CHEM102 Exam III (Aug 13 2009).
$33\frac{1}{3}$ points / problem with maximum of 100 points.

1. Consider a 100 mL of buffer solution consisting of equal amounts of A^- (conjugate base) and HA (an acid with $pK_a = 5.0$). (a) What concentration of the buffer solution is sufficient to approximately prevent changes in the pH when adding 50 mL of 1.0 M NaOH solution? (b) Would an acid with $pK_a = -2.0$ and its conjugate base make a good buffer?

2. Titration of 50 mL of 1.0 M NH_3(aq) ($pK_a = 9.25$) with 0.25 M HCl.

(a) What is the initial pH?

(b) What is the equivalence point?

(c) What is the pH after adding 250 mL of the acid?

(d) How do you determine pK_b and pK_a from the titration curve?

(e) How would you choose the indicator for this titration?

3. An electrolytic cell consists of two inert Pt-electrodes and 1.0 M NaOH(aq) solution under standard conditions.

(a) What are the half-reactions for the anode and cathode?

(b) What is the standard cell potential for this cell?

(c) What external potential must be applied to this cell so that it will function as an electrolytic cell?

(d) How many electrons flow through the cell if the cell is driven by 2.0 A current for 1.5 hours? ($e^- = 1.6022 \times 10^{-19}$ C)

(e) How many electrons are required to generate one mole of O_2(g) at the anode?

(f) How many moles of O_2(g) would be formed at the anode when the cell was driven by 2.0 A current for 1.5 hours? (Avogadro's number $N_A = 6.022 \times 10^{23}$ mol^{-1})

(g) If the generated O_2(g) is contained in 1.00 m^3 volume, what would be the resulting O_2(g) pressure at room temperature? Assume that O_2(g) follows the ideal gas law. (the gas constant $R = 8.314$ J K^{-1} mol^{-1})