150. mL, 0.030M **Unit 2: AP Free Response Practice ~~#2~~ #4** (2008 FR #3, modified) [10 points]

1. A 0.~~150~~ g sample of solid lead (II) nitrate is added to 125 mL of 0.100 M sodium iodide solution. Assume no change in volume of the solution.

   a. A chemical reaction takes place and a precipitate is formed.

      i. Write the balanced equation for the reaction, including states. [*2 point]*

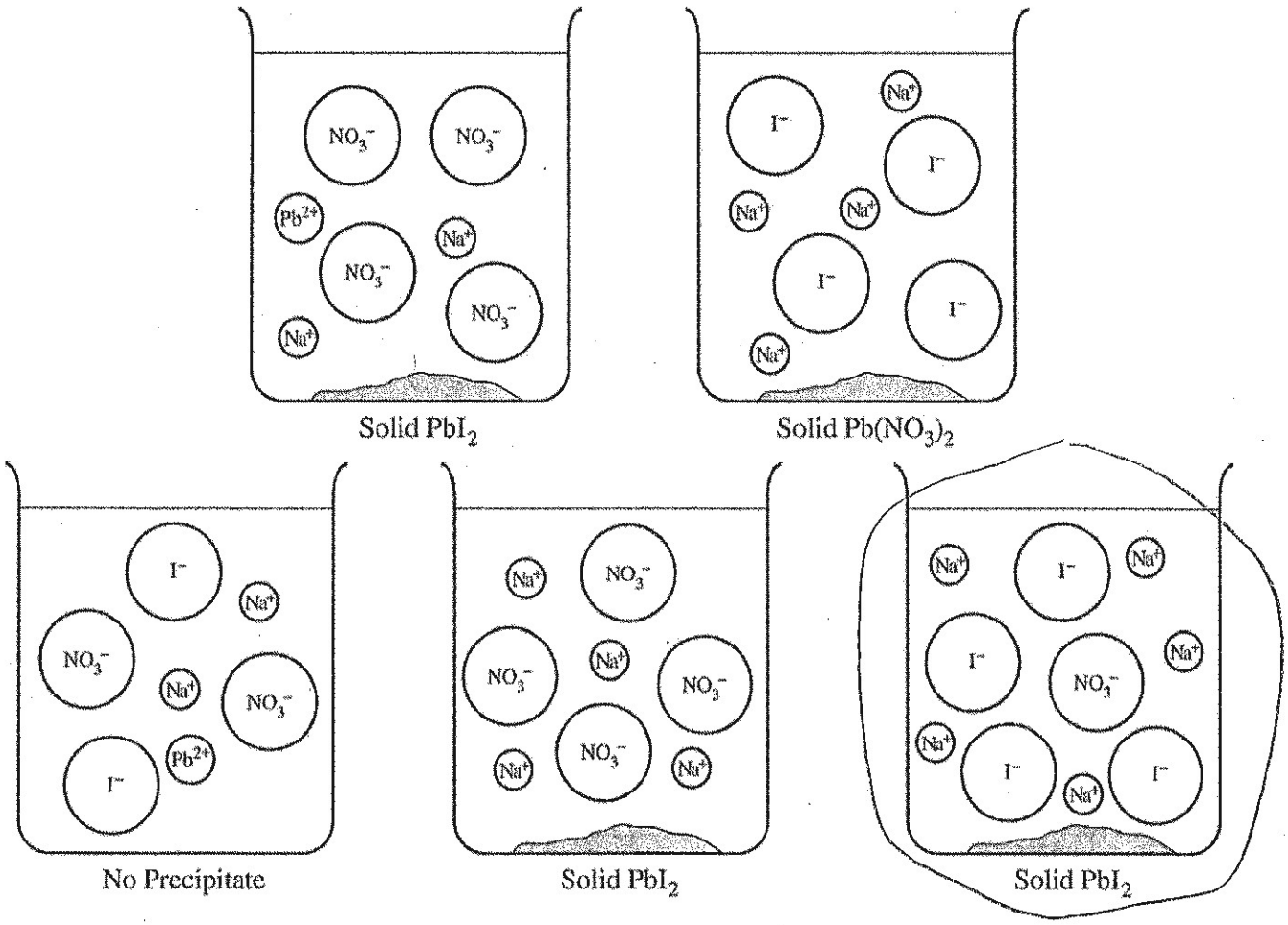
      ii. Write the balanced net ionic equation for the reaction, including states. [*1 point*]

   b. Calculate the number of moles of each reactant. [*2 points*]

   c. Identify the limiting reactant. Show calculations to support your identification. [*1 point]*

   d. Calculate the molar concentration of $NO_3^-(aq)$ in the mixture after the reaction is complete. [*2 points*]

   e. Circle the diagram below that best represents the results after the mixture reacts as completely as possible. Explain the reasoning used in making your choice. [*2 points*]



a.)(i) $\underline{1}\ Pb(NO_3)_{2(aq)} + \underline{2}\ NaI_{(aq)} \rightarrow \underline{1}\ PbI_{2(s)} + \underline{2}\ NaNO_{3(aq)}$

(ii) $Pb^{2+}_{(aq)} + 2I^-_{(aq)} \rightarrow PbI_{2(s)}$

b.) $0.150\ L \times 0.030\ M = \boxed{0.0045\ mol\ Pb(NO_3)_2}$

$moles_{NaI} = 0.100M \times 0.125\ L = \boxed{0.0125\ mol\ NaI}$

c.) $\frac{0.0045\ mol\ Pb(NO_3)_2}{1} = 0.0045$; $\frac{0.0125\ mol\ NaI}{2} = 0.00625$

smaller!

limiting!

d.) All NO_3^- comes from $Pb(NO_3)_2$:

$$4.5E\text{-}3\ mol\ Pb(NO_3)_2 \times \frac{2\ mol\ NO_3^-}{1\ mol\ Pb(NO_3)_2} = 0.0090\ mol\ NO_3^-$$

$$[NO_3^-] = \frac{0.0090\ mol}{0.275\ L} = \boxed{0.033\ M\ NO_3^-}$$

e.) $PbI_{2(s)}$ precipitated. $Pb(NO_3)_2$ was limiting, so no Pb^{2+} was in sol'n. NaI was in excess, so both Na^+ and I^- are aqueous, but $[I^-] < [Na^+]$, since some I^- was used up in the precipitate.