ELEG 667–016; MSEG-667-016 - Solid State Nanoelectronics – Fall 2005
Solution
Homework #4 - due Tuesday, 4 October 2005, in class

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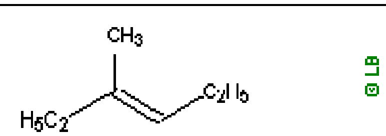
1. (a) 1,2 dichloroethene

In one, the two chlorine atoms are locked on opposite sides of the double bond. This is known as the ***trans*** isomer. (*trans* : from Latin meaning "across" - as in transatlantic).

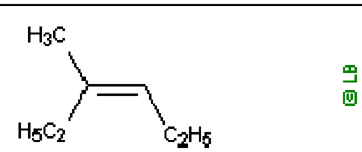
In the other, the two chlorine atoms are locked on the same side of the double bond. This is known as the ***cis*** isomer. (*cis* : from Latin meaning "on this side")

trans-1,2-dichloroethene *cis*-1,2-dichloroethene

(b) 3-methyl-3 hexene:
trans:

C_7H_{14} 98.19 g/mol 3899-36-3		(E)-3-methyl-3-hexene; *trans*-3-methyl-hex-3-ene; *trans*-3-methyl-3-hexene; 3-methyl-*trans*-3-hexene; 3-hexene, 3-methyl-, (E)-

cis:

C_7H_{14} 98.19 g/mol 4914-89-0		(Z)-3-methyl-3-hexene; *cis*-3-methyl-hex-3-ene; *cis*-3-methyl-3-hexene; 3-hexene, 3-methyl-, (Z)-

2.

The electrical conductivity is $\sigma = ne\mu$. The approach is to first find the equivalent density of electrons in the polymer, and then to calculate the mobility that would be required to yield the same conductivity as for Cu metal..

For the conjugated single and double bonds, the bond length is 154 pm for the single bond, and 134 pm for the double bond, or 288 pm for the pair. In a bulk sample with conducting chains surrounding each other, assume that the spacing between chains is also 288 pm (in actuality it will probably be much larger than this value).
We have then 2 electrons per $(288\ \text{pm})^3 = 8.37\text{x}10^{28}\ \text{m}^{-3} = 8.37\text{x}10^{22}\ \text{cm}^{-3}$.

$\mu = \sigma/ne = 5.96\text{x}10^{5}\text{S/cm} / 8.37\text{x}10^{22}\text{cm}^{-3}\ \text{x}\ 1.6\text{x}10\text{-}^{19}\text{Coul} = 44.5\ \text{cm}^2/\text{V-s}$

This value of mobility is low for metals or semiconductors, but relatively high for organic polymers.