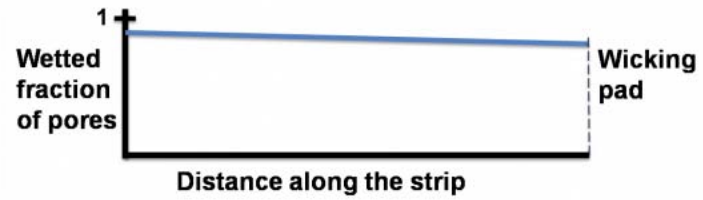
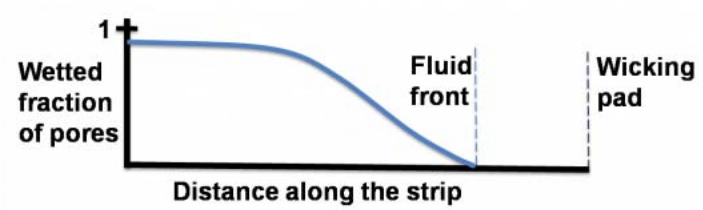
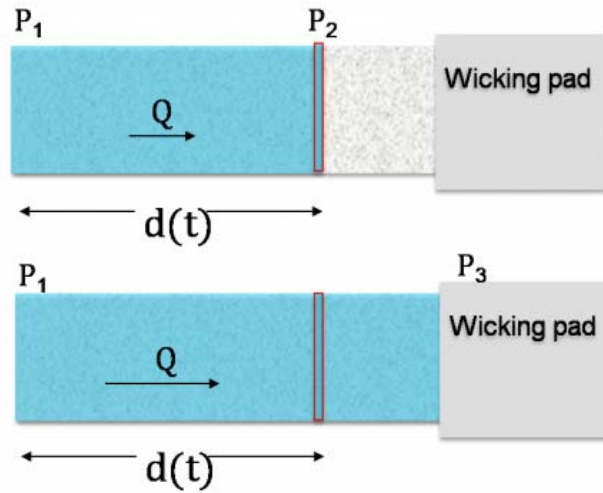


# **Lab #5 Paper Microfluidics**

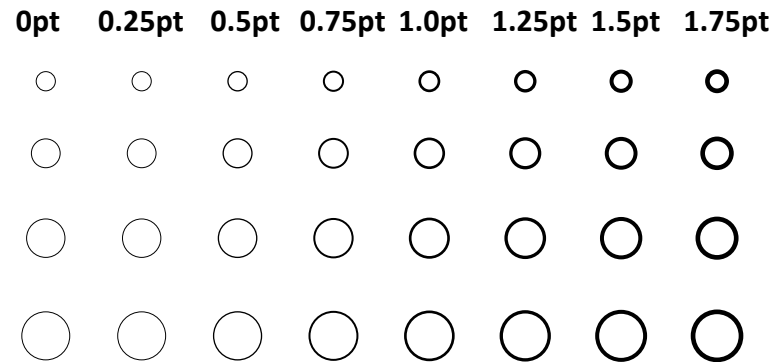
# Design Rules

- Liquid volume
- Indicator volume
- Baking time
- Baking temperature
- Line width
- Channel width
- Channel length
- Channel shape

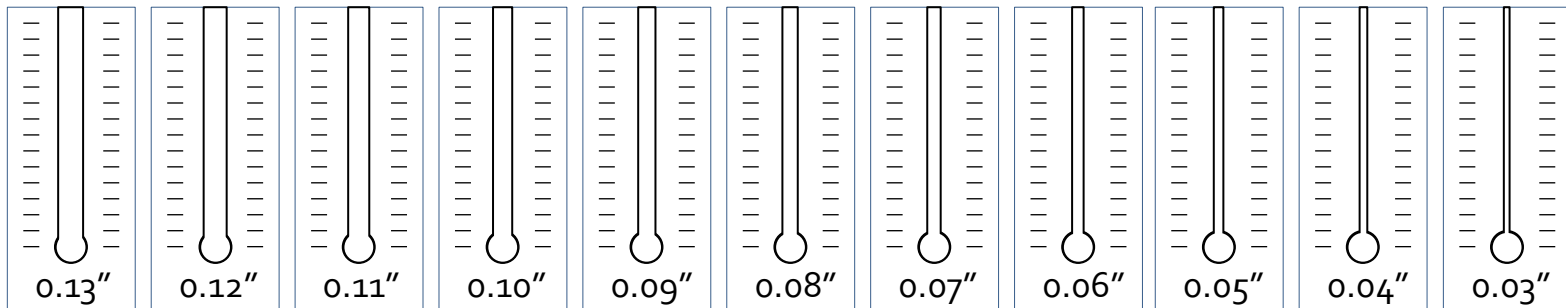
# Design Rules



# Design Rules

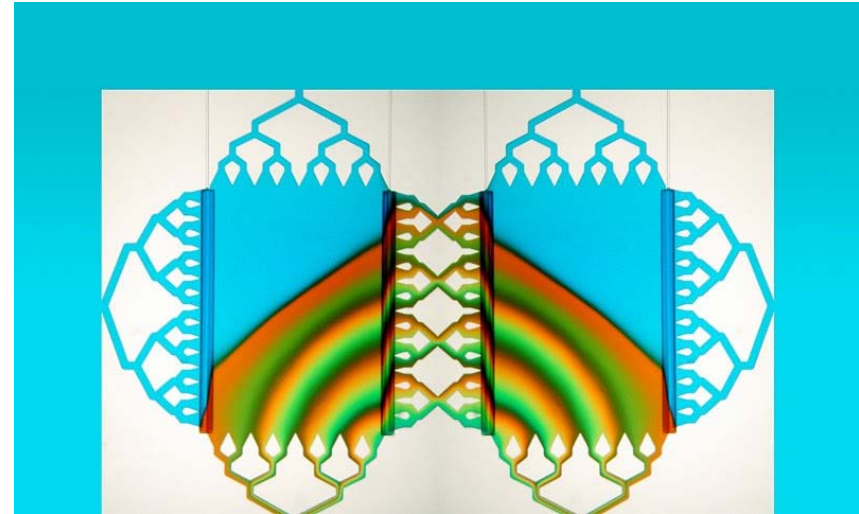
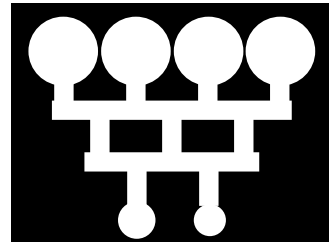
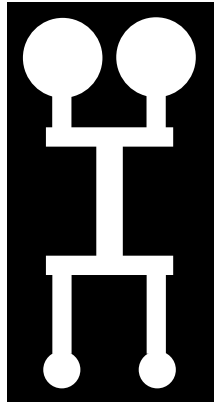


- Why is the line width important?



- Why is the channel width important?

# Mixers



7ci fhYgmicZ; fY[ '7cc\_gYmiUbX'5'VYfh: c'Wk''7cdmYZh 'H\]g'g'U'ZfYY'k cf\_ž'mci  
WUb 'Včdnž'X]ghf]Vi hYž'UbX'a cX]žm]hi bXYf'hY'hYfa g'cZh\Y': fYY'5fh@WbgY"

$$L = 2\sqrt{Dt}$$

where  $L$  is the diffusion length,  $t$  is the time,  $D$  is the molecular diffusion coefficient. The diffusion coefficient scales roughly with the inverse of the size of the molecule and also depends to some extent on the shape of the molecule. It also increases with temperature and decrease with pressure.

# Inkjet Indicators

## **Turmeric solution (base indicator):**

Turns from yellow to red-maroon in the presence of a stronger base. (pH > 8)

## **Benedict's solution (reducing sugar indicator):**

In the presence of a reducing sugar, turns from blue to brown upon heating on a hotplate

## **Ninhydrin solution (amine indicator):**

In the presence of amines, changes from pink to a darker purple upon heating on a hotplate



**Acid/Base:** changes its molecular shape with changes in pH. As the shape changes then the color of the solution changes.

**Benedict's:** reduces the  $\text{Cu}^{2+}$  to  $\text{Cu}^{+}$  which forms as a red precipitate-copper (I) oxide

**Ninhydrin:** degrades amino acids into aldehydes, ammonia, and  $\text{CO}_2$  through a series of reactions; then condenses with ammonia and hydrindantin to produce an intensely blue or purple pigment

# Chemical Indicator

## Indicator 1

### **Benedict's solution (reducing sugar indicator):**

In the presence of a reducing sugar, turns from blue to brown upon heating on a hotplate

## Indicator 2

### **Ninhydrin solution (amine indicator):**

In the presence of amines, changes from pink to a darker purple upon heating on a hotplate

## Indicator 3

### **Turmeric solution (base indicator):**

Turns from yellow to red-maroon in the presence of a stronger base. (pH > 8)

Water  
Salt water  
Sugar water  
Apple juice  
Cranberry juice  
Windex  
Coke  
White wine vinegar  
Baking soda  
Rice vinegar



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