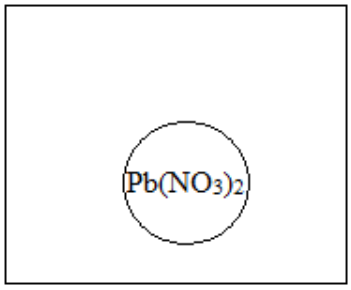
Multiple Choice Sample (Stoichiometry)

NO CALCULATORS MAY BE USED FOR THESE QUESTIONS

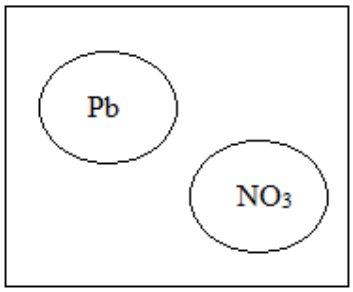
Questions 1-3 refer to the aqueous solutions $Pb(NO_3)_2$ and NaI.

1. When a specific amount of solid lead (II) nitrate, $Pb(NO_3)_2$, is sufficiently dissolved in 1.0 L of water, which diagram best describes a particle-view of this aqueous solution.

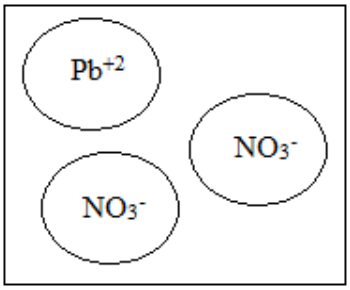
(A)



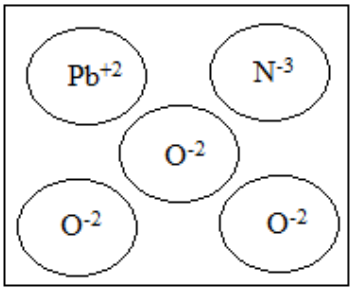
(B)



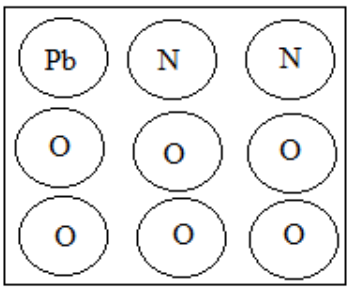
(C)



(D)



(E)



Answer: C – Since $Pb(NO_3)_2$ is an ionic compound and has nitrate, NO_3^-, it will be able to dissociate in water. Therefore, there will be one Pb^{2+} (aq) and 2 NO_3^- (aq).

- **A is incorrect because the compound will dissociate or split up.**
- **B is incorrect because there is only one of each and there are no charges shown.**
- **D is incorrect because water will not break up the bonds of NO_3^-.**
- **E is incorrect because water will not break up the compound into atoms.**

2. If the solution above of $Pb(NO_3)_2$ is combined with an equimolar solution of NaI, what is the result?
   (A) No reaction
   (B) A white precipitate of PbI_2 (s)
   (C) A white precipitate of $NaNO_3$ (s)
   (D) A yellow precipitate of PbI_2(s)
   (E) A white precipitate of $NaNO_3$ (s)

Answer: D – According to the reaction $Pb^{2+} + 2\ I^- \rightarrow PbI_2$ (s), there will be a yellow precipitate of lead (II) iodide. Na^+ and NO_3^- will always be spectator ions in water and will never precipitate.

3. If 1.0 mole of NaI (aq) is mixed with an excess amount of $Pb(NO_3)_2$, how many moles of product will be produced.
   (A) 0.25 moles
   (B) 0.50 moles
   (C) 1.0 moles
   (D) 2.0 moles
   (E) 3.0 moles

Answer: B – Since the reaction is $Pb^{2+} + 2\ I^- \rightarrow PbI_2$ (s), the molar ratio of I^- to product is 2:1. So if there is 1.0 moles of I^- there will only be 0.50 moles of PbI_2.

$$\_\_\ H_2\ (g) + \_\_\ O_2\ (g) \rightarrow \_\_\ H_2O\ (g)$$

4. According to the reaction above if 0.25 moles of oxygen gas reacts with an excess amount of hydrogen gas, how many grams of water is produced?
   (A) 9 grams
   (B) 18 grams
   (C) 36 grams
   (D) 45 grams
   (E) 54 grams

Answer: A – Since the balanced chemical reaction is $2\ H_2$ (g) + $1\ O_2$ (g) $\rightarrow$ $2\ H_2O$ (g), if there is 0.25 moles of O_2 then there is 0.50 moles of H_2O (1:2 ratio). If there are 0.50 moles of H_2O and water is 18 grams/mole, then 0.50 x 18 = 9 grams.

$$Zn\ (s) + 2\ HCl\ (aq) \rightarrow ZnCl_2\ (aq) + H_2\ (g)$$

5. An excess amount of Zn (s) is added to 500. mL of 0.800 M HCl. What mass in grams of H_2 (g) is produced?
   (A) 0.100 g
   (B) 0.200 g
   (C) 0.400 g
   (D) 0.600 g
   (E) 0.800 g

Answer: C – Since the word "of" in chemistry means multiply, then 0.800 M x 0.500 L = 0.400 moles of HCl. If you have 0.400 moles of HCl, then you have 0.200 moles of H_2 (2:1 ratio according to the chemical reaction). If you have 0.200 moles of H_2 and H_2 has a molar mass of 2 grams/mole, then 0.200 x 2 = 0.400 grams.