Chemistry 1A Fall 1999

Midterm Exam I, version C
September 14, 1999

(Closed book, 75 minutes, 110 points)

Name: _____ Section Number: _____

SID: _____ T.A. Name: _____

Identification Sticker

Exam information, exam directions, and useful hints to maximize your score:

- Write your name on all 6 pages.
- There are two parts to this exam: 1) multiple choice and 2) short answer problems.
  For the multiple choice problems, fill in the Scantron™ form AND circle the answer on your exam.
- Answer the questions you know how to do first, then work on the questions you skipped.
- Show all work for which you want credit and do not forget to include units!
- You may use the back side of the exam pages to show your work and/or for scratch paper.

Unit Prefixes

milli, m (x 10^{-3})	micro, μ (x 10^{-6})	nano, n (x 10^{-9})
kilo, k (x 10^{3})	mega, M (x 10^{6})	giga, G (x 10^{9})

Some possibly useful information:

$$E_{photon} = h\upsilon = \frac{h\,c}{\lambda} \qquad \lambda_{particle} = \frac{h}{p}$$

$$E_{kin}(e^-) = h\upsilon - \Phi = h\upsilon - h\upsilon_o$$

υ ← Violet Blue Green Yellow Orange Red → λ

(Do not write in this box, it's for official use only)

Page	Points
2–3	/ 40
4	/ 25
5	/ 30
6	/ 15
all	/ 110

 Name:_____

Part 1: Multiple Choice.
(4 pts each, 40 pts total)

Instructions: Bubble in the correct answer on your Scantron™ form AND circle the answer on your exam. Each question has one correct answer.

1.) The answer to question 1 is **C**. Bubble in **C** on your Scantron™ form.

2.) Which ionic compound is comprised of isoelectronic ions?

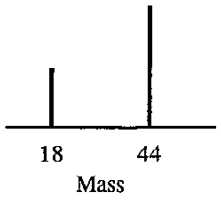
A.) NaBr B.) KI C.) BeF_2 D.) $MgBr_2$ E.) $CaCl_2$

3.) Which compound has the highest percentage of chlorine by *mass*?

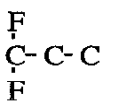
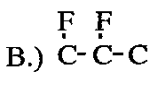
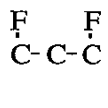
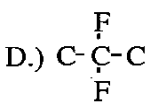
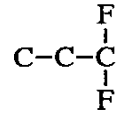
A.) HCl B.) KCl C.) $MgCl_2$ D.) $BaCl_2$ E.) $AlCl_3$

4.) What is the empirical formula of a hydrocarbon whose combustion products give the mass spectrum shown on the right?

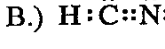
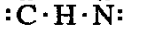
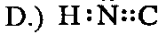
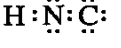
A.) C_4H B.) C_2H C.) CH D.) CH_2 E.) CH_4



5.) Which difluoropropane ($C_3H_6F_2$) molecule is chiral? (note: the H atoms are not shown)

A.)  B.)  C.)  D.)  E.) 

6.) Which is the correct Lewis structure of hydrogen cyanide?

A.) H:C:::N: B.)  C.)  D.)  E.) 

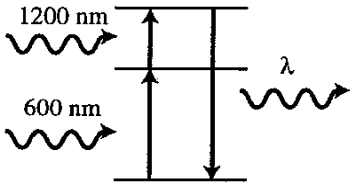
 Name:_____

7.) Which molecule does *not* have an electric dipole moment?

A.) CO B.) NH_3 C.) SiO_2 D.) CH_2F_2 E.) ICl_3

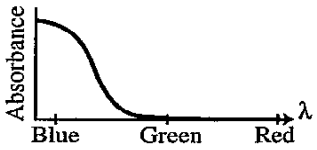
8.) Two photons are absorbed and one is emitted as shown. What is the wavelength of the emitted light (nm)?

A.) 200 B.) 400 C.) 600 D.) 800 E.) 1800

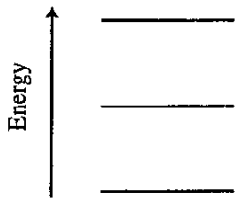


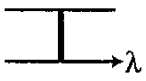
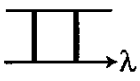
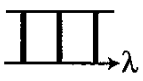
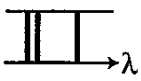
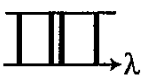
9.) Viewed through a filter with the absorption spectrum shown, a yellow solution will appear:

A.) Black B.) Blue C.) Green D.) Yellow E.) Red



10.) Which emission spectrum corresponds to the energy level diagram shown?



A.)  B.)  C.)  D.)  E.) 

11.) The nucleus of which of the following exotic isotopes contains the most neutrons?

A.) $^{38}_{17}Cl$ B.) $^{40}_{18}Ar$ C.) $^{40}_{19}K$ D.) $^{40}_{20}Ca$ E.) $^{38}_{21}Sc$

 Name:_____

Part 2: Short Answer Problems (70 pts total)

Instructions: Enter answers in the boxes provided. Show your work. **Where requested, write explanations in fifteen words or less.**

(25 pts)

1.) Acetaldehyde molecules contain carbon : hydrogen : oxygen in the mass ratio 6 : 1 : 4.

a) What is the mole percent of the elements in acetaldehyde?

C:	
H:	
O:	
Total:	

b) What is the empirical formula of acetaldehyde?

Answer:

c) The molar mass of acetaldehyde is 44 g/mol. What is the molecular formula? Explain.

Explanation:

Answer:

d) Draw the Lewis structure for acetaldehyde.
(note: the molecule has a C–C single bond)

Structure:

e) What is the approximate H–C–O bond angle in acetaldehyde? Explain.

Explanation:

Answer:

 Name:_____

(30 pts)

2.) Consider the following reactions that you encountered in the laboratory:

I) ____ $C_6H_{12}O_{6\,(s)}$ + ____ $O_{2\,(g)}$ ⟶ ____ $H_2O_{\,(l)}$ + ____ $CO_{2\,(g)}$

II) ____ $NaN_{3\,(s)}$ ⟶ ____ $Na_{\,(s)}$ + ____ $N_{2\,(g)}$

a) Balance the reactions by writing the coefficients in the spaces provided above.

b) One mole of each of the reactants in reaction I is placed in a baggie. Which is the limiting reactant? Explain.

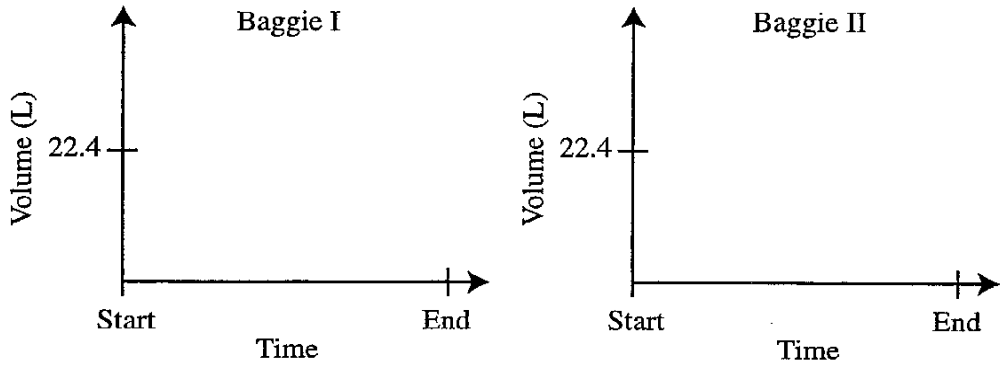
Explanation:

Answer:

c) What mass of water is produced by the reaction in part b)?

Answer:

d) Separate baggies are prepared for reactions I and II with 1 mole of each of the reactants. Plot the baggie volume versus time for each of the reactions. (note: you may neglect the volume of the solids and liquids and assume that a mole of gas occupies a volume of 22.4 L)



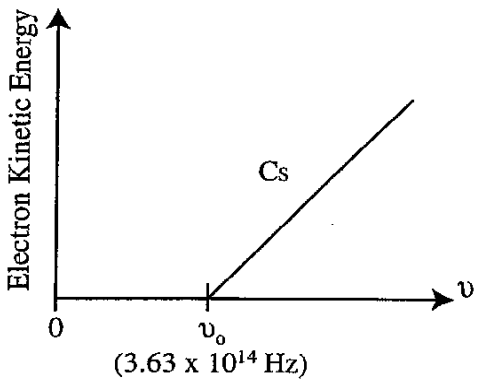
e) Explain why reaction II is better suited than reaction I for automobile airbags.

Explanation:

 Name:_____

(15 pts)

3.) Consider the following plot depicting the photoelectric effect for Cs metal:



a) Will yellow light (600 nm) eject electrons from Cs? Explain.

Explanation:

Answer:

b) Draw a line on the plot above for Mg metal which has a work function (Φ) equal to two times the work function of Cs.

c) If 1.00×10^{15} Hz light is used, electrons from which metal will have a longer de Broglie wavelength, Mg or Cs?

Explanation:

Answer: