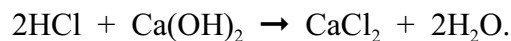


Fill in the correct answer on the answer sheet.

$$N_A = 6.022 \times 10^{+23}$$

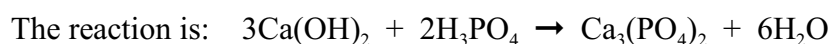
$$V_{\text{STP}} = 22.4 \text{ L mol}^{-1}$$

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



ANSWER:  $2.085 \times 10^0 \text{ M}$

- 2) 22.8 g of  $\text{Ca(OH)}_2$  is neutralized with 5.41 M  $\text{H}_3\text{SO}_4$ . How many milliliters of  $\text{H}_3\text{PO}_4$  is required?



ANSWER: 38.0 mL

- 3) What volume does 3.84 g of HCl gas occupy at  $0^\circ\text{C}$  and 1.00 atm pressure?

ANSWER: 2.36 L

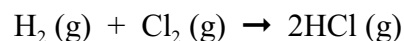
- 4)  $\text{N}_2$  is contained in 8.88 L at a pressure of 5.10 atm and a temperature of  $-29.5^\circ\text{C}$ . How many moles of  $\text{N}_2$  are there?

ANSWER: 2.27 mol

- 5) 30.7 g of HF are contained in 526 mL at  $225^\circ\text{C}$ . 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.  $\text{Cl}_2$  gas is reacted with an excess of  $\text{H}_2$ . The starting pressure for the  $\text{Cl}_2$  is 21.8 atm. What is the final pressure of the HCl gas?



ANSWER: 43.60 atm.

- 7) The following reaction was initiated at  $297^{\circ}\text{C}$  at  $2.25\text{ atm}$  of  $\text{O}_2$  atm in a constant volume container. The  $\text{H}_2$  was in excess. At the end of the reaction the temperature was  $480^{\circ}\text{C}$ . What was the final pressure of the  $\text{H}_2\text{O}$  gas?
- $$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}(\text{g})$$

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.



ANSWER: A)  $\text{KO}_2$  O =  $-1/2$       B)  $\text{SiF}_4$  Si = +4

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



ANSWER: A)  $\text{KO}_2$  K = +1      B)  $\text{Cu}_2\text{SO}_4$  Cu = +1

Fill in the correct answer on the answer sheet.

10) Name the following compounds:

A)  $\text{H}_2\text{SO}_4$ ?                      B)  $\text{V}_2\text{SO}_4$ ?

ANSWER:    A)  $\text{H}_2\text{SO}_4$  sulfuric acid                      B)  $\text{V}_2\text{SO}_4$  vanadium IV sulfate

11) Name the following compounds:

A)  $\text{H}_2\text{S}$  in water?                      B)  $\text{KCl}$ ?

ANSWER:    A)  $\text{H}_2\text{S}$  in water hydrosulfuric acid                      B)  $\text{KCl}$  potassium chloride

12)  $\text{H}_2$  diffuses 4.870 times faster than an unknown gas. What is the molar mass of the unknown gas?

ANSWER:     $47.9 \text{ g mol}^{-1}$

13) A gas mix is composed of  $\text{CH}_4$ ,  $\text{NH}_3$  and  $\text{H}_2$ . The pressure of the  $\text{CH}_4$  is 316.1 torr. The pressure of  $\text{NH}_3$  is 278.7. The total pressure is 724.8 torr. What is the pressure of  $\text{CH}_4$ ?

ANSWER:    130.0 torr

14)  $\text{CH}_4$  is collected over water at  $6.0^\circ\text{C}$ . The barometric pressure is 603 torr. What is the pressure of the dry  $\text{CH}_4$ ?

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? ( $a = 24.39 \text{ atm L}^2 \text{ mol}^{-1}$  and  $b = 0.1735 \text{ L mol}^{-1}$ ) **Give the answer to three significant figures!**

$$\left[ P + \left( \frac{an^2}{V^2} \right) \right] (V - bn) = nRT$$

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<sup>-1</sup>

- 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<sub>3</sub> 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)  $2.085 \times 10^0$

2)

3)

4)

5)

6)

7)

8)

9)

10)

11)

12)

13)

14)

15)

16)

17)

18)

19)

20)