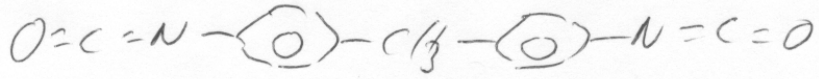
090218 Quiz 6 Introduction to Polymers

1) Polyurethane in the video shown in class is formed from two liquids that are mixed. After mixing the solution foams and expands fairly rapidly forming a solid foam after a few minutes.
   a) One of the liquids contains MDI. Give the full name and structure for MDI.
   b) What is the reactant (co-monomer) in the second liquid?
   c) Name a catalyst (give acronym) that might be in the second liquid.
   d) What role would water play if it were present in the second liquid?
   e) What happens if a diamine is used rather than what you listed in part b?

2) In class we made a novolac polymer
   a) What two reactants were used to make the novalac?
   b) How do these reactants differ from those used to make a resole polymer?
   c) For the novolac what condition is needed?
   d) Outline the reaction scheme for formation of the novolac polymer.
   e) Why is the novolac procedure easier to demonstrate than the resole procedure?

3) We also discussed polyimides and epoxys last week.
   a) Give the structure of an imide bond.
   b) Give the reactants that form a cyclic polyimide such as kapton.
   c) Show the two reaction steps to form a polyimide
   d) Give the structure of epichlorohydrin.
   e) Give the structure of a glycidyl ether.

1) a) methylene 4,4' diphenyl diisocyanate

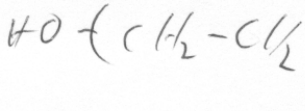


b) A diol

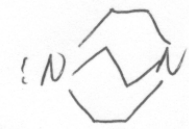
ethylene glycol

or

poly ethylene oxide



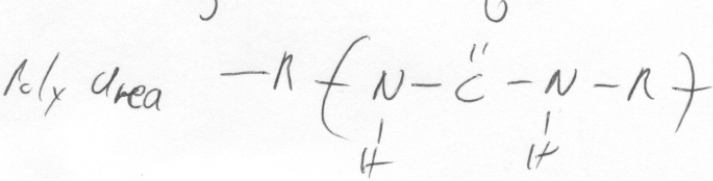
c) DABCO



d) Water + isocyanate ⇒ CO_2 (g) + N–R

CO_2 (g) ⇒ Foaming

e) You form a poly urea

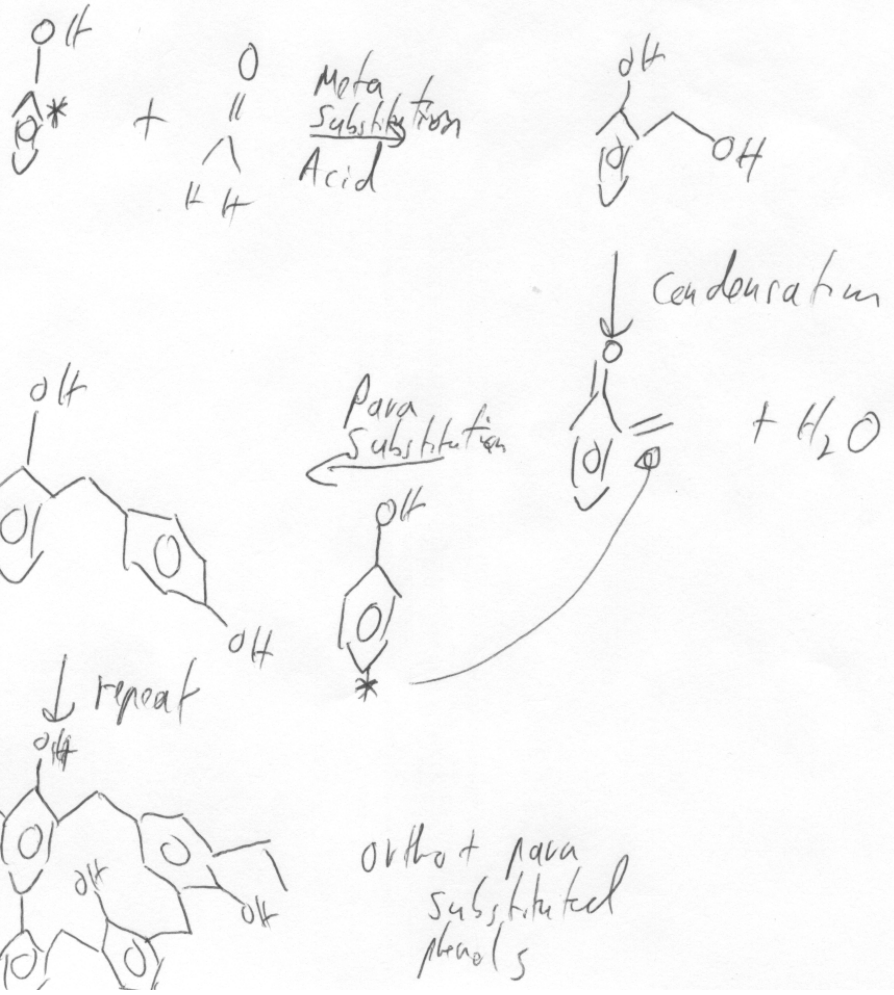


2) a) Phenol & Formaldehyde

b) Same reactants for a resole

c) Acid we used Acetic acid + HCl

d)



ortho + para substituted phenols

e) Resole requires heating to a boil for the last step. Novolac only requires addition of acid to fully form the polymer (pink precipitate on the stir rod).