Answer the following questions on the answer sheet.

$N_A = 6.022 \times 10^{23}$ mol^{-1} $T_K = t_{\circ C} + 273.15$

$V_{STP} = 22.4$ L mol^{-1} $R = 0.08206$ L atm K^{-1} mol^{-1}

$v_1 / v_2 = \sqrt{m_2 / m_1}$ $(P + [an^2 / V^2])(V - bn) = nRT$

1) Calculate the molarity of a solution made with 45.9 g of $Co(ClO_4)_3$ in 420.9 mL of water solution.

2) What is the molarity of a solution would one get if 378 mL of 7.23 M $CaCl_2$ solution is diluted to 3.389 L.

3) In the following titration reaction 27.26 mL of 0.5051 M KOH is reacted with 32.14 mL of H_2SO_4. What is the concentration of the H_2SO_4?

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$.

4) 31.73 kg of NaOH is neutralized with 7.1 M H_2SO_4. How many liters of H_2SO_4 is required? (Be careful with the units.)
The reaction is: $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

5) Write the Brønsted–Lowry reaction for each of the following Arrhenius reactions. ("H^+" is an acceptable substitute for "H_3O^+". In either case, balance the reaction.)

Reaction 1: $HIO_2 + OH^- \rightarrow$

Reaction 2: $CH_3NH_2 + H_3O^+ \rightarrow$

6) What volume of 5.64 M $BaCl_2$ solution is needed to make 231.0 mL of a 0.481 M solution?

7) How many grams of $BaCl_2$ are needed to create 72.0 mL of a 0.417 M solution?

milliliters of 11.0 M HCl

8) How many ~~liters of HCl at STP~~ are required to create 832 mL of a 0.372 M solution?

9) What volume does 8.85 mol of CH_4 gas occupy at STP?

10) What volume does 4.37 g of HCl gas occupy at 0°C and 1.00 atm pressure?

11) N_2 is contained in 1.61 L at a pressure of 7.20 atm and a temperature of 55.7 °C. How many moles of N_2 are there?

12) 44.4 g of CH_3NH_2 are contained in 356 mL at 174°C. What is the pressure of this ideal gas?

13) What mass of HF is required to fill a volume of 8.16 L at a pressure of 543 torr and a temperature of 197.9°C?

14) The molar mass of a liquid is determined by the Dumas method. The volume of the flask used was 696 mL. The mass of the flask before the experiment was 42.5911 g. After the experiment, the mass was found to be 43.6186 g. The atmospheric pressure at the time was 763.5 torr. What is the molar mass of the liquid? (A boiling water bath was used to vaporize the liquid at 100.0°C.)

15) What volume does 12.2 g of hydrogen gas occupy at STP?

16) What volume does 836 g of xenon gas occupy at STP?

17) Hydrogen is collected over water at 3°C. The atmospheric pressure is 762.2 torr. What is the pressure of the dry hydrogen? (Vapor pressures are given in the attached table.)

18) Using the Van der Waal equation, calculate the pressure of 3.17 mole of ethanol contained in a volume of 3.51 L at a temperature of 255°C.
a = 12.02 atm L^{-2} mol^{-2} and b = 0.0841 L mol^{-1}

19) Helium diffuses 3.85 times faster than an unknown gas. What is the molar mass of the unknown gas?

20) Circle the correct answer on the answer sheet. Pressure is defined as:
A) the energy expended in increasing a volume
B) the number of molecules per unit area
C) the number of moles of gas per unit area
D) the energy required to remove molecules from a surface
E) the force applied per unit area
F) the number of moles in a volume

CHEM 1110 test 2 – Fall 2010

Vapor pressure of water as a function of temperature

temperature /°C	Pressure /torr	temperature /°C	Pressure /torr	temperature /°C	Pressure /torr
0.0	4.6				
1.0	4.9	21.0	18.7	41.0	58.3
2.0	5.3	22.0	19.8	42.0	61.5
3.0	5.7	23.0	21.1	43.0	64.8
4.0	6.1	24.0	22.4	44.0	68.3
5.0	6.5	25.0	23.8	45.0	71.9
6.0	7.0	26.0	26.2	46.0	75.7
7.0	7.5	27.0	26.7	47.0	79.6
8.0	8.0	28.0	28.3	48.0	83.7
9.0	8.6	29.0	30.0	49.0	88.0
10.0	9.2	30.0	31.8	50.0	92.5
11.0	9.8	31.0	33.7	51.0	97.2
12.0	10.5	32.0	35.7	52.0	102.1
13.0	11.2	33.0	37.7	53.0	107.2
14.0	12.0	34.0	39.9	54.0	112.5
15.0	12.8	35.0	42.2	55.0	118.0
16.0	13.6	36.0	44.6	56.0	123.8
17.0	14.5	37.0	47.1	57.0	129.8
18.0	15.5	38.0	49.7	58.0	136.0
19.0	16.5	39.0	52.4	59.0	142.6
20.0	17.6	40.0	55.3	60.0	149.4

Chart of the common polyions

ClO^-	ClO_2^-	ClO_3^-	ClO_4^-
BrO^-	BrO_2^-	BrO_3^-	BrO_4^-
IO^-	IO_2^-	IO_3^-	IO_4^-
SO_2^{2-}	SO_3^{2-}	SO_4^{2-}	
	NO_2^-	NO_3^-	
PO_2^{3-}	PO_3^{3-}	PO_4^{3-}	
		CO_3^{2-}	

$N_A = 6.022 \times 10^{23}\ \text{mol}^{-1}$ $\quad T_K = t_{\circ C} + 273.15$

$V_{STP} = 22.4\ \text{L mol}^{-1}$ $\quad R = 0.08206\ \text{L atm K}^{-1}\ \text{mol}^{-1}$

$v_1 / v_2 = \sqrt{m_2 / m_1}$ $\quad (P + [an^2 / V^2])(V - bn) = nRT$

NAME_____

WARNING: Points will be taken off for wrong or missing units!

1) 0.305 M

2) 0.806 M

3) 0.2142 M (units)

4) 55.9 L (units)

5) Reaction 1: $HIO_2 + OH^- \rightarrow IO_2^- + H_2O$

Reaction 2: $CH_3NH_2 + H_3O^+ \rightarrow CH_3NH_3^+ + H_2O$

6) 19.7 mL (units)

7) 6.25 g (units)

8) 28.1 mL (units) (original 6.93 L)

9) 198 L (units)

10) 2.67 L (units)

11) 0.430 mol (units)

12) 147 atm (units)

13) 3.018 g (units)

14) 45.0 $g\ mol^{-1}$ (units)

15) 136 L (units)

16) 143 L (units)

17) 756.5 torr (units)

18) 32.6 atm (units)

19) 59.2 $g\ mol^{-1}$ (units)

20) **A** **B** **C** **D** **(E)** **F**

KEY
(Note: the number of sig. figs. may not be correct. The program does not provide the capability.)

1) 0.305

2) 0.806

3) 0.2142 M

4) 55.9 L

5) Reaction 1: $HIO_2 + OH^- \rightarrow IO_2^- + H_2O$
Reaction 2: $CH_3NH_2 + H_3O^+ \rightarrow$

6) 19.7 mL

7) 6.251 g

8) 6.93 L

9) 198.2 L

10) 2.685 L

11) 0.430 mol

12) 147.3 atm

13) 3.018 g

14) 45 g mol^{-1}

15) 136 L

16) 143 L

17) 756.5 torr

18) 32.6 atm (39.1 atm ideal. dfference =6.6 atm)

19) 59.2g mol^{-1}

20) **E**