CHEM 111 Your full name (PLEASE PRINT) _____
Third hour test **page 1 of 5**
November 2, 2001 Your scheduled **Tuesday** quiz section (please circle) B hr E hr

Your scheduled **Tuesday** quiz instructor:_____

You may use a writing implement, hand-calculator, and your Periodic Table (unmarked, tan, honor code) as obtained in this course. **NO** scratch paper is permitted! As requested of the faculty by the Student Executive Committee, students must sit in every other seat during the test. The PROPER METHOD (i.e., Problem
Set 0) must be shown clearly on all problems, and final answers must be expressed in appropriate form. Pay attention to dimensions and significant figures!! When blanks for answers are provided, write your answer to be graded in the blank---we will not grade answers written in other locations!

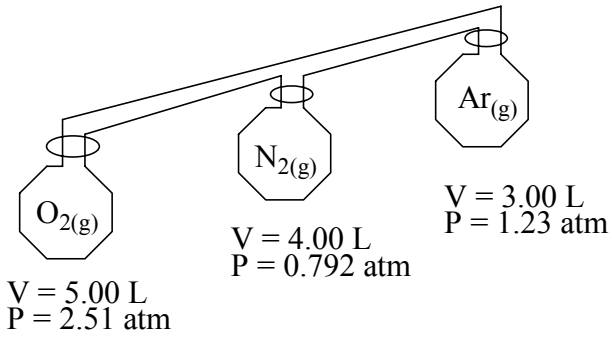
These constants may apply to problems on this test:
$h = 6.626 \times 10^{-34}$ J·s,
$c = 2.998 \times 10^{8}$ m/s,
1 eV = 1.602×10^{-19} J
dimensions of the Joule (J) = $kg \cdot m^2 \cdot s^{-2}$
mass of electron, $m_e = 9.109 \times 10^{-31}$ kg

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

DO NOT DETACH THIS PAGE FROM YOUR TEST!!!!

It is your responsibility to make sure the test you turn in has 5 securely fastened pages.

1. (7 pts) The following arrangement of flasks is set up. Assuming no temperature change, determine the final pressure inside the system after all the stopcocks are opened. The connecting tube has zero volume.



Answer:_____

2. (7 pts) To 0.0075 L of a 0.250 M Na_2SO_4 solution are added 9.2 mL of a 0.250 M Na_3PO_4 solution. This mixture is then diluted with pure water to the 250.0 mL calibration mark in a volumetric flask. Determine the final molarity of Na^+.

Answer:_____

3. (7 pts) For the reaction $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$ what is the volume of CO_2 gas (MW = 44.01) at STP that will be produced if 34 g of O_2 (MW = 32.00) reacts completely with C_3H_8 (MW = 44.11)?

Answer:_____

4. (2 pts) Write the de Broglie equation: _____.

5. (2pts) Write Beer's Law:_____.

6. (2 pts) Write the equation relating current activity to initial radioactivity:
_____.

7. (3 pts) In the area **to the right of this question**, draw a π_{2pz} M.O.
(be sure to indicate phases, axes, and label and identify nodes:

8. (2 pts) What are the possible values of l, and m_l for a 6p electron?

l = _____; m_l = _____

9. (9 pts) Write the oxidation numbers for the elements in the following compounds:

CH_2ClBr (C central atom)	$NaBH_4$	KO_2
C_____	Na_____	K_____
H_____	B_____	O_____
Cl_____	H_____	
Br_____		

10. (8 pts) Define the following terms briefly and accurately according to lecture and F&R material (do **NOT** illustrate them).

(a) Bronsted acid:_____

(b) Lewis base:_____

(c) Polarizability:_____

(d) Hard:_____

11. (12 pts) Show by appropriate formula(s) what occurs when each of the following substances is mixed (individually) with water. Clearly distinguish between ions, molecules, and solids in the final aqueous mixtures.

H_3PO_4	$Fe(OH)_3$	$Na_3[Co(CN)_6]$
$NaClO_4$	CH_3CH_2OH	NH_4KHPO_4

12. (16 pts) The following pairs of substances were first, as separate substances, mixed with water. Then the two aqueous mixtures were combined with thorough stirring. **For each pair:**

(a) show by appropriate formula(s) what would be present **in the separate mixtures;** and then

(b) deduce and write the **balanced chemical equation for the reaction(s)** which occurs when the two mixtures are combined. **If no reaction occurs upon mixing, write "NR".**

(I) hydrochloric acid and nitric acid

(a)

(b)

(II) H_2SO_4 and excess potassium hydroxide

(a)

(b)

(III) NaBr and silver sulfate

(a)

(b)

(IV) $FeSO_4$ and 6 equivalents of ammonia

(a)

(b)

13. (2pts) Write a balanced nuclear equation for the following: $^{232}Th \rightarrow$

14. (5 pts) Which of the following molecules is/are polar? [Circle your choice(s)]

CO_2 CF_4 NH_3 $CHCl_3$ H_2

15. (5 pts) The nuclide ^{131}I undergoes beta decay with a half-life of 6.947×10^5 seconds. Large quantities of this nuclide were released into the environment in the Chernobyl accident. A victim of radiation poisoning has absorbed 5.3×10^{-6} g of ^{131}I. Compute the activity in becquerels (Bq or decays per second) of the ^{131}I in this person, taking the atomic mass of ^{131}I to equal 131 $g \cdot mol^{-1}$ and the victim's weight to be 57 kg.

Answer:_____

16. (6 pts) What volume will 4.0 g of He gas have at 35 ^oC and 0.752 atm?

Answer:_____

17. (5 pts) Circle the letter of all of the following that are true:

(a) All molecules struck by visible light will phosphoresce visible light.

(b) All molecules that absorb visible light have an electron promoted in energy from a ground electronic state to an excited electronic state.

(c) If a sample in the UV-vis spectrophotometer has an absorbance of 0.75, reducing the sample's concentration by a factor of 3 will probably give an absorbance of 0.25.

(d) In the flame tests, the colors you observe are due to the light that is absorbed by the species in the flame.

(e) In a precipitation reaction, the centrifugate is the solid in the test tube and the precipitate is the supernatant liquid.

PLEDGE:_____