

1) (2 marks) Which of the following salts has the greatest molar solubility?

- A - AgCl
- B - CaF₂
- C - CuCO₃
- D - Mg₃(PO₄)₃

$K_{sp} = 1.8 \times 10^{-10}$
 $K_{sp} = 3.2 \times 10^{-11}$
 $K_{sp} = 3 \times 10^{-12}$
 $K_{sp} = 5.2 \times 10^{-24}$

$x^2 = 1.8 \times 10^{-10}$
 $4x^3 = 3.2 \times 10^{-11}$
 $x^2 = 3 \times 10^{-12}$
 $108x^5 = 5.2 \times 10^{-24}$ B

$x = 1.3 \times 10^{-5}$
 $x = 2 \times 10^{-4}$
 $x = 1.7 \times 10^{-6}$
 $x = 8.6 \times 10^{-6}$

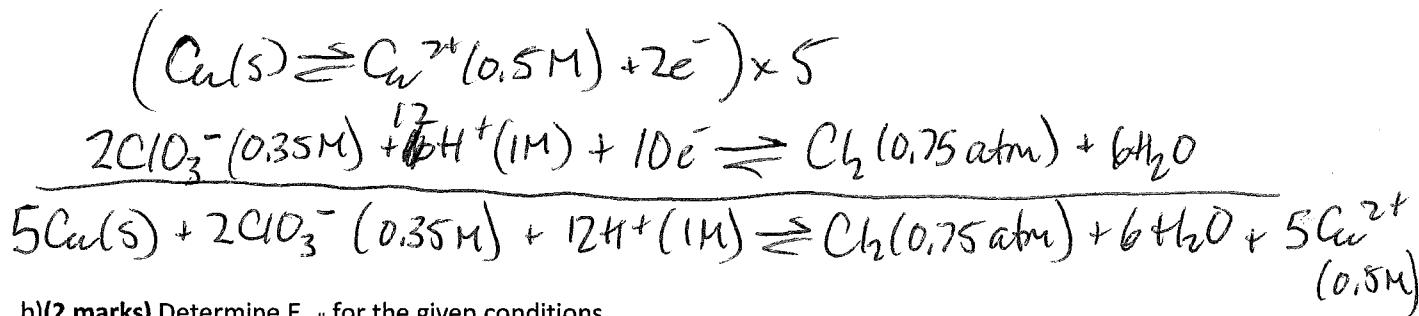
2) (2 marks) The pH of Mn(OH)₂ at 25°C is 9.53, determine the K_{sp} of Mn(OH)₂

pH = 9.53 means pOH (@ 25°C) = 4.47
 $\therefore [OH^-]_e = 10^{-4.47}$
 From $Mn(OH)_2 \rightleftharpoons Mn^{2+} + 2OH^-$
 $[Mn^{2+}]_e = \frac{1}{2} \times 10^{-4.47}$
 $K_{sp} = \frac{1}{2} \times (10^{-4.47})^3$
 $= 1.9 \times 10^{-14}$

3) Cu(s) | Cu²⁺(aq)(0.50 M) || ClO₃¹⁻(aq)(0.35 M), H¹⁺(aq)(1.0 M) | Cl₂(g)(0.75 atm) | Pt(s)

E⁰_{cell} = 1.133 V

a) (2 marks) Write the balanced chemical equation for the reaction happening in the cell?



b) (2 marks) Determine E_{cell} for the given conditions.

$Q = \frac{(0.75)(0.5)^5}{(0.35)^2 \times (1)^{12}} = 0.191 \dots$
 $E = E^0 - \frac{0.059159}{10} \log(0.191 \dots) = 1.137V$

c) (1 mark) If E⁰_{red} for Cu²⁺ is 0.337 V, what is E⁰_{red} for ClO₃¹⁻?

$Cu^{2+} + 2e^- \rightleftharpoons Cu \quad E^0 = 0.337 \rightarrow Cu \rightleftharpoons Cu^{2+} + 2e^- \quad E^0 = -0.337$
 $ClO_3^- \rightleftharpoons Cl_2 \quad E^0 = x$
 $x - 0.337 = 1.133$
 $x = 1.47V$