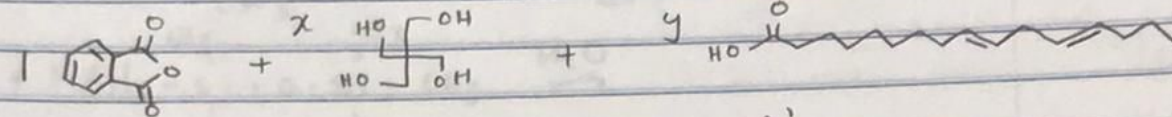
Dr. Robson Storey

Zachary Ahmad

Exam 2

1\.



A - A B_4 A'

A	2(1)	0	1y
B	0	4x	0

$$P_c = 1 = \frac{2}{f_{avg}}$$

$$2 = 1 f_{avg}$$

$$2 = f_{avg} \rightarrow \text{gels}$$

$$2 = \frac{2((2\cdot 1) + (y))}{1 + x + y}$$

$$\frac{2}{1} = \frac{4 + 2y}{1 + x + y}$$

$$4 + 2y = 2 + 2x + 2y$$

$$4 = 2 + 2x$$

$$2 = 2x$$

$$1 = x$$

$$r = \frac{[COOH]}{[OH]} = 0.75$$

$$.75 = \frac{2 + y}{4x}$$

$$3x = 2 + y$$

$$3x - 2 = y$$

$$1 = y$$

> so 1 mol of PE and 1 mol of LOFA per 1 mol PA to make alkyd resin with the given characteristics (1:1:1)

2\.

A-A $2(2) = 4$

-A' $0.5(1) = 0.5$

B_3 $1.4(3) = \frac{21}{5}$

$$r = \frac{1.4(3)}{(2(2)) + (0.5(1))} = \frac{14}{15}$$

$$f_{wA} = \frac{2^2(2) + 1^2(0.5)}{2(2) + 1(0.5)} = \frac{17}{9}$$

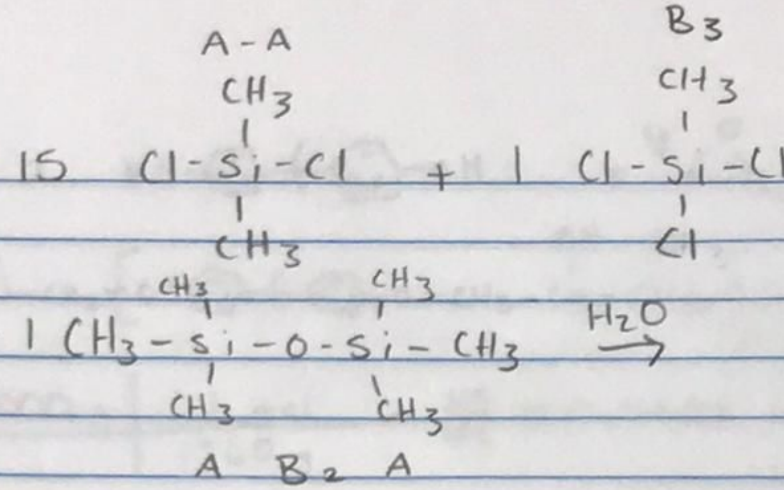
$$f_{wB} = \frac{3^2(1.4)}{3(1.4)} = 3$$

$$f_{avg} = \frac{2(3 \cdot 1.4)}{2 + 0.5 + 1.4} = \frac{28}{13} \approx 2.15$$

$$P_c = \frac{2}{\left(\frac{28}{13}\right)} = \boxed{\frac{13}{14} \approx 0.929}$$

$$P_c = \frac{1}{\left[\frac{14}{15}\left(\frac{17}{9} - 1\right)(3 - 1)\right]^{1/2}} = \boxed{0.776}$$

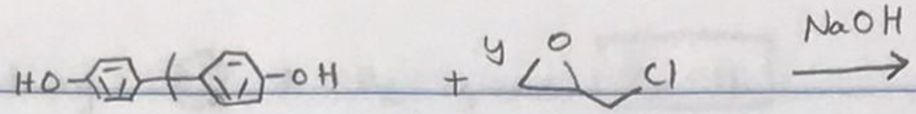
3.

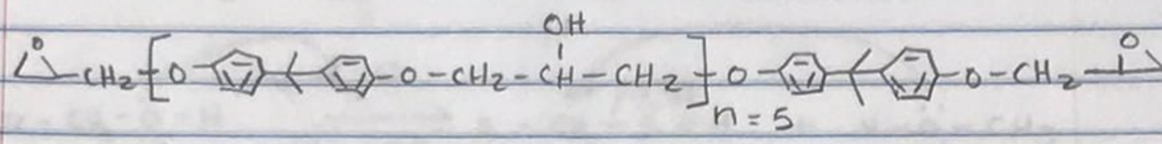


A-A 15(2) = 30
B3 1(3) = 3
B2 1(2) = 2
A2 1(2) = 2

$$f_{avg} = \frac{2((15\cdot 2) + 1(3) + 1(2))}{15 + 1 + 3 + \frac{33}{2}} = \frac{140}{71}$$

$$\bar{X}_n = \frac{2}{2-\left(\frac{140}{71}\right)} = \boxed{71}$$

4. x 



$$\frac{1000\text{ g}}{} \left| \frac{1\text{ mol}}{1760\text{ g}} \right. = \frac{25}{44} \approx 0.5682 \text{ mols}$$

$X_n = 2n+3$

$2(5)+3 = 13$

$1760 = 142 \cdot 2 \cdot n + 340$

$226 + 58$

$1760 = 284n + 340$

$1420 = 284n$

$n = 5$

$$r = \frac{[BPA]}{[ECH]} = \frac{n+1}{n+2} = \frac{6}{7}$$

$$13 = \frac{2}{2 - f_{avg}}$$

$$\frac{24}{13} = \frac{2(2 \cdot x)}{x+y}$$

~~$\frac{6}{7} = \frac{x}{y}$~~

$2 = 26 - 13 f_{avg}$

$$\frac{24}{13} = \frac{4x}{x+y}$$

~~$\frac{6}{7} = \frac{\frac{6}{7}y}{y}$~~

$-24 = -13 f_{avg}$

$\frac{24}{13} = f_{avg}$

$52x = 24x + 24y$

$28x = 24y$

~~$6y = 6y$~~

$x = \frac{6}{7}y$

$$\bar{X}_n = \frac{N_0}{N} \qquad 13 = \frac{x+y}{\frac{25}{44}} = \frac{325}{44} = x + y$$

$$\frac{325}{44} - x = y$$

$$x = \frac{6}{7}\left(\frac{325}{44} - x\right)$$

$$x = \frac{975}{154} - \frac{6}{7}x$$

$$y = \frac{325}{44} - \left(\frac{75}{22}\right) = \frac{175}{44}$$

$\approx$ **3.977 mols**

$$\frac{13}{7}x = \frac{975}{154}$$

$3.977 \times 92.5 =$

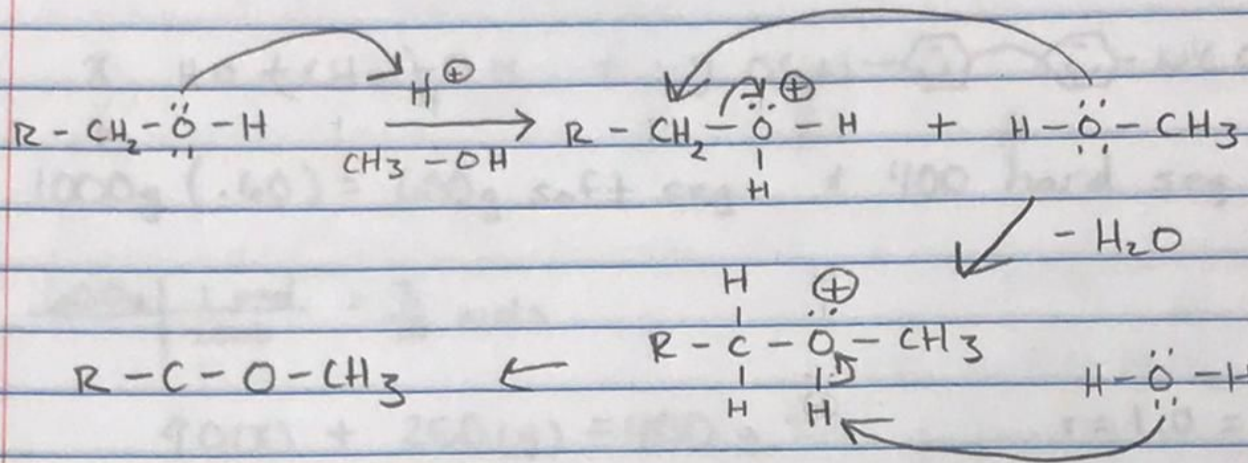
367.898 g ECH

$x = \frac{75}{22} \approx$ **3.409 mols**

777.25 g BPA

5. Counting  & CH_2 gives $\bar{x}_n = 16$

6.



R is obviously the rest of the HMMM

7. A - A N

B_3 M

$p < 1$, gels

$N/M \approx 3/2$

$$2 = \frac{2(2 \cdot N)}{M+N}$$

$$p = \frac{2}{f_{avg}} = f_{avg} = 2$$

$$2 = \frac{4N}{M+N}$$

$$4N = 2M + 2N$$

$$2N = 2M$$

$$N = M$$

If $N=1$, then $M=1$

$$\bar{X}_n = \frac{2}{2-(2)}$$

$$\bar{X}_n \to \infty$$

$$N/M = 1$$

$$2 = \frac{2(3 \cdot M)}{N+M}$$

$$2 = \frac{6M}{N+M}$$

$$2 = \frac{6}{N+1}$$

$$6 = 2N + 2$$

$$4 = 2N$$

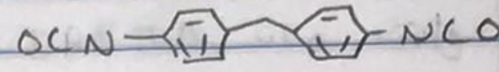
$$2 = N$$

$$\bar{X}_n \to \infty$$

$$N/M = 1/2$$

* This is tough but interesting

8. $\frac{3}{10}\ H\left[O\left(CH_2\right)_4 O-\overset{O}{\overset{\parallel}{C}}-CH_2-\overset{O}{\overset{\parallel}{C}}\right]OH$

$x\ HO\left(CH_2\right)_4 OH \quad + \quad y$ 

1000g (.60) = 600g soft seg & 400 hard seg

$\frac{600g}{} \Big| \frac{1\ mol}{2000} = \frac{3}{10}$ mols

$90(x) + 250(y) = 400\ g$

$x = \frac{400-250y}{90}$

$x = \frac{40}{9} - \frac{25}{9}y$

$x = \frac{40}{9} - \frac{25}{9}\left(\frac{3}{10} + x\right)$

$x = \frac{40}{9} - \frac{5}{6} - \frac{25}{9}x$

$\frac{34}{9}x = \frac{65}{18}$

$x = \frac{65}{68} \approx$ **0.956 mols BD**

$\frac{65}{68} \times \frac{90g}{mol} =$ **86.03 g BD**

$r = 1.0 = \frac{[OH]}{[NCO]}$

$1 = \frac{\left(\frac{3}{10}\cdot 2\right) + (2\cdot x)}{2y}$

$1 = \frac{\frac{3}{5} + 2x}{2y}$

$2y = \frac{3}{5} + 2x$

$y = \frac{\frac{3}{5} + 2x}{2}$

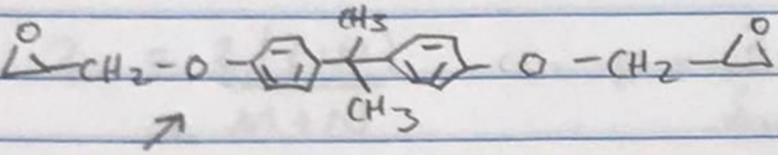
$y = \frac{3}{10} + x$

$y = \frac{3}{10} + \frac{65}{68} = \frac{427}{340}$

$\approx$ **1.256 mols MDI**

$\frac{427}{340} \times \frac{250g}{mol} =$ **313.97 g MDI**

9. One side (the yellow side) is Diglycidyl ether bisphenol A. The hardener (clear) side is a polyamine that cures the DGEBA via ring-opening polymerization



↗

DGEBA

poly Amine ↓

$NH_2 - R - NH_2$

But likely something like:

$H_2N - CH_2 - CH_2 - NH - CH_2 - CH_2 - NH_2$

(diethylene triamine)