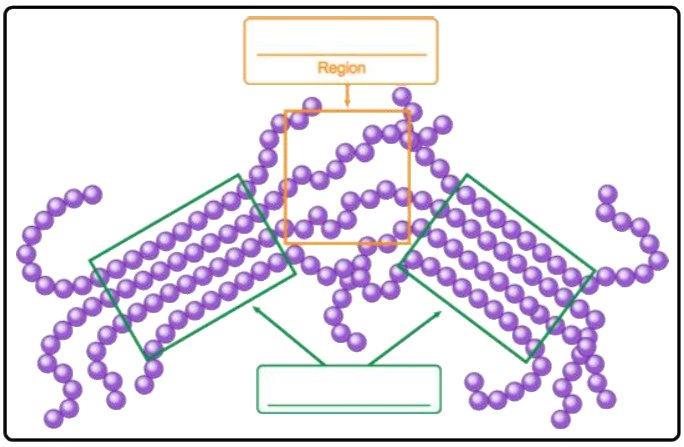
CONCEPT: POLYMERS STRUCTURE AND PROPERTIES

Crystallinity

- **Crystallinity** determines the _____ and *thermal properties* of a polymer.
- Though not crystalline structures, polymers possess _____: small regions of crystalline structure.
  - □ Higher degree of crystallinity = ____ density, ____rigidity and ____ strength.
- **Amorphous regions**: polymer chains in _____ordered arrangement.



EXAMPLE: Select a **true** statement that best describes crystalline polymers.

a) Higher density polymers are softer than amorphous polymers.

b) Higher degree of crystallinity leads to decreased polymer brittleness.

c) Higher degree of branching introduces regions of highly ordered chains.

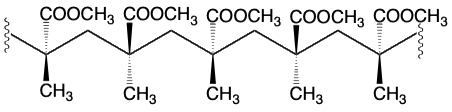
d) Crystalline regions are more rigid than amorphous regions in a polymer.

Factors Affecting Crystallinity

- Higher crystallinity results from _____ intermolecular forces and specific _____.
  - □ Degree of crystallinity: _____tactic > _____tactic > ____tactic.

EXAMPLE: By analyzing the stereochemistry of each, determine which polymer is considered stronger.

a)



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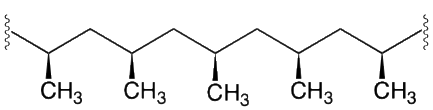

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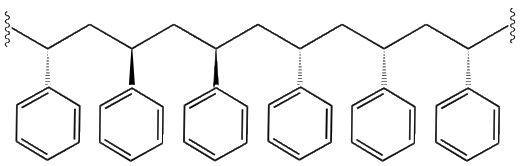

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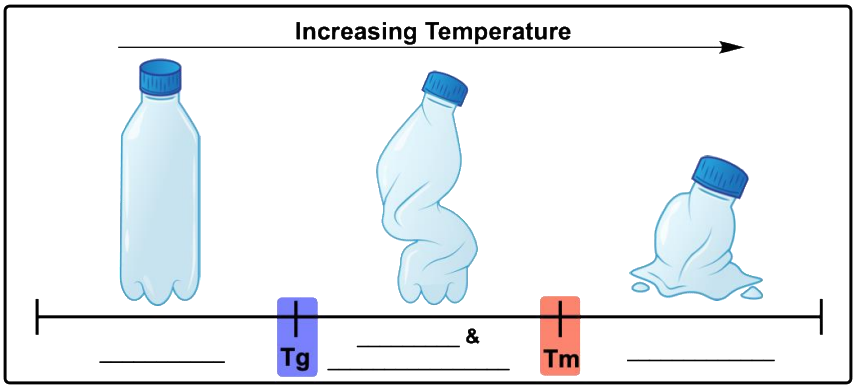
Thermal Properties

- **Glass Transition Temperature (_____):** temp above which polymer transitions from hard to soft and moldable.
- **Crystalline Melting Temperature (_____):** temp at which polymer turns into a viscous liquid.



- As degree of crystallinity _____, so does _____ and _____ of polymers.

EXAMPLE: Two polymers are being studied in a lab. Polymer A has highly ordered regions and strong IMFs, while polymer B has an amorphous structure and weak IMFs. Explain why polymer A has higher Tg and Tm than polymer B.

a) Polymer A has higher Tg and Tm because crystalline structures are more flexible than amorphous.

b) Strong IMFs and higher degree of crystallinity in polymer A restrict chain movement, resulting in higher Tg and Tm.

c) Higher Tg and Tm cause polymers to develop stronger IMFs.

d) Crystalline polymers allow for more movement along the chains, resulting in higher Tg and Tm.