

NAME \_\_\_\_\_

**CHEMISTRY 101****FINAL****FORM B****SECTIONS 501-511****SPRING 2005****DR. KEENEY-KENNICUTT**

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- Directions:
- (1) Put your name and signature on PART 1 and PART 2 of the exam where indicated.
  - (2) Sign the Aggie Code on PART 2 of this exam.
  - (3) 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.
  - (4) Do NOT write on the envelope.
  - (5) When finished, put everything in the envelope and wait to be excused. At the table, take everything out of the envelope. You can pick up the multiple choice part with the answers outside my office after the exam.
  - (6) There are a total of 59 questions (32 actual questions).
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**PART 1**

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**1&2.** Which of the following substances is INSOLUBLE?

- (a) HCl      (b) RbOH      (c)
- $\text{CH}_3\text{COOH}$
- (d)
- $\text{CaCO}_3$
- (e) all are soluble

**3&4.** A species having 22 electrons and 24 protons could be

- (a)
- $\text{Ti}^{2+}$
- (b)
- $\text{Ti}^{2-}$
- (c)
- $\text{Cr}^{2+}$
- (d)
- $\text{Cr}^{2-}$
- (e) something else

**5&6.** Which is an appropriate set of 4 quantum numbers for the last electron to go into an atom of iodine?

	n	$\ell$	$m_\ell$	$m_s$
(a)	5	2	0	+1/2
(b)	5	1	-1	-1/2
(c)	4	2	2	+1/2
(d)	4	1	-1	-1/2
(e)	4	3	-1	-1/2

**7&8.** The number of  $\pi$  bonds in a molecule of acetic acid is:

- (a) 0      (b) 1      (c) 2      (d) 3      (e) more than 3

**9&10.** The oxidation state of sulfur in  $\text{Al}_2(\text{SO}_3)_3$  is \_\_\_\_\_.

- (a) +4                      (b) +6                      (c) -2                      (d) 0                      (e) +2

**11&12.** A hypothetical molecule,  $\text{AB}_2$ , has one (1) lone pair of electrons on the center atom, A. The hybridization of A is \_\_\_\_\_.

- (a) sp                      (b)  $\text{sp}^2$                       (c)  $\text{sp}^3$                       (d)  $\text{sp}^3\text{d}$                       (e)  $\text{sp}^3\text{d}^2$

**13&14.** The following ground state atomic configuration:  $1\text{s}^2 2\text{s}^2 2\text{p}^6 3\text{s}^2 3\text{p}^6 3\text{d}^5 4\text{s}^1$  corresponds to

- (a) K                      (b) Zn                      (c) Mn                      (d) Cu                      (e) Cr

**15&16.** Which statement is WRONG?

- (a) A potassium atom is larger than the potassium cation.  
(b) The atomic weight for platinum is about 195.  
(c) A tin atom is larger than a xenon atom.  
(d) The first ionization energy of silicon is greater than that of phosphorus.  
(e) The most stable ion of oxygen is  $\text{O}^{2-}$ .

**17&18.** The correct dot structure for  $\text{BrF}_3$  contains \_\_\_\_\_ lone pair(s) of electrons on the central atom.

- (a) 0                      (b) 1                      (c) 2                      (d) 3                      (e) 4

**19&20.** Which of the following statements is FALSE concerning the compound  $\text{Cu}(\text{ClO}_4)_2$ ?

- (a) Each formula unit of  $\text{Cu}(\text{ClO}_4)_2$  contains 8 atoms of oxygen.
- (b) Each formula unit of  $\text{Cu}(\text{ClO}_4)_2$  contains 2 perchlorate ions.
- (c) Each mole of  $\text{Cu}(\text{ClO}_4)_2$  contains 3 moles of ions.
- (d) Each mole of  $\text{Cu}(\text{ClO}_4)_2$  contains 63.5 g of copper.
- (e) Each mole of  $\text{Cu}(\text{ClO}_4)_2$  contains  $6.02 \times 10^{23}$  atoms of chlorine.

**21&22.** The substance  $\text{Na}_2\text{S}(\text{s})$  would be classified as a(n) \_\_\_\_\_ solid.

- (a) molecular
- (b) covalent (network)
- (c) ionic
- (d) metallic
- (e) amorphous

**23&24.** A sample of  $\text{CO}_2$  gas behaves most ideally at:

- (a)  $0^\circ\text{C}$  and 10 atm
- (b)  $0^\circ\text{C}$  and 2 atm
- (c)  $0^\circ\text{C}$  and 1 atm
- (d)  $200^\circ\text{C}$  and 10 atm
- (e)  $200^\circ\text{C}$  and 1 atm

**25&26.** Valence Bond Theory uses the concept of resonance to explain the structure of \_\_\_\_\_.

- (a)  $\text{NH}_3$
- (b)  $\text{CO}_3^{2-}$
- (c)  $\text{CO}_2$
- (d)  $\text{SO}_4^{2-}$
- (e)  $\text{H}_2\text{O}$

**27&28.** The correct ranking of substances according to their boiling points from lowest boiling point to highest boiling point is:

- (a)  $\text{KCl} < \text{H}_2 < \text{HCl} < \text{HF}$
- (b)  $\text{HCl} < \text{H}_2 < \text{HF} < \text{KCl}$
- (c)  $\text{H}_2 < \text{HCl} < \text{HF} < \text{KCl}$
- (d)  $\text{H}_2 < \text{HCl} < \text{KCl} < \text{HF}$
- (e)  $\text{H}_2 < \text{KCl} < \text{HCl} < \text{HF}$

**29&30.** Which of the following species is INCORRECTLY paired with its molecular or ionic geometry?

- (a)  $\text{SO}_3$  trigonal planar
- (b)  $\text{SO}_3^{2-}$  pyramidal
- (c)  $\text{AsF}_5$  trigonal bipyramidal
- (d)  $\text{CO}_2$  linear
- (e)  $\text{SO}_2$  linear

**31&32.** According to Bronsted-Lowry Theory, which acid is INCORRECTLY matched with its conjugate base?

**ACID      CONJUGATE BASE**

- (a)  $\text{H}_3\text{O}^+$   $\text{OH}^-$
- (b)  $\text{H}_2\text{F}^+$  HF
- (c) HCl  $\text{Cl}^-$
- (d)  $\text{HCO}_3^-$   $\text{CO}_3^{2-}$
- (e)  $\text{H}_2\text{PO}_4^-$   $\text{HPO}_4^{2-}$

**33&34.** Which of the following species is polar? (Cl = chlorine)

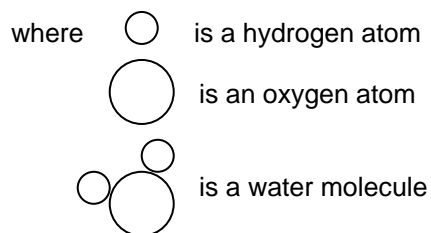
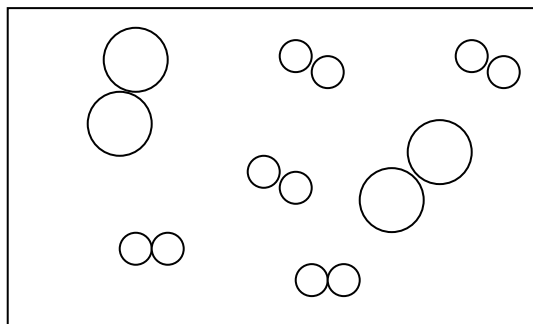
- (a)  $\text{BCl}_3$
- (b)  $\text{CCl}_3^-$
- (c)  $\text{NCl}_4^+$
- (d)  $\text{SCl}_6$
- (e)  $\text{CCl}_4$

**35&36.** What volume (in mL) of 2.0 M KF can be prepared using 6.5 g of KF (FW = 58.1 g/mol)?

- (a) 63 mL
- (b) 72 mL
- (c) 450 mL
- (d) 23 mL
- (e) 56 mL

**37&38.** Consider the reaction:  $\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{g})$  **UNBALANCED**

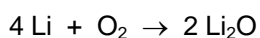
The initial system before the reaction began is represented by the following particle view:



Give the limiting reactant and the number of molecules of H<sub>2</sub>O that can be produced.

- (a) H<sub>2</sub>, 2      (b) H<sub>2</sub>, 4      (c) O<sub>2</sub>, 2      (d) O<sub>2</sub>, 4      (e) another answer

**39&40.** How many grams of Li<sub>2</sub>O (FW = 29.88 g/mol) can be produced from the reaction of 10.0 g of lithium metal with excess oxygen gas if the percent yield of the reaction is only 65.0%?



- (a) 14.0 g      (b) 21.3 g      (c) 16.2 g      (d) 32.7 g      (e) 11.2 g

**41&42.** You are given the data for all the isotopes of the newly discovered element, Aggiemomium:

Abundance (%)	Isotopic Mass (amu)
30.00	143.00
60.00	145.00
10.00	149.00

What is the atomic weight of Aggiemomium (in amu) to 4 significant figures?

- (a) 145.5      (b) 146.0      (c) 145.2      (d) 145.0      (e) 144.8

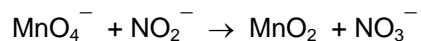
**43&44.** What is the percent of carbon by mass in Vitamin E,  $\text{C}_{29}\text{H}_{50}\text{O}_2$ ?

- (a) 80.9%      (b) 86.3%      (c) 77.4%  
(d) 71.2%      (e) 29.0%

**45&46.** What could be the identity of a gas if its density is 3.17 g/L at STP?

- (a) Ar                      (b) PH<sub>3</sub>                      (c) Kr                      (d) Cl<sub>2</sub>                      (e) SO<sub>2</sub>

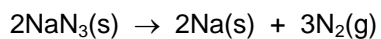
**47&48.** A student must prepare a 0.300 N solution of KMnO<sub>4</sub> which will be used in this UNBALANCED net ionic reaction occurring in acidic solution:



How many grams of KMnO<sub>4</sub> must be used to make 500 mL of this 0.300 N solution?

- (a) 3.25 g                      (b) 7.90 g                      (c) 12.3 g                      (d) 21.1 g                      (e) 26.4 g

**49&50.** Air bags for automobiles are inflated during a collision by the explosion of sodium azide,  $\text{NaN}_3$  (FW = 65.0 g/mol). The equation for the decomposition is:



What mass of sodium azide is needed to inflate a 15.0 L bag to a pressure of 1.20 atm at 25°C?

- (a) 31.9 g      (b) 47.1 g      (c) 58.3 g      (d) 94.5 g      (e) 115 g

**51&52.** This is the question being replaced by your doing the evaluation of our course on the web.



## PERMISSION SLIP

**SPRING 2005**

I, (print your name) \_\_\_\_\_ give permission to Dr. Wendy Keeney-Kennicutt to anonymously use any of my work done in her Chemistry 101 class during Spring 2005 as examples to illustrate to others how she teaches in her class. This includes homework, abstracts, CPR assignments, free response part of exams, labs, etc.

Signed: \_\_\_\_\_

Date: \_\_\_\_\_



**CHEMISTRY 101**

**SPRING 2005**

NAME \_\_\_\_\_

FINAL

S 501-511

Form B

Signature \_\_\_\_\_

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**PART 2**

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Please read and sign: "On my honor, as an Aggie, I have neither given  
nor received unauthorized aid on this exam." \_\_\_\_\_

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(6 pts) **53.** Given the following data:

Specific Heat of ice:	2.09 J/g°C
Heat of fusion of ice at 0°C	334 J/g
Specific Heat of liquid H <sub>2</sub> O	4.18 J/g°C
Heat of vaporization of liquid water at 100°C	$2.26 \times 10^3$ J/g
Specific Heat of steam	2.03 J/g°C

Calculate the amount of heat (in kJ) required to convert 25.0 g of water at 30.0°C to steam at 120.0°C.

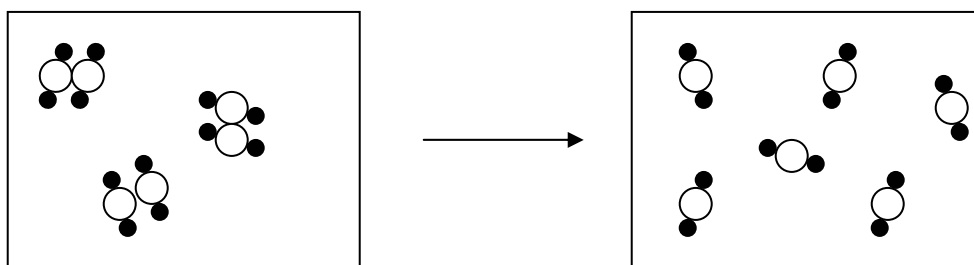
(4 pts) **54.** Draw a picture of an s orbital. How many s orbitals are in a major energy level?

**OVER ⇒**

- (7 pts) **55.** Write a balanced net ionic equation to represent the oxidation of chromite ions ( $\text{CrO}_2^-$ ) by hypochlorite ions ( $\text{ClO}^-$ ) in basic solution to yield chromate ions ( $\text{CrO}_4^{2-}$ ) and chloride ions ( $\text{Cl}^-$ ). Use smallest whole number coefficients.

- (6 pts) **56.** What is the initial boiling point of a solution prepared by dissolving 50.0 g of calcium nitrate in 300.0 g of water. The boiling point of water is  $100.00^{\circ}\text{C}$  and  $K_b$  for water is  $0.512^{\circ}\text{C/m}$ .

- (5 pts) **57.** Here is a molecular representation of a reaction occurring in the gas phase at 300 K and 1 atm pressure. If the initial volume is 1.00 L, determine the final volume if the temperature and the pressure don't change and explain briefly how you arrived at your answer.



(6 pts) **58.** Draw a typical phase diagram. Label the axes and the areas where solids, liquids and gases can be found. Draw a line segment representing the phase change of a gas to a liquid at constant temperature.

(6 pts) **59.** Determine the complete net ionic equation for the reaction between perchloric acid and magnesium hydroxide.

## SCRAP PAPER OR COMMENTS ON EXAM

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**CHEMISTRY 101**

FINAL Form B

**Spring 2005**

S 501-511

NAME \_\_\_\_\_

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