

**BMEN 343: Fall 2009**

You must know repeat unit structure, morphology, and T<sub>g</sub> for Exam I.

Polymer	Morphology	T <sub>g</sub> (°C)
<b>NON-DEGRADABLE POLYMERS</b>		
<b>Polyethylene (PE)</b>		
<i>HDPE</i>	Semi-crystalline: 70-90% “ <u>high</u> ”	- 90
<i>LDPE</i>	Semi-crystalline: ~50%	-110
<i>UHMWPE</i>	Semi-crystalline: ~60%	-100
<b>Polypropylene (PP)</b>		
<i>Isotactic</i>	Semi-crystalline: 70-90% “ <u>high</u> ”	- 8
<i>Syndiotactic</i>	Semi-crystalline	- 8
<i>Atactic</i>	<i>Amorphous</i>	- 8
<b>Polystyrene (PS)</b>		
<i>Isotactic</i>	Semi-crystalline: 70-90% “ <u>high</u> ”	100
<i>Syndiotactic</i>	Semi-crystalline	100
<i>Atactic</i>	<i>Amorphous</i>	100
<b>Poly(tetrafluoroethylene ) PTFE</b>	Semi-crystalline: 70-90% “ <u>high</u> ”	117
<b>Poly(vinyl chloride) PVC</b>	Semi-crystalline	73
<b>Poly(vinyl alcohol) PVA or PVOH</b>	Semi-crystalline	85
<b>Poly(methyl methacrylate) PMMA</b>	<i>Amorphous</i>	105
<b>Poly(hydroxyethylmethacrylate) PHEMA</b>	<i>Amorphous</i>	55
<b>Poly(dimethyl siloxane) PDMS</b>	Semi-crystalline	-127
<b>Nylon 6,6</b>	Semi-crystalline	50
<b>Poly(ethylene glycol) PEG (aka PEO)</b>	Semi-crystalline	-41
<b>Poly(ethylene terephthalate) PET</b>	Semi-crystalline	61
<b>Poly(carbonate) PC</b>	<i>Amorphous</i>	150
<b>BIODEGRADABLE POLYMERS</b>		
<b>Poly(glycolic acid) (PGA)</b>	Semi-crystalline: (~50%)	36
<b>Poly(L-lactic acid) (PLLA)</b>	Semi-crystalline: (~40%)	60-65
<b>Poly(DL-lactic acid) (PDLA)</b>	<i>Amorphous</i>	55-60
<b>Polydioxanone (PDS)</b>	Semi-crystalline	-10
<b>Poly(<math>\epsilon</math>-caprolactone) (PCL)</b>	Semi-crystalline	-60

These T<sub>g</sub> values are for thermoplastic polymers (i.e. not crosslinked). Table 15.2 Also lists values of T<sub>g</sub>'s. Some vary compared to what is reported here; for instance, T<sub>g</sub> of PTFE = -97 °C. For exams and homeworks, information from [this table](#) is what is “correct”. (Data reported here is compiled from several sources considered to be the “gold” standard in polymer science).

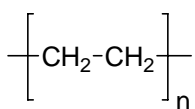
Lactic acid is a chiral molecule: exists in two stereoisomeric forms (D and L) with opposite configurations (arrangement in 3-D space).

**Examples of Amorphous Polymers:** Atactic PP, Atactic PS, PMMA, PHEMA, PC, PDLA

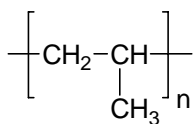
**Examples Highly Crystalline Polymers (70-90% crystalline):** HDPE, Isotactic PP, Isotactic PS, PTFE

## Repeat Unit Structures:

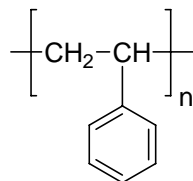
For information regarding "repeat unit structures": see Sec. 14.3 and 14.4



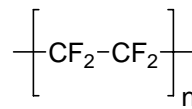
**PE**



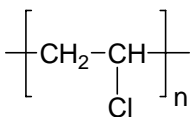
**PP**



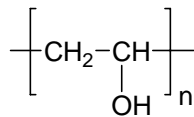
**PS**



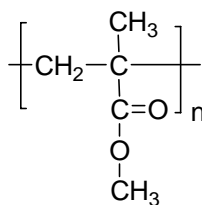
**PTFE**



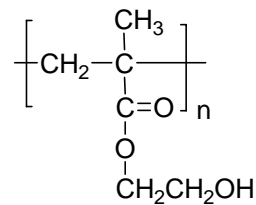
**PVC**



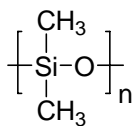
**PVOH**



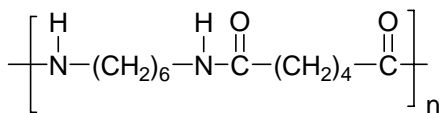
**PMMA**



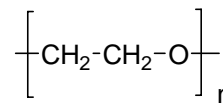
**PHEMA**



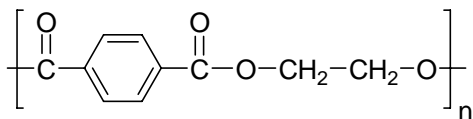
**PDMS**



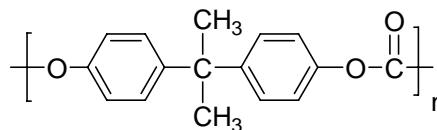
**Nylon 6,6**



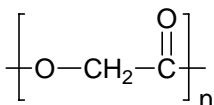
**PEG or PEO**



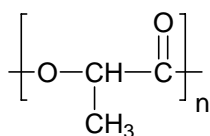
**PET**



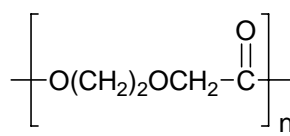
**PC**



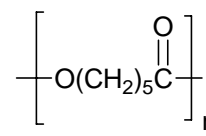
**PGA**



**PLLA or PDLLA**



**PDS**

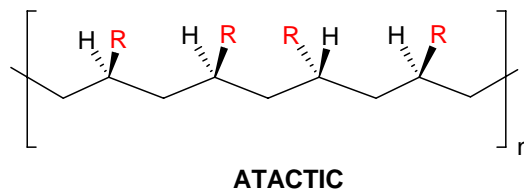
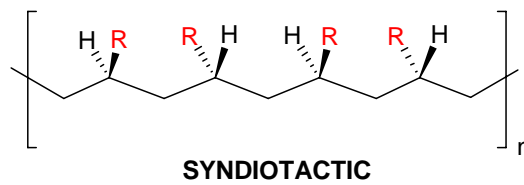
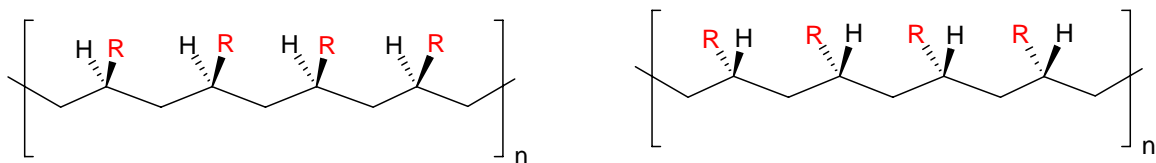
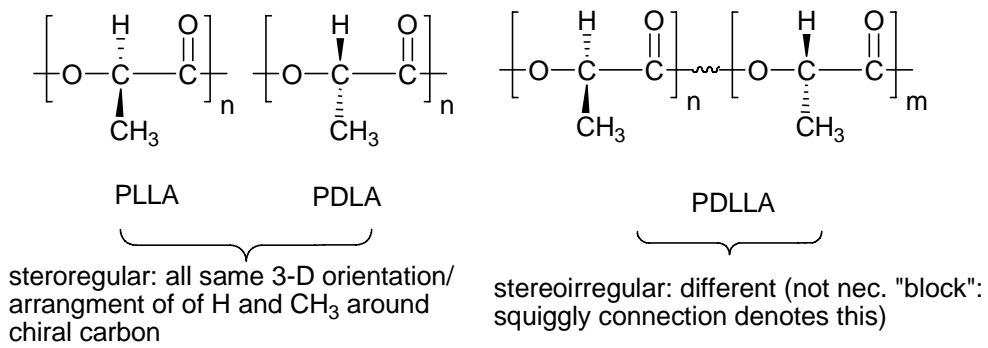


**PCL**

## Other Information:

Repeat unit structure has "**CHIRAL CARBON**": 4 different atoms or atom groups

**Stereochemistry:** spatial arrangement of atoms around chiral carbon



R = CH<sub>3</sub> (**PP**)  
R = Ph ("Phenyl ring") (**PS**)