any two of those would be sufficient.

B. Which two of these elements would be the most similar to each other chemically? Explain your answer.

Al and Ga are in the same group, and have the same number of valence electrons, so they would be the most similar.

C. These elements are all solids at room temperature. The temperatures of the four metals are increased at the same rate until only one of them melts. Which metal would melt first?   Explain your answer.

Ga has the lowest melting point (listed on table S) so it would melt first, at the lowest temperature.

D. Which of these elements would combine with chlorine only in a ratio of 1 to 2 ? Explain your answer.

Zn has an oxidation number of 2+, so it would form $ZnCl_2$, a ratio of 1 to 2

E. If you had 10.0 gram samples of **each** of these metals, which sample would have the largest volume?   Explain your answer.

The metal with the smallest density would have the largest volume, because D=m/V. Aluminum has the smallest density of these metals.

IV. Mr. Cohen has a Handbook of Chemistry that was published in 1961. It has the following data about the isotopes of Zinc:

Isotope	^{64}Zn	^{66}Zn	^{68}Zn
Mass	63.95	65.95	67.95
%	48.87	29.72	21.41

Based on the data above, calculate the average atomic mass of zinc. (3 points)

You must show your equation as well as your answer.
*.4887(63.95) + .2972(65.95) + .2141(67.95) = 65.40*

Extra Credits

I. He developed the first modern atomic theory, and also has a gas law named after him. Who was this great scientist? *Dalton*

II. Compare the dot structure of SO_3 with the dot structure of NH_3. One of these molecules IS a dipole, while the other is not. On the basis of your dot structures, explain this observation.
The dot structure of SO_3 contains a double bond and two single bonds. No lone pairs. It is an equilateral triangle. NH_3 has three bonds plus a lone pair. It forms a pyramid. SO_3 is symmetrical and not a dipole, while NH_3 has two different sides and is a dipole.

III. Draw the dot structure of C_4H_8
There are several possible correct answers.
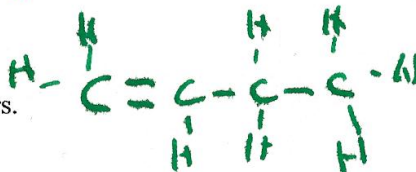
IV. Calculate the specific heat of the liquid state from the heating curve used in the first 8 questions. Include the correct unit.
From the 10 minute mark to the 18 minute mark the temp. goes from 0 to 40. 8 minutes at 10 J per minute is 80 joules. The change in temperature is 40° and the mass is 4.00 grams. The specific heat is 80 joules/(40° x 4.00 g) = 0.50 joule/g°

V. Super extra credit: A sample of ice initially at 0° C is heated. It melts, and then eventually reaches a temperature of 50° C. If the total amount of heat that was absorbed by the ice and water was 1250 joules, how many grams of ice were there in the original sample?

Let x = grams of ice. Then 334 x are the joules needed to melt the ice. To heat the melted ice from 0 to 50 degrees requires (4.18)(50)(x) joules. So 334 x + 209 x = 1250. x = 2.3 grams