Name_____

University of Louisville **Chem 105 Day** **Spring 2016**

Exam 2 March 7

DO NOT OPEN THE EXAM UNTIL YOU ARE TOLD TO DO SO.

In the meantime, read this...

You will write all of your answers on the answer sheets, on the next two pages. At the end of the exam, turn in **your entire test booklet, with Answer Sheet, and your Scantron card.**

✍ **Write your name**:

- ✍ on the front of the exam,
- ✍ on the "Answer Sheet," and
- ✍ on the Scantron card.

You may use your calculator and a pen or pencil. Please do not use green or red.

Problems marked ** come straight from the assigned homework or from worksheets in class.

Put all notes, books, etc away and out of sight. Turn off the ringers of electronic devices and put them away and out of sight. **Electronic devices (other than calculators) must be silenced and put away. Use of calculator functions on communication devices is not permitted. Sharing calculators is not permitted.** Points will be deducted for electronic devices in view or making noise, and devices will be confiscated.

No outside paper is allowed. If you need more scratch paper, ask one of the proctors.

Strategy hint: take a quick look over the whole exam before you start. If you see something that looks easy for you, go for it! It's good to get a few points in the bag right away.

Strategy hints for multiple choice:

- when you have determined that an option is not correct, mark it off so you don't have to check it again!
- even if you think you have found the right answer, look at the remaining answers to see if any of them are a better match.
- on calculation problems, show your work somewhere on the page. Even if you miss the problem, it certainly will be easier to see later where mistakes were made.

Looking at another student's work, intentionally or accidentally, will not be tolerated. Students who seem to have trouble keeping their eyes on their own papers will be moved to the front of the room. Students who cheat earn a failing grade.

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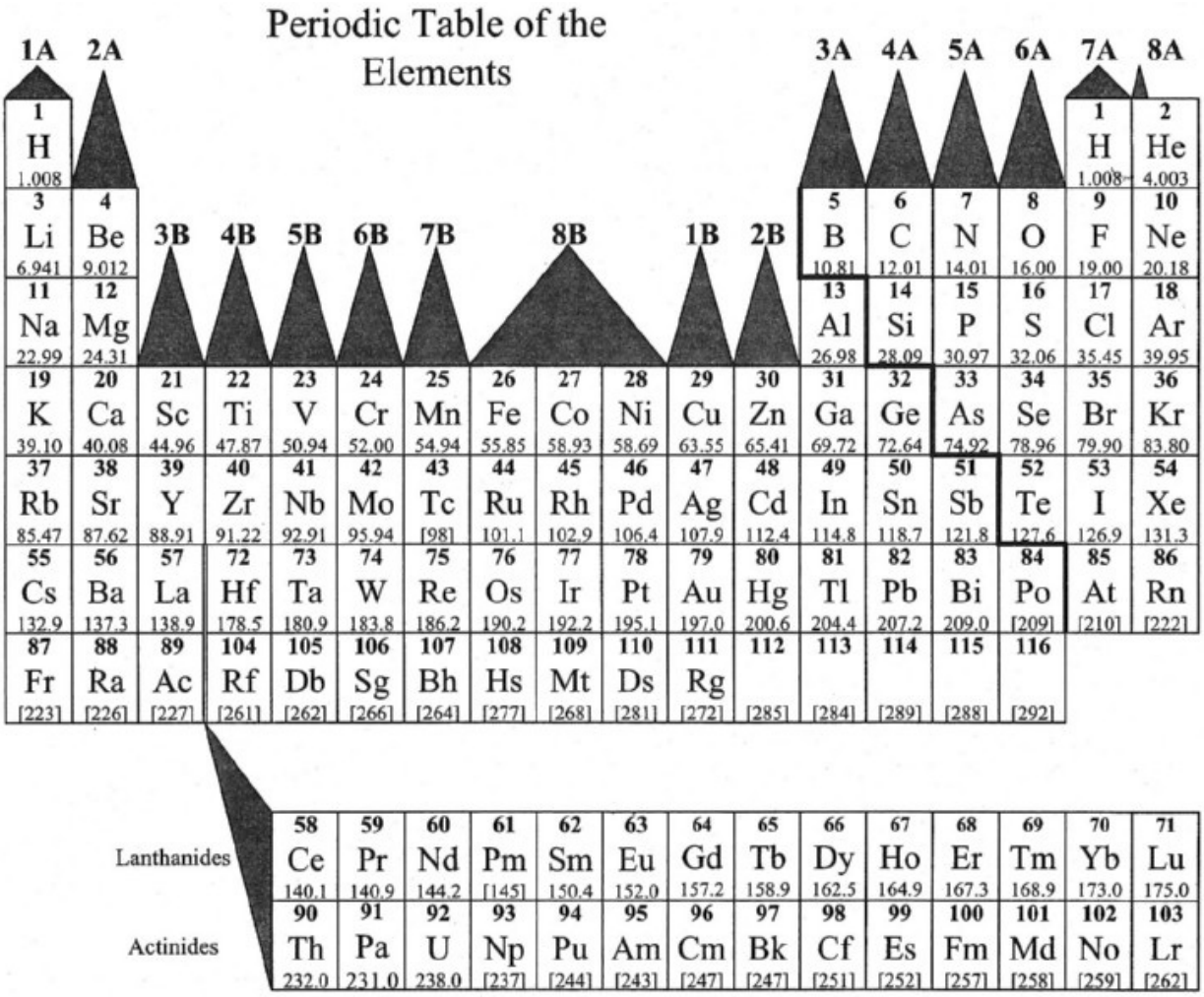

You may remove this page and use it as scratch paper and a cover sheet. If you need more scratch paper, you may get it from the proctor.

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Potentially useful information:

$C_1V_1 = C_2V_2$ 1% w/v = 1g/100 mL = 1 g/dL

1 ppm = 1 μg/mL 1 ppb = 1 ng/mL

6.022×10^{23}

Equivalents = moles x charge

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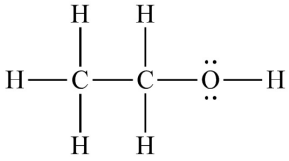
(MC score_____ FR score_____ Total raw_____ total %_____)

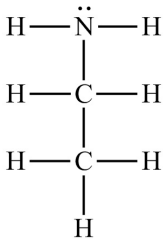
FREE-RESPONSE ANSWER SHEET: Write your answers in the spaces provided.

1. [4 pts] **Sketch a hydrogen bonding interaction of the molecule below with a molecule of water.**

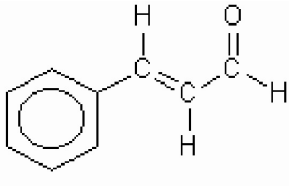


3. [3 pts]**In the space below, sketch the interaction of a **chloride ion** with a water molecule. Represent charges accurately.

2. [6 pts] In the molecule shown below, **circle all atoms that can participate in hydrogen bonding.**



4. [6 pts] The molecule shown below is a major flavor compound in cinnamon. Clearly **circle and label all functional groups** in this molecule.



5. In each space below, write and balance the equation for the reaction described. Include appropriate phase labels on all species. (Partial credit is available. At least write formulas and phase labels for all species.)

a. [8] **Nitric oxide reacts with elemental oxygen to produce nitrogen dioxide.**

reminder–phase labels?

b. [6] **Lead(II) nitrate dissociates in aqueous solution.**

reminder–phase labels?

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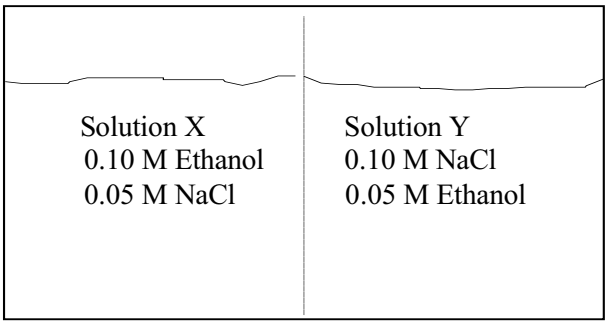
Multiple choice (problems in this section earn 1 point per correct answer.)

1 Mark A on the Scantron card. (This item is a form identifier and will not be scored.)

For items on this page, record whether each statement is A. TRUE or B. FALSE. [1 point each]

*In the osmosis apparatus shown, solution X and solution Y are separated by a membrane that is **permeable to molecular compounds and ions**. (Ethanol is CH_3CH_2OH.)*



Decide whether each of the following statements is
A. TRUE B. FALSE.

2 Osmosis will occur, with water flowing from Solution X to Solution Y.

3 Ethanol dialyzes from Solution Y into Solution X.

4 NaCl dialyzes from Solution X to Solution Y.

5 Over time, the volume of Solution X will increase.

6 Both solutions will conduct electricity.

Record whether each statement is A. TRUE or B. FALSE.

7 All ionic compounds are soluble in water.

8 When balancing chemical equations, it is common that some formulas must be altered to achieve balance.

9 Solids dissolve well in water, but gases do not.

10 When using the dilution equation $C_1 \times V_1 = C_2 \times V_2$, all volumes must be in L.

11 When more solvent is added to dilute a solution, the concentration may increase.

12 The designation “pure substances” includes compounds and elements.

13 When ionic compounds dissolve in water, they dissociate into ions.

14 The concentration of a solution will differ depending on the size of the sample taken.

15 Substances that dissociate to form ions in water are called electrolytes.

16 The warmer the solution, the greater the solubility of a gas solute.

17 A 50-ppm solution is more concentrated than a 50-ppb solution.

18 “Dilution” means adding more solute to a solution to change its concentration.

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Multiple Choice [3 points each]: Choose the **best** answer and mark the answer on the Scantron card.

19 Skip the rest of the spaces on this side of the card; turn your Scantron card over and start with #51.

51 The CO molecule has the Lewis structure shown at right. :C≡O:
(C has a nonstandard bonding arrangement in this molecule–use the structure given.) How many **lone pairs** are in the CO molecule?

A 1 B 2 C 4 D 6 E 12

52 How many **bonding electrons** are in the CO molecule?

A 2 B 3 C 4 D 6 E 10

53 In which of the following bonds would nitrogen have a partial positive (δ+) charge?

A NaN B CN C NN D NO
E none of these; nitrogen is never positive

54 Which bond is **nonpolar**?

A NaN B CN C NN D NO E more than one, or none

55 Which of the following represents a **physical** change, rather than a chemical reaction?

A $2H_2O\ (l) \rightarrow H_3O^+\ (aq) + OH^-\ (aq)$ B $H_2O\ (l) \rightarrow 2\ H\ (g) + O\ (g)$
C $2\ H_2\ (g) + O_2\ (g) \rightarrow 2\ H_2O\ (g)$ D $2\ H_2O\ (l) \rightarrow 2\ H_2\ (g) + O_2\ (g)$
E $H_2O\ (g) \rightarrow H_2O\ (l)$

56 You need to make 200 mL of 0.86% (w/v) sodium lactate in water. You have a bottle of 5% (w/v) sodium lactate solution, which you must dilute to the correct concentration. What volume of the 5% solution should you use?

A 0.029 mL B 34.4 mL C 100 mL D 291 mL E 860 mL

57 One of the following ionic compounds is **insoluble** in water. Which one is it?

A potassium hydroxide B iron(III) nitrate C sodium sulfide
D calcium chloride E aluminum carbonate

58 Which solution is isotonic with blood plasma (total solute concentration = 0.28 M)?

A 0.14 M ethanol, CH_3CH_2OH B 0.14 M sodium iodide
C 0.14 M magnesium chloride D more than one of these
E none of these

59 Which of the solutions in the previous problem would cause a cell to undergo hemolysis (burst)?

A 0.14 M ethanol, CH_3CH_2OH B 0.14 M sodium iodide
C 0.14 M magnesium chloride D more than one of these
E none of these

60 Which of the following is a reasonable mass for a single atom?

A 0.5 amu B 5 amu C 0.5 grams D 5 grams E more than one of these

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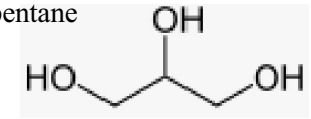
The next several questions refer to these five options. In this and the following sets, you may use an answer once, more than once, or not at all. Hint: draw the structures of 2-methylpentane and propene.

A glycerol (see structure) B 3-pentanol (see structure) C 2-methylpentane

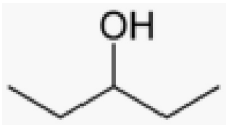
D propene E More than one of these, or none of these



A glycerol

61 Which substance has the strongest total attractions between its molecules?

62 Which substance is ionic?



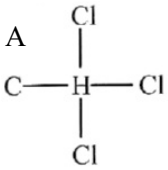
B 3-pentanol

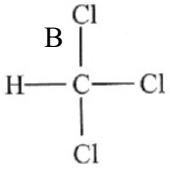
63 Which compound is expected to have the **lowest** boiling point?

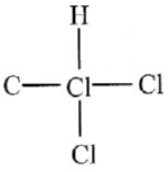
64 Which compound is expected to have the greatest solubility in water?

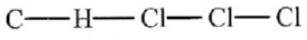
65 Which compound is a gas at room temperature?

66 Which of the following is a reasonable structure for the compound $CHCl_3$, based on the normal bonding requirements of the atoms involved?

A 

B 

C 

D 

E. more than one of these is reasonable.

67 Carbon tetrachloride is a **liquid** at room temperature. It was once commonly used in dry cleaning fabrics. Which of the following sets of values could apply to carbon tetrachloride?

	melting point	boiling point
A	–23 ºC	77 ºC
B	37 ºC	150ºC
C	77 ºC	0 ºC
D	–20 ºC	0 ºC
E	35 ºC	150ºC

68 Calcium chloride is a white, crystalline substance that melts at 772 ºC. Which statement correctly describes its high melting point?

A Melting the substance requires breaking covalent bonds between the calcium and chloride atoms.
B Melting the substance requires breaking ionic bonds to separate the calcium ions and chloride ions.
C Melting the substance requires getting water molecules between the atoms or ions.
D Melting the substance requires overcoming hydrogen bonds between the calcium chloride molecules.
E Melting the substance requires overcoming dispersion forces between the calcium chloride molecules.

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69 What types of attractive forces (if any) exist between the **oxygen and hydrogen atoms** in **a single water molecule**?

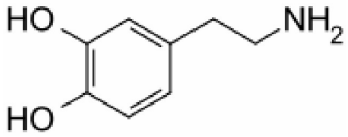
A ionic bonds B covalent bonds C dispersion forces
D hydrogen bonds E both dispersion forces and hydrogen bonds

70 What types of attractive forces (if any) exist between **two separate water molecules**?

A ionic bonds B covalent bonds C dispersion forces
D hydrogen bonds E both dispersion forces and hydrogen bonds

71 The structure of dopamine, an important neurotransmitter, is shown. How many **carbon atoms** are there in the dopamine molecule?

A 6 B 7 C 8 D 9 E more than 9



dopamine

72 Which statement is **true** for dopamine?

A Dopamine contains a carboxylic acid functional group.
B Dopamine is a hydrocarbon.
C Dopamine is an ionic compound.
D Dopamine is an organic compound.
E More than one of these statements is true.

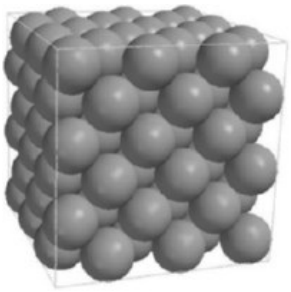
73 Which set of characteristics is TRUE for dopamine?

	Hydrogen bonding as pure substance?	Hydrogen bonding with water molecules?
A	no	no
B	yes	no
C	no	yes
D	yes	yes

74 The concentration of LDL in Fred's blood plasma is 173 mg/dL. What is the total mass, in **grams**, of LDL in 600 mL of his blood plasma?

A 0.288 g B 0.1625 g C 1.04 g D 28.3 g E 104 g

75 Which category is correct for the substance represented in the picture at right?



A element B ionic compound C molecular/covalent compound

D heterogeneous mixture E homogeneous mixture

76 Which phase label is correct for the substance represented?

A (s) B (l) C (g) D (aq)

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