NAME

# CHEMISTRY 101SPRING 2003EXAM 2FORM BSECTIONS 501-509DR. KEENEY-KENNICUTT

### Directions: (1) Put your name, S.I.D. number and signature on the free response part of the exam where indicated.

- (2) Each multiple choice question is actually 2 questions on your scanning sheet. If you are sure of an answer, put the same answer down for both questions for 5 pts. If you cannot decide between two answers, put one answer down for one question and the other answer down for the other question. If you get one correct you'll get half credit for 2.5 pts. If there is an ambiguous multiple choice question, use the last page to explain your answer.
  - (3) Do NOT write on the envelope.
  - (4) Bubble in OPTION A on the scanning sheet IF you want your grade posted.
  - (5) When finished, put the free response answers in the envelope with the scanning sheet. You can keep the multiple choice part the answers will be given to you as you leave.
  - (6) There are a total of 28 questions (17 actual questions).

### PART 1

- **1&2.** Give the number of protons, neutrons, and electrons in an atom of the <sup>22</sup>Ne isotope:
  - (a) 10 p, 12 n, 10 e(b) 10 p, 10 n, 12 e(c) 10 p, 12 n, 12 e(d) 12 p, 10 n, 12 e(e) 10 p, 22 n, 10 e

- **3&4.** Which is an insoluble base?
  - (a)  $Sr(OH)_2$  (b)  $NH_3$  (c)  $CH_3OH$  (d)  $Cu(OH)_2$  (e)  $Ba(OH)_2$

- **5&6.** What is the maximum number of orbitals that have n=5 and l=3?
  - (a) 5 (b) 7 (c) 10 (d) 14 (e) 2

7&8. Which of the following are examples of strong electrolytes?

(1) LiOH	(2) K <sub>2</sub> S	(3) HBrO <sub>3</sub>	(4) NH <sub>4</sub> NO <sub>3</sub>	(5) K <sub>2</sub> SO <sub>4</sub>	(6) HI
(a) 1, 2, 3, 5, 6	(b) 2, 5, 6	(c)	1, 2, 4, 5, 6	(d) 1, 2, 4	(e) another combination

- **9&10.** In the Rutherford gold foil experiment, the fact that a few of the alpha particles WERE deflected as they passed through the gold foil indicates that:
  - (a) atoms are solid spheres touching each other in the solid state.
  - (b) the atom is mostly empty space.
  - (c) the nucleus is positively charged.
  - (d) gold is very dense.
  - (e) none of the above is correct.

**11&12.** On a far and distant world, the element, Whoopium, was discovered to have 3 isotopes. What is the atomic weight of the element?

Isotopes	Mass	Abundance		
1	37.00 amu	30.00%		
2	38.00 amu	50.00%		
3	40.00 amu	20.00%		
(a) 38.00 amu	(b) 38.10 amu	(c) 38.20 amu	(d) 39.98 amu	(e) 37.40 amu

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**13&14.** Group IIIA is represented by:

(a)  $ns^2 np^1$  (b)  $ns^2 np^2$  (c)  $ns^2 np^3$  (d)  $ns^2 np^4$  (e)  $ns^2 np^5$ 

15&16. Which statement is FALSE?

- (a) A set of *p* orbitals can accommodate a maximum of 6 electrons.
- (b) The 2p energy sublevel has  $m_I = -1, 0, 1$ .
- (c) The second shell (or major energy level) with n = 2 has no *d* orbitals.
- (d) None of the *d* orbitals are spherically symmetric.
- (e) There are 10 *d* orbitals in a set.
- **17&18.** Which of the following pictures is the best representation of HCIO(aq)? Ignore the charges on any ions. What I want is the best illustration of the concept occurring in solution.



19&20. Which of the following statements is TRUE given the following net ionic equation?

 $2H^{+}(aq)$  + Mg(OH)<sub>2</sub>(s)  $\rightarrow$  Mg<sup>2+</sup>(aq) +  $2H_2O(I)$ 

- (a) The base in this reaction is a weak electrolyte.
- (b) The acid could be HF.
- (c) This could be the net ionic equation for HNO<sub>2</sub> reacting with Mg(OH)<sub>2</sub>.
- (d) This reaction is classified as a precipitation reaction.
- (e) The salt produced could be Mg(NO<sub>3</sub>)<sub>2</sub>.
- **21&22.** In class we had a demonstration of the emission lines of hydrogen. In this experiment, 182 kJ of energy is released as red light when <u>one mole</u> of electrons falls from the n=3 to the n=2 principle energy level.

Calculate the frequency of light emitted when excited electrons fall from the n=3 energy level to the n=2 energy level. (Hint: you'll need to first find the energy released per 1 electron.)



(a)	1.42 x 10 <sup>-28</sup> s <sup>-1</sup>
(d)	4.56 x 10 <sup>14</sup> s <sup>-1</sup>

(b)  $2.83 \times 10^{38} \text{ s}^{-1}$ (e)  $6.11 \times 10^{21} \text{ s}^{-1}$  (c) 7.21 x 10<sup>-8</sup> s<sup>-1</sup>

- **23&24.** What volume of 0.533 M sulfuric acid is required to totally react with 16.0 mL of 0.227 M sodium hydroxide?
  - (a) 6.65 mL (b) 3.41 mL (c) 12.4 mL (d) 23.5 mL (e) 39.4 mL

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Form B

Signature

## PART 2

(4 pts) **25.** Sketch the following orbitals. Label the relevant axes.

(a)  $p_x$  orbital

(b) d<sub>xv</sub> orbital

26. Consider the reaction  $8\text{HCl}(\text{aq}) + \text{K}_2\text{Cr}_2\text{O}_7(\text{aq}) + 3\text{K}_2\text{SO}_3(\text{aq}) \rightarrow 2\text{Cr}\text{Cl}_3(\text{aq}) + 3\text{K}_2\text{SO}_4(\text{aq}) + 2\text{KCl}(\text{aq}) + 4\text{H}_2\text{O}(\text{I})$ (10 pts) Name all the compounds in this reaction:

	HCI(aq)	
	K <sub>2</sub> CrO <sub>7</sub>	
	K <sub>2</sub> SO <sub>3</sub>	
	CrCl <sub>3</sub>	
	K <sub>2</sub> SO <sub>4</sub>	
(2 pts)	Which is the element being reduced?	
(2 pts)	The element changes in oxidation number from to	
(2 pts)	The reducing agent is	OVFR Þ

(6 pts) **27.** (a) Write the formula unit, total ionic and net ionic equations for the precipitation reaction between barium chlorate and sodium phosphate. (Note: there will be deductions if you forget to put the correct phase and charges for all species.)

(4 pts) (b) Show the particle view in the beaker before the reaction occurs and after the reaction is finished. You don't need to include water.



### BEFORE

AFTER

**28.** Write the correct ground state electron configurations  $(1s^2 2s^2 \text{ etc.})$  for the following elements and tell if they are diamagnetic or paramagnetic. Give an acceptable set of 4 quantum numbers for the last electron added to an atom of the element. You can use the shorthand notation with the appropriate noble gas for the electronic configuration.

(5 pts) (a) manganese, Mn

(5 pts) (b) bismuth, Bi

# SCRAP PAPER OR COMMENTS ON EXAM

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