Names: _____ Chem 227/ Dr. Rusay Sec. _____

Polymer Chemistry

1. Match the following set of monomers (A-T) to the polymeric units that are on the following pages. Beneath the monomer's or monomers' letter(s) indicate if the polymeric unit forms as part of an *addition* or *condensation* polymer. More than one monomer (co-monomers) will be necessary in some cases.







2. Draw condensed or line structures for the two respective co-monomers of nylon 6,6 as seen in the videos. Describe the physical characteristics of the nylon observed in the video and briefly explain how the molecular structure produced from the monomers relates to nylon's material properties.

3. Write a mechanism for the polymerization of sebacoyl chloride and 1,6-hexanediamine. (Use condensed or line structures and one molecule of each reactant to illustrate the mechanism. Show a complete mechanism.)

4. "Super glue" contains methylcyanoacrylate, which readily polymerizes upon exposure to traces of water or alcohols on the surfaces to be bonded together. The polymer provides a strong bond between the two surfaces and is thought to proceed via an anionic mechanism. Draw the structure for 2 units of the polymer formed by hydroxide ion reacting with methylcyanoacrylate monomer to illustrate the polymer's formation. If you were an emergency room physician, what would you use to "unglue" the super-glued fingers of a do-it-yourself home owner? What physical or chemical principle can account for this procedure working?



5. Draw the structure of one unit of *Kevlar*, which is molecularly similar to nylon but which has dramatically different material properties. Briefly explain the material differences and provide chemical reasoning that would account for the differences.

6. "Fiberglass" is used to make lightweight kayaks that are very expensive and very delicate versus the relatively inexpensive, much heavier, but very durable polyethylene built boats. A German company, Prijon, built a boat from a thermosetting polymer that was intermediate between the two. Describe the chemical and material properties of a thermosetting polymer and how it differs from a thermoplastic polymer.

7. PVA can produce a variety of materials with widely different physical properties. One product is a highly absorbent cloth-like, mesh coated material that is used in place of animal derived "chamois". Another is as an adhesive in pressure-sensitive labels. Match the adhesive (A) and synthetic chamois (SA) to an atactic or a syndiotactic polymer structure. Indicate the stereochemistry in the structures below. NOTE: you will need to alter the 3-D portrayal of each of the alcohol functions to indicate whether they are coming out toward you (▼), or back, away from you (...).



Briefly explain the reason(s) for your adhesive (A) and synthetic chamois (SA) choices relative to the atactic / syndiotactic structures.