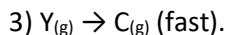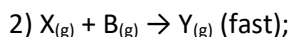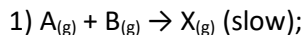1. Lanthanum(III) chloride dissolves in water according to: $LaCl_{3(s)} \rightarrow La^{3+}_{(aq)} + 3\ Cl^-_{(aq)}$. What is the boiling point of the solution when 0.2453 g of $LaCl_3$ (molar mass 245.3 g/mol) is dissolved in 10.0 g of H_2O (K_b of water is 0.512 °C·kg/mol)? [**100.205 °C**]
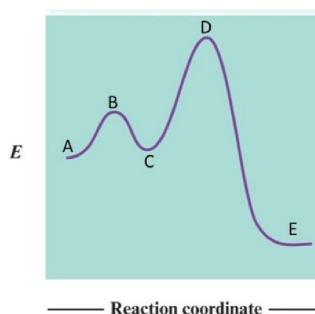
2. Calculate the molarity of an aqueous solution that is 22.3% by mass calcium chloride. You might need to know that the density is 1.20 g/mL. [**2.41 M**]

3. The proposed mechanism for a reaction is:
1) $A_{(g)} + B_{(g)} \rightarrow X_{(g)}$ (slow);
2) $X_{(g)} + B_{(g)} \rightarrow Y_{(g)}$ (fast);
3) $Y_{(g)} \rightarrow C_{(g)}$ (fast).
Which of the following would be a rate law for the reaction? [**rate = k[A][B]**]

4. The figure shown is the reaction coordinate for a reaction with labeled points A → B → C → D → E. Classify the reaction based on the coordinate diagram. [**A two-step exothermic reaction**]

— Reaction coordinate —

5. Calculate the pH of a solution prepared by adding 20 ml of 0.1M HCl to 80 ml of a buffer that is comprised of 0.25 M NH_3 and 0.25M NH_4Cl. K_b of NH_3 is 1.8×10^{-5}. [**9.17**]
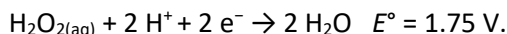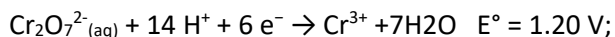
6. The K_{sp} of AgCl at 25 °C is 1.6×10^{-10}. Consider a solution that is 1.0×10^{-2} M in $CaCl_2$ and 1.0×10^{-8} M in $AgNO_3$. Will a precipitate of AgCl form? [**$Q > K_{sp}$ and a precipitate will form**]

7. The K_{sp} of AgCl is 1.6×10^{-10}. What is the solubility of AgCl in 0.001 M $MgCl_2$? Give your answer using scientific notation (1.23e−4) and to two significant figures (one decimal place). [**8.0e-8 M**]

8. For the reaction $2\ H_{2(g)} + Fe_2O_{3(s)} \rightleftharpoons 2\ Fe_{(s)} + 3\ H_2O_{(g)}$, $\Delta G° = 53$ kJ and $\Delta H° = 100$ kJ. Which of the following is completely true about the relationship between ΔG and T for this reaction?
A. $\Delta G < 0$ when T>635K;   B. $\Delta G > 0$ when T>635K;   C. $\Delta G < 0$ when T>0.6K;   D. $\Delta G < 0$ when T<635K;

9. Consider a galvanic cell built from the following half-reactions with their standard reduction potentials:
$Cr_2O_7^{2-}_{(aq)} + 14\ H^+ + 6\ e^- \rightarrow Cr^{3+} + 7H2O$ $E° = 1.20$ V;
$H_2O_{2(aq)} + 2\ H^+ + 2\ e^- \rightarrow 2\ H_2O$ $E° = 1.75$ V.
What is $\Delta G°$ at 25 °C for the reaction involved? (F = 96,485 J/V·mol) [**−3.18kJ**]
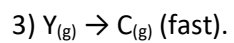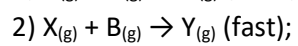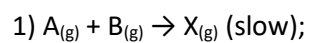
10. Consider the following system at equilibrium at 25 °C: $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ for which $\Delta G° = -92.5$ kJ. What will happen to the ratio of partial pressures of PCl_5 to Cl_2 if the temperature is raised? [**decreases**]

11. ^{210}Pb decays to produce exclusively ^{206}Hg with a half-life of 22.3 years. Starting with a sample of 7.50 g of ^{210}Pb, how many grams of ^{206}Hg (which does not decay) will be present after 17.5 years? [**3.09 g**]

1. Lanthanum(III) chloride dissolves in water according to: $LaCl_{3(s)} \rightarrow La^{3+}_{(aq)} + 3\ Cl^-_{(aq)}$. What is the boiling point of the solution when 0.2453 g of $LaCl_3$ (molar mass 245.3 g/mol) is dissolved in 10.0 g of H_2O (K_b of water is 0.512 °C·kg/mol)? **[100.205 °C]**
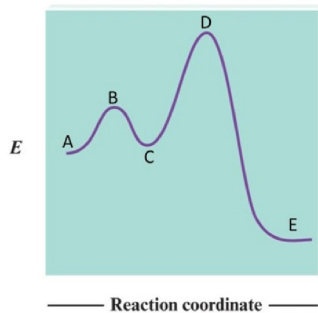
2. Calculate the molarity of an aqueous solution that is 22.3% by mass calcium chloride. You might need to know that the density is 1.20 g/mL. [**2.41 M**]

3. The proposed mechanism for a reaction is:

1) $A_{(g)} + B_{(g)} \rightarrow X_{(g)}$ (slow);

2) $X_{(g)} + B_{(g)} \rightarrow Y_{(g)}$ (fast);

3) $Y_{(g)} \rightarrow C_{(g)}$ (fast).

Which of the following would be a rate law for the reaction? [**rate = k[A][B]**]

4. The figure shown is the reaction coordinate for a reaction with labeled points A → B → C → D → E. Classify the reaction based on the coordinate diagram. [**A two-step exothermic reaction**]

Reaction coordinate

5. Calculate the pH of a solution prepared by adding 20 ml of 0.1M HCl to 80 ml of a buffer that is comprised of 0.25 M NH_3 and 0.25M NH_4Cl. K_b of NH_3 is 1.8×10^{-5}. [**9.17**]

6. The K_{sp} of AgCl at 25 °C is 1.6×10^{-10}. Consider a solution that is 1.0×10^{-2} M in $CaCl_2$ and 1.0×10^{-8} M in $AgNO_3$. Will a precipitate of AgCl form? [**$Q > K_{sp}$ and a precipitate will form**]

7. The K_{sp} of AgCl is 1.6×10^{-10}. What is the solubility of AgCl in 0.001 M $MgCl_2$? Give your answer using scientific notation (1.23e−4) and to two significant figures (one decimal place). [**8.0e-8 M**]

8. For the reaction $2\,H_{2(g)} + Fe_2O_{3(s)} \rightleftharpoons 2\,Fe_{(s)} + 3\,H_2O_{(g)}$, $\Delta G° = 53$ kJ and $\Delta H° = 100$ kJ. Which of the following is completely true about the relationship between ΔG and T for this reaction?

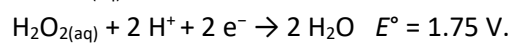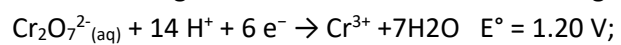**A. ΔG <0 when T>635K;**   B. ΔG >0 when T>635K;   C. ΔG <0 when T>0.6K;   D. ΔG <0 when T<635K;

9. Consider a galvanic cell built from the following half-reactions with their standard reduction potentials:

$Cr_2O_7^{2-}{}_{(aq)}$ + 14 H$^+$ + 6 e$^-$ → Cr^{3+} +7H2O   E° = 1.20 V;

$H_2O_{2(aq)}$ + 2 H$^+$ + 2 e$^-$ → 2 H$_2$O $E°$ = 1.75 V.

What is $\Delta G°$ at 25 °C for the reaction involved? (F = 96,485 J/V·mol) [**−3.18kJ**]

10. Consider the following system at equilibrium at 25 °C: $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ for which $\Delta G° = -92.5$ kJ. What will happen to the ratio of partial pressures of PCl_5 to Cl_2 if the temperature is raised? [**decreases**]

11. ^{210}Pb decays to produce exclusively ^{206}Hg with a half-life of 22.3 years. Starting with a sample of 7.50 g of ^{210}Pb, how many grams of ^{206}Hg (which does not decay) will be present after 17.5 years? [**3.09 g**]