Labs Covered

Le Chatelier
Calculating Kc
Calculating Ka
Redox lab
Kitchen Chemistry Project

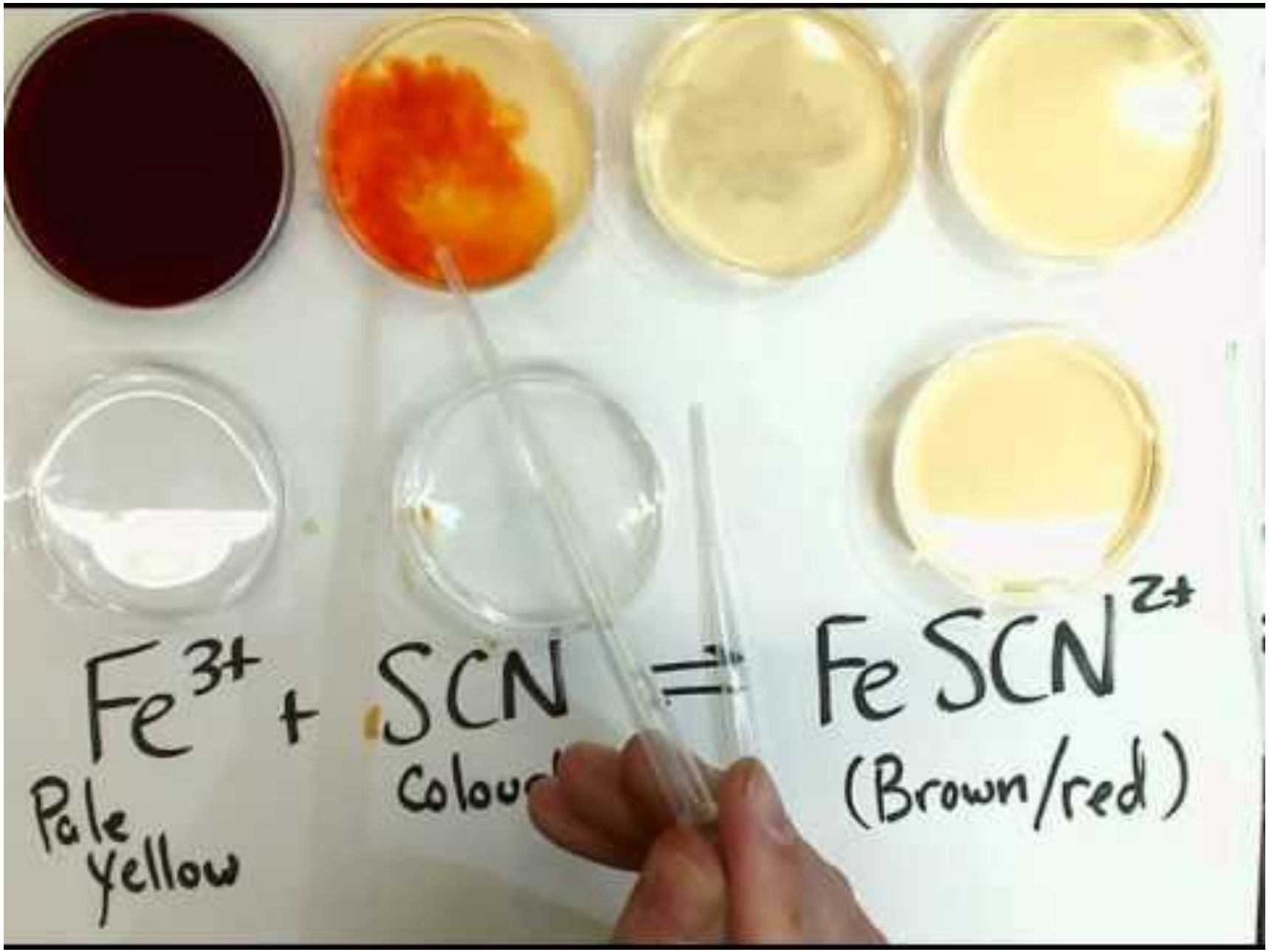
LeChatelier Sample Questions

$Fe^{+3}_{(aq)} + SCN^{-1}_{(aq)} \rightleftharpoons FeSCN^{+2}_{(aq)}$

Light orange colourless red

a) To create the above equilibrium, did you initially need to use all three compounds?

No we just used $Fe^{+3}_{(aq)} + SCN^{-1}_{(aq)}$, which then form $FeSCN^{+2}_{(aq)}$


Fe^{3+} + SCN ⇌ $FeSCN^{2+}$
Pale Yellow
(Brown/red)

b) The source of $Fe^{+3}_{(aq)}$ was a solution of $Fe(NO_3)_{3\ (aq)}$. You were also asked to observe that $KNO_{3(aq)}$ was colorless. How did help you deduce that $Fe(NO_3)_{3\ (aq)}$'s color was only from one ion?

Since NO_3^- does not impart any color on the $FeSCN^{+2}_{(aq)}$, it will not color $Fe(NO_3)_3$. So $Fe(NO_3)_3$'s light orange color must have come from $Fe^{+3}_{(aq)}$

c) Which caused a deeper color to form? Adding more aqueous Fe^{+3}? Or adding more solid KSCN?

solid KSCN

d) Why?

e) When it dissolves the solid creates a higher concentration of SCN- than the already dissolved $Fe^{+3}_{(aq)}$

e) How did the addition of HPO_4^{2-} favour the reverse reaction?

It reacted with the Fe^{+3} leaving only colorless SCN^- behind.

Calculating K

$$Fe^{+3}_{(aq)} + SCN^{-1}_{(aq)} \rightleftharpoons FeSCN^{+2}_{(aq)}$$


save the whales!

2. a) In this lab you kept using the same initial concentration of $SCN^{-1}_{(aq)}$ but you kept using more dilute initial concentrations of $Fe^{+3}_{(aq)}$. What effect did this have on the equilibrium concentration of $FeSCN^{+2}_{(aq)}$?

It kept lowering it.

b) Once all 5 equilibria were created, you pulled solution out of the most concentrated one (#1) until it matched, one at a time, each of the other solutions.

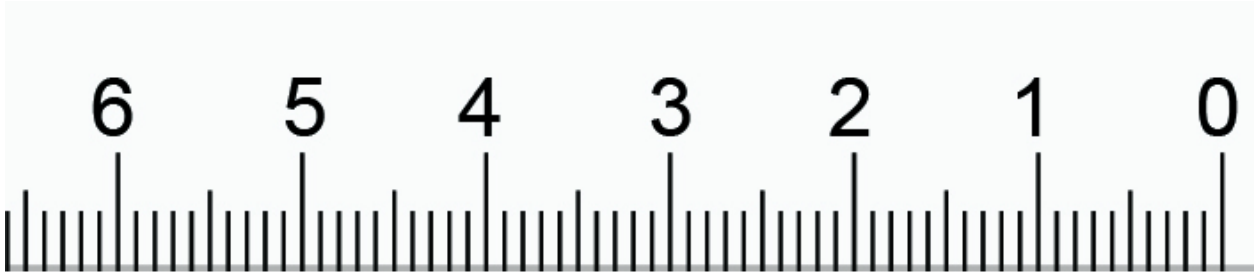
By pulling out solution from solution #1, were you changing its concentration?

No

a) If $h_1/h_2 > h_1/h_3$, which solution was more concentrated?
Also draw test tubes to show what we mean by h_2 and h_1.

Solution 2 was more concentrated than solution 3.
The h_1's (h_1 kept changing from one liquid to the next) refer to the height of the liquid 1(reference) after the colors matched as we viewed them from the top. Light's path length influences the color we see. The less concentrated the solution was the more liquid we had to pull out from the reference tube (which had a higher concentration) in order to get a color match.

d) If the ruler you were using to measure height looked like this, how would you report a height, in cm, that landed exactly on the 3 line? Uncertainty?



Smallest division/2 = 0.10/2 = 0.05= 2 decimals, so the measurement = 3.00***±0.05 cm***

e) Percent error associated with the measurement?

0.05/3.00 * 100% = 2%

f) What was the main error source in *the design of this experiment*?

We were using our eye(and brain's) judgment of color to decide when to stop pulling liquid out.

3. Calculating K_A of HCH_3CO_2 (acid in vinegar) This is also the basis of June Lab Exam Make sure you're familiar with the procedure.

To calculate K_A you need the equilibrium concentrations of $H^+_{(aq)}$, $\mathbf{CH_3CO_2^-}_{(aq)}$, and of $\mathbf{HCH_3CO_{2(aq)}}$

a) What did you do in the lab to get $[H^+_{(aq)}]$?

We used a pH measurement of the equilibrium mixture before neutralization.

a) What did you do in the lab to get $[\mathbf{CH_3CO_2^-}_{(aq)}]$?

Nothing. It equalled $[H^+_{(aq)}]$

a) What did you do in the lab to get $[\mathbf{HCH_3CO_{2(aq)}}]$?

We neutralized it with NaOH. Since the mole ratio of base to acid was 1:1, then n =CV, where C = concentration of base and V = volume of base needed to neutralize.

Finally we divided n by the acid's original volume

d) How did you know when all the **$HCH_3CO_{2(aq)}$** had been neutralized by NaOH?

We used phenolphthalein which gave us a pink color.

e) If you wait several minutes the pink color of phenolphthalein fades. What side-reaction could be causing this?

CO_2 from the air forms carbonic acid.

f) What's more accurate than pH paper?

A pH meter

g) Use actual H^+ to find the % error associated with a pH paper reading of 3.0 if an instrument reveals the $H^+_{(aq)}$ to really be 2.75.

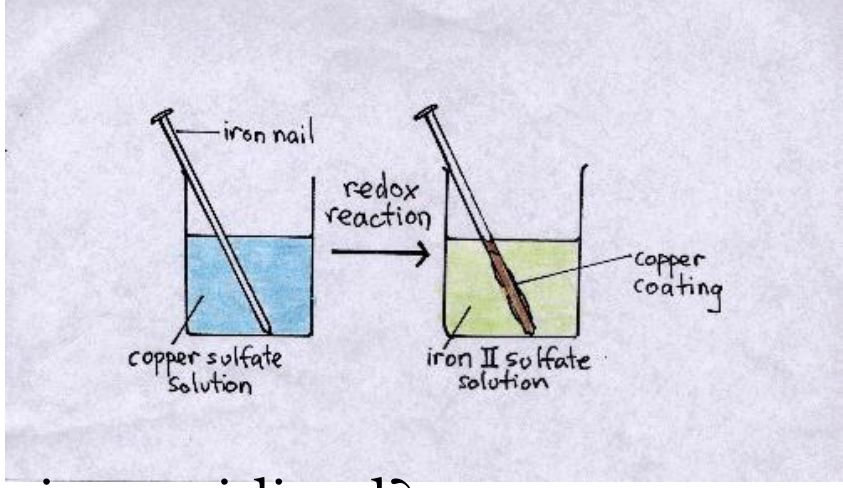
$10^{-2.75}-10^{-3}/10^{-2.75}$ X 100% = 44% error.

A hole-y cow.

4. Redox lab

The redox reaction was:

$Fe_{(s)} + CuSO_{4(aq)} \rightarrow FeSO_{4(aq)} + Cu_{(s)}$



a)Did the sulfate ion play any role in the reaction?

No, it was a spectator with no changes in oxid. #

b)What evidence did we have that the iron nail was being oxidized?

Its mass decreased (solid turned to aqueous)

c)What solid product was formed from the reduction?

Neutral Copper element

d)How many significant figures have to be used for the amount of Cu formed, if the original mass of Fe was 1.45 g and the remaining amount was 1.01 g?

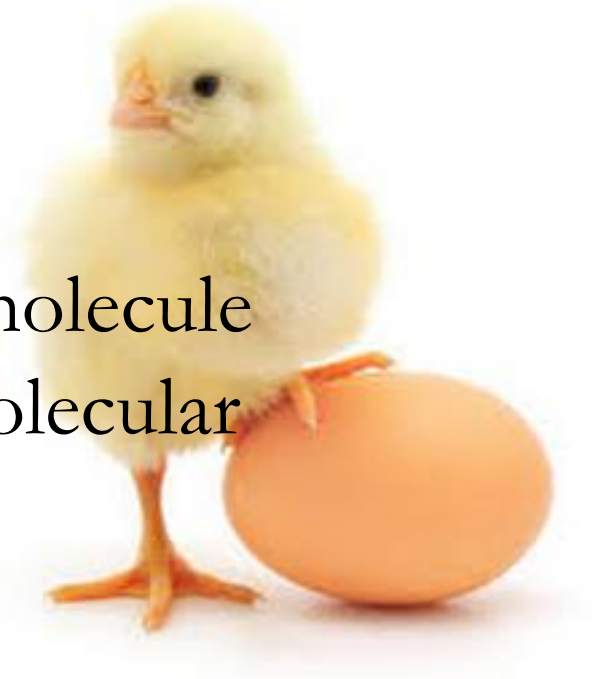
Since the difference is what's actually used in the initial calculation, and 0.44 has only 2 SF, the answer only has 2 SF.

e) If you had been asked to weigh the amount of Cu formed, think of **two** experimental error sources that could be encountered.

1)Cu could still be wet. We use to dry it with volatile and toxic acetone, but we can't do that anymore.

2) scrapings of Fe from the nail could also be adding mass to the copper.

5. Kitchen Chemistry



a)When cooking a hard-boiled egg, which type of molecule in the egg becomes even more dense due to intermolecular bonds?

Protein(white)

b) Where does the yolk go if you don't keep rotating it?

up

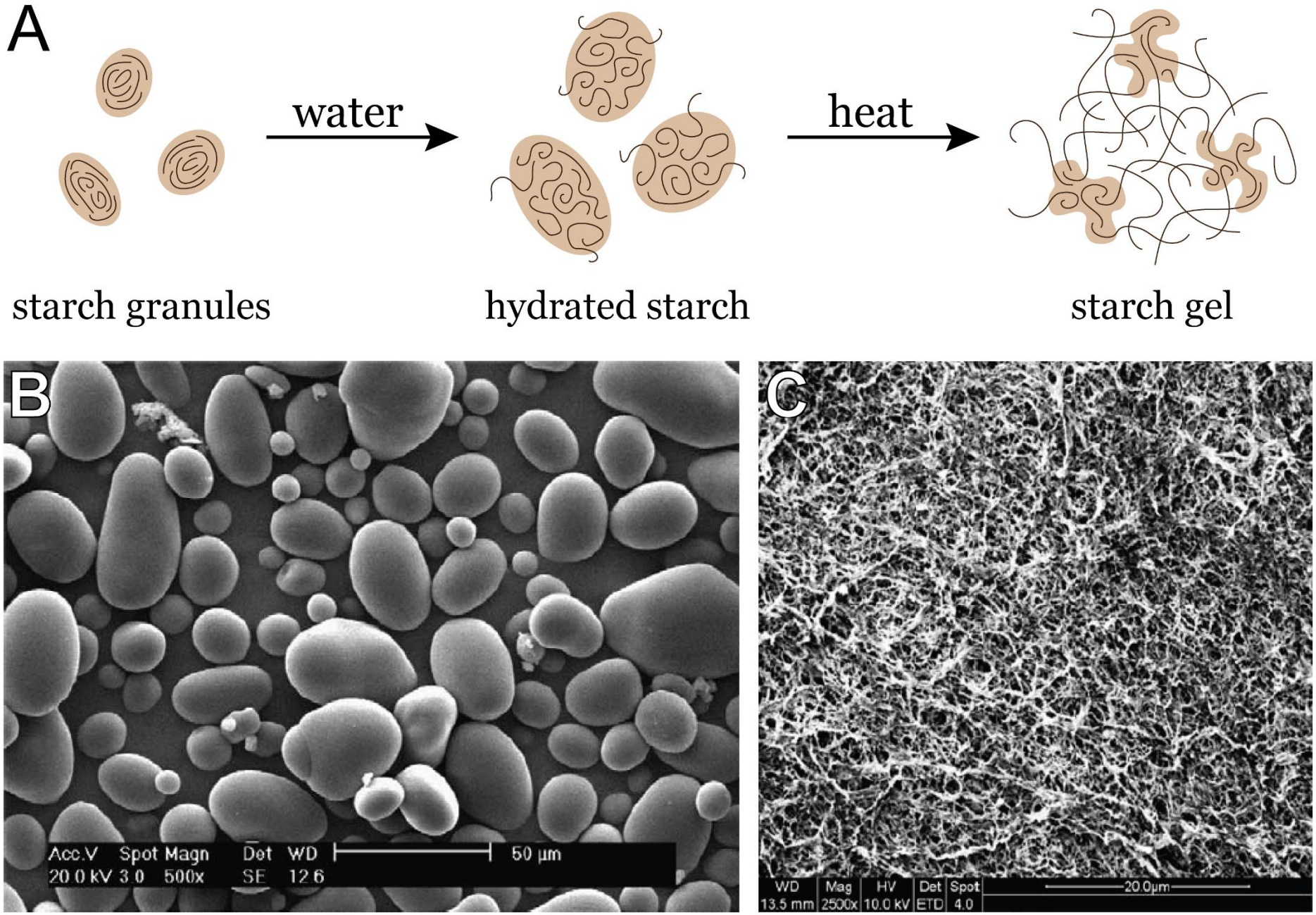
c) In which positon should the egg be when rotating it to make it perfectly centered after it's hard-boiled?

upright

d)When cooking pasta, what two types of molecules in the pasta are absorbing water?

Starch and protein

e) Which one forms a network that tries to keep granules of the other trapped in?
Protein (gluten)
f) What could be added to the pasta to make the network stronger and prevent stickiness?
acid
g) When cooking pasta, when do we add the noodles to the water solution in the pot?
Only after the water boils; otherwise there will be too much time for water absorption.


A
water
heat
starch granules
hydrated starch
starch gel
B
Acc.V Spot Magn Det WD 50 µm
20.0 kV 3.0 500x SE 12.6
C
WD Mag HV Det Spot 20.0µm
13.5 mm 2500x 10.0 kV ETD 4.0

h) How do you get a toast to burn on just one side without using a freezer or adding anything to it?

Leave it out for several days, face down. The side (face up) exposed to the air will lose water. That's the side that will burn.

i) What does specific heat have to with the trick used in (h)?

The dry side has less water and a lower specific heat so its temperature rises more even though it received just as much heat from the toaster.