

Name _____

Student number _____

Chem 115
Sample Examination #1

This exam consists of seven (7) pages, including this cover page. Be sure your copy is complete before beginning your work. If this test packet is defective, ask for another one.

A copy of the Periodic Table is attached to the end of this exam. You may remove it and use the back side as scratch paper. No work on scratch paper will be graded or collected.

The following information may be useful:

<u>Constants of nature</u>	<u>Conversions/Metric Prefixes</u>
<i>Avogadro's number</i> $N_A = 6.022 \times 10^{23}$ units = 1 mole of units	1 mL = 1 cm ³

DO NOT WRITE BELOW THIS LINE

Part I: Multiple-choice	Part II: Problems	Part III: Laboratory
Q1-18 _____ (max 54)	Problem 1 _____ (max 20) Problem 2 _____ (max 16) Extra credit _____ (max 4)	<i>omitted from this sample exam since laboratory is now a separate course</i>

Total (out of 100 points) =

*due to Part III omission,
no longer sums to 100*

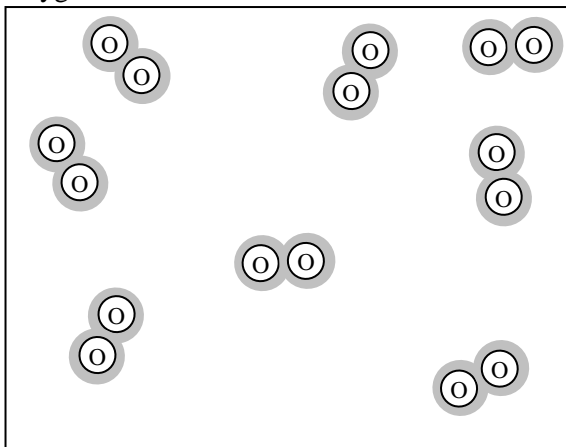
Disclaimer:

This is a copy of a typical Exam 1 given in Chem 115 during the academic year. Your test will be different. This test is being posted to give you a sense of the format, style, scope and level of a typical test on this material. This test may have questions on topics that may not be covered on your exam. Moreover, your test may have questions on topics not covered in this practice exam. Posting this test in no way limits the format, style, scope and level of the test that you will take. Do not limit your preparation to the material in this practice exam.

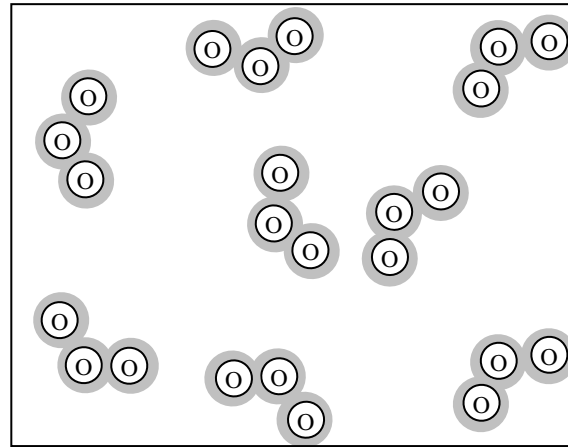
Part I. Multiple-Choice or Short Response

Each multiple-choice question is worth 3 points. This part of the exam is worth 54% of the total points.

Oxygen



Ozone



1. Oxygen and ozone (pictured above) are
- A) the same substance and the same element.
 - B) the same element, but two different substances.
 - C) the same substance, but two different elements.
 - D) two different substances and two different elements.

2. What is the molar mass (in $\text{g}\cdot\text{mol}^{-1}$) of anhydrous iron (III) sulfate, to the nearest whole number?

Atomic molar masses	
Fe	$55.8 \text{ g}\cdot\text{mol}^{-1}$
O	$16.0 \text{ g}\cdot\text{mol}^{-1}$
S	$32.1 \text{ g}\cdot\text{mol}^{-1}$

- A) 104 B) 152 C) 248 D) 336 E) 400
3. The species designated as ${}^{56}_{24}\text{X}$ is

- A) Fe B) Ge C) Ba D) Cr
4. Which pair of particles has the same number of electrons?

- A) F^- , Mg^{2+} C) Br^- , Se
- B) Ne, Ar D) Al^{3+} , P^{3-}

5. The ions present in solid silver chromate, Ag_2CrO_4 , are

- A) Ag^+ and CrO_4^{2-} C) Ag^+ and Cr^{6+} and O^{2-}
 B) Ag^{2+} and CrO_4^{4-} D) Ag^+ and Cr^{3+} and O^{2-}
-

6. Which represents an isotope of element “E”?



- A) ${}^{26}\text{Al}$ B) ${}^{27}\text{Si}$ C) ${}^{27}\text{Co}$ D) ${}^{25}\text{Mg}$
-

7. What is the correctly reported mass of water based on these data?

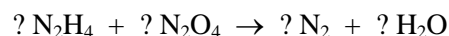
Mass of beaker and water	29.62 g
Mass of beaker only	28.3220 g

- A) 1.3 g B) 1.30 g C) 1.298 g D) 1.2980 g
-

8. Based on their positions in the periodic table, which is most likely to replace selenium, Se, in a biological system?

- A) Te B) Br C) As D) I
-

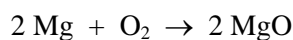
9. Balance the equation



How many moles of N_2 will be produced for every mole of N_2O_4 that reacts?

- A) one B) two C) three D) four
-

10. Which procedure can be used to demonstrate experimentally that the reaction



- A) Take a mass of 1.000 g of Mg ribbon, burn it in pure O_2 , and compare the mass of the product with the original mass of the Mg.
 B) Show that the sum of 2 atomic masses of Mg plus 1 molar mass of O_2 is equal to 2 molar masses of MgO.
 C) Determine the mass of a sealed flash-bulb containing magnesium and oxygen, ignite (light on fire) the mixture, cool, and compare the final mass of bulb plus contents with the original mass of the bulb plus contents.
 D) Burn 1.000 g of Mg ribbon in a tall beaker filled with air, scrape out all of the MgO formed, and compare with the original mass of the Mg.

Use the periodic table below for questions 11-12.

	Main Groups							
	1	2	3	4	5	6	7	8
First period								${}^2\text{He}$
Second period							${}^9\text{F}$	
Third period	${}_{19}\text{K}$	E		M		Q	T	${}_{36}\text{Kr}$
Fourth period	X	Y						

11. Judging from its position in the periodic table, what type of element is element X?

- A) a metal
 B) a nonmetal
 C) an amphoteric element
 D) an inert gas
 E) unpredictable in character

12. How many electrons will an atom of element Q need to gain to form a stable ion?

- A) 1
 B) 2
 C) 3
 D) 4
 E) 7

13. If 1.0 g samples of each compound were dehydrated, which sample would lose the greatest mass of water?

Molar masses	
$\text{LiCl} \cdot \text{H}_2\text{O}$	$60. \text{ g} \cdot \text{mol}^{-1}$
$\text{MgSO}_4 \cdot \text{H}_2\text{O}$	$138. \text{ g} \cdot \text{mol}^{-1}$
$\text{FeSO}_4 \cdot \text{H}_2\text{O}$	$170. \text{ g} \cdot \text{mol}^{-1}$
$\text{SrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	$194. \text{ g} \cdot \text{mol}^{-1}$

- A) $\text{LiCl} \cdot \text{H}_2\text{O}$
 B) $\text{MgSO}_4 \cdot \text{H}_2\text{O}$
 C) $\text{FeSO}_4 \cdot \text{H}_2\text{O}$
 D) $\text{SrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$

14. A compound containing only carbon and hydrogen has this composition: C = 80% and H = 20% by mass. What is the simplest formula of the compound?

Atomic molar masses	
C	$12.0 \text{ g} \cdot \text{mol}^{-1}$
H	$1.0 \text{ g} \cdot \text{mol}^{-1}$

- A) CH_4
 B) CH_3
 C) C_2H_6
 D) C_3H_8
 E) C_4H_{10}

15. What is the percentage of nitrogen by mass in $(\text{NH}_4)_3\text{PO}_4$?

Atomic molar masses	
H	$1.0 \text{ g}\cdot\text{mol}^{-1}$
N	$14.0 \text{ g}\cdot\text{mol}^{-1}$
O	$16.0 \text{ g}\cdot\text{mol}^{-1}$
P	$31.0 \text{ g}\cdot\text{mol}^{-1}$

A) $(14/62) \times 100\%$

C) $(14/113) \times 100\%$

B) $(21/80.) \times 100\%$

D) $(42/149) \times 100\%$

16. The element X occurs naturally to the extent of 20.0% ^{12}X and 80.0% ^{13}X . The atomic mass of X is nearest to

A) 12.2

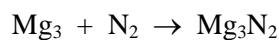
B) 12.5

C) 12.6

D) 12.8

E) 13.0

17. Why is the following equation incorrect?



A) Some of the subscripts are incorrectly used.

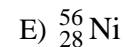
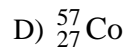
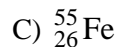
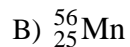
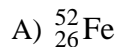
B) The equation is not balanced.

C) The valence (charge) of the nitride ion is incorrect.

D) The valence (charge) of the magnesium ion is incorrect.

E) The coefficient of N_2 is incorrect.

18. Which of these atoms has the greatest number of neutrons in its nucleus?



Part II. Problems

Points possible per question and per part are indicated in curly braces {...}.

1. {20 pts} Nomenclature: correct spelling and correct symbols matter.

a) Name the following compounds. {10 pts}

NaCl _____

HCl _____

HClO₂ _____

CH₄ _____

Ni(NO₂)₂ _____

b) Provide chemical formulas for the following compounds. {10 pts}

calcium fluoride _____

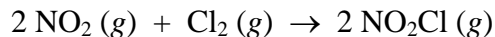
dinitrogen tetroxide _____

ammonium permanganate _____

hypobromous acid _____

iron (II) sulfate _____

2. {16 pts} Consider the following reaction:



Molar masses	
NO ₂	46.01 g·mol ⁻¹
Cl ₂	70.90 g·mol ⁻¹
NO ₂ Cl	81.46 g·mol ⁻¹

Notes:

- The parts of this problem are independent.
- You must show your work to receive credit. Partially correct work will receive partial credit. A correct answer with no work shown will receive no credit.

a) How many molecules of Cl₂ are in 1.39 g of Cl₂? {6 pts}

b) If 1.39 g of Cl₂ reacts with sufficient NO₂ for the reaction to go to completion, how many grams of NO₂Cl will be produced? {10 pts}

Extra credit on this problem: If 2.10 g of NO₂ and 2.00 g of Cl₂ were placed in a reaction vessel and this reaction occurred, which one would be the limiting reagent?

{up to 4 pts extra credit, work must be shown to receive extra credit, use back side of this page if the space below is insufficient}