Moles = (molarity)(volume)

Moles of $Ca(OH)_2$ = (0.01 M)(0.500 L) = 0.005 moles

Grams = (moles)(MW)

Grams of $Ca(OH)_2$ = (0.005 mol)(74 g/mol) = 0.37 g

(c) We can find $[OH^-]$ from (b).

If $[Ca^{2+}] = 0.01\ M$, then $[OH^-]$ must be twice that, so $[OH^-] = 0.02\ M$.

$pOH = -\log[OH^-] = 1.7$

$pH = 14 - pOH = 14 - 1.7 = 12.3$

(d) Find the new $[OH^-]$. The hydroxide already present is small enough to ignore, so we'll use only the hydroxide just added.

$$\text{Molarity} = \frac{\text{moles}}{\text{liters}}$$

$$[OH^-] = \frac{(1.0\text{ mol})}{(0.500\text{ L})} = 2.0\ M$$

Now use the K_{sp} expression.

$K_{sp} = [Ca^{2+}][OH^-]^2$

$5.5 \times 10^{-6} = [Ca^{2+}](2.0\ M)^2$

$[Ca^{2+}] = 1.4 \times 10^{-6}\ M$

ESSAYS

3. (a) Freezing-point depression is a colligative property, which means that it depends on the number of particles in solution, not their identity.

Sodium chloride dissociates into Na^+ and Cl^-, so every unit of sodium chloride produces two particles in solution. Ethanol does not dissociate, so sodium chloride will put twice as many particles in solution as ethanol.

(b) An electrolyte is a substance that ionizes in solution, thus causing the solution to conduct electricity.

Both of the salts dissociate into ions, but $PbCl_2$ is almost insoluble, so it will produce very few ions in solution, while NaCl is extremely soluble and produces many ions.

(c) Water is best at dissolving polar substances.

Propanol (C_3H_7OH) has a hydroxide group, which makes it polar, and thus soluble in water. Propane (C_3H_8) is nonpolar and is best dissolved in nonpolar solvents.

(d) Remember the definitions, and remember that a dilute solution has very little solute.

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{liters of solution}}$$

$$\text{Molality} = \frac{\text{moles of solute}}{\text{kilograms of solvent}}$$

For water, 1 liter weighs 1 kilogram, so for a dilute solution this distinction disappears.

If there is very little solute, the mass and volume of the solution will be indistinguishable from the mass and volume of the solvent.

4. (a) Entropy increases when a salt dissociates because aqueous particles have more randomness than a solid.

(b) Most salt solution processes are endothermic, and endothermic processes are favored by an increase in temperature, therefore increasing temperature will increase the solubility of most salts.

(c) $Ce_2(SO_4)_3$ becomes less soluble as temperature increases, so the solution process for this salt must be exothermic.

(d) Freezing-point depression is a colligative property, which means that it depends on the number of particles in solution, not their identity.

HCl is a strong acid, which means that it dissociates completely. This means that 1 mole of HCl in solution will produce 2 moles of particles. HF is a weak acid, which means that it dissociates very little. This means that 1 mole of HF in solution will remain at about 1 mole of particles in solution.

Therefore, the HCl solution will have more particles than the HF solution.