

1. The first man-made polymer made from small molecules was \_\_\_\_\_.

- (A) phenol
- (B) formaldehyde
- (C) bakelite**
- (D) nylon

**Hint:** In the early 1900's Leo Baekeland heated formaldehyde and phenol to make a compound he called Bakelite.

2. The two things that help synthesize polymers are \_\_\_\_\_.

- (A) a double bond and a free radical**
- (B) a starter polymer and a double bond
- (C) a starter polymer and a free radical
- (D) a starter polymer and a double bond

**Hint:** Free radicals, atoms with a single unpaired electron, start the polymerization process because they are looking desperately for an electron to pair with its unpaired electron.

A double bond contains 4 electrons.

When the free radical grabs 1 of the 4 electrons in a double bond, the unpaired electron in the double bond moves out of the double bond and becomes an unpaired electron itself, and the whole process repeats itself as the double bonds are broken into long chain, single-bonded molecules.

3. Ethylene is made into strands of polyethylene which bond together by \_\_\_\_\_.

- (A) hydrogen bonding
- (B) covalent bonding
- (C) London dispersion forces**
- (D) ionic bonding

**Hint:** Ethylene consists of long chain hydrocarbons whose hydrogen and carbon atoms are bonded with non-polar covalent bonds.

Long-chain hydrocarbons are attracted to each other with London dispersion forces.

4. Polyethylene can be strengthened by adding \_\_\_\_\_.

- (A) carbon atoms
- (B) hydrogen atoms
- (C) London dispersion forces between polyethylene strands
- (D) covalent bonding between polyethylene strands**

**Hint:** Strands of hydrocarbons are like strands of spaghetti sliding past each other.

To prevent the sliding, cross-link the polyethylene strands with covalent bonds between them.

5. Proteins are polymers of \_\_\_\_\_.

- (A) **amino acids**
- (B) carboxyl groups
- (C) glucose molecules
- (D) amide groups

**Hint:** Proteins are chains (or polymers) of amino acids bonded to each other with peptide bonds.

6. Examples of proteins include all of the following except \_\_\_\_\_.

- (A) silk
- (B) **glycogen**
- (C) cartilage
- (D) wool

**Hint:** Glycogen is a carbohydrate. There are no amino acids in a carbohydrate.

7. Hair and rubber are both polymers held together and strengthened by cross-bridging atoms of \_\_\_\_\_.

- (A) nitrogen
- (B) silicon
- (C) fluorine
- (D) **sulfur**

**Hint:** In 1839, Charles Goodyear discovered that by adding sulfur to natural rubber and heating the mixture greatly improved the elastic properties of rubber.

8. The key bond between links in a protein is called a(n) \_\_\_\_\_.

- (A) amine bond
- (B) **peptide bond**
- (C) carboxyl bond
- (D) terminal bond

**Hint:** An amino acid has a carboxyl group on one end and an amino group on the other end. The carboxyl group  $\text{OH}^-$  on it and the amino group has a  $\text{H}^+$  on it.

This allows two separate amino acids to bond by removing the  $\text{H}^+$  and the  $\text{OH}^-$  to form a molecule of water.

That bond is a peptide bond, so proteins are called “polypeptides.”