ANSWER KEY

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3.8 Representations of Solutions

AP Chemistry | ANSWER KEY

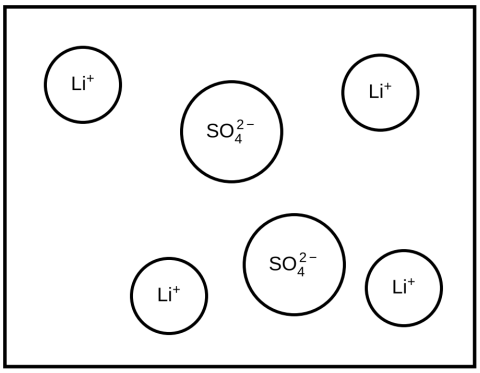
Show all work with units and correct significant figures.

1. A student draws methanol, CH_3OH, dissolved in water as separate CH_3^+ and OH^- ions. (a) Explain what is wrong with this drawing. (b) Name the main attraction between methanol and water molecules, and describe how to show it in a particle diagram.

(a) Methanol is molecular, so it does not dissociate into ions. Each CH_3OH molecule stays whole.

(b) Hydrogen bonding between the O-H group of methanol and water. Show it as dashed lines between molecules.

2. Draw a particle diagram of aqueous lithium sulfate that includes two sulfate ions. You may leave out the water molecules. Label each ion with its charge.

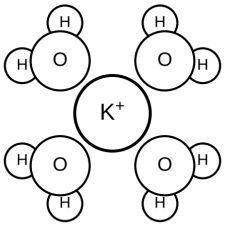


$Li_2SO_4(s) \rightarrow 2Li^+(aq) + SO_4^{2-}(aq)$

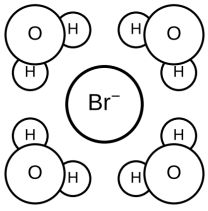
Draw 4 Li^+ and 2 SO_4^{2-} ions, all separated from each other.

Check: 4(+1) + 2(−2) = 0

3. Around each ion below, draw four water molecules oriented correctly. On one water molecule for each ion, label the end that faces the ion as δ+ or δ−.



O end (δ−) faces K^+



H ends (δ+) face Br^-

The O end (δ−) of water faces K^+. The H ends (δ+) face Br^-. These are ion-dipole attractions.

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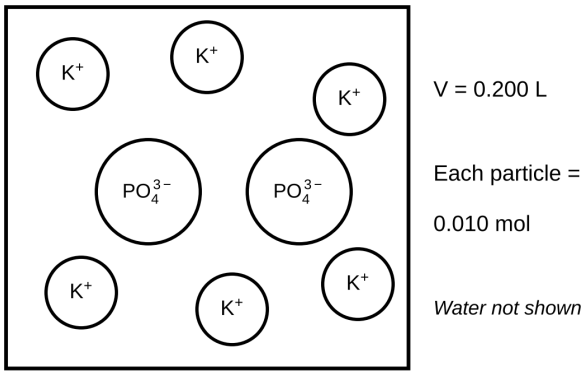
4. The box shows all of the ions in 0.200 L of a K_3PO_4 solution. (a) Calculate $[K^+]$. (b) Calculate the molarity of K_3PO_4. (c) Explain why the diagram correctly shows more K^+ ions than PO_4^{3-} ions.

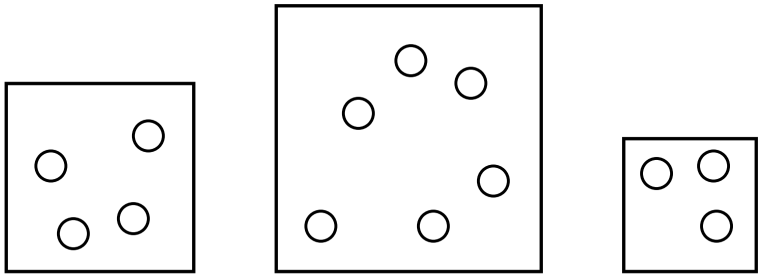


(a) 6 × 0.010 mol = 0.060 mol K^+; 0.060 mol ÷ 0.200 L = 0.30 M

(b) 2 × 0.010 mol = 0.020 mol PO_4^{3-} = 0.020 mol K_3PO_4; 0.020 mol ÷ 0.200 L = 0.10 M

(c) $K_3PO_4 \rightarrow 3K^+ + PO_4^{3-}$, so there are 3 K^+ for every PO_4^{3-}. 6 : 2 = 3 : 1, and 6(+1) + 2(−3) = 0.

5. Each box holds the same solute dissolved in water. The volume of each box is given. Rank the samples from highest to lowest molarity, and explain your ranking.

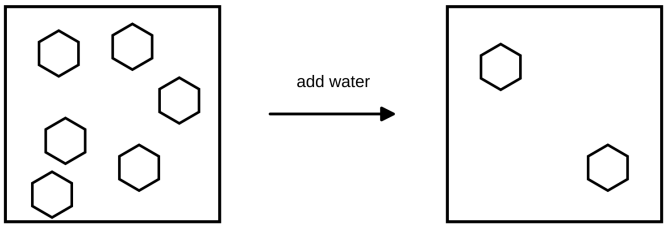


A: 1.0 L **B: 2.0 L** **C: 0.50 L**

C > A > B. Compare particles per liter, not just the number of particles.

A: 4 ÷ 1.0 L = 4 per L; B: 6 ÷ 2.0 L = 3 per L; C: 3 ÷ 0.50 L = 6 per L

6. Box A represents 50.0 mL of 0.60 M sucrose solution. Water is added until the total volume is 150.0 mL. (a) Calculate the new molarity. (b) Box B is the same size as Box A. Draw the number of sucrose molecules that belong in Box B.



Box A: 0.60 M **Box B: ? M**

(a) $M_1V_1 = M_2V_2$; (0.60 M)(50.0 mL) = M_2(150.0 mL); M_2 = 0.20 M

(b) 0.20 M is one third of 0.60 M, so Box B holds one third of the molecules: 6 ÷ 3 = 2 sucrose molecules (drawn whole).

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