Fill in the correct answer on the answer sheet.

$N_A = 6.022 \times 10^{+23}$ $\mathbf{V}_{STP} = 22.4$ L mol^{-1}

1) In the following titration 283.84 mL of 0.08125 M $Ca(OH)_2$ is reacted with 22.12 mL of HCl. What is the concentration of the HCl?

$2HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O.$

ANSWER: 2.085×10^{0} M

2) 22.8 g of $Ca(OH)_2$ is neutralized with 5.41 M H_3SO_4. How many milliliters of H_3PO_4 is required?

The reaction is: $3Ca(OH)_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6H_2O$

ANSWER: 38.0 mL

3) What volume does 3.84 g of HCl gas occupy at 0 °C and 1.00 atm pressure?

ANSWER: 2.36 L

4) N_2 is contained in 8.88 L at a pressure of 5.10 atm and a temperature of –29.5 °C. How many moles of N_2 are there?

ANSWER: 2.27 mol

5) 30.7 g of HF are contained in 526 mL at 225 °C. What is the pressure of this ideal gas?

ANSWER: 119 atm

6) The following reaction was performed in a rigid volume and the temperature was returned to the starting temperature. Cl_2 gas is reacted with an excess of H_2 . The starting pressure for the Cl_2 is 21.8 atm. What is the final pressure of the HCl gas?

$H_2\,(g) + Cl_2\,(g) \rightarrow 2HCl\,(g)$

ANSWER: 43.60 atm.

7) The following reaction was initiated at 297°C at 2.25 atm of O_2 atm in a constant volume container. The H_2 was in excess. At the end of the reaction the temperature was 480°C. What was the final pressure of the H_2O gas?
$2H_2 + O_2 \rightarrow 2H_2O$ (g)

ANSWER: 5.94 atm

8) Give the oxidation number for the atoms indicated: WARNING: The plus sign must be present if the number is positive.

A) KO_2 O = ? B) SiF_4 Si = ?

ANSWER: A) KO_2 O = –1/2 B) SiF_4 Si = +4

9) Give the oxidation number for the atoms indicated: WARNING: The plus sign must be present if the number is positive.

A) KO_2 K = ? B) Cu_2SO_4 Cu = ?

ANSWER: A) KO_2 K = +1 B) Cu_2SO_4 Cu = +1

Fill in the correct answer on the answer sheet.

10) Name the following compounds:

A) H_2SO_4 ? B) V_2SO_4 ?

ANSWER: A) H_2SO_4 sulfuric acid B) V_2SO_4 vanadium IV sulfate

11) Name the following compounds:

A) H_2S in water ? B) KCl ?

ANSWER: A) H_2S in water hydrosulfuric acid B) KCl potassium chloride

12) H_2 diffuses 4.870 times faster than an unknown gas. What is the molar mass of the unknown gas?

ANSWER: 47.9 g mol^{-1}

13) A gas mix is composed of CH_4 , NH_3 and H_2 . The pressure of the CH_4 is 316.1 torr. The pressure of NH_3 is 278.7 . The total pressure is 724.8 torr. What is the pressure of CH_4 ?

ANSWER: 130.0 torr

14) CH_4 is collected over water at 6.0°C. The barometric pressure is 603 torr. What is the pressure of the dry CH_4 ?

ANSWER: 596 torr Note that the vapor pressures were given on page 3

15) What is the pressure according to the van der Waal equation for 0.423 moles of hexane confined to a volume of 2.07 L at 454 K K? (a = 24.39 atm L2 mol–1 and b = 0.1735 L mol–1) **Give the answer to three significant figures!**

$$[\, P + (\, an^2/V^2\,)](\, V - bn\,) = nRT$$

ANSWER: VdW = 6.87 atm

16) What is the deviation of the ideal gas law calculation compared to the van der Waal value obtained in question 14? **Give the answer to three significant figures!**

ANSWER: % deviation = 10.7% (Ideal = 7.61 atm)

17) The Dumas method was performed on an unknown volatile liquid. The difference between the flask used before the experiment and at the end was 0.04132 g. The volume of the flask was 341.5 mL. The temperature at the time when the liquid was vaporized was 100.0°C. and the pressure was 866.5 torr. What is the molar mass of the liquid?

ANSWER: 32.5 g mol^{-1}

18) 3.65 mol of gas had a pressure of 40.3 atm at 106°C. The volume was adjusted to give a temperature and pressure of 0°C and 1.00 atm. What is the final gas volume?

ANSWER: 81.8 L

19) A gas mix is composed of 42.9 torr of NH_3 and water vapor at 2.0°C. What is the total gas pressure?

ANSWER: 48.2 torr total

20) How many molecules are there in 22.4 L at STP?

ANSWER: $6.02 \times 10^{+23}$ molecules

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

1) 2.085×10^{0}

2)

3)

4)

5)

6)

7)

8)

9)

10)
11)

12)

13)

14)

15)

16)

17)

18)

19)

20)