BeCl₂

1. 2.54 g of beryllium chloride are completely dissolved into 50.00 mL of water inside a beaker.

   a) Draw a particulate representation of all species in the beaker after the solute has dissolved. Your diagram should include at least **one formula unit of beryllium chloride** and **four water molecules**. Make sure the atoms and ions are correctly sized and oriented relative to each other. [*2 points*]
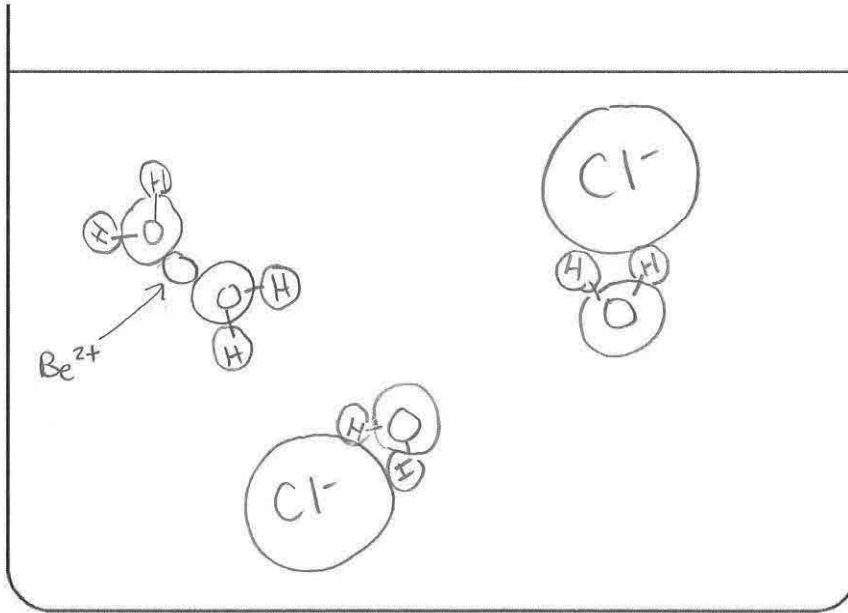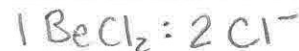

   b) Calculate the concentration of beryllium ions, chloride ions, and total ions in the beaker. [*2 points*]

A solution of 0.850 M lead (II) nitrate is then titrated into the beaker, causing a precipitate of lead (II) chloride to form.

   c) Identify the net ionic reaction occurring in the beaker. [*1 point*]

   d) Determine the volume of lead (II) nitrate that must be added to the beaker to cause the maximum precipitate to form. [*2 points*] (in mL) ☺

   e) What is the theoretical yield of precipitate? [*2 points*]

   f) A student performing this lab has a percent error of 7.45%. They claim that the source of their error was dissolving the beryllium chloride in only 45.00 mL of water. Do you agree with the student? Justify your response. [*1 point*]
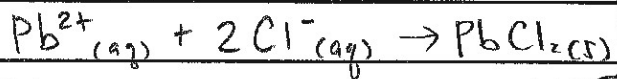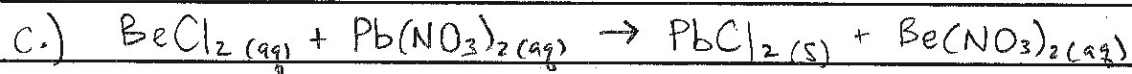
b) $2.54 \text{ g } BeCl_2 \times \dfrac{1 \text{ mol } BeCl_2}{79.91 \text{ g } BeCl_2} = 0.0318 \text{ mol } BeCl_2 \Big/ 0.05000 \text{ L} = 0.635 \text{ M } BeCl_2$

Since $1 \, BeCl_2 \rightarrow 1 \, Be^{2+} + 2 \, Cl^- \Rightarrow 1 \, BeCl_2 : 1 \, Be^{2+} \Rightarrow [Be^{2+}] = 0.635 \text{ M}$

$1 \, BeCl_2 : 2 \, Cl^-$

$\Rightarrow [Cl^-] = 2 \times 0.635 = 1.27 \text{ M } Cl^-$

$1 \, BeCl_2 : 3 \text{ total ions}$

$\Rightarrow [\text{total ions}] = 3 \times 0.635 = 1.91 \text{ M total ions}$

c.) $BeCl_{2(aq)} + Pb(NO_3)_{2(aq)} \rightarrow PbCl_{2(S)} + Be(NO_3)_{2(aq)}$

$$\boxed{Pb^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow PbCl_{2(S)}}$$

d.) $0.0318 \text{ mol } BeCl_2 \times \dfrac{1 \text{ mol } Pb(NO_3)_2}{1 \text{ mol } BeCl_2} = 0.0318 \text{ mol } Pb(NO_3)_2$

$V = \dfrac{mol}{M} = \dfrac{0.0318 \text{ mol}}{0.850 \text{ M}} = \boxed{0.0374 \text{ L} = 37.4 \text{ mL } Pb(NO_3)_2}$

e.) $0.0318 \text{ mol } BeCl_2 \times \dfrac{1 \text{ mol } PbCl_2}{1 \text{ mol } BeCl_2} \times \dfrac{278.1 \text{ g } PbCl_2}{1 \text{ mol } PbCl_2} = \boxed{8.84 \text{ g } PbCl_2}$

f.) I disagree! Adding less water will have no effect on the total amount of $BeCl_2$ and thus cannot be the source of the error.