Chem 11 moles practice test. /50

Part 1: Written response

1) What is AVOGADRO'S HYPOTHESIS. (3)

2) 1L of Hydrogen gas reacts with 1L of Chlorine gas to create 2L of Hydrogen Chloride gas. Explain why, using Avogadro's hypothesis, each gas must be diatomic. (3)

Part 2: Mole conversions. Show all work, and give answers to correct sig figs.

1) How many moles of Iron are in a 5.1 g sample? (3)

$$5.1\text{ g Fe} \times \frac{1\text{ mol}}{55.8\text{ g}} = 0.091\text{ mol}$$

2) What is the mass of 12.1 moles of Zirconium? (3)

$$12.1\text{ mol Zr} \times \frac{91.2\text{ g}}{1\text{ mol}} = 1.10 \times 10^{3}\text{ g}$$

3) How many atoms of Titanium are there in a 6.31 mole sample? (3)

$$6.31\text{ mol Ti} \times \frac{6.022 \times 10^{23}\text{ atoms}}{1\text{ mol}} = 3.80 \times 10^{24}\text{ atoms}$$

4) Express 6.11×10^{31} atoms of Gold in ~~atoms~~ moles. (3)

$$6.11\times10^{31}\text{ atoms} \times \frac{1\text{ mol}}{6.022\times10^{23}\text{ atoms}} = 1.01\times10^{8}\text{ mol}$$

*at STP... oops!

5) How many liters of space do 2.91 moles of gas take up? (3)

$$2.91\text{ moles gas} \times \frac{22.4\text{ L}}{1\text{ mol}} = 65.2\text{ L}$$

6) How many moles of gas are there in a 3.14 L balloon? (3)

$$3.14\text{ L} \times \frac{1\text{ mol}}{22.4\text{ L}} = 0.140\text{ mol}$$

7) How many moles of solute is needed to make a 0.500 M solution with 0.311 mL of Solvent? (3)

$M = \frac{n}{V}$

$0.500\text{ M} = \frac{n}{0.000311\text{ L}}$

$n = 1.56\times10^{-4}\text{ mol}$

8) A rectangular block of pure silver is measured to be 2 mm x 3 mm x 4 mm. How many atoms of silver are there in the block? (density = 10.49 $\frac{g}{cm^3}$) (5)

$2\times3\times4 = 24\text{ mm}^3$

$24\text{ mm}^3 \times \left(\frac{1\text{ cm}}{10\text{ mm}}\right)^3 = 0.024\text{ cm}^3$

$D = \frac{m}{V}$

$10.49\frac{g}{cm^3} = \frac{m}{0.024\text{ cm}^3}$

$0.25176\text{ g} = m$

$0.25176\text{ g} \times \frac{1\text{ mol}}{107.9\text{ g}} \times \frac{6.022\times10^{23}\text{ atoms}}{1\text{ mol}}$

$= 1\times10^{21}\text{ atoms}$

9) What is the mass of 8.12×10^{23} molecules of Oxygen gas? (5)

$$8.12\times10^{23}\text{ molecules } O_2 \times \frac{1\text{ mol}}{6.022\times10^{23}\text{ molecules}} \times \frac{32.0\text{ g}}{1\text{ mol}} = 43.1\text{ g}$$

10) 61.7 L of HCl gas at STP is bubbled through 3.0 L of water. What is the molarity of the acid made if 91.0% of the gas is absorbed. (5)

$$61.7\text{ L HCl} \times \frac{1\text{ mol}}{22.4\text{ L}} \times 0.910 = 2.5065625\text{ mol absorbed}$$

$$M = \frac{n}{V} = \frac{2.5065625\text{ mol}}{3.0} = 0.84\text{ M}$$

11) 1.21×10^{20} molecules of Aluminum chloride are dissolved into 500.1 mL of water. What is the concentration of Cl^- ions? (5)

$$AlCl_3 \rightarrow Al^{3+} + 3Cl^-$$

$$1.21\times10^{20}\text{ molecules } AlCl_3 \times \frac{1\text{ mol}}{6.022\times10^{23}\text{ molecules}} \times \frac{3\text{ mol } Cl^-}{1\text{ mol } AlCl_3} = 0.000602789\text{ mol } Cl^-$$

$$M = \frac{0.000602789\text{ mol } Cl^-}{0.5001\text{ L}} = 0.00120\text{ M}$$

12) 74.1 mL of water is added to the solution in #11. What is the new concentration of Cl^- ion? (3)

$$\frac{0.000602789\text{ mol } Cl^-\ \text{(from \#11)}}{0.5742\text{ L}}$$

$0.5001\text{ L} + 0.0741\text{ L}$

$= 0.00105\text{ M}$

sig figs for adding

$$\begin{array}{r} 0.5001 \\ 0.0741 \\ \hline 0.5742 \end{array}$$