2013-05-08

Chemistry Lab Exam Lab Review (keep scrolling down to page 6 for answers: recall that all four areas will be represented: (1) significant errors, measurements and lab techniques; (2) observations and interpretation of redox reactions; (3) collection of hydrogen gas—ideal gas law (4) Calorimetry Lab (find *c*)

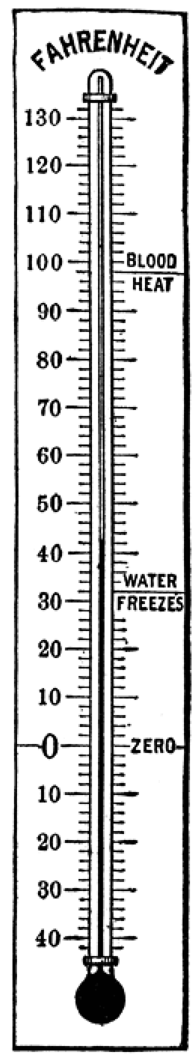
1. Your teacher squeezes the bulb to suck liquid into a 10.00 ml pipette. He lets the liquid rise to the brown line above the pipette's bulky part. He reads it at eye-level, making sure that the top of the meniscus matches the line. Then he lets it out, without forcing the small amount of liquid that seems to be stuck at the tip of the glassware. **What is he doing incorrectly**?

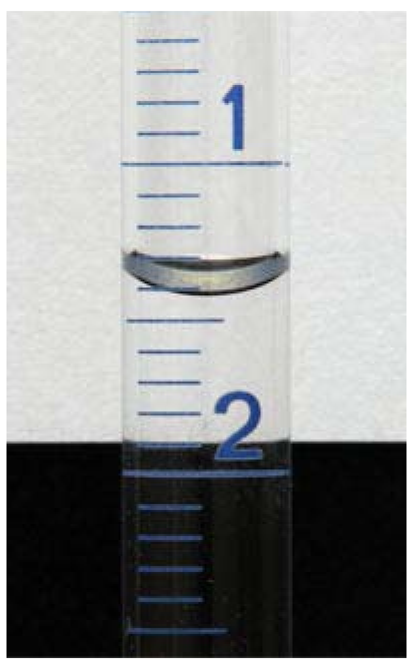
2. a. Your lab partner wants to measure the air temperature and is holding the thermometer. What could lead to an obvious error? (2 marks)

   b. Is the uncertainty for this thermometer larger than usual? Why or why not?

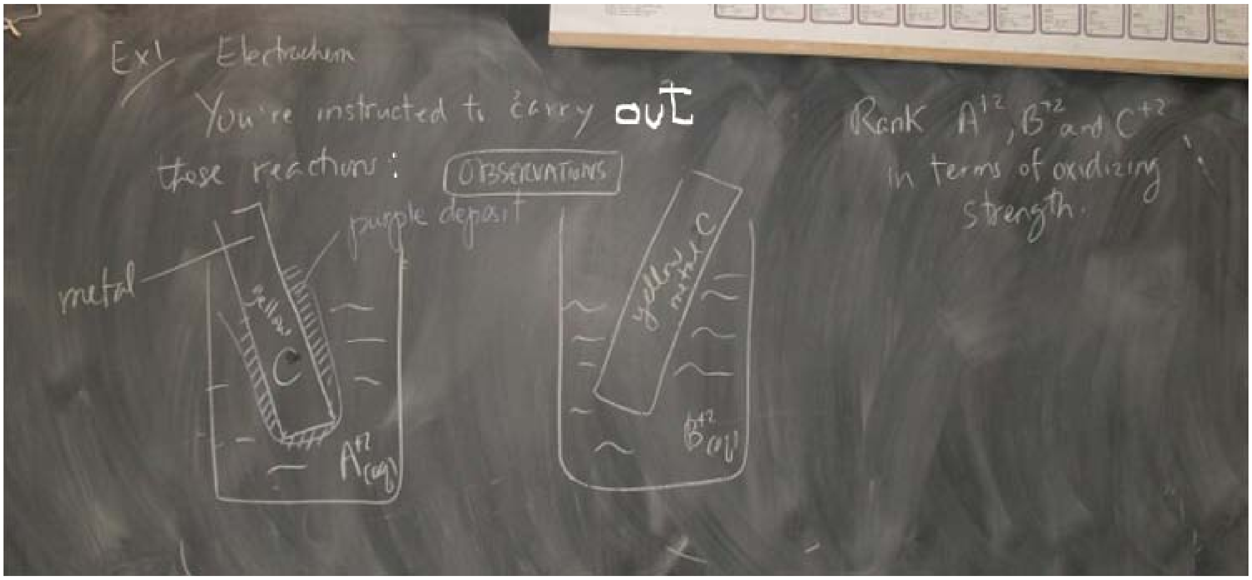
   c. Read the volumes with the correct number of decimal places.

   d. What is the percent error associated with the first measurement if the uncertainty is $\pm 0.05\ ml$?





3.

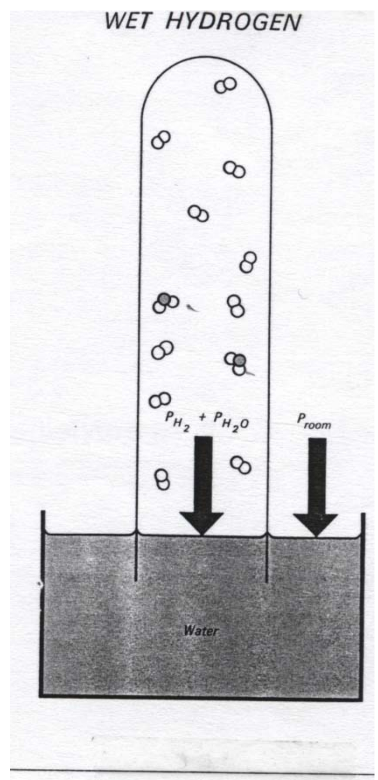


a) Rank A^{2+}, B^{2+}, C^{2+} in terms of oxidizing strength. There's no reaction on the right.

b) What would have happened if you had placed metal plate B in $C^{2+}{}_{(aq)}$?

4. <u>Questions and Notes on two other labs you are responsible for:</u>

- **<u>Lab 1.1 The Reaction of Mg and HCl to Generate H_2 Gas</u>**



1. *What happened in the lab?*

- The reaction was: $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$

We trapped Mg in a copper cage. Strong acid was added to a burette and topped with water. We inserted the cage into the water, stoppered the burette and turned it upside down. The denser acid slowly descended and reached the magnesium metal. The above reaction generated hydrogen gas, which rose to the top of the burette(see diagram) and pushed down on the water. We waited for the gas to cool to room temperature.

2. *Why was the burette placed in a giant cylinder?*

This was done to equalize the atmospheric pressure(room pressure) with the gas pressure(P_{total}) inside the burette. At this point:

$P_{H2} + P_{H2O} = P_{total}$ or $P_{H2} = P_{total} - P_{H2O}$

3. *What is P_{H2O}?*

Whenever you collect gas over water, part of the water evaporates and contaminates the gas. To get the true gas pressure one has to consult a table to know how much of the total collisions in the container are actually due to the evaporated water. The warmer the water, the bigger the contribution.

4. *How did we get the real volume of hydrogen collected from the partial pressure P_{H2}?*

$V_{H2} = (P_{H2}/P_{total}) (V_{measured})$, where $P_{total} = P_{room}$.

5. *Why did we use V = nRT/P afterwards?*

We did this to compare the theoretical volume with the volume obtained in #4

6. *Why did some of us get a yield that was greater than 100%?*

Since yield = $V_{actual}/ V_{theoretical}$ *100% it meant that the actual volume measured was greater than it should have been due to the air bubble that was trapped in the burette at the beginning of the experiment.

How to Measure the Specific Heat of a Substance.

Example:
Design an experiment that would allow you to measure the specific heat of alcohol.

Equipment: alcohol; water; hot plate; thermometer; balance; pipette

1. **Find the mass of about 100 ml of alcohol.**
2. **Bring it to a boil and measure its temperature.**
3. **Meanwhile record the mass of 75 ml of water in an insulated cup.**
4. **Record its temperature.**
5. **Pipet an exact amount of hot alcohol and add it to water.**
6. **Record the stable temperature.**

You can use $-m_w c_w \Delta T_w = m_a c_a \Delta T_a$ **; the only unknown will be** c_a**, and remember that the stable temperature is really the** T_f **common to both** ΔT **'s in the formula.**

If you had a metal, you could just place it in boiling water and you'll have its initial temperature of about 100 C.

Answers to first three questions (the rest are within question 4).

1. The mistake was in reading the top of the meniscus. The bottom has to be read. (He should not have forced out the extra bit of liquid. The instrument is calibrated to deliver the exact amount while excluding what is stuck at the narrow tip.)
2. A) There could be a transfer of heat from the hand to the thermometer, which will exaggerate the temperature reading.
   B) The uncertainty is larger than normal because they are using only 5 divisions(lines) for every 10 ^{o} on the scale.
   C) 1.40 ml and 1.42 ml. Notice that they must have the same number of decimal places.
   D) 0.05/1.40 * 100% = 4% (1 SF only in % due to 0.05's 1SF). Notice that the error is not too bad since the measurement itself did have three SF's.

3. In the first reaction the purple deposit came from the solution's $A^{2+}_{(aq)}$ which presumably stole electrons from the metal plate C to become neutral A. (Neutral metals do not become negative, so C would not have further raised $A^{2+}_{(aq)}$' s charge!)

   So the reaction was: $C + A^{2+}_{(aq)} \rightarrow C^{+2}_{(aq)} + A$, meaning that $A^{2+}_{(aq)} > C^{+2}_{(aq)}$

   In the second beaker there is no reaction, meaning that $B^{2+}_{(aq)} < C^{2+}$

   Overall then, $A^{2+}_{(aq)} > C^{+2}_{(aq)} > B^{2+}_{(aq)}$