42. a) Heterogeneous

b) Solvent: Water
Solute: Organic acids, sugars, and gums

c) Solvent: Water
Solute: Some minerals and gases

d) Solvent: gold
Solute: Silver/Copper

Deleted: Water

7.5/8

43. Gasoline: No, since gasoline is non-polar and a lot heavier than water.
Methanol: Yes because methanol is polar and has an OH group to allow for a hydrogen bond.
Sodium Bicarbonate: Yes, since it is an ionic compound and will dissolve into the solvent through ionic dissociation.

3/3

44. a)

$$Na_2CO_{3(s)} \rightarrow 2Na^{+}_{(aq)} + CO^{2-}_{3(aq)}$$

b)

$$MgCl_{2(s)} \rightarrow Mg^{2+}_{(aq)} + 2Cl^{-}_{(aq)}$$

c)

$$NH_4OH_{(s)} \rightarrow NH^{+}_{4(aq)} + OH^{-}_{(aq)}$$

45. In both the ionic and covalent compounds, the water will attach to both through its polarity as well as surround both the molecules as to disassociate both of them further.

2/2

46. Water is a fantastic solute because of its capability to hydrogen bond, its incredible abundance, and its polarity. It also very small, which allows many water molecules to easily surround larger solute particles.

1/2

47. a) Barium Phosphate will be the precipitate.

b) Silver Acetate will be the precipitate.

c) Copper (II) Chloride will be the precipitate. Copper (I) chloride

2/3

48. a) Balanced Chemical Equation:

$$3Ba(OH)_{2(aq)} + 2(NH_4)_3PO_{4(aq)} \rightarrow Ba_2(PO_4)_{2(aq)} + 6NH_4OH_{(aq)}$$

$$3Ba^{2+}_{(aq)} + 6OH^-_{(aq)} + 6NH^+_{4(aq)} + 2PO^{3-}_{4(aq)} \rightarrow Ba_3(PO_4)_{2(s)} + 6NH^+_{4(aq)} + 6OH^-_{(aq)}$$

Net Ionic Equation:

$$3Ba^{2+}_{(aq)} + 2PO^{3-}_{4(aq)} \rightarrow Ba_3(PO_4)_{2(s)}$$

Spector Ions:

$$OH^-_{(aq)} \text{ and } NH^+_{4(aq)}$$

b) Balanced Chemical Equation:

$$AgNO_{3(aq)} + KC_2H_3O_{2(aq)} \rightarrow AgC_2H_3O_{2(s)} + KNO_{3(aq)}$$

$$Ag^+_{(aq)} + NO^-_{3(aq)} + K^+_{(aq)} + C_2H_3O^-_{2(aq)} \rightarrow AgC_2H_3O_{2(s)} + K^+_{(aq)} + NO^-_{3(aq)}$$

Net Ionic Equation:

$Ag^+_{(aq)} + C_2H_3O^-_{2(aq)} \rightarrow AgC_2H_3O_{2(s)}$

Spector Ions:

$NO^-_{3(aq)}$ and $K^+_{(aq)}$

c)

Balanced Chemical Equation:

$Cu_2SO_{4(aq)} + 2NaCl_{(aq)} \rightarrow 2CuCl_{(s)} + Na_2SO_{4(aq)}$

$2Cu^+_{(aq)} + SO^{2-}_{4(aq)} + 2Na^+_{(aq)} + Cl^-_{(aq)} \rightarrow 2CuCl_{(s)} + 2Na^+_{(aq)} + SO^{2-}_{4(aq)}$

Net Ionic Equation:

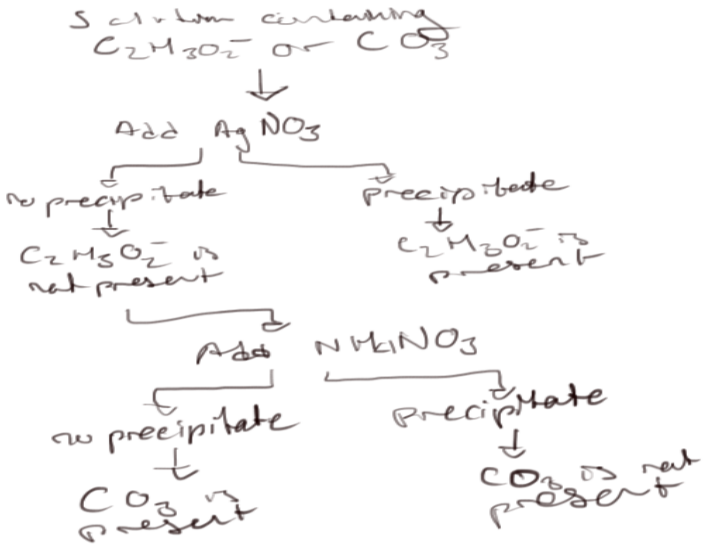
$Cu^+_{(aq)} + Cl^-_{(aq)} \rightarrow CuCl_{(s)}$

Spector Ions:

$SO^{2-}_{4(aq)}$ and $Na^+_{(aq)}$

9/9

49.



The silver should be added *after* the magnesium. This is because silver will form a precipitate with both ions, while magnesium will only form a precipitate with carbonate.

Also, the net ionic equations are required for both of these reactions.

2/4

50. Precipitation reactions can be used in water treatment plants to test for pollutants. For example, if a technician wanted to test for SO_4, then they would take a sample and mix perhaps $Ca(NO_3)$ into it. If there was a precipitate, then they may want to repeat with $AgNO_3$, $Pb(NO_3)_2$, or even $Ba(NO_3)_2$ to ensure if they have SO_4 as a pollutant.

This is true, but SO_4^{2-} is not considered to be a pollutant. However, barium, lead, and silver would be. So you would need to add sulfate to get rid of these ions, not the other way around.

1/2

51. a) Bottled Water in Local Municipality (Vancouver)

Benefits	Challenges
Cheap	Environmental Waste
Convienent*	Use of Public Water

b) Country with Limited Water Resources

Benefits	Challenges
Access to Clean Water	Environmental Waste
Convenient*	Expensive

* Note that convenience for a person in a municipality may mean that they can have water next to their desk rather going to the kitchen. Convenience to a person who has limited access to clean water may mean that a person won't have to travel long distances and can instead relax and not expend a large amount of calories or time. In other words, the benefit of convenience to a person with limited access has a different meaning than to a person living in a municipality; although there are people inside municipalities that have limited access to water such as the homeless to whom, at times, have to use a public bathroom tap for water.

4/4

52.

$$C = \frac{n}{V} = \frac{30\ mL}{600\ mL} = 5\%$$

This should have three sig figs (5.00%) since 30.0 mL and 600. mL both have three sig figs.

2.5/3

53.

$$m = 1\ M$$

$$n = \frac{m}{M} = \frac{35.5\ g}{(122.99 + 1.01 + 12.01 + 3(16))\ g/mol}$$

$$= \frac{35.5\ g}{84.01\ g/mol} \approx 0.42\ mol$$

$$c = \frac{0.42\ mol}{4.5\ L} \approx 0.095\ mol/L$$

This should have three sig figs. The answer provided has two.

2.5/3

54.

$$V_2 = \frac{C_1 V_1}{C_2} = \frac{(0.5\,M)(150\,mL)}{8.5\,M} = 8.82\,mL$$

The volume should be given to two sig figs (8,8 mL), since 150 mL only has two sig figs.

2.5/3

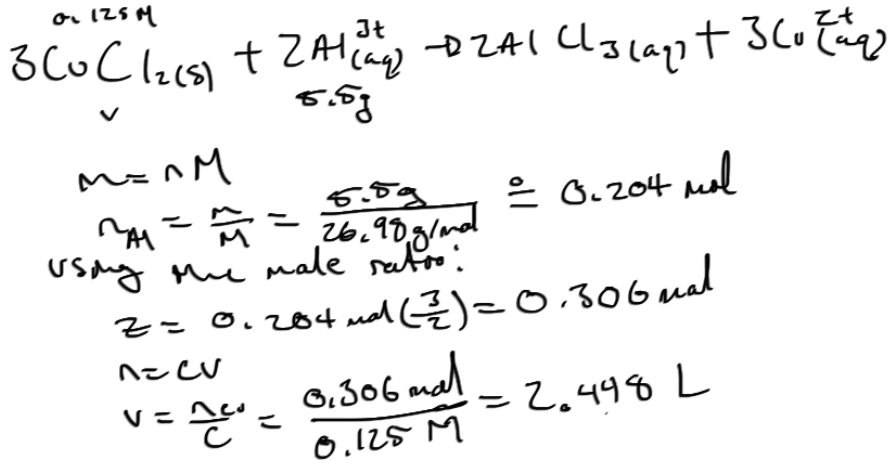
55. First, the final volume would need to be calculated. Second, the student would measure out the solute using a pipette. Third, the student would add at least half of the final volume (4.41 millilitres) in distilled water to a volumetric flask. Half of the final volume would be 75 mL. This is how much should be put into a 150 mL volumetric flask. Fourthly, the student will rinse the pipette three times and pour it into the flask. Finally, the student then fills up the flask to the final volume.

3/4

56. Solutes should be added to water because sometimes it may splash and it is safer for water to splash than a concentrated solution that may react or become heated.

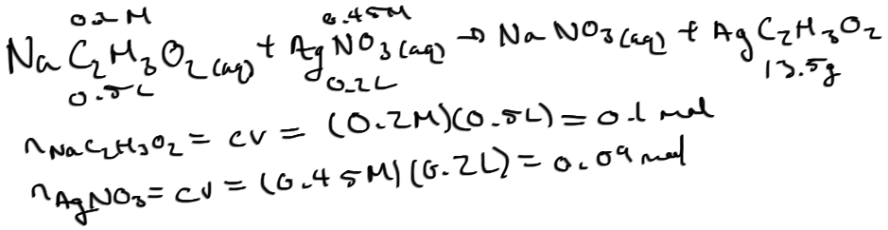
1/1

57.



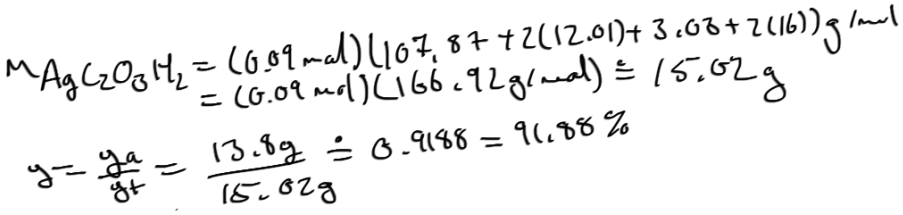
This should only have three sig figs (2.45 L)

58.



This should be 0.090 mol (with two sig figs)

And let $AgNO_3$ be the limiting reagent.



Using the figures in the calculation for mass of silver acetate, there should only be one sig fig.

Using the values for percent yield, there should only be three sig figs in the calculated value.

4/5

59. The Arrhenius Theory of acids predicts that the conductivity of water with an acidic solute is caused from the acid dissociating into two separate ions. Of these ions, the hydrogen cation will attach itself to the water molecule from the oxygens electron pairs creating $H_3O^+_{(aq)}$.

Demonstrate using hydrogen acetate (acetic acid.)

1/2

60. The nitrous acid with a pH of approximately 4 has a low electrical conductivity because the nitrous acid doesn't easily ionize in the solution. The nitric acid which is more acidic than the nitrous acid at 4 easily ionizes in the solution which is why it has a high electrical conductivity.

4/4

61.

Balanced chemical equation:

$2Ca(OH)_{2(aq)} + 4HCl_{(s)} \rightarrow 2CaCl_{2(aq)} + 4H_2O_{(l)}$

$n_{HCl} = \frac{m}{M} = \frac{2.68\,g}{(1.01 + 35.45)\,g/mol} = 0.0735\,mol$

$n_{Ca(OH)_2} = 0.0735\,mol\left(\frac{3}{4}\right) = 0.03675\,mol$

$n = cV$

$V = \frac{n}{c} = \frac{0.03675\,mol}{0.01\,mol/L} = 3.675\,L$

62.

$V_{KOH_{(aq)}} = \frac{(25.3 + 25.21 + 25.38)\,mL}{3} \doteq 25.30\,mL$

Balanced chemical equation

$KOH_{(aq)} + HC_2H_5O_{2(aq)} \rightarrow KC_2H_5O_{2(aq)} + H_2O_{(l)}$

$3 \times 10^{-4}\,M$ $25.3\,mL$ $10\,mL$

$n_{KOH_{(aq)}} = cV = (3 \times 10^{-4}\,M)(25.3\,mL) = (3 \times 10^{-4}\,M)(0.02532\,L) = 7.59 \times 10^{-6}\,mol$

$C_{HC_2H_5O_{2(aq)}} = \frac{n}{V} = \frac{7.59 \times 10^{-6}\,mol}{0.0010\,L} = 7.59 \times 10^{-4}\,M$

$pH_{HC_2H_5O_{2(aq)}} = -\log(7.59 \times 10^{-4}) \doteq 3.12$

7/7

Total for Unit 4: 71/81 = 88%