

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 ^{moles} atoms. (3)

$$6.11 \times 10^{31} \text{ atoms} \times \frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ atoms}} = 1.01 \times 10^8 \text{ mol}$$

- 5) How many liters of space do 2.91 moles of gas take up? (3)
 at STP... cool!

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

- 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)

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

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

$$n = 1.56 \times 10^{-4} \text{ mol}$$

- 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 = $10.49 \frac{\text{g}}{\text{cm}^3}$) (5)

$$2 \times 3 \times 4 = 24 \text{ mm}^3$$

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

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

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

$$0.25176 \text{ g} = m$$

$$0.25176 \text{ g} \times \frac{1 \text{ mol}}{107.87 \text{ g}} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol}}$$

$$= 1 \times 10^{21} \text{ atoms}$$

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

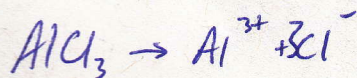
$$8.12 \times 10^{23} \text{ molecules } O_2 \times \frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ molecules}} \times \frac{32.0 \text{ g}}{1 \text{ mol}} = 43.1 \text{ g}$$

- 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)



$$1.21 \times 10^{20} \text{ molecules AlCl}_3 \times \frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ molecules}} \times \frac{3 \text{ mol Cl}^-}{1 \text{ mol AlCl}_3} = 0.000602789 \text{ mol Cl}^-$$

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

- 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

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