

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 **A**. Bubble in **A** on your Scantron™ form.

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

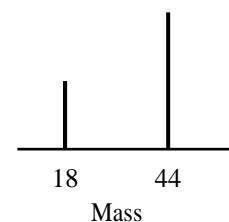
- A.) NaBr B.) KI C.) BeF₂ D.) MgBr₂ E.) CaCl₂

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

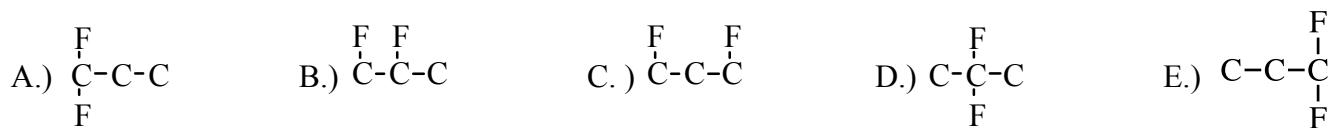
- A.) HCl B.) KCl C.) MgCl₂ D.) BaCl₂ E.) AlCl₃

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

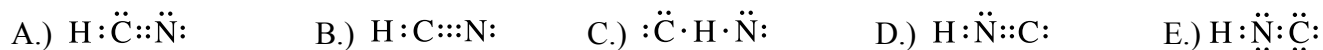
- A.) C₄H B.) C₂H C.) CH D.) CH₂ E.) CH₄



5.) Which difluoropropane (C₃H₆F₂) molecule is chiral? (note: the H atoms are not shown)



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

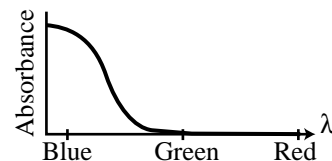


7.) Which molecule does not have an electric dipole moment?

- A.) CO B.) NH₃ C.) SiO₂ D.) CH₂F₂ E.) ICl₃

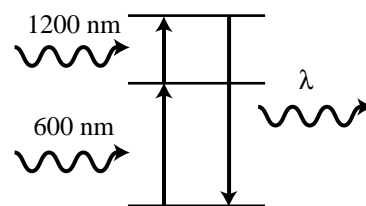
8.) Viewed through a filter with the absorption spectrum shown, a yellow solution will appear:

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

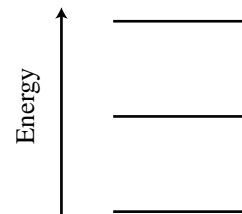


9.) Two photons are absorbed and one is emitted as shown. What is the wavelength of the emitted light (nm)?

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



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.) ³⁸₁₇Cl B.) ⁴⁰₁₈Ar C.) ⁴⁰₁₉K D.) ⁴⁰₂₀Ca E.) ³⁸₂₁Sc

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:

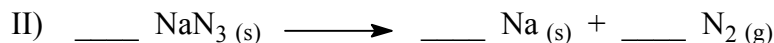
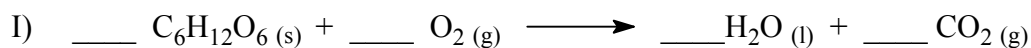
e) What is the approximate H–C–O bond angle in acetaldehyde? Explain.

Explanation:

Answer:

(30 pts)

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



- 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.

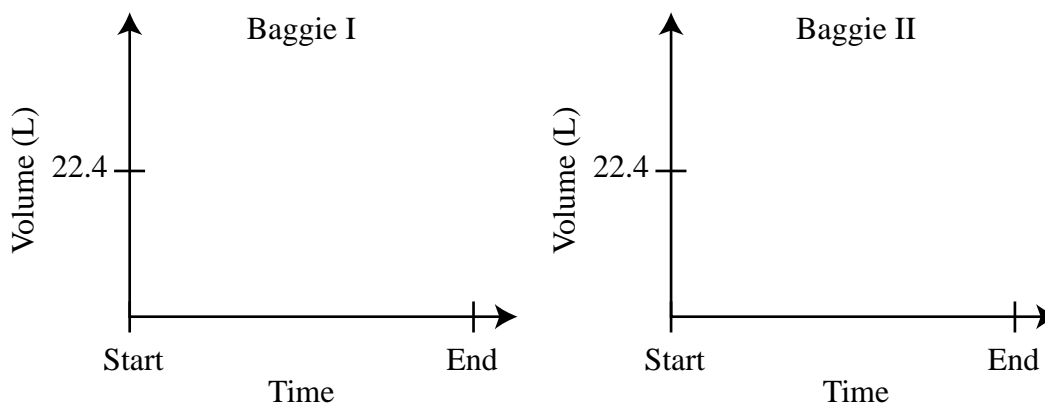
Explanation:

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)

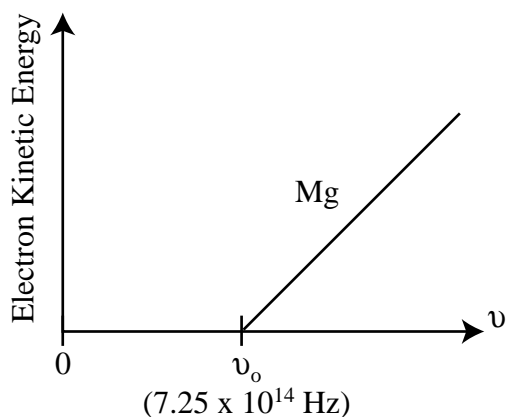


- e) Explain why reaction II is better suited than reaction I for automobile airbags.

Explanation:

(15 pts)

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



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

Explanation:

Answer:

b) Draw a line on the plot above for Cs metal which has a work function (Φ) equal to one half of the work function of Mg.c) If $1.00 \times 10^{15} \text{ Hz}$ light is used, electrons from which metal will have a longer de Broglie wavelength, Mg or Cs?

Explanation:

Answer: