

CHEM 1215  
Exam I  
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September 15, 1999

Name \_\_\_\_\_  
TA's Name \_\_\_\_\_  
Lab Section \_\_\_\_\_

Please sign your name below to give permission to post your course scores on homework, laboratories and exams. If you do not sign no scores will be posted. All scores will be posted by a random number assigned to you by Dr. Gelder.

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(signature)

### INSTRUCTIONS:

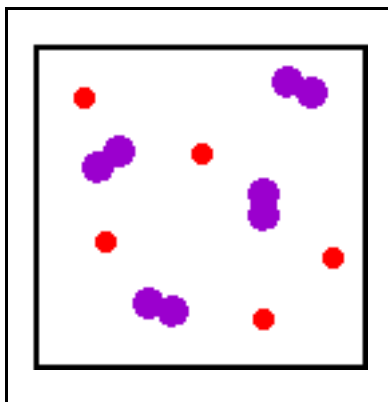
1. This examination consists of a total of 6 different pages. The last page includes a periodic table and some useful information. All work should be done in this booklet.
2. PRINT your name, TA's name and your lab section number now in the space at the top of this sheet. **DO NOT SEPARATE THESE PAGES.** You will receive 2 points for knowing your TA's name AND laboratory section number in which you are officially enrolled.
3. Answer all questions that you can and whenever called for show your work clearly. Your method of solving problems should pattern the approach used in lecture. You do not have to show your work for the multiple choice (if any) or short answer questions.
4. No credit will be awarded if your work is not shown in problems 6, 7, 8, 10 and 11.
5. Point values are shown next to the problem number.
6. Budget your time for each of the questions. Some problems may have a low point value yet be very challenging. If you do not recognize the solution to a question quickly, skip it, and return to the question after completing the easier problems.
7. Look through the exam before beginning; plan your work; then begin.
8. ~~Relax~~ and do well.

	Page 2	Page 3	Page 4	Page 5	TOTAL
SCORES	_____	_____	_____	_____	_____
	(31)	(32)	(18)	(19)	(100)

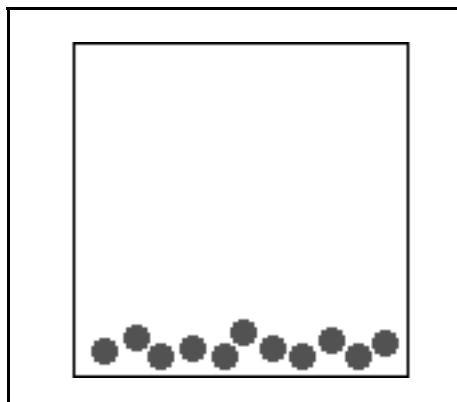
- (8) 1. Complete the following table with the missing information.

Name	Formula	Symbol	Phase (25 °C)
Silicon	<b>Si</b>	<b>Si</b>	<b>solid</b>
<b>Phosphorus</b>	P <sub>4</sub>	<b>P</b>	<b>solid</b>
<b>gold</b>	<b>Au</b>	Au	<b>solid</b>
Chlorine	<b>Cl<sub>2</sub></b>	<b>Cl</b>	<b>gas</b>

- (10) 2. Diagram each of the following systems as viewed at the atomic level in the space provided. Be sure to clearly label each of the substances in your diagram.



A solution of helium and oxygen at 25 °C.

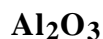


Mercury in the liquid phase.

- (6) 3. Indicate the number of significant figures in each of the following numbers;
- a)  $1.310 \times 10^6 \text{ L}$                       **4**
- b)  $0.00047 \text{ g}$                               **2**
- c)  $210,006 \text{ m}$                               **6**
- (7) 4. Complete each calculation and report the answer to the correct number of significant figures (include the units also).
- a)  $17.365 \text{ cm} - 11.07 \text{ cm} = \mathbf{6.30}$
- b) 
$$\frac{6.626 \times 10^{-34} \text{ J s} \cdot 2.9979 \times 10^8 \text{ m s}^{-1}}{576 \times 10^{-9} \text{ m}} = \mathbf{3.45 \times 10^{-34} \text{ J}}$$
- c) 
$$\left( \frac{2.420 \text{ g} + 15.6 \text{ g}}{5.31 \text{ g}} \right) \cdot 3.005 = \mathbf{10.2}$$

(8) 5. Write the formula for the binary ionic compound formed from the following pairs of elements.

a) aluminum and oxygen



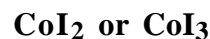
b) sodium and sulfur



c) calcium and chlorine



d) cobalt and iodine



(24) 6. Perform the following conversions;

a) 100. meters to yards (use at least 3 conversion factors)

$$100. \text{ meters} \left( \frac{100 \text{ cm}}{1 \text{ m}} \right) \left( \frac{1 \text{ in}}{2.54 \text{ cm}} \right) \left( \frac{1 \text{ yd}}{36 \text{ in}} \right) = 109 \text{ yd}$$

b) the body temperature of most birds is 106 °F, calculate the temperature in °C and K.

$$^{\circ}\text{C} = \frac{5}{9}(^{\circ}\text{F} - 32) = \frac{5}{9}(106 - 32) = 41 \text{ }^{\circ}\text{C}$$

$$\text{K} = 273 + 41 = 314 \text{ K}$$

c) to repair a small hole requires a patch which is 32.7 cm<sup>2</sup>. Calculate the size of the patch in square kilometers(km<sup>2</sup>).

$$32.7 \text{ cm}^2 \left( \frac{1 \text{ m}}{100 \text{ cm}} \right)^2 \left( \frac{1 \text{ km}}{1000 \text{ m}} \right)^2 = 3.27 \times 10^{-9} \text{ km}^2$$

d) in c) how much would it cost to purchase the material to repair the hole if the cost of the material is \$2.75 per in<sup>2</sup>?

$$32.7 \text{ cm}^2 \left( \frac{1 \text{ inch}}{2.54 \text{ cm}} \right)^2 \left( \frac{\$2.75}{1 \text{ in}^2} \right) = \$13.94$$

- (6) 7. Calculate the heat required to change the temperature of 12.0 g of water from 17.0 °C to 83.4 °C.

$$\text{Heat} = 4.184 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}} \cdot 12.0 \text{ g} \cdot (83.4 ^\circ\text{C} - 17.0 ^\circ\text{C}) = 3.33 \times 10^3 \text{ J}$$

- (6) 8. A 30.5 g sample of an alloy experiences a 71.3 °C temperature change when it absorbs  $1.12 \times 10^3$  J of heat. Calculate the specific heat (capacity) of the alloy.

$$\text{heat} = \text{mass} \cdot \text{S.H.} \cdot \Delta T$$

$$\text{Specific heat} = \frac{\text{heat}}{\text{mass} \cdot \Delta T} = \frac{1.12 \times 10^3 \text{ J}}{30.5 \text{ g} \cdot 71.3 ^\circ\text{C}} = 0.515 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$$

- (6) 9. Complete the following table.

Symbol	# protons	# neutrons	# electrons	charge
$^{75}_{33}\text{As}^{-3}$	33	42	36	3-
$^{193}_{77}\text{Ir}^{3+}$	77	116	74	+3

- (10)10. Determine the relative, weighted average atomic mass of the following element, given the three naturally occurring isotopes. (You must show the calculation for full credit.)

Isotope	Isotopic Mass (u)	Percent Abundance
$^{24}\text{Mg}$	23.9850	78.99
$^{25}\text{Mg}$	24.9858	10.00
$^{26}\text{Mg}$	25.9826	11.01

$$\text{average atomic mass} = \Sigma(\text{isotopic mass} \cdot \text{fractional abundance})$$

$$\text{average atomic mass} = (23.9850 \cdot 0.7899) + (24.9858 \cdot 0.1000) + (25.9826 \cdot 0.1101)$$

$$\text{average atomic mass} = 24.30 \text{ u}$$

- (9) 11. An empty vial weighs 49.67 g. When filled with mercury it weighs 192.39 g. The density of mercury is  $13.53 \text{ g cm}^{-3}$ .

- a) Calculate the volume of the vial.

$$(192.39 \text{ g} - 49.67 \text{ g}) \left( \frac{1 \text{ cm}^3}{13.53 \text{ g}} \right) = 10.55 \text{ cm}^3$$

- b) What would be the weight of the vial if it is filled with water at  $25^\circ\text{C}$ ?  
(The density of water is  $0.997 \text{ g cm}^{-3}$  at  $25^\circ\text{C}$ ).

$$10.55 \text{ cm}^3 \left( \frac{0.997 \text{ g}}{1 \text{ cm}^3} \right) = 10.52 \text{ g}$$

$$49.67 \text{ g} + 10.52 \text{ g} = 60.19 \text{ g}$$

## Useful Information

$$1 \text{ pound (lb)} = 453.59237 \text{ gram (gm)}$$

$$1 \text{ liter (L)} = 1.056718 \text{ quart (qt)}$$

$$1 \text{ inch (in)} = 2.54 \text{ centimeters (cm)}$$

$$^{\circ}\text{F} = \frac{9}{5}^{\circ}\text{C} + 32$$

$$\text{K} = ^{\circ}\text{C} + 273.15$$

$$\text{average atomic mass} = \Sigma(\text{isotopic mass} \cdot \text{fractional abundance})$$

$$\text{heat} = \text{mass} \cdot \text{S.H.} \cdot \Delta T$$

$$\text{Specific Heat (capacity) for H}_2\text{O} = 4.184 \frac{\text{J}}{\text{g}^{\circ}\text{C}}$$