2.3 CASE STUDY: AN EYEFUL OF POLYMERS: CONTACT LENSES

PRACTICE

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Making Connections

1. (Sample answer) Transparent; refractive properties to enable large corrective factor in a thin lens; sufficiently rigid to keep shape; sufficiently flexible to be comfortable for wearer; permeable to oxygen to nourish eye; chemically unreactive; does not soften and change shape with temperature.
2. (Sample answer) Some polymer molecules such as transparent plastics; some degree of crosslinking to provide rigidity as well as flexibility, and to keep shape with body temperature; selected functional groups to allow interaction with water but not dissolve.

PRACTICE

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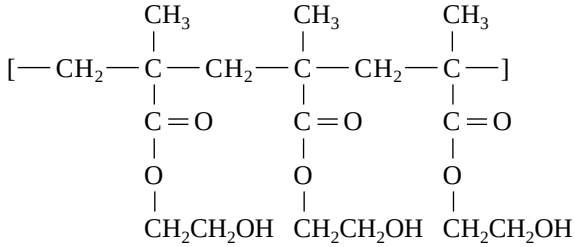
Understanding Concepts

3.



4. When a polymer is deformed, its polymer chains are forced out of alignment. Crosslinking pulls the polymer chains back together, returning the lens to its original shape.

Making Connections

5. (Sample answers) Some crosslinking gives the lens elasticity and comfort for the wearer; however, elasticity is at the expense of the lens retaining its shape for correcting vision. A high water content in the lens is needed to provide oxygen to the eye; however, increased water content decreases refractive index of the lens and lowers corrective effect.

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Understanding Concepts

6. This is a valid statement. Properties of polymers can be changed by altering the type of functional groups and substituted groups on the monomers, and by altering the type of interchain linkages. The possible organic compounds to serve as monomers are almost endless as carbon atoms can form four bonds and can form long carbon chains.

Making Connections

7. (Sample answers) Desirable features include: gas permeable, rigid and easy to maintain, can be worn for long periods of time. Future developments: Design and test polymers with different functional groups and substituted groups, and varying degrees of crosslinking.

SECTION 2.3 QUESTIONS

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Understanding Concepts

1. Hard lenses: Plastic lenses (PMMA) replaced glass lenses for comfort; did not allow sufficient oxygen to reach the eye. Soft lenses: PolyHEMA replaced hard contact lenses, more comfortable and better oxygen permeability; not long-lasting as they were easily deformed. Rigid gas-permeable lenses: New polymer that is gas permeable and retains shape; however, there is an increased risk of protein and lipid deposits on lens. New polymers were developed for rigid

gas-permeable lenses, and research is ongoing to develop new organic compounds with desired properties for use in improving vision and eye care.

Making Connections

2. (Sample answer)
Drug delivery systems, e.g., nicotine patches, estrogen patches.
Problem to be solved: Patients quitting smoking need a bridging program to relieve withdrawal from nicotine; patients requiring estrogen to relieve symptoms due to surgery.
Existing solution: nicotine gum; estrogen capsules. Problems: Patients may forget to take medication. As well, a low but continuous dosage most effective.
Improved solution: Polymers used to provide an adhesive patch on the skin, allowing the nicotine or estrogen to be absorbed through the skin on a continuous basis.

2.4 PROTEINS—NATURAL POLYAMIDES

Try This Activity: Making Chiral Molecules

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(a) L-alanine
(b) D-alanine
(c) They do not have the same properties because they are structurally different, and are isomers.

PRACTICE

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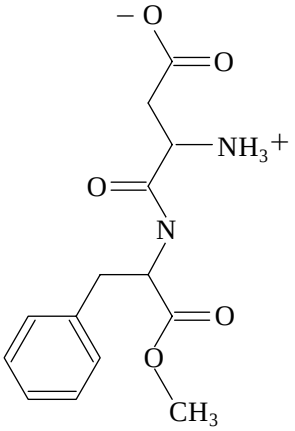
Understanding Concepts

1. (a)



aspartame

(b) $M_{\text{aspartame}} = 294.34 \text{ g/mol}$

The portion in the aspartame molecule attributable to methanol is CH_3O.

$m_{CH_3O} = 31.04$

$$\%CH_3O = \frac{31.04 \text{ g}}{294.34 \text{ g/mol}} \times 100\%$$

$\%CH_3O = 10.55\%$

2. (a) Aspartic acid, phenylalanine, methanol (which is further oxidized to formaldehyde and formic acid)
(b) $CH_3OH + (O) \rightarrow HCHO + H_2O$
$HCHO + (O) \rightarrow HCOOH$