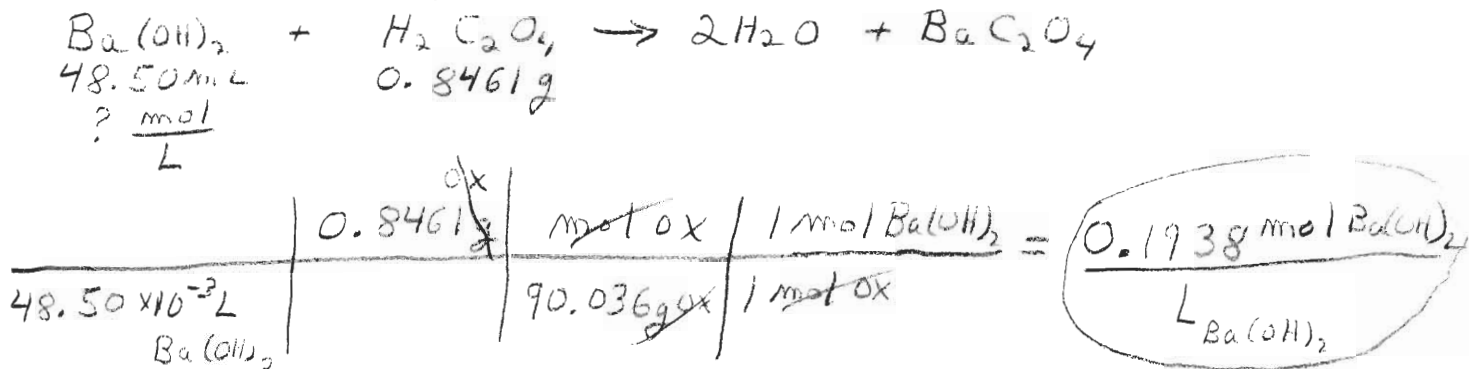**Show all work to receive credit.**

Molar masses: H 1.008, C 12.01, O 16.00, Na 22.99, P 30.97, Cl 35.45, Ba 137.33
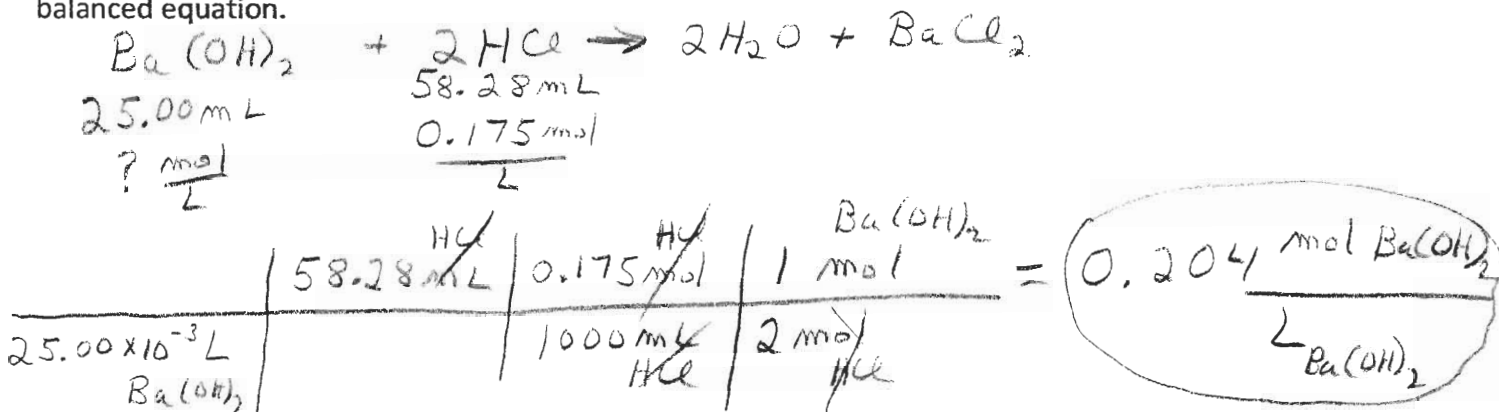
1. (5 Pts) Determine the molarity of a solution that is prepared by dissolving 0.429 g of sodium dihydrogen phosphate (NaH_2PO_4) in enough water to make 350.0 mL of solution.

$$\frac{0.429\, g\, NaH_2PO_4}{} \left| \frac{mol}{119.976\, g} \right| \frac{1}{0.3500\, L} = \boxed{0.0102\ \frac{mol\, NaH_2PO_4}{L}}$$

2. (8 Pts) In a titration, it took 48.50 mL of $Ba(OH)_2$ solution to neutralize 0.8461 g of oxalic acid ($H_2C_2O_4$). Determine the molarity of the $Ba(OH)_2$ solution. You must start with a balanced equation.

$$Ba(OH)_2 \quad + \quad H_2C_2O_4 \longrightarrow 2H_2O + BaC_2O_4$$

48.50 mL
? $\frac{mol}{L}$

0.8461 g

$$\frac{0.8461\, g\, ox}{48.50 \times 10^{-3}\, L\, Ba(OH)_2} \left| \frac{mol\, ox}{90.036\, g\, ox} \right| \frac{1\, mol\, Ba(OH)_2}{1\, mol\, ox} = \boxed{0.1938\ \frac{mol\, Ba(OH)_2}{L_{Ba(OH)_2}}}$$

3. (8 Pts) A chemist performed a titration to standardize a barium hydroxide solution. If it took 58.28 mL of 0.175 M hydrochloric acid to neutralize 25.00 mL of the barium hydroxide solution, what was the concentration of the barium hydroxide solution in moles per liter (M)? You must start with a balanced equation.

$$Ba(OH)_2 \quad + \quad 2HCl \longrightarrow 2H_2O + BaCl_2$$

25.00 mL
? $\frac{mol}{L}$

58.28 mL
0.175 $\frac{mol}{L}$

$$\frac{58.28\, mL\, HCl}{25.00 \times 10^{-3}\, L\, Ba(OH)_2} \left| \frac{0.175\, mol\, HCl}{1000\, mL\, HCl} \right| \frac{1\, mol\, Ba(OH)_2}{2\, mol\, HCl} = \boxed{0.204\ \frac{mol\, Ba(OH)_2}{L_{Ba(OH)_2}}}$$

4. (4 Pts) How many mL of 7.00 M HCl solution are needed to prepare 850 mL 2.00 M HCl solution?

$$M_1 V_1 = M_2 V_2$$

$$(7.00\, M)\, V_1 = (2.00\, M)(850\, mL)$$

$$\boxed{V_1 = 243\, mL}\ of\ 7.00\, M\, HCl\ needed$$
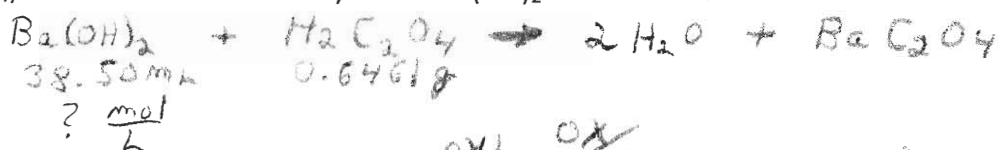
Show all work to receive credit.

Molar masses: H 1.008, C 12.01, O 16.00, Na 22.99, P 30.97, Cl 35.45, Ba 137.33

1. (5 Pts) Determine the molarity of a solution that is prepared by dissolving 0.529 g of sodium hydrogen phosphate (Na_2HPO_4) in enough water to make 250.0 mL of solution.
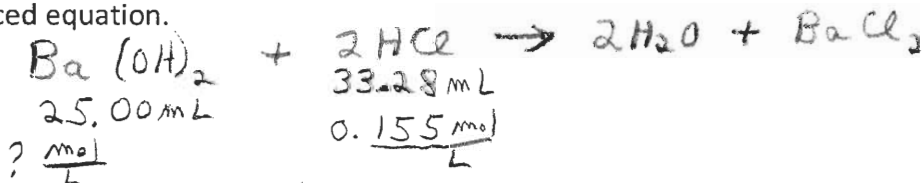
$$\frac{0.529 \text{ g } Na_2HPO_4}{} \left|\frac{mol}{141.958g}\right|\frac{}{0.2500 L} = \boxed{0.0149 \frac{mol}{L}}$$

2. (8 Pts) In a titration, it took 38.50 mL of $Ba(OH)_2$ solution to neutralize 0.6461 g of oxalic acid ($H_2C_2O_4$). Determine the molarity of the $Ba(OH)_2$ solution.   You must start with a balanced equation.

$$Ba(OH)_2 + H_2C_2O_4 \rightarrow 2 H_2O + BaC_2O_4$$

38.50 mL   0.6461 g

? $\frac{mol}{L}$

$$\frac{0.6461 \text{ g ox}}{38.50\times10^{-3} L \; Ba(OH)_2} \left|\frac{mol}{90.036 g \text{ ox}}\right|\frac{1 \text{ mol } Ba(OH)_2}{1 \text{ mol ox}} = \boxed{0.1864 \frac{mol\, Ba(OH)_2}{L\, Ba(OH)_2}}$$

3. (8 Pts) A chemist performed a titration to standardize a barium hydroxide solution. If it took 33.28 mL of 0.155 M hydrochloric acid to neutralize 25.00 mL of the barium hydroxide solution, what was the concentration of the barium hydroxide solution in moles per liter (M)? You must start with a balanced equation.

$$Ba(OH)_2 + 2 HCl \rightarrow 2 H_2O + BaCl_2$$

25.00 mL   33.28 mL

? $\frac{mol}{L}$ 0.155 $\frac{mol}{L}$

$$\frac{33.28 \text{ mL HCl}}{25.00\times10^{-3} L \; Ba(OH)_2}\left|\frac{0.155 \text{ mol HCl}}{1000 \text{ mL HCl}}\right|\frac{1 \text{ mol } Ba(OH)_2}{2 \text{ mol HCl}} = \boxed{0.103 \frac{mol\, Ba(OH)_2}{L\, Ba(OH)_2}}$$

4. (4 Pts) How many mL of 5.00 M HCl solution are needed to prepare 850 mL 2.00 M HCl solution?

$$M_1 V_1 = M_2 V_2$$

$$(5.00 M) V_1 = (2.00 M)(850 \text{ mL})$$

$$V_1 = \boxed{340 \text{ mL}} \text{ of } 5.00 \text{ M HCl}$$