Chemistry 1A **Midterm Exam 1** **September 17, 1996**
Page 1 of 7. **(Closed Book, 60 minutes, 75 points)** **Professor Pines**

Version B

Name:_____ **TA:**_____

SID:_____ **Section:**_____

Identification Sticker

Whose picture is this (circle one), and what is his connection to Chemistry 1A?

Boyle Avogadro Bach Neumark Boltzmann

Test-taking strategy: PLEASE READ THIS FIRST!
Write your name on all 7 pages. This test consists of two parts: multiple choice (**answers to be circled *and* entered on the Scantron sheet**) and short answer. In order to maximize your score on the exam:

- Do the questions you know how to do first.
- Then, go back and spend more time on the questions you find more challenging.
- Budget your time carefully -- don't spend too much time on one problem.
- Show all work for which you want credit and don't forget to include units.
- **The tear-out back page has a periodic table as well as some data and useful equations.**

Page	Points
2 - 3	
4	
5	
6	
Total:	

 Name: _____

Section 1: Multiple Choice. 12 questions, 3 points each.

Instructions: For the following questions, circle the answer on the exam sheet **and** bubble in the correct answer on your Scantron sheet. **Unless you are specifically told that there might be more than one answer to a problem, assume that only one answer is correct. No credit will be awarded for partially-correct answers.**

1.) You are taking test version **B**. Please fill in bubble "**B**" on your Scantron sheet.

2.) Which of the following must be the same before and after a **chemical** reaction? Mark **all** that apply.

A) The total number of molecules.
B) The total number of moles.
C) The total mass.
D) The total pressure.
E) The total number of atoms (including those in molecules).

3.) Which of the following contains the most *molecules*?

A) 5.0 g CN **B)** 5.0 g O_2 **C)** 5.0 g BF_3 **D)** 5.0 g LiH **E)** 5.0 g Ar

4.) 2.50 g of a gaseous hydrocarbon occupies 3.0 L at a temperature of 800 K and a pressure of 2.1 atm. What is the molecular formula of the hydrocarbon? Assume ideal gas behavior.

A) C_2H_2 **B)** CH_4 **C)** C_6H_6 **D)** C_4H_{12} **E)** C_2H_6

5.) Two gases, neon and argon, are placed in two containers at the same temperature. Both gases occupy the same volume and are at the same pressure. Which of the following are true? Mark **all** that apply.

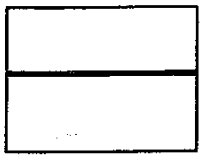
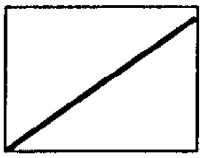
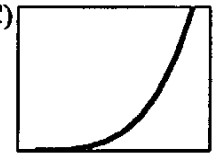
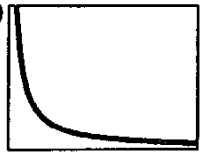
A) Both gases have the same molar mass.
B) The distribution of molecular speeds is broader for Ar.
C) The numbers of the moles of the two gases are the same.
D) The average atomic kinetic energies of the two gases are different.
E) None of the above.

6.) Which of the following compounds exhibit covalent bonding? Mark **all** that apply.

A) Cl_2 **B)** CO_2 **C)** CH_4 **D)** RbCl **E)** $MgBr_2$

 Name: _____

7-10. In the next four problems, choose which of the following five graphs best describes the behaviors listed below. Assume ideal gases for the first three problems (7-9).

A)  B)  C)  D)  E) 

7.) The universal gas constant R as a function of n.

8.) Compressibility (squeezability) as a function of P.

9.) Kinetic energy as a function of T.

10.) Vapor pressure as a function of T.

11.) At 300 K, argon atoms travel with a rms speed of 433 m/s. Which of the following gases has the same rms speed at twice the temperature?

A) H_2 **B)** C_6H_8 **C)** Ne **D)** Br_2 **E)** N_2

12.) At what temperature is °C equal to °F (see equation on last page)?

A) -273 **B)** -40 **C)** 0 **D)** 100 **E)** 212

13.) When diving, for every 10 meters down from the surface (at 1 atm) the pressure increases by 1 atm. Which ascent (in meters) is *least* dangerous for a diver?

A) 20 --> 10 **B)** 70 --> 50 **C)** 110 --> 10 **D)** 50 --> 40 **E)** 40 --> 0

 Name: _____

Section 2: Short Answer. 9 questions.

1.) (6 points) In lecture, a balloon full of H_2 and O_2 was ignited to form water vapor. Suppose the reaction were carried out in a rigid, 3 L vessel that is not damaged by the explosion. Assume that H_2, O_2 and H_2O are ideal gases and the temperature is constant.

a.) If the vessel initially contained 0.60 atm of H_2 and 0.40 atm of O_2, what would be the final pressure after the reaction? Show your work.

P:

b.) If the vessel initially contained 0.70 atm of H_2 and 0.30 atm of O_2, what would be the final pressure after the reaction? Show your work.

P:

2.) (5 points) In the airbag experiment, you simulated an automobile airbag using 6M acetic acid and baking soda to inflate a plastic bag. Consider the errors in the experiment where the following problems exist:

a.) 3% of the mass of baking soda used was due to moisture from the air.

This is a **systematic / random** (circle one) error.

It would affect the **accuracy / precision** (circle one) of the results.

State in **15 words or less** how your results would be affected.

b.) The pipettes used to measure the amounts of acetic acid to be used were poorly manufactured and measured within ±5% of the marked volume.

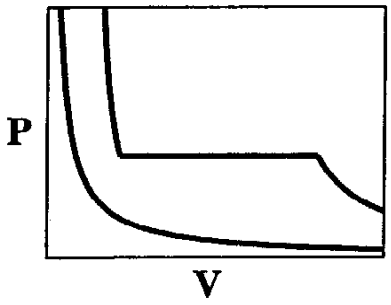
This is a **systematic / random** (circle one) error.

It would affect the **accuracy / precision** (circle one) of the results.

Page 5 of 7. **Name:** _____

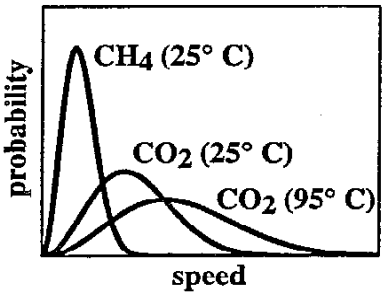
3-7. In no more than twenty words per response, state what is wrong with the following pictures. **Note: only the first 20 words of each answer will be read!**

3.) (4 points) For a real gas:



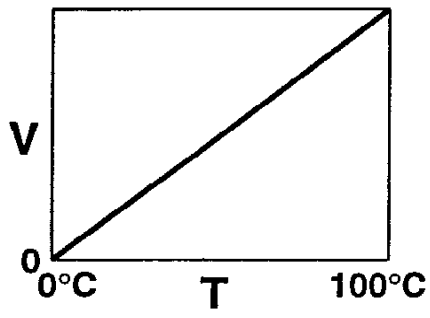
Answer:

4.) (4 points) For an ideal gas:



Answer:

5.) (3 points) For an ideal gas:

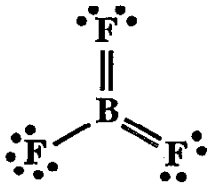


Answer:

 Name: _____

3-7 (cont.) In no more than twenty words per response, state what is wrong with the following pictures. **Note: only the first 20 words of each answer will be read!**

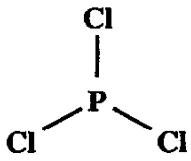
6.) (3 points):



Answer:

7.) (4 points) The *molecular* structure of PCl_3 drawn as:

Trigonal Planar



Answer:

8.) (4 points) Balance the following equation:

_____ $HAsBr_4$ + _____ H_2O -----> _____ As_2O_3 + _____ HBr

9.) (6 points) At one time, it was thought that indium formed a chloride of the formula $InCl_2$. More recent work shows that the compound in question is actually $In_3[In_2Cl_9]$. Determine the percent mass of indium according to each formula and explain **in 20 words or less** how this error could be made.

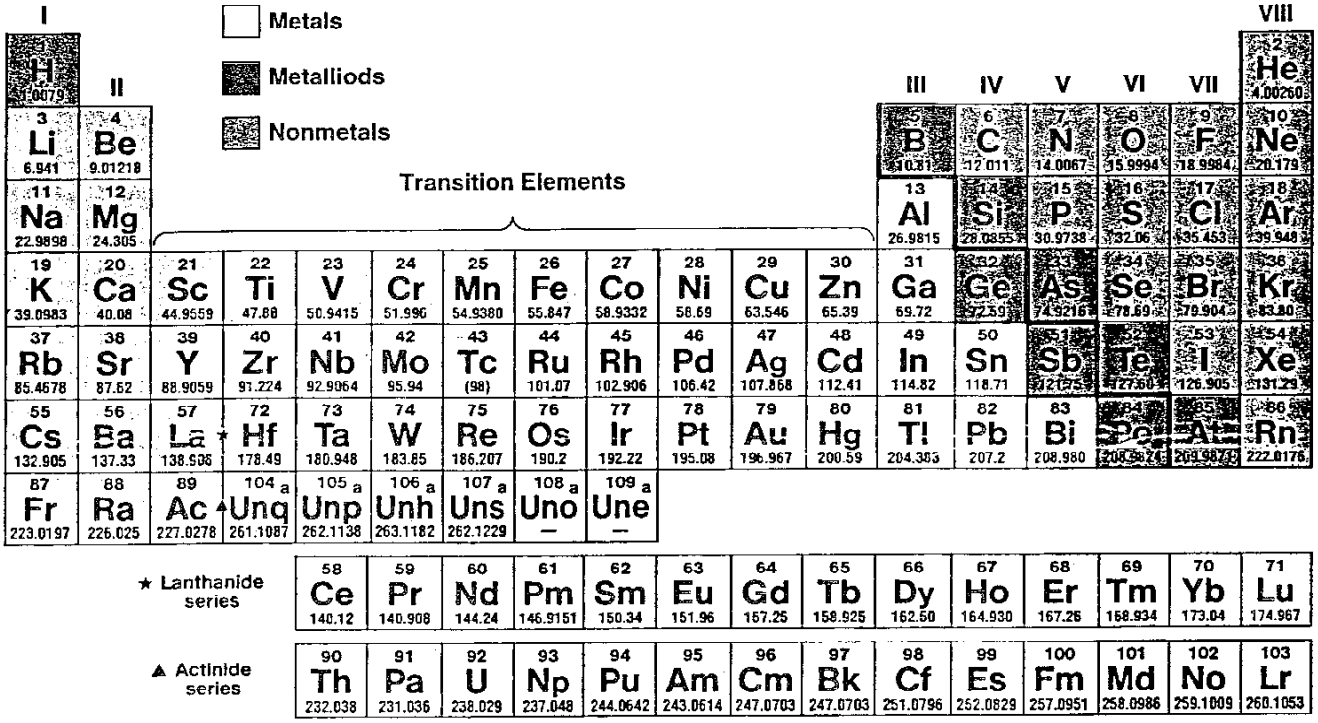
$InCl_2$
% In:

$In_3[In_2Cl_9]$
% In:

Answer:

Name: _____

Periodic Table of the Elements



Note: Atomic masses shown here are the 1983 IUPAC values (maximum of six significant figures). [a] Symbols based on IUPAC systematic names.

Possibly Useful Information:

Absolute T(K) = T(°C) + 273.15

T(°F) = 1.8 x T(°C) + 32

$N_0 = 6.0221 \times 10^{23}\ mol^{-1}$

1.000 atm = 760.0 torr

$R = 0.08206\ L{\cdot}atm{\cdot}mol^{-1}{\cdot}K^{-1}$

$R = 8.3145\ J{\cdot}mol^{-1}{\cdot}K^{-1}$

Ideal Gas: $PV = nRT$

$V_m = 22.414\ L{\cdot}mol^{-1}$

STP is 273.15 K, 1.00 atm

$$u_{rms} = \sqrt{\overline{u^2}} = \sqrt{\frac{3RT}{M}}$$

$$E_k = \frac{nN_o m\overline{u^2}}{2} = \frac{3}{2}nRT$$

$$\overline{\varepsilon_k} = \frac{1}{2}m\overline{u^2} = \frac{E_k}{nN_0}$$