Chemistry 1A Fall 2000

Midterm Exam I, version B
September 19, 2000

(Closed book, 75 minutes, 105 points)

Name: _____ Section Number: _____

SID: _____ T.A. Name: _____

Identification Sticker

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

- Write your name on all six pages.
- There are two parts to the 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 on the short answer problems for which you want credit and do not forget to include units!
- You may use the back side of the exam for scratch paper.

Unit Prefixes

milli, m (x 10^{-3})	micro, ì (x 10^{-6})	nano, n (x 10^{-9})
kilo, k (x 10^{3})	mega, M (x10^{6})	giga, G (x 10^{9})

Some possibly useful information:

$E_{photon} = hí = hc/ë$

$E_{kin}\ (e^-) = hí - Ö = hí - hí_o = mv^2/2$

$ë_{de\ Broglie} = h/p = h/mv$

(Do not write in this box; it is for official use only.)

Page	Points
2-4	/ 45
5	/ 30
6	/ 30
Total	/ 105

 Name:_____

Part 1: Multiple Choice.
(3 pts each, 45 pts total)
Instructions: Bubble in the correct answer on your Scantron sheet AND circle the answer on your exam. Each question has one correct answer.

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

2.) Which is required in the greatest quantity (mass) in order to produce 1 gram of Br_2?

A.) HBr B.) NaBr C.) KBr D.) $MgBr_2$ E.) $CaBr_2$

3.) Which has $ë_{\text{de Broglie}}$ equal to twice that of ^{16}O at the same speed?

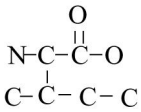
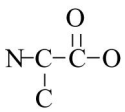
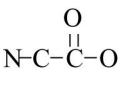
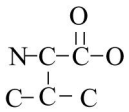
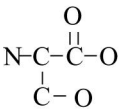
A.) ^{4}He B.) ^{8}B C.) ^{20}Ne D.) ^{24}Mg E.) ^{32}S

4.) Including the structure below, how many structural isomers of propanol exist?

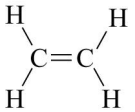
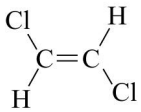
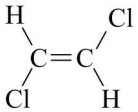
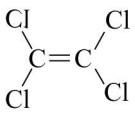
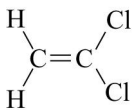
$$CH_3-CH_2-CH_2-OH$$

A.) 0 B.) 1 C.) 2 D.) 3 E.) 4

5.) Which of the following amino acids is *not* chiral? (note: the H atoms are not shown)

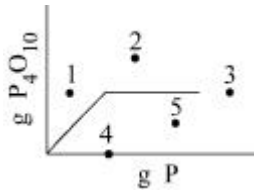
A.)  B.)  C.)  D.)  E.) 

6.) Which of the following molcules does have an electric dipole moment?

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

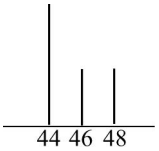
 Name:_____

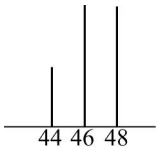
7.) Shown is the graph depicting the quantity of P_4O_{10} accumulated in the oxidation of P as a function of added P for a fixed amount of O_2. Through which point would the graph pass for a similar reaction with access to half the amount of O_2?

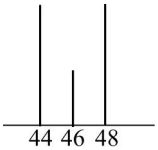


A.) 1 B.) 2 C.) 3 D.) 4 E.) 5

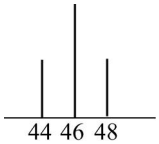
8.) A mixture of one-third ^{12}C, one-third ^{16}O, and one-third ^{18}O reacts to form pure CO_2. Which is the correct mass spectrum of the CO_2?

A.) 

B.) 

C.) 

D.) 

E.) 

9.) How many grams of $CaCO_3$ are formed from the reaction of 56 g of CaO and 56 g of CO_2?

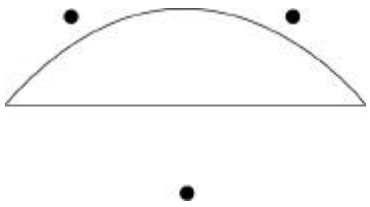
A.) 44 B.) 56 C.) 100 D.) 112 E.) 128

10.) For which of the following are all ions isoelectronic with Ar?

A.) NaCl B.) $MgCl_2$ C.) KCl D.) $CaBr_2$ E.) NaBr

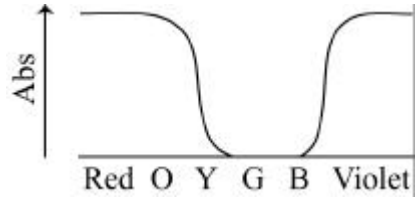
11.) Shown is the standing wave electron wave function for n=1. For which n will the wave function pass through all three points?

A.) 0 B.) 1 C.) 2 D.) 3 E.) 4



 Name:_____

12.) The absorption spectrum of a given compound is shown below. What color does it appear under illumination with green light?



A.) black B.) red C.) green D.) blue E.) white

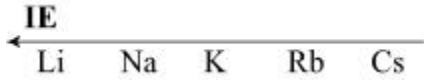
13.) Consider the electrolysis of 10 g of liquid water into hydrogen and oxygen gas. Approximately what volume of gas will be formed?

A.) ~ 1 m^3 B.) ~ 1 L C.) ~ 10 mL D.) ~ 10 L E.) ~ 1 kL

14.) Which of the following has a linear molecular structure?

A.) NH_2^- B.) ICl_2^- C.) IF_2^+ D.) H_2S E.) SO_2

15.) Ionization energy (IE) is the energy required to remove an electron from an atom. For which pair X + Y below will transfer of an electron from X to Y occur at the longest distance to form ions X^+ and Y^-?



A.) Li + Br B.) Na + Br C.) K + Br D.) Rb + Br E.) Cs + Br

 Name:_____

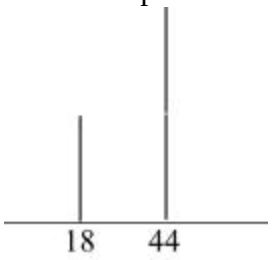
Part 2: Short Answer Problems (60 pts total)

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

(30 pts)

1.) A compound containing only carbon and hydrogen is combusted with oxygen.

a) Shown is a mass spectrum of the combustion products. Identify the products.



Product 1:	Product 2:

b) Based on the ratio of peak heights in the mass spectrum, determine the empirical formula of the unknown.

Answer:

c) The molecular mass of the unknown is 26 g/mol. What is its molecular formula?

Answer:

d) Draw the Lewis electron dot structure for the unknown.

Structure:

e) Which is true for the H–C–C bond angle (θ) in the unknown? Circle the appropriate answer and explain.

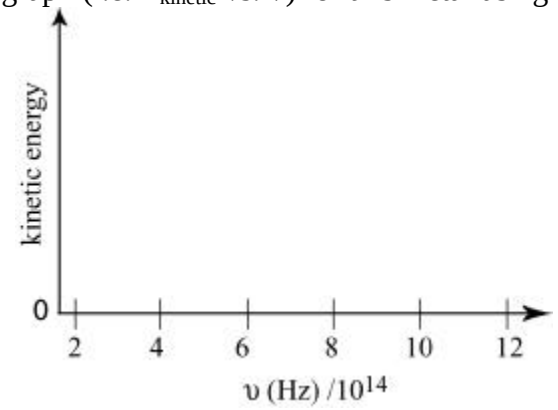
Explanation:

 Name:_____

(30 pts)

2.) The minimum amount of energy a photon needs to eject an electron from a metal M, occurs in the infrared at λ = 800nm.

a) Sketch the photoelectric graph (i.e. $E_{kinetic}$ vs. ν) for this metal using the given axes.



b) What is the energy of an incident blue photon with λ = 400nm?

Answer:

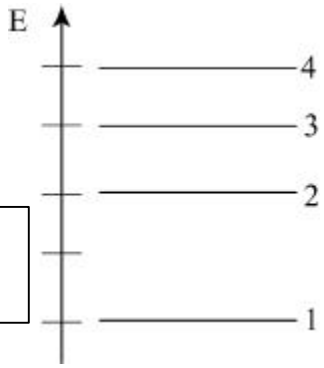
c) What is the kinetic energy of an electron ejected from M by the photon in part b)?

Answer:

d) Calculate the de Broglie wavelength for the electron ejected in part c).

Answer:

e) 800 nm light corresponds to transition 3→1 in the energy level diagram shown below. What λ corresponds to the 4→1 transition?



Answer: