

CHEM 1215
Exam IV
John IV. Gelder
December 7, 1998

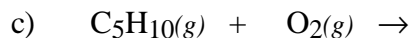
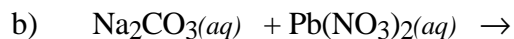
Name _____
TA's Name _____
Lab Section _____

INSTRUCTIONS:

1. This examination consists of a total of 7 different pages. The last two pages include a periodic table, a solubility 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.
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 or short answer questions.
4. No credit will be awarded if your work is not shown in problems 5a and 5b.
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 | <u> </u> (26) | <u> </u> (31) | <u> </u> (23) | <u> </u> (20) | <u> </u> (100) |

(12) 1. Write the chemical formula(s) of the product(s) and balance the following reactions. Identify all products phases as either (g)as, (l)iquid, (s)olid or (aq)ueous.



(8) 2. Write the balanced ionic and balanced net ionic chemical equations for part a) and part b) in Problem 1. (Remember to include the correct charges on all ions and the phase of each species.)

1a)

Ionic equation:

Net Ionic equation:

1b)

Ionic equation:

Net Ionic equation:

(6) 3. The ionic radius for a Ca^{2+} ion is 114 pm, while the ionic radius for S^{2-} is 170 pm. Which ion is larger? Explain why?

- (8) 4. Briefly describe how chemists view the nature of an electron in an atom. (Indicate where it is located relative to the nucleus and how it behaves/moves.)
- (18) 5. A hydrogen atom is known to absorb a photon of light with a frequency of $2.47 \times 10^{19} \text{ s}^{-1}$.
- Calculate the wavelength of this photon.
 - Calculate the energy of the photon.
 - Draw a picture that represents, and briefly explain what happens, to the electron when a hydrogen atom absorbs a photon of this frequency. (Label the parts of your picture.)

(12) 6. Write the complete electron configuration for each of the following atoms, or ions:

i. Cu

ii. Bi

iii. Ca^{2+}

iv. As^{3-}

(16) 7. Draw a possible Lewis electron-dot structure for each of the species below. Include all resonance structures if they are needed to adequately represent the bonding.

(a) NF_3

(b) C_3H_6

(c) HClO_3

d) CO_3^{2-}

- (9) 8. Predict the formula of the ionic compound formed between the following pairs of elements.
- a) Li and O_2
 - b) Al and F_2
 - c) Mg and N_2
- (6) 9. Explain why the energy required to remove the second electron in K is significantly larger than the first electron.
-
-
-
-
-
-
-
-
-
-
- (5) 10. Draw the orbital diagram, showing all the electrons, for P.

Periodic Table of the Elements

| | | | | | | | | | | | | | | | | | | |
|---|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | IA | | | | | | | | | | | | | | | | VIII A | |
| 1 | 1 H 1.008 | | | | | | | | | | | | | | | | | 2 He 4.00 |
| 2 | 3 Li 6.94 | IIA | 4 Be 9.01 | | | | | | | | | | IIIA | IVA | VA | VIA | VIIA | 10 Ne 20.18 |
| 3 | 11 Na 22.99 | 12 Mg 24.30 | | | | | | | | | | | 5 B 10.81 | 6 C 12.01 | 7 N 14.01 | 8 O 16.00 | 9 F 19.00 | 18 Ar 39.95 |
| 4 | 19 K 39.10 | 20 Ca 40.08 | IIIB | IVB | VB | VIB | VIIB | VIII | | IB | IIB | 13 Al 26.98 | 14 Si 28.09 | 15 P 30.97 | 16 S 32.06 | 17 Cl 35.45 | 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

$$\lambda = \frac{c}{\nu}$$

$$E = h\nu$$

$$c = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$$

Solubility Table

| <u>Ion</u> | <u>Solubility</u> | <u>Exceptions</u> |
|---------------------|-------------------|---|
| NO_3^- | soluble | none |
| ClO_4^- | soluble | none |
| Cl^- | soluble | except Ag^+ , Hg_2^{2+} , Pb^{2+} |
| SO_4^{2-} | soluble | except Ca^{2+} , Ba^{2+} , Sr^{2+} , Hg^{2+} , Pb^{2+} , Ag^+ |
| CO_3^{2-} | insoluble | except Group IA and NH_4^+ |
| PO_4^{3-} | insoluble | except Group IA and NH_4^+ |
| CrO_4^{2-} | insoluble | except Group IA, IIA and NH_4^+ |
| OH^- | insoluble | except Group IA, Ca^{2+} , Ba^{2+} , Sr^{2+} |
| S^{2-} | insoluble | except Group IA, IIA and NH_4^+ |
| Na^+ | soluble | none |
| NH_4^+ | soluble | none |
| K^+ | soluble | none |

*slightly soluble