CHEM 1215
Exam I
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February 2, 2000

Name _____

TA's Name _____

Lab Section _____

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 5 and 9.

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.

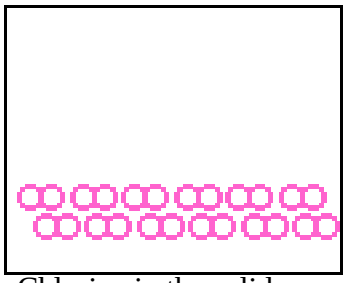
8. Relax and do well.

	Page 2	Page 3	Page 4	Page 5	TOTAL
SCORES	_____	_____	_____	_____	_____
	(36)	(24)	(24)	(14)	(100)

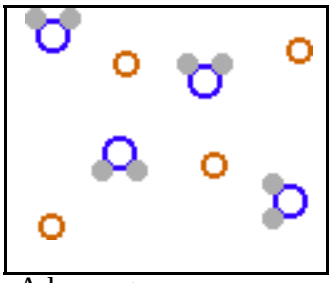
(12) 1. Complete the following table with the missing information.

Name	Formula	Symbol	Phase (25 ˚C)
Potassium	**K**	K	**solid**
sulfur	**S_8**	**S**	**solid**
platinum	**Pt**	**Pt**	**solid**
Fluorine	F_2	**F**	**gas**

(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.



Chlorine in the solid phase.



A homogeneous mixture of an element and a compound.

(6) 3. Indicate the number of significant figures in each of the following numbers;

a) 6.05×10^{-3} L **3**

b) 0.0220022 g **6**

c) 350.00 m **5**

(8) 4. Complete each calculation and report the answer to the correct number of significant figures.

a) $\frac{6.00}{30.000} =$ **0.200**

b) $\frac{0.100 \cdot 0.010}{0.003} =$ **0.3**

c) $\left(\frac{1.00866 - 1.00728}{6.02205 \times 10^{23}}\right) \cdot 14.00 =$ **3.21×10^{-26}**

d) $1.285 \times 10^{-2} + 1.24 \times 10^{-3} =$ **1.409×10^{-2}**

(24) 5. Perform the following conversions;

a) 73.5 km to miles (use at least 3 conversion factors)

$$\mathbf{73.5\ km}\left(\frac{\mathbf{1000\ m}}{\mathbf{1\ km}}\right)\left(\frac{\mathbf{100\ cm}}{\mathbf{1\ m}}\right)\left(\frac{\mathbf{1\ in}}{\mathbf{2.54\ cm}}\right)\left(\frac{\mathbf{1\ ft}}{\mathbf{12\ in}}\right)\left(\frac{\mathbf{1\ mile}}{\mathbf{5280\ ft}}\right) = \mathbf{45.7\ mile}$$

b) liquid nitrogen boils at –196 ˚C, calculate the temperature in ˚F and K.

$$\mathbf{^\circ F} = \frac{\mathbf{9}}{\mathbf{5}}\mathbf{^\circ C + 32} = \frac{\mathbf{9}}{\mathbf{5}}\mathbf{(-196) + 32} = \mathbf{-321\ ^\circ F}$$

$$\mathbf{K = ^\circ C + 273 = -196 + 273 = 77\ K}$$

c) a fertilizer suggests an application of $2.06 \times 10^{-1}\ \frac{kg}{m^2}$. Convert to $\frac{pounds}{foot^2}$.

$$\mathbf{2.06 \times 10^{-1}\ \frac{kg}{m^2}}\left(\frac{\mathbf{1000\ g}}{\mathbf{1\ kg}}\right)\left(\frac{\mathbf{1\ lb}}{\mathbf{454\ g}}\right)\left(\frac{\mathbf{1\ m}}{\mathbf{100\ cm}}\right)^2\left(\frac{\mathbf{2.54\ cm}}{\mathbf{1\ inch}}\right)^2\left(\frac{\mathbf{12\ in}}{\mathbf{1\ ft}}\right)^2 = \mathbf{4.22 \times 10^3\ \frac{lb}{ft^2}}$$

d) How many gallons in a 575 mLs?

$$\mathbf{575\ mL}\left(\frac{\mathbf{1\ L}}{\mathbf{1000\ mL}}\right)\left(\frac{\mathbf{1.0567\ quart}}{\mathbf{1\ L}}\right)\left(\frac{\mathbf{1\ gal}}{\mathbf{4\ guart}}\right) = \mathbf{1.52 \times 10^{-1}\ gallons}$$

(8) 6. In class we observed the reaction of the alkali metals (lithium, sodium, etc.) with water.

a) How would you describe the trend in reactivity of the alkali metals as you go down the group.

The reactivity of the alkali metals increases going down the group.

b) Describe the reaction of any one of the alkali metals with water. In your description of the reaction include some physical properties of each reactant and one product.

When sodium (a soft, silvery solid) was added to water (a clear, colorless liquid) its irregular shape was immediately modified to a sphere as the irregular edges reacted quickly with the water. The remaining sodium raced over the surface, diminishing, in size as it reacted until it disappeared. A gas, hydrogen, which is also clear and colorless was produced in the reaction.

(8) 7. How many significant figures must the number Q possess, in each of the following mathematical equations, to make the equation valid from a significant figure standpoint?

	Mathematical equation	Number of significant figures (in Q)
a)	7.312 x Q = 4.13	**3**
b)	7.312 x Q = 0.1100	**4 or more**
c)	94,461 x Q = 1.0	**2**
d)	94,461 x Q = 230,900,000	**4**

(8) 8. Round off each of the following numbers to the indicated number of significant digits;

a) 18.1818 (3 significant digits)

18.2

b) 300,000 (2 sig figs)

3.0×10^5

c) 8.0499×10^{-3} (4 sig figs)

8.050×10^{-3}

d) 8.0499×10^{-3} (2 sig figs)

8.0×10^{-3}

(6) 8. Two students are measuring the density of samples of the element gold. One is working with a sample weighing 100. grams the other is working with a sample which is 200. grams. Will one student measure a density higher than the other? Explain your answer.

No, both students will measure the same density. The sample with 200. grams of gold will have twice the volume compared to the sample of 100. g. This way the density ($\frac{\text{mass}}{\text{volume}}$) remains constant independent of the amount of substance.

(8) 9. An aqueous solution of concentrated ammonia, NH_3, is 58.0 % pure ammonia (by weight). A 255 mL sample of concentrated ammonia solution was found to contain 133 grams of pure ammonia. Calculate the density (in $\frac{\text{g}}{\text{mL}}$) of the concentrated ammonia solution.

$$\textbf{Density} = \frac{\textbf{mass concentrated ammonia}}{\textbf{volume concentrated ammonia}}$$

The volume of concentrated ammonia is 255 mL. To calculate the mass of concentrated ammonia,

$$\textbf{133 g pure ammonia} \left(\frac{\textbf{100 g concentrated ammonia}}{\textbf{58.0 g pure ammonia}}\right) = \textbf{229 grams of concentrated ammonia}$$

$$\textbf{Density} = \frac{\textbf{229 grams of concentrated ammonia}}{\textbf{255 mL concentrated ammonia}} = \textbf{0.899} \ \frac{\textbf{g}}{\textbf{mL}}$$

Periodic Table of the Elements

	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 **H** 1.008																	2 **He** 4.00
2	3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
3	11 **Na** 22.99	12 **Mg** 24.30											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
4	19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.38	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
5	37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
6	55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
7	87 **Fr** (223)	88 **Ra** 226.0	89 **Ac** 227.0	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)									

Lanthanides	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.2	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
Actinides	90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** 237.0	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Useful Information

1 pound (lb) = 453.59237 gram (gm)

1 liter (L) = 1.056718 quart (qt)

1 inch (in) = 2.54 centimeters (cm)

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

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