

Chem 205: GENERAL CHEMISTRY I MIDTERM EXAMINATION

PLEASE READ THIS PAGE WHILE WAITING TO START

INSTRUCTIONS: This test paper includes 8 pages, including a periodic table; please check that your paper is complete. You may detach the periodic table if you wish. For Part A, you do not need to show calculations; for Part C, you must show your calculations to receive full marks. Please write clearly and organize your work logically. Non-programmable calculators are permitted; book-style translation dictionaries are allowed, but electronic dictionaries and cell phones are not allowed.

Duration: 70 minutes - spend at least half that time on Parts B & C. **GOOD LUCK!**

LAST NAME: _____ FIRST NAME: _____

STUDENT NUMBER: _____

Mark breakdown:

Page 2. / 14

Page 3. / 10

Page 4. / 6

Page 5. / 11

Page 6. / 10

TOTAL: / 50 (MAXIMUM MARK = 51)

PERCENT: %

EARNED towards FINAL GRADE: / 20

PART A: ONLY YOUR FINAL ANSWER WILL BE MARKED

1. (___ / 3 marks) Identify the following statements as true or false. (*Circle T or F.*)

T / F The last digit in any measurement is estimated, so it is uncertain and not significant.

T / F A sample containing 1.2×10^{15} atoms could be described as 2.0 nanomoles of atoms.

T / F When sugar melts, the arrangement and composition of the sugar molecules change.

2. (___ / 3 marks) Fill in the blanks:

a) Number of neutrons in ^{197}Au (*i.e.*, gold-197) _____

b) Formula of a common strong base _____

c) Products of the decomposition of H_2CO_3 _____

3. (___ / 4 marks) Write each compound's formula or name, **and** circle *ionic* or *molecular* to describe each:

a) potassium phosphate _____ ionic / molecular ?

b) carbon tetrachloride _____ ionic / molecular ?

c) $\text{Cr}_2(\text{SO}_4)_3$ _____ ionic / molecular ?

d) N_2O _____ ionic / molecular ?

4. (___ / 2 marks) Which of the following groups of elements is so reactive towards water and/or oxygen that they are never found in elemental form in nature?

- a) group 14 (4A)
- b) group 15 (5A): pnictogens
- c) group 16 (6A): chalcogens
- d) alkali metals
- e) transition metals

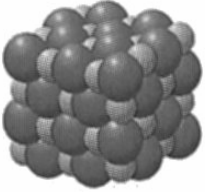
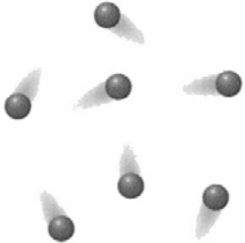
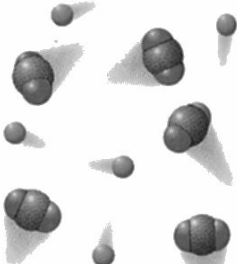
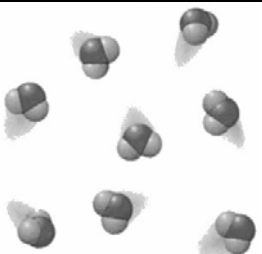
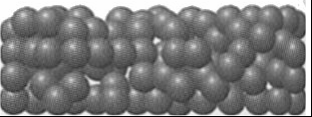
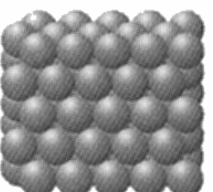
5. (___ / 2 marks) All of the following statements are true EXCEPT

- a) for any neutral element, the number of protons and electrons are equal.
- b) electrons and protons have equal mass, but opposite charges.
- c) the mass number is the sum of the number of protons and neutrons.
- d) the atomic number equals the number of protons.
- e) isotopes of an element have identical atomic numbers.

- # 6. (___ / 2 marks)** You are given an unknown white solid that may be either $\text{Pb}(\text{NO}_3)_2$ or $\text{Zn}(\text{NO}_3)_2$. If you prepare an aqueous solution of the unknown and test it by adding the various reagents listed below, which reagent will allow you to distinguish between the two compounds?
- KBr
 - HNO_3
 - $\text{CH}_3\text{CO}_2\text{H}$
 - NH_4ClO_4
 - LiNO_3
- # 7. (___ / 2 marks)** What is the net ionic equation for the reaction of aqueous lithium hydroxide and aqueous nitric acid?
- $\text{H}^+(\text{aq}) + \text{LiOH}(\text{aq}) \rightarrow \text{H}_2\text{O}(\ell) + \text{Li}^+(\text{aq})$
 - $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\ell)$
 - $\text{HNO}_3(\text{aq}) + \text{LiOH}(\text{aq}) \rightarrow \text{H}_2\text{O}(\ell) + \text{LiNO}_3(\text{aq})$
 - $\text{Li}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{LiNO}_3(\text{aq})$
 - $\text{LiOH}(\text{aq}) + \text{H}_2\text{O}(\ell) \rightarrow \text{H}^+(\text{aq}) + \text{Li}(\text{OH})_2(\text{s})$
- # 8. (___ / 2 marks)** Which one of the following chemical equations is an acid-base reaction?
- $2 \text{HCl}(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{H}_2(\text{g}) + \text{ZnCl}_2(\text{aq})$
 - $\text{HCl}(\text{aq}) + \text{NH}_3(\text{aq}) \rightarrow \text{NH}_4\text{Cl}(\text{aq})$
 - $\text{HCl}(\text{aq}) + \text{AgNO}_3(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{HNO}_3(\text{aq})$
 - $\text{Ba}(\text{OH})_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2 \text{NaOH}(\text{aq})$
 - $2 \text{NaOH}(\text{aq}) + \text{CuCl}_2(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s}) + 2 \text{NaCl}(\text{aq})$
- # 9. (___ / 2 marks)** From the results of his gold foil experiment, Ernest Rutherford concluded that
- electrons have a charge of $-1.602 \times 10^{-19} \text{ C}$.
 - atoms contain equal numbers of protons and electrons.
 - uranium ores emit a form of radiation that affect photographic plates.
 - alpha particles are helium nuclei.
 - atoms are composed of a small, dense nucleus surrounded by a cloud of electrons.
- # 10. (___ / 2 marks)** The density of lithium is 0.546 g/cm^3 . What volume is occupied by 1.96×10^{23} Li atoms?
- 0.0859 cm^3
 - 0.596 cm^3
 - 4.14 cm^3
 - 5.63 cm^3
 - 39.0 cm^3

PART B: Check the right boxes...

11. (/ 6 marks) In the table, check (✓) ALL boxes that apply to the pictures in the boxes to the left.
(Note: marks will be deducted for wrong choices.)

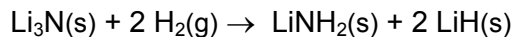
	Solid	Liquid	Gas	Element	Ionic Compound	Covalent Compound	Mixture
							
							
							
							
							
							

PART C: Written answers & problems (detailed calculations & comments)

12. (/ 4 marks) Consider the following compounds: C_2H_5OH , C_3H_8 , and $CH_3CH_2COCH_3$. If 1.5 mol of each compound is burned with excess oxygen, which one will produce the largest number of moles of H_2O ? Which will produce the least? Explain, and include relevant chemical equations.

13. (/ 7 marks) A compound with formula $KBrO_x$ is analyzed and found to contain 52.92% Br by mass. Determine the value of x , and write the complete formula and name for this compound.

14. (___ / 10 marks) Lithium nitride is used to store hydrogen in a solid form via the following reaction:



a) (1 mark) What type of reaction is this? (circle all that apply)

acid-base gas-forming oxidation-reduction precipitation none of these

b) (2 marks) Which reactants (if any) can be described by each term below? How you can tell (be specific!)?

Acid:

Base:

Oxidizing agent:

Reducing agent:

c) (7 marks) The reaction can proceed in reverse if the solid products are heated, which releases the stored hydrogen. If the reverse reaction occurs in 92% yield, how many grams of H_2 would be released by heating a mixture of 33.6 g of $\text{LiNH}_2\text{(s)}$ and 12.3 g of LiH(s) ?

POTENTIALLY USEFUL INFORMATIONAtomic mass unit: $1 \text{ amu} = 1.66054 \times 10^{-27} \text{ kg}$ Avogadro's number: $N = 6.022 \times 10^{23} \text{ mol}^{-1}$ **EXTRA SPACE FOR ROUGH WORK ONLY – WILL NOT BE MARKED**