

**Chemistry 236 -- Quiz 7**  
October 22, 2003 — Freezing Point Depression

**Pledge and signature:**

**Note:** If you want your paper returned folded (*i.e.*, score concealed), please print your name on the back.

1. (3)  $\text{MgCl}_2$  and  $\text{NaOH}$  react in aqueous solutions to yield  $\text{Mg}(\text{OH})_2(s)$ . If 100 mL of 0.210 M  $\text{MgCl}_2$  is mixed with 100 mL of 0.120 M  $\text{NaOH}$ , and volumes are assumed to be additive, which of the following ions is present after the reaction, and in what concentration?  
a.  $[\text{Mg}^{2+}] = 0.150 \text{ M}$       b.  $[\text{Mg}^{2+}] = 0.090 \text{ M}$       c.  $[\text{Mg}^{2+}] = 0.075 \text{ M}$   
d.  $[\text{Mg}^{2+}] = 0.045 \text{ M}$       e.  $[\text{OH}^-] = 0.015 \text{ M}$
2. (3) 70.0 mL of aqueous 0.30 M  $\text{Na}_2\text{SO}_4$  is mixed with 30.0 mL of aqueous 0.10 M  $\text{NaCl}$ . Using the simplest theory of the role of ions in freezing point depression, and assuming that volumes are additive and that molality = molarity in these dilute solutions, the freezing point of the resulting solution should be ( $k_f = 1.855 \text{ K kg/mol}$ )  
a.  $-1.28^\circ\text{C}$       b.  $-0.89^\circ\text{C}$       c.  $-0.74^\circ\text{C}$       d.  $-0.45^\circ\text{C}$       e. none of these
3. (3) A 0.038 m° solution of an electrolyte in water has a freezing point of  $-0.191^\circ\text{C}$ . The electrolyte is most likely  
a.  $\text{Fe}(\text{NO}_3)_3$       b.  $\text{CoCl}_2$       c.  $\text{Mg}(\text{OH})_2$       d.  $\text{HBr}$   
e. More than one of these could be correct.
4. (3) Iodic acid ( $\text{HIO}_3$ ) has  $K_a^\circ = 0.16$  at  $25^\circ\text{C}$ . Neglecting activity coefficients, the freezing point of an aqueous iodic acid solution of concentration 0.25 m° should be about  
a.  $-0.46^\circ\text{C}$       b.  $-0.71^\circ\text{C}$       c.  $-0.83^\circ\text{C}$       d.  $-0.93^\circ\text{C}$       e.  $-1.21^\circ\text{C}$