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 19.4 g of $Ca_3(PO_2)_2$ in 306.5 mL of water solution.
ANS: 0.257 M

2) What is the molarity of a solution would one get if 306 mL of 9.62 M NH_3 solution is diluted to 2.004 L.
ANS: 1.47 M

3) In the following reaction 26.35 mL of 0.1325 M H_2SO_4 is reacted with 48 mL of NaOH. What is the concentration of the NaOH?

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$.
ANS: 0.1455 M

4) 26.42 kg of NaOH is neutralized with 5.89 M H_2SO_4. How many liters of H_2SO_4 is required? (Be careful with the units.)
The reaction is: $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
ANS: 56.1 L

5) What volume of 7.87 M $FeCl_2$ solution is needed to make 659.0 mL of a 0.724 M solution?
ANS: 60.6 mL

6) How many grams of NaCl are needed to create 56.0 mL of a 0.873 M solution?
ANS: 2.857 g

7) How many liters of HF at STP are required to create 552 mL of a 0.132 M solution?
ANS: 1.63 L

8) What volume does 2.56 mol of CH_4 gas occupy at STP?
ANS: 57.3 L

atm

9) In the following reaction, 6.46 Ł of C_2H_6 is reacted with an excess of O_2 in a rigid container. The temperature is returned to the initial temperature. What is the final pressure of CO_2 ?

$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$
ANS: 12.92 atm

10) What volume does 1.28 g of HF gas occupy at 0°C and 1.00 atm pressure?
ANS: 1.433 L

11) N_2 is contained in 5.04 L at a pressure of 1.48 atm and a temperature of 110.8 °C. How many moles of N_2 are there?
ANS: 0.237 mol

12) 55.0 g of HBr are contained in 640 mL at 167°C. What is the pressure of this ideal gas?
ANS: 38.4 atm

13) What mass of HCl is required to fill a volume of 7.35 L at a pressure of 538 torr and a temperature of 25.1°C?
ANS: 7.751 g

14) The molar mass of a liquid is determined by the Dumas method. The volume of the flask used was 855 mL. The mass of the flask before the experiment was 50.8143 g. After the experiment, the mass was found to be 52.2533 g. The atmospheric pressure at the time was 768.0 torr. What is the molar mass of the liquid? (A boiling water bath was used to vaporize the liquid at 100.0°C.)
ANS: 51 g mol^{-1}

15) What volume does 12.1 g of fluorine gas occupy at STP?
ANS: 7.13 L

16) What volume does 602 g of xenon gas occupy at STP?
ANS: 103 L

17) Hydrogen is collected over water at 26°C. The atmospheric pressure is 753.1 torr. What is the pressure of the dry hydrogen? (Vapor pressures are given in the attached table.)
ANS: 726.9 torr (0.956 atm)

18) Using the van der Waal equation, calculate the pressure of 2.14 mole of ethanol contained in a volume of 3.77 L at a temperature of 293°C.
a = 12.02 atm L^{-2} mol^{-2} and b = 0.0841 L mol^{-1}
ANS: 23.8 atm (26.4 atm ideal. dfference =2.5 atm)

19) Helium diffuses 7.01 times faster than an unknown gas. What is the molar mass of the unknown gas?
ANS: 196.4g mol^{-1}

atm

20) In the following reaction, 8.39 L of H_2 is reacted with an excess of N_2 in a rigid container. The initial temperature is 25.6°C. The final temperature is 284.1°C. What is the final pressure of NH_3 ?

$3H_2 + N_2 \rightarrow 2NH_3$

ANS: 10.4 atm

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-}	

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

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

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

KEY

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

1) 0.257 M

2) 1.47 M

3) 0.1455 M

4) 56.1 L

5) 60.6 mL

6) 2.857 g

7) 1.63 L

8) 57.3 L

9) 12.92 atm

10) 1.433 L

11) 0.237 mol

12) 38.4 atm

13) 7.751 g

14) 51 g mol^{-1}

15) 7.13 L

16) 103 L

17) 726.9 torr (0.956 atm)

18) 23.8 atm (26.4 atm ideal. dfference =2.5 atm)

19) 196.4g mol^{-1}

20) 10.4 atm