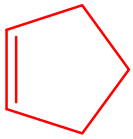
CH 302 Spring 2007 Worksheet 14

(Note:Tthere are specific rules about which groups get priority in numbering, but you aren't responsible for knowing them. So if your name has different numbers from mine, try flipping your numbering system around on the carbon backbone and seeing if that fixes it.)

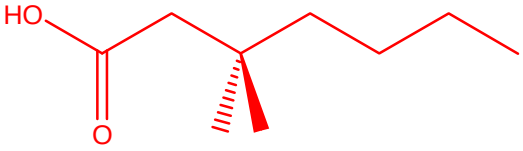
Draw the following compounds.

1. cyclopentene



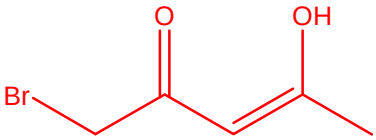
Answer:

2. 3,3-dimethylheptanoic acid



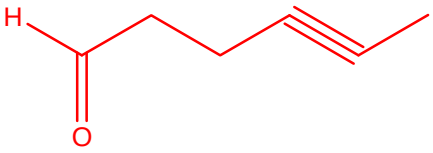
Answer:

3. 1-bromo-4-hydroxypent-3-en-2-one



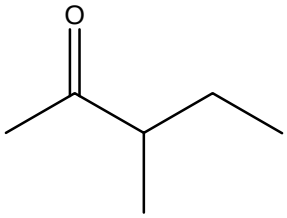
Answer:

4. hex-4-ynal

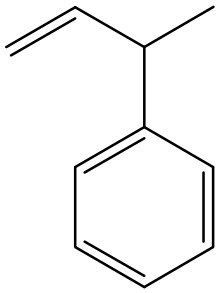


Answer:

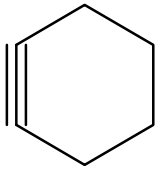
Name the following compounds.

5. 

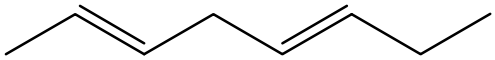
Answer: 3-methylpentan-2-one

6. 

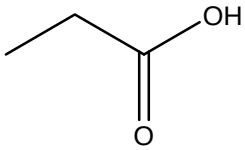
Answer: 2-phenylbut-3-ene

7. 

Answer: cyclohexyne

8. 

Answer: octa-2,5-diene

9. 

Answer: propanoic acid

10. List the following in order of increasing miscibility with water: methane, methanol, butane, butanol

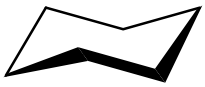
Answer: methane < butane < butanol < methanol

Butane is more miscible than methane because it has stronger instantaneous dipoles (since it's bigger). Methanol is more miscible than butanol because it has a smaller nonpolar portion.

11. Briefly explain why benzene is a more stable structure than the seemingly similar cyclohexane.

Answer: Benzene has two resonant forms formed by the pi bonds of the overlapping p orbits. Cyclohexane doesn't have these resonant forms.

12. Cyclohexane adopts a "chair" conformation (see below), while benzene is planar. Why is this?



Answer: Each carbon in benzene is surrounded by 3 electron-rich regions (2 neighboring carbons and one hydrogen), while each carbon in cyclohexane has 4 (2 neighboring carbons and 2 hydrogens). So the carbons in benzene form a trigonal **planar** structure, while those in cyclohexane form a tetrahedral structure which has 109.5^{o} bond angles that go out of the plane.

13. Explain why you'd expect hexanol to have a higher boiling point than hexane.

Answer: A hydroxyl group always implies hydrogen bonding. Hexanol has hydrogen bonding while hexane doesn't, so it has stronger IMFs and a higher boiling point.

14. How many structural isomers of heptane, C_7H_{16}, are there?
Answer: There are nine:

- Heptane (*n*-heptane), $CH_3CH_2CH_2CH_2CH_2CH_2CH_3$, straight chain of seven carbon atoms.
- 2-Methylhexane, $CH_3CH(CH_3)CH_2CH_2CH_2CH_3$, chain of six carbon atoms, and a methyl group attached to the second.
- 3-Methylhexane, $CH_3CH_2CH(CH_3)CH_2CH_2CH_3$ (chiral), chain of six carbon atoms, and a methyl group attached to the third.
- 2,2-Dimethylpentane, $CH_3C(CH_3)_2CH_2CH_2CH_3$, chain of five carbon atoms, and two methyl groups attached to the second.
- 2,3-Dimethylpentane, $CH_3CH(CH_3)CH(CH_3)CH_2CH_3$ (chiral), chain of five carbon atoms, and methyl groups attached to the second and third.
- 2,4-Dimethylpentane, $CH_3CH(CH_3)CH_2CH(CH_3)CH_3$, chain of five carbon atoms, and methyl groups attached to the second and fourth.
- 3,3-Dimethylpentane, $CH_3CH_2C(CH_3)_2CH_2CH_3$, chain of five carbon atoms, and two methyl groups attached to the third.
- 3-Ethylpentane, $CH_3CH_2CH(C_2H_5)CH_2CH_3$, chain of five carbons, and an ethyl group attached to the third.
- 2,2,3-Trimethylbutane, $CH_3C(CH_3)_2CH(CH_3)CH_3$, chain of four carbon atoms, with two methyl groups attached to the second, and one to the third.[1]

Name the following reactions (substitution, elimination, or addition)

15. bromomethane + OH^- → methanol + Br^-
Answer: substitution

16. ethene + HCl → chloroethane
Answer: addition

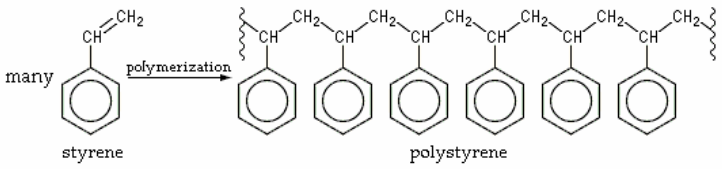
17. 2-fluoro-2-methylpropane → 2-methylpropene + HF

Answer: elimination

18. The compound written below is a monomer unit that makes a very famous polymers. Name the polymer it forms, its famous function and draw its structures.

Phenylethylene (also styrene or vinyl benzene) $C_6H_5CH=CH_2$

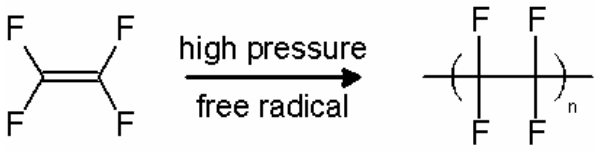
Answer: polystyrene (packing material foam)



19. The compound written below is a monomer unit that makes a very famous polymers. Name the polymer it forms, its famous function and draw its structures.

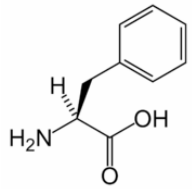
Tetrafluoroethene

Answer: Teflon

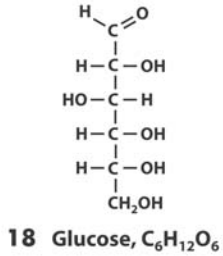


20. Several monomers that form very famous biopolymers are printed below. For each, name the category of biopolymer and indicate the features of the monomer that define the biopolymer.

Answer: This is the amino acid phenylalanine. Amino acids are the building blocks of peptides that are, in turn, the building blocks of protein—features include an amine group and a carboxylic acid group.

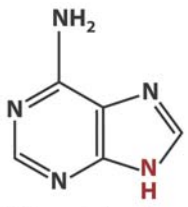


Answer: This is a sugar. Sugars are the building blocks polysaccharides which are the building blocks of starches and cellulose—the common feature is extensive hydroxyl groups

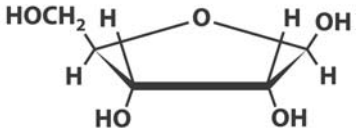


18 Glucose, $C_6H_{12}O_6$

Answer: The sugar, ribose, and bases like adenine, form nucleosides, which when a phosphate group is added form nucleotides. DNA and RNA are formed from polynucloeotides.



22 Adenine



20 Ribose, $C_5H_{10}O_5$