Class Announcements

LAST LAB: Saturday, Dec 3RD, 1:30-4:30

EXAM III: Tuesday, Dec 6th, 12:45-2:15, In class
Review, Sunday, Dec 4th, 3:00-4:45 pm, ISB 135

FINAL EXAM: Tuesday, Dec 13th, 8:00-10:00 am, ISB 135
Review, Sunday, Dec 11th, 1:00-2:30 pm, ISB 135

In the laboratory you dilute **4.00 mL** of a concentrated **3.00 M hydriodic acid** solution to a total volume of **150 mL**. What is the **concentration** of the **dilute** solution ?

_0.08_ **M**

$$M = \frac{\# \, mol}{V(L)} \quad or \quad \# \, mol = M \times V(L)$$

$$\# \, mol \; HI = 3.00 \times 0.004 = 1.20 \times 10^{-2} \, mol \; HI$$

$$M = \frac{\# \, mol \; HI}{V(L)} = \frac{1.20 \times 10^{-2}}{0.150} = 0.08M$$

$BaBr_2$

How many **milliliters** of an aqueous solution of **0.134 M** barium bromide is needed to obtain **4.00 grams** of the salt ?

$Ba : 137.33$ $Br : 79.90$

100
_____?.00_____ mL

$$M = \frac{\#mol}{V(L)} \qquad\qquad \#mol = \frac{\#g}{MM}$$

$$BaBr_2 \; : \; 137.33 + 2(79.90) = 297.13 \text{ g.mol}^{-1} \quad \ldots \quad \frac{297.13 \text{ g}}{1 \text{ mol}}$$

$$\# mol \; BaBr_2 = 4.00g \left| \frac{1 \text{ mol}}{297.13 \text{ g}} \right. = 1.35 \times 10^{-2} \text{ mol } BaBr_2$$

$$\#mol = M \times V(L)$$

$$1.35 \times 10^{-2} = 0.134 \times V(L)$$

$$V(L) = \frac{1.35 \times 10^{-2}}{0.134} = 0.100 L \left| \frac{1000 \text{ mL}}{1 \text{ L}} \right. = 100 \text{ mL}$$
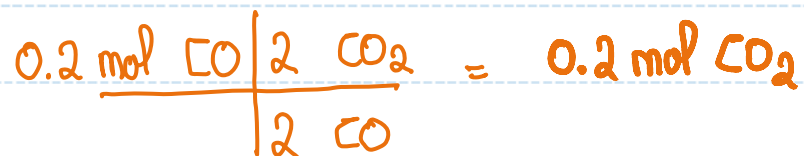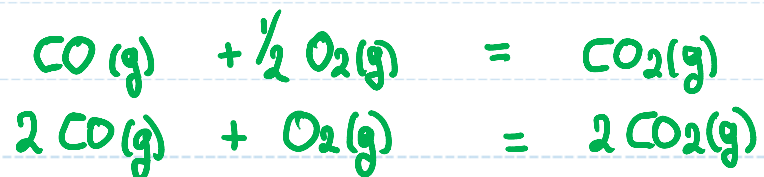
How many moles of **carbon dioxide** will be formed upon the complete reaction of **0.2** moles of **carbon monoxide** with **excess** oxygen gas?

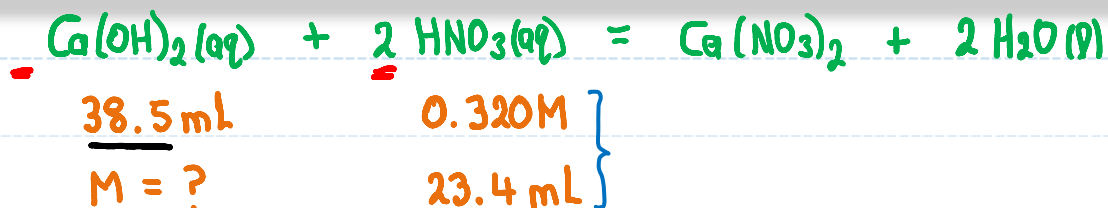**Carbon monoxide (g) + oxygen (g) = carbon dioxide (g)**

_0.2_ _____ mol

$$CO\,(g) \;+\; \tfrac{1}{2}\,O_2(g) \;=\; CO_2(g)$$

$$2\,CO\,(g) \;+\; O_2(g) \;=\; 2\,CO_2(g)$$

$$0.2 \text{ mol } CO \; \frac{2 \; CO_2}{2 \; CO} \;=\; 0.2 \text{ mol } CO_2$$

> **Calcium hydroxide** is standardized by titration with **0.320 M** solution of **nitric acid**. If **38.5 mL** of **base** are required to neutralize **23.4 mL** of **acid**, what is the **molarity** of the **calcium hydroxide solution?**

$$Ca(OH)_2\,(aq) \;+\; 2\,HNO_3\,(aq) \;=\; Ca(NO_3)_2 \;+\; 2\,H_2O\,(l)$$

$$\begin{array}{ll} 38.5\,mL & 0.320\,M \\ M = ? & 23.4\,mL \end{array}$$

$$M = \frac{\#\,mol}{V(L)} \quad ; \quad \#\,mol = M \times V(L)$$

$$Ca(OH)_2 : \quad M = \frac{\#\,mol\;Ca(OH)_2}{V(L)}$$

$$\#\,mol\;HNO_3 = 0.320 \times 0.0234 = 7.49 \times 10^{-3}\,mol$$

$$M = \frac{3.74 \times 10^{-3}}{0.0385}$$

$$7.49 \times 10^{-3}\,mol\;HNO_3 \left|\frac{1\;Ca(OH)_2}{2\;HNO_3}\right. = \frac{3.74 \times 10^{-3}\,mol}{Ca(OH)_2}$$

$$= 0.0972$$

How many **grams** of **solid** barium hydroxide are needed to exactly neutralize **12.7 mL** of a **1.49 M** hydrochloric acid solution?
Assume that the volume remains constant.

$$Ba(OH)_2 (aq) + 2 HCl(aq) = BaCl_2 + 2 H_2O (l)$$

?, g

12.7 ml
1.49 M

mol HCl $= 1.49 \times 0.0127 = 1.89 \times 10^{-2}$ mol

$Ba(OH)_2$: $137.33 + 2(16.00 + 1.01)$

171.35 g.mol^{-1} ..... $\dfrac{171.35 g}{1 mol}$

$$\dfrac{1.89 \times 10^{-2} \text{ mol } HCl}{} \left| \dfrac{1 Ba(OH)_2}{2 HCl} \right. = 9.46 \times 10^{-3} \text{ mol } Ba(OH)_2$$

$$\dfrac{9.46 \times 10^{-3} \text{ mol } Ba(OH)_2}{} \left| \dfrac{171.35 g}{1 mol} \right. = 1.62 g \ Ba(OH)_2$$

How many **grams** of **hydrochloric acid** will be formed upon the complete reaction of **29.0 grams** of **water** with **excess** **chlorine gas**?

Chlorine (g) + water (l) = hydrochloric acid (aq) + chloric acid ($HClO_3$)

$$3\ Cl_{2(g)} + 3\ H_2O_{(l)} = 5\ HCl_{(aq)} + HClO_3$$

$$= 29.0g \qquad = g.\ ?$$
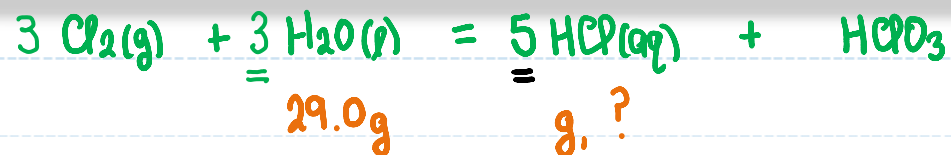
$H_2O:\quad 2(1.01) + 16.00 = 18.02\ g.mol$

$$\frac{29.0g}{18.02\ g}\ \bigg|\ \frac{1\ mol}{} = 1.61\ mol\ H_2O$$

$$\frac{1.61\ mol\ H_2O}{}\ \bigg|\ \frac{5\ HCl}{3\ H_2O} = 2.68\ mol\ HCl$$

$HCl:\quad 1.01 + 35.45 = 36.46\ g.mol^{-1}$

$$\underbrace{}_{\downarrow}$$

$$\frac{36.46\ g}{1\ mol}$$

$$\frac{2.68\ mol\ HCl}{}\ \bigg|\ \frac{36.46\ g}{1\ mol} = 97.8g\ HCl$$

What **volume** of **hydrogen gas** is produced when **63.3 g** of **iron** reacts completely with excess **hydrochloric acid?**

      Iron (s) + hydrochloric acid (aq) = iron(II) chloride (aq) + hydrogen (g)

$P = 1\ atm \quad T = 25°C \quad R = 0.08205\ L.atm.K^{-1}.mol^{-1}$

$$Fe(s) \quad + \quad 2\ HCl\ (aq) \quad = \quad FeCl_2\ (aq) \quad + \quad H_2(g)$$

      63.3 g   V, ?
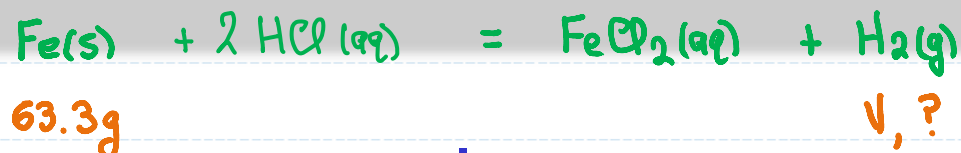
$$\frac{63.3\ g\ Fe \quad | \quad 1\ mol}{\quad\quad\quad | \quad 55.85\ g} = 1.13\ mol\ Fe$$

$$PV = nRT$$

$$1(V) = 1.13 \times 0.08205 \times 298$$

$$= 76.8$$

$$\frac{1.13\ mol\ Fe \quad | \quad 1\ H_2}{\quad\quad\quad\quad\quad | \quad 1\ Fe} = 1.13\ mol\ H_2$$

$$V = \frac{76.8}{1} = 76.8\ L$$