Answer the following questions on the answer sheet.

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

$\boldsymbol{V}_{STP} = 22.4$ L mol^{-1} $\quad R = 0.08206$ L atm K^{-1} mol^{-1}

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

1) Calculate the molarity of a solution made with 66.7 g of $Ca_3(PO_2)_2$ in 655.2 mL of water solution.

2) What is the molarity of a solution would one get if 151 mL of 3.44 M H_2SO_4 solution is diluted to 1.645 L.

3) In the following reaction 38.61 mL of 0.1525 M NaOH is reacted with 31.69 mL of H_3PO_4. What is the concentration of the H_3PO_4?

$H_3PO_4 + 3NaOH \rightarrow Na_3PO_4 + 3H_2O$.

4) 37.43 kg of $Ca(OH)_2$ is neutralized with 10.27 M HCl. How many liters of HCl is required? (Be careful with the units.)
The reaction is: $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$

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: $HNO_3 + KOH \rightarrow KNO_3 + H_2O$
Reaction 2: $HClO + NaOH \rightarrow NaClO + H_2O$

6) What volume of 7.76 M $BaCl_2$ solution is needed to make 443.0 mL of a 0.479 M solution?

7) How many grams of NaCl are needed to create 18.0 mL of a 0.694 M solution?

8) How many liters of NH_3 at STP are required to create 876 mL of a 0.340 M solution?

9) What volume does 2.96 mol of CH_4 gas occupy at STP?

10) What volume does 5.14 g of NH_3 gas occupy at 0°C and 1.00 atm pressure?

11) N_2 is contained in 7.61 L at a pressure of 1.68 atm and a temperature of 111.2 °C. How many moles of N_2 are there?

12) 67.5 g of HCl are contained in 184 mL at 105°C. What is the pressure of this ideal gas?

13) What mass of NH_3 is required to fill a volume of 8.23 L at a pressure of 680 torr and a temperature of 82.2°C?

14) The molar mass of a liquid is determined by the Dumas method. The volume of the flask used was 111 mL. The mass of the flask before the experiment was 41.8526 g. After the experiment, the mass was found to be 42.0077 g. The atmospheric pressure at the time was 756.2 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 84.5 g of hydrogen gas occupy at STP?

16) What volume does 349 g of helium gas occupy at STP?

17) Hydrogen is collected over water at 4°C. The atmospheric pressure is 751.8 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 2.43 mole of ethanol contained in a volume of 3.62 L at a temperature of 293°C.
a = 12.02 atm L^{-2} mol^{-2} and b = 0.0841 L mol^{-1}

19) Helium diffuses 6.21 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 number of moles in a volume
B) the energy expended in increasing a volume
C) the number of molecules per unit area
D) the number of moles of gas per unit area
E) the energy required to remove molecules from a surface
F) the force applied per unit area

CHEM 1110 test 2 – Fall 2009

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-}	

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

$\boldsymbol{V}_{\mathbf{STP}} = 22.4\ \text{L mol}^{-1}$ $\quad R = 0.08206\ \text{L atm K}^{-1}\ \text{mol}^{-1}$

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

NAME_____

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

1) _____

2) _____

3) _____ _____ (units)

4) _____ _____ (units)

5) Reaction 1: _____

Reaction 2: _____

6) _____ _____ (units)

7) _____ _____ (units)

8) _____ _____ (units)

9) _____ _____ (units)

10) _____ _____ (units)

11) _____ _____ (units)

12) _____ _____ (units)

13) _____ _____ (units)

14) _____ _____ (units)

15) _____ _____ (units)

16) _____ _____ (units)

17) _____ _____ (units)

18) _____ _____ (units)

19) _____ _____ (units)

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

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

1) 0.414

2) 0.316

3) 0.0799 M

4) 98.5 L

5) Reaction 1: $H_3O^+ + OH^- \rightleftharpoons 2H_2O$
Reaction 2: $HClO + OH^- \rightleftharpoons ClO^- + H_2O$

6) 27.3 mL

7) 0.730 g

8) 6.67 L

9) 66.3 L

10) 6.759 L

11) 0.405 mol

12) 312.2 atm

13) 4.302 g

14) 43 g mol^{-1}

15) 939 L

16) 1.95×10^3 L

17) 745.7 torr

18) 27.6 atm (31.2 atm ideal. dfference =3.5 atm)

19) 154.1g mol^{-1}

20) **F**