CHE 113 MIDTERM EXAMINATION October 25, 2012

University of Kentucky Department of Chemistry

READ THESE DIRECTIONS CAREFULLY BEFORE STARTING THE EXAMINATION!

It is *extremely* important that you fill in the answer sheet EXACTLY as indicated, otherwise your answer sheet may not be processed; ALL entries are to be made on SIDE 1 of the answer sheet. Use a #2 pencil (or softer); fill in the circles completely and firmly. Erasures must be complete. Use only the following categories:

NAME:	Print your name starting at the first space, LAST NAME first, then a space, followed by your FIRST NAME, then another space, followed by your MIDDLE INITIAL. Fill in the correct circles below your printed name corresponding to the letters of your name; for the spaces, fill in the top blank circle.
STUDENT NUMBER:	This is **VERY IMPORTANT!** Under IDENTIFICATION NUMBER, put in your **8 DIGIT STUDENT ID NUMBER** (**do not use the 9 at the beginning of your number**) beginning in column A and continuing through column H, column I will be blank, (do NOT use column J at this time); be sure to fill in the correct circles (a common error to be avoided is mistaking "0" for "1").
TEST FORM:	Fill in the "1" blank in the J column under IDENTIFICATION NUMBER (to indicate Hour Examination I).
SPECIAL CODES:	Use for course and section number; in positions K-P write in your course and section: Dr. April French 113-xxx
SIGNATURE:	You **MUST** sign the examination answer sheet (bubble sheet) on the line directly above your printed name. Use your legal signature.

Answering Questions:

Starting with answer "1" on SIDE 1, fill in the circle indicating the one best answer for each of the **25 questions** in this examination. Your score is the sum of the appropriate credit for each response. On the day following the examination, an examination key will be posted on Blackboard.

Grading and Reporting:

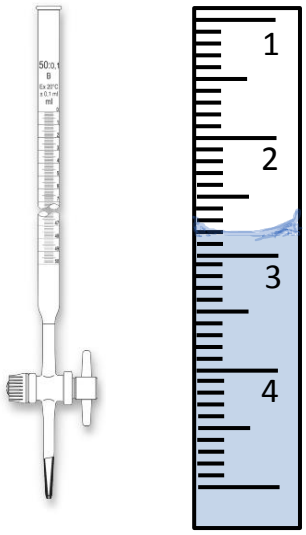
The examination scores will be posted in Blackboard as soon as possible after the examination. If an error has occurred in scoring your answers, inform your instructor within 48 hours of the posting of your score.

BE SURE THAT YOUR TEST HAS 25 QUESTIONS, A PERIODIC TABLE, AND ONE SHEET OF SCRATCH PAPER. You may NOT use your own scratch paper during this examination. Cell phones, computer, and pagers are to be turned off and out of sight during the exam.

1. Goggles are worn to protect your eyes from chemical splashes. If a chemical is splashed into your eyes, how long should you wash your eyes in an eyewash station?

A. 3 minutes
B. 5 minutes
C. 15 minutes
D. You don't need to wash your eyes.

2. A 25 mL buret, shown in the picture, was used to measure the volume of a liquid reagent added to the reaction flask. A section of the buret, which includes the meniscus of the solution, is enlarged for illustrative purposes. What is the initial volume of the buret?



A. 3.19 mL
B. 2.85 mL
C. 2.13 mL
D. 3.53 mL

3. A 3.82 g sample of magnesium nitride is reacted with 7.73 g of water.

$$Mg_3N_2 + 3H_2O \rightarrow 2NH_3 + 3MgO$$

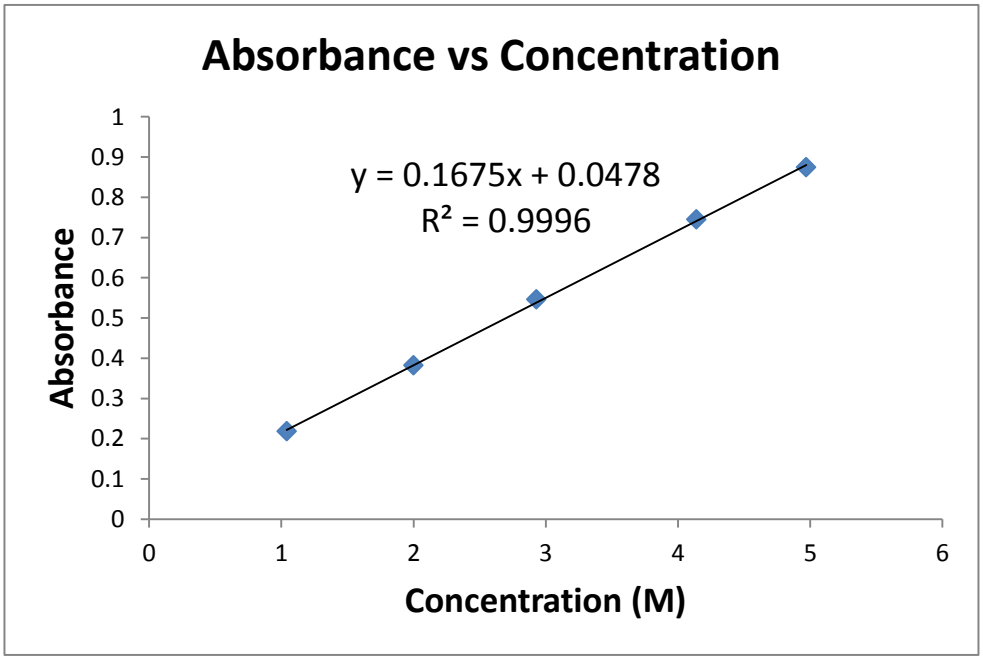
The yield of MgO is 3.60 g. What is the percent yield of the reaction?

A. 94.5 %
B. 78.7 %
C. 46.6 %
D. 49.4 %

4. What is the empirical formula of a compound that is 62.0% C, 10.4% H, and 27.5% O by mass?

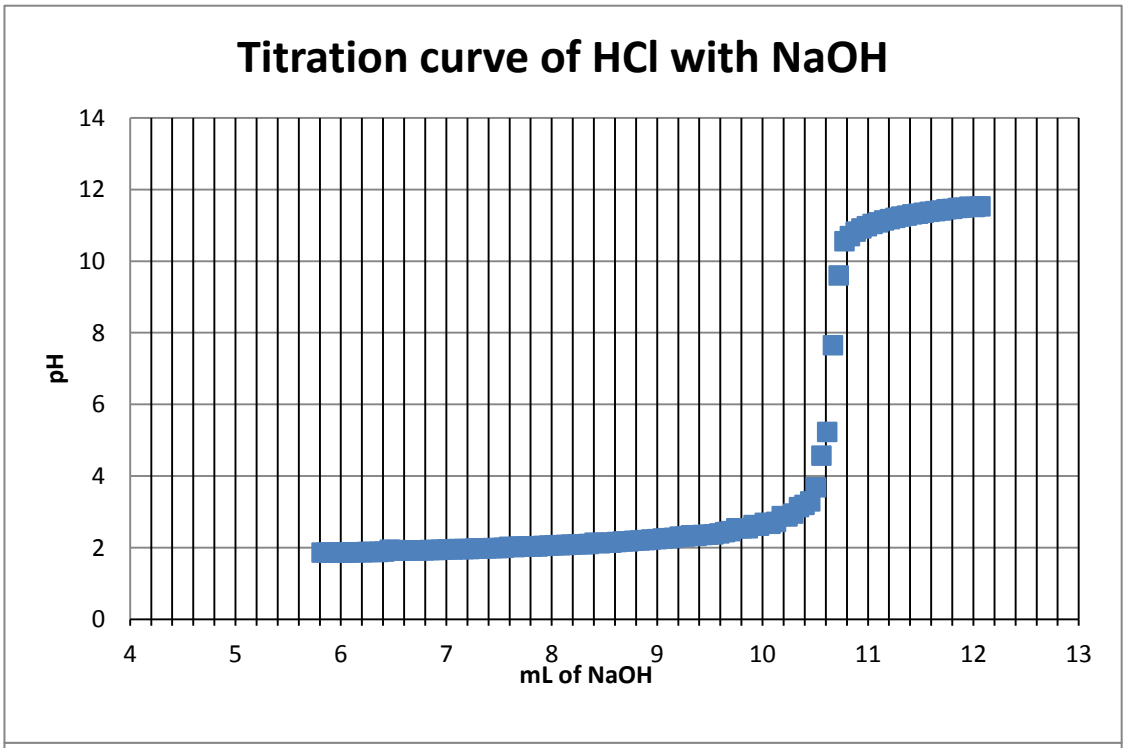
A. $C_5H_{10}O_2$
B. $C_6H_{12}O_2$
C. C_3HO
D. C_3H_6O

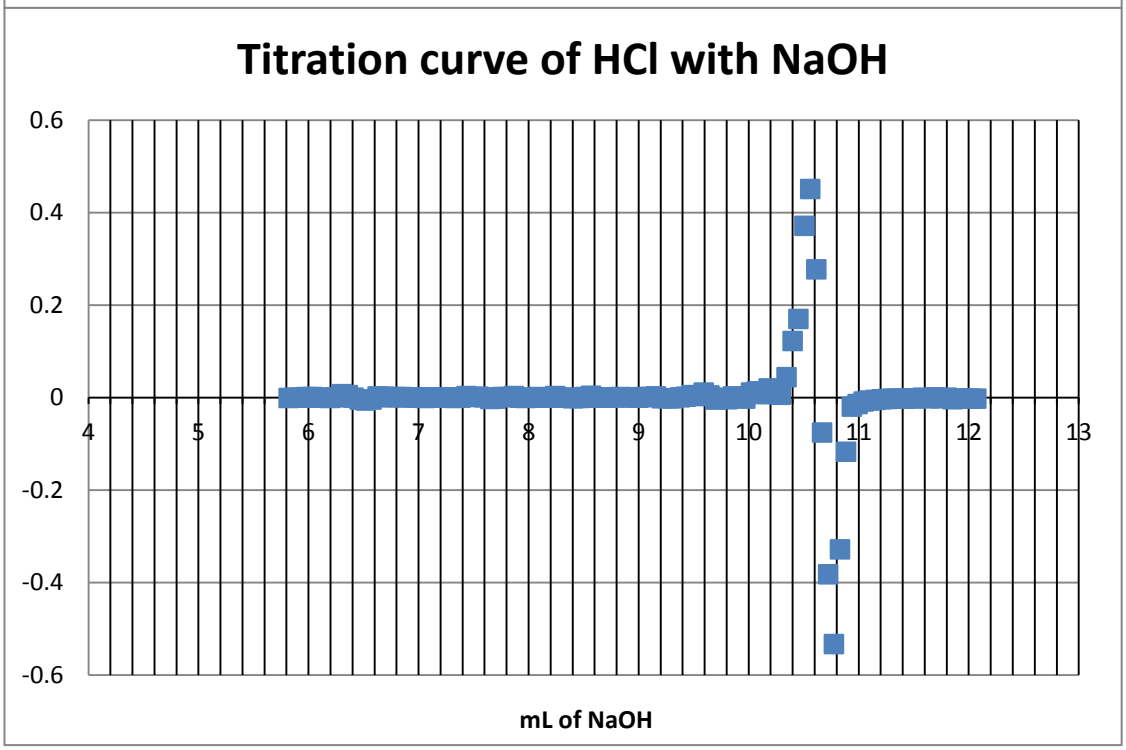
5. Using the following graph, what is the concentration of a solution whose absorbance is 0.586?



A. 3.21 M
B. 0.146 M
C. 0.0478 M
D. 2.68 M

6. In lab, 25.0 mL of an unknown concentration of HCl was titrated with 0.20 M NaOH to the equivalence point. The following data was collected. What is the concentration of the HCl?





A. 0.085 M
B. 0.0022 M
C. 12 M
D. 0.20 M

7. What is the electron geometry of the central atom in carbonate ion, CO_3^{-2}?

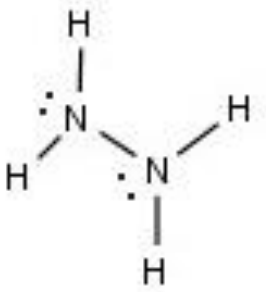
A. octahedral
B. tetrahedral
C. square planar
D. trigonal planar

8. What is the total number of electron groups in IF_3?

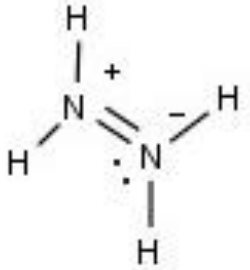
A. 3
B. 4
C. 5
D. 6

9. Which of the following structures best represents the Lewis structure of hydrazine, N_2H_4?

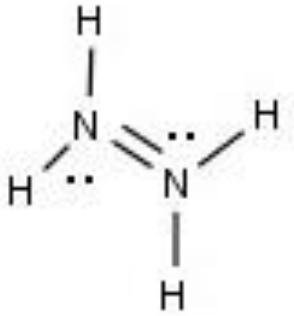
A.



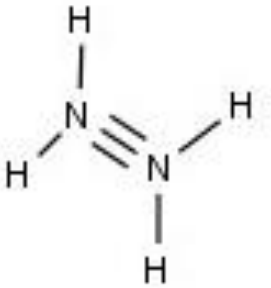
B.



C.



D.



10. How many lone pairs of electrons are around the central atom in BrF_3?

A. 1 pair
B. 2 pairs
C. 4 pairs
D. 5 pairs

11. What is the hybridization of the central atom of PCl_4^-?

A. sp
B. sp^3
C. sp^3d
D. sp^3d^2

12. What is the molality of a solution prepared using 20. g of glucose, $C_6H_{12}O_6$, in 50 mL of water?

A. 0.4 m
B. 1.2 m
C. 2.2 m
D. 3.3 m

13. A student is trying to determine the molar mass of a substance using freezing point depression. The student collected the following information:

i. The molal freezing point constant, K_f, of the solvent

ii. The freezing point of the pure solvent and the freezing point of the solution.

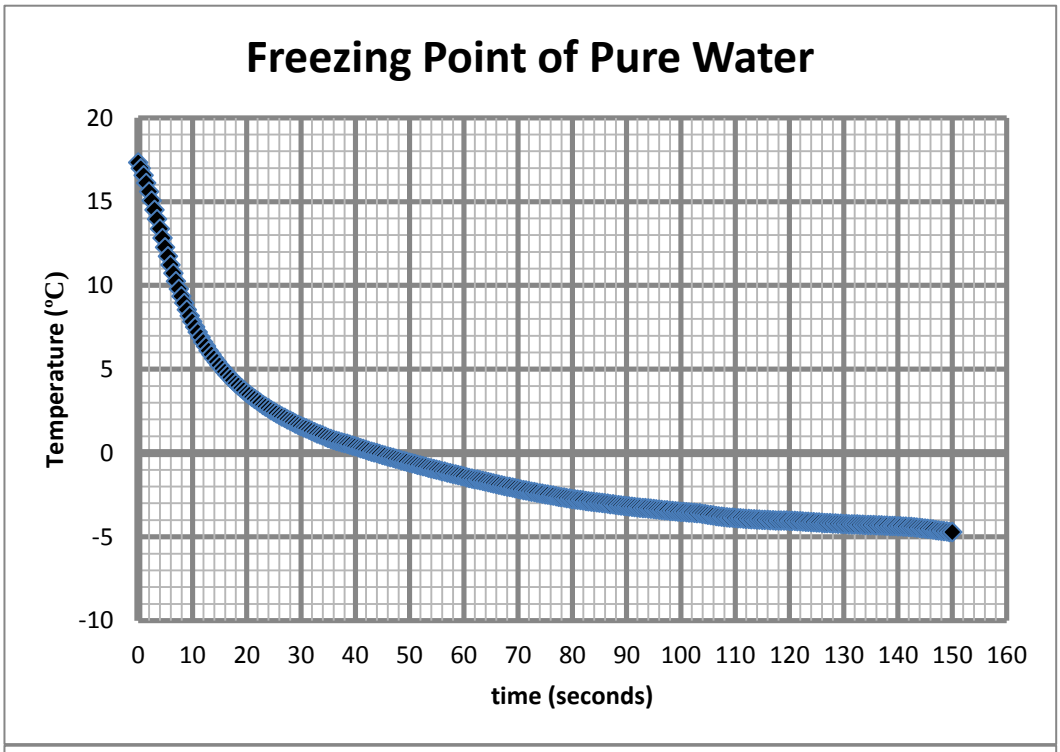
What additional information is needed for the student to determine the molar mass of the substance?

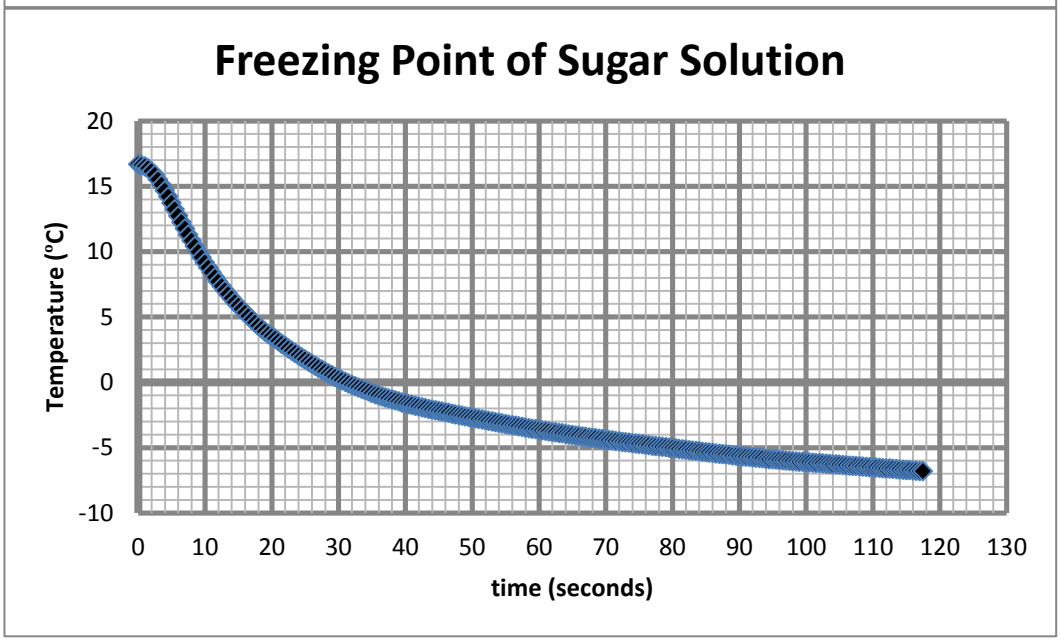
A. The mass of the solute only
B. The volume of the solvent and the mass of the solute
C. The mass of the solvent and the boiling point of the solvent
D. The mass of the solvent and the mass of the solute

14. What is the freezing point of a 0.05500 m aqueous solution of $NaNO_3$? The molal freezing point depression constant of water is 1.86 ºC/m.

A. –0.205 ºC
B. 0.0286 ºC
C. –0.0562 ºC
D. –0.106 ºC

15. In lab, Johnny prepared a solution containing 3.00 g of sugar ($C_6H_{12}O_6$) in 5.00 mL of water. He then conducted a freezing-point depression experiment and obtained the following graphical data:





What is the freezing point depression constant, K_f, for his solution?

A. 0.973 ºC/m
B. 5.89 ºC/m
C. 1.89 ºC/m
D. 0.0600 ºC/m

16. What is the ideal van't Hoff factors for the following compounds?

NaH_2PO_4, Fe_2S_3, KI, Na_3PO_4

A. 4, 5, 2, 6
B. 2, 5, 2, 4
C. 2, 2, 5, 4
D. 3, 2, 2, 4

17. The rate of reaction is affected by all of the following except:

A. the heat of reaction
B. a catalyst
C. the concentration of the reactants
D. the temperature at which the reaction occurs

18. Consider the following rate data for the reaction below at a particular temperature.

$2A + 3\ B \rightarrow$ products

Experiment	[A]	[B]	Initial rate (M/sec)
1	0.10	0.30	7.20×10^{-5}
2	0.10	0.60	1.44×10^{-4}
3	0.20	0.90	8.64×10^{-4}

What is the rate law for this reaction?

A. rate = $k[A]^2[B]^3$
B. rate = $k[A]^2[B]$
C. rate = $k[A]\ [B]$
D. rate = $k[A]^3[B]^2$

19. The rate of decomposition of hydrogen peroxide can be decreased by

A. adding a catalysis
B. raising the temperature
C. increasing the concentration of hydrogen peroxide
D. decreasing temperature

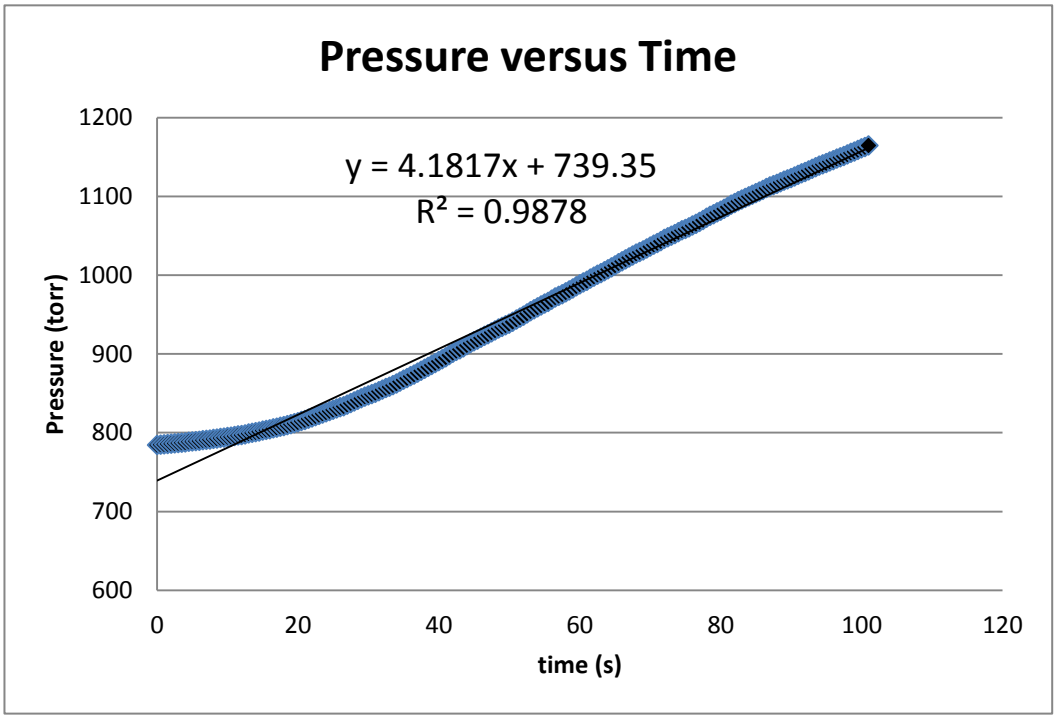
20. Consider the reaction

$$N_2O_5\,(g) \rightarrow 2NO_2(g) + \tfrac{1}{2}\,O_2\,(g)$$

where at 25 ºC the rate constant is $3.46 \times 10^{-5}\ s^{-1}$ and at 35 ºC the rate constant is $1.48 \times 10^{-4}\ s^{-1}$. What is the activation energy, E_a, for the following reaction?

A. 1.1×10^2 kJ/mol
B. 8.4 kJ /mol
C. 3.46×10^2 kJ/mol
D. 1.1 kJ/mol

21. In order to determine the rate law for the decomposition of hydrogen peroxide, a student collected pressure versus time measurements as the hydrogen peroxide decomposed with the addition of KI. The following graph was produced at 30.5 ºC.



Based upon the student's data, what is the initial rate of the reaction in $\frac{mol}{L*s}$?

A. 0.168
B. 4.18
C. 2.21×10^{-4}
D. 6.71×10^{-2}

22. Consider the following reaction:

$$2B(s) + 3F_2(g) \rightleftharpoons 2BF_3(g)$$

What is the equilibrium expression for this reaction?

A. $K_{eq} = \frac{[2BF_3]}{[3F_2]}$

B. $K_{eq} = \frac{[F_2]^3}{[BF_3]^2}$

C. $K_{eq} = \frac{[BF_3]^2}{[F_2]^3}$

D. $K_{eq} = \frac{[BF_3]^2}{[B]^2[F_2]^3}$

23. Consider the following equilibrium:

$$Cl_2O_7(g) + 8H_2(g) \rightleftharpoons 2HCl(g) + 7H_2O(g)$$

Which of the following would increase the number of moles of HCl?

A. Increase $[H_2O]$

B. Increase $[Cl_2O_7]$

C. Increase total pressure

D. Increase volume of the system

24. Consider the following equilibrium system:

$$CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$$

1.00 mole of CO_2 and 2.00 mol of H_2 are placed into a 2.00 L container. At equilibrium, the [CO] = 0.31 mol/L. Based on this data, what is the equilibrium $[CO_2]$?

A. 0.19 M

B. 0.31 M

C. 0.38 M

D. 0.69 M

25. At elevated temperatures, molecular hydrogen and molecular bromine react to partially form hydrogen bromide:

$$H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$$

A mixture of 0.682 mol of H_2 and 0.440 mol of Br_2 is combined in a reaction vessel with a volume of 2.00 L. At equilibrium at 700 K, there are 0.566 mol of H_2 present. At equilibrium, how many mole of Br_2 are present in the reaction vessel?

A. 0.440

B. 0.232

C. 0.566

D. 0.324

CHE 113 Midterm

	KEY
1	C
2	B
3	B
4	D
5	A
6	A
7	D
8	C
9	A
10	B
11	C
12	C
13	D
14	A
15	D
16	B
17	A
18	B
19	D
20	A
21	C
22	C
23	B
24	A
25	D