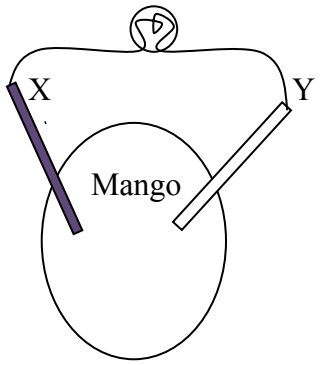
Chemistry
Lab Exam Study Outline

1. a) Know how to assemble an electrochemical cell, given two metals, two solutions each containing the ion of a metal, a dissolved salt, a U-tube and some wires.
   b) Know how to attach a voltmeter to the electrochemical cell and how to read the voltmeter, respecting significant figures.
   c) Know how to identify the anode from the way it is connected to the voltmeter.
   d) If metal W was in a solution of W^{+2} and X was in a solution of X^{+3}, what would be the half reactions? (W is connected to the positive end of the voltmeter when its needle swung to the right.)
   e) Which ions from the salt solution would be attracted towards W?
   f) Which metal would eventually gain mass?

Sample Additional Questions

2. 

   a) A student made an electrochemical cell using a mango, some wire and two metals. Wire was used to attach it to a light bulb.
   Could X and Y be the same metal? Why or why not?
   b) Draw a setup that you could use to increase the voltage by using another mango. Show the connection to the light bulb.
   c) If one of the reactions in the mango electrochemical cell is $2H^+ + 2e^- \rightarrow H_2$
   calculate the volume of hydrogen gas created from a 2.25 mA current flowing for 48 hours. The gas will be collected at 30.0 ^oC and at 102 kPa.
   By definition, 1 A = 1 C/s and exactly1 mole of electrons = 96 400 C
   d) The overall reaction of the mango is $Mg_{(s)} + 2\ H^+_{(aq)} \rightarrow Mg^{+2}_{(aq)} + H_{2(g)}$ Looking at the experimental setup, what is one obvious reason why the reaction cannot attain equilibrium?
   e) Alkaline batteries contain base which helps oxidize zinc. Why would injecting base into the mango be a bad idea (aside from the fact that you may want to eat it afterwards)?

ANSWERS

1. a) Place metal X on a solution containing X^{+2} in one beaker and metal Y in a solution with metal Y^{+2} in a 2nd beaker. Fill a U-tube with salt; (don't put salt in Youtube though; you'll ruin your computer). Then plug the ends with cotton. Invert it so that each end of the tube is in one of the beakers. Attach the electrodes with a wire.

   b) Try attaching X to the negative end of a voltmeter and Y to the (+) end. If needle swings to the left, invert their positions.

   c) The electron-rich anode is the one attached to the negative end.

   d) $W^{+2} + 2\ e^- \rightarrow W$

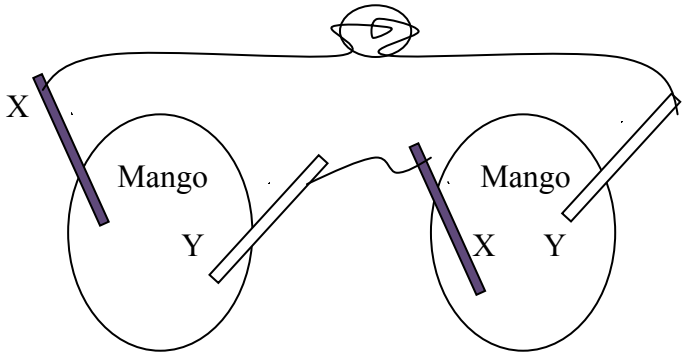
   $X \rightarrow X^{+3} + 3e$ (anode)

   e) cations will be attracted to W because positive ions are disappearing, creating a surplus of (-)'s

   f) W

2. a) No. If they are both the same metal, they will either both release electrons or neither will release them.

   b)



   c) 2.25 mA = 2.25 $X10^{-3}$ A = 2.25 $X10^{-3}$ C/s

   2.25 X 10^{-3} C/s * 3600 s /h* 48 h = 388.8 C

   96 400 C per 1 mole of electrons:

   388.8 C*(1mole/96 400 C) = 0.004033195021 moles electrons

   Since $2H^+ + 2e^- \rightarrow H_2$

   = 0.004033195021 moles electrons ($1H_2/2e$)= 0.002016597511 moles H_2

   V= nRT/P = 0.002016597511(8.31)(30 +273)/102 =0.04978089580

   = 5.0 X 10^{-2} L

   d) It is an open system. The hydrogen gas will escape.

   e) Base will destroy H^+, which is needed to act as an oxidizing agent.