GETTING STARTED

REFLECT ON YOUR LEARNING

(Page 178)

1. (Sample response) Organic compounds are similar in structure, similar in types of atoms, similar in size, and similar in chemical reactivity.
2. Solubility: "like dissolves like;" compounds that have large nonpolar components tend to be soluble in nonpolar solvents; and compounds that have small nonpolar components and polar groups such as C=O, OH, or NH groups tend to be soluble in polar solvents
   Melting and boiling points: compounds with strong intermolecular attractions tend to have higher melting and boiling points because more energy is required to separate the molecules.
3. (Sample response) "Organic" means made by plants or animals; compounds that contain carbon atoms; grown without use of synthetic materials.

TRY THIS ACTIVITY: KEEPING BABY DRY WITH POLYMERS

(Page 179)

(a) The addition of table salt causes some of the water to come out of the gel because the presence of sodium ions reduces the attraction of water to the polymer, and thus reduces absorbency. The addition of sucrose or calcium chloride does not produce any change because no sodium ions are added.

(b) Determine the mass of a dry diaper. Add a few millilitres of water to the absorbent surface of the diaper, then hold the diaper vertically and note whether any leakage occurs. Repeat until the first sign of leakage of water occurs. Determine the mass of the wet diaper. Subtract the mass of the dry diaper from the mass of the wet diaper to obtain the mass of water absorbed. Calculate the volume of water absorbed, using the density of water (1.0 g/mL).

3.1 HYDROCARBONS

TRY THIS ACTIVITY: HYDROCARBONS ARE MADE OF…

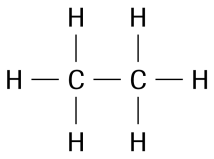
(Page 180)

(a) The black powder formed is soot: pure carbon.

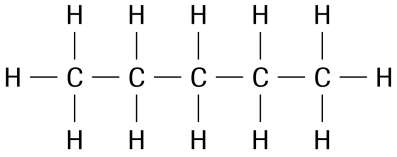
PRACTICE

(Page 183)

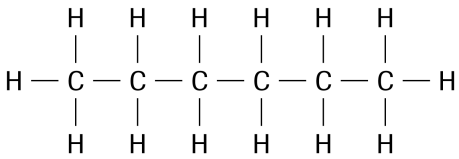
1. (a)



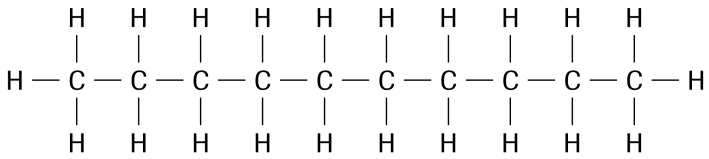
(b)



(c)



(d)

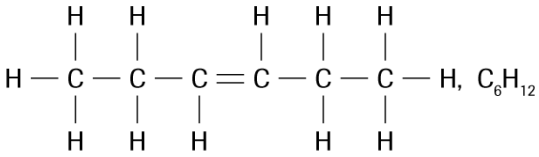


2. (a) nonane, C_9H_{20}
   (b) heptane, C_7H_{16}

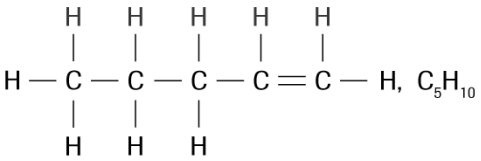
PRACTICE

(Page 186)

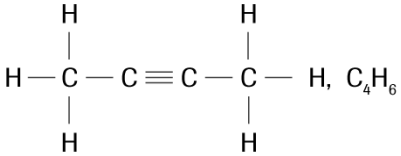
3. (a)



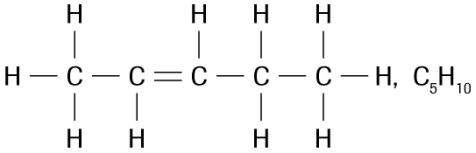
   (b)



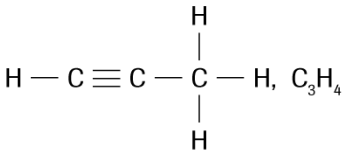
   (c)



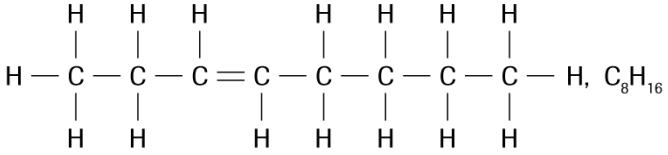
   (d)



   (e)



   (f)



4. (a) 1-pentene, C_5H_{10}
   (b) 1-butyne, C_4H_6
   (c) 2-heptene, C_7H_{14}

PRACTICE

(Page 188)

5. (a) $CH_4 + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(g)}$
   (b) $2\ CH_3CH_3 + 7\ O_{2(g)} \rightarrow 4\ CO_{2(g)} + 6\ H_2O_{(g)}$
   (c) $HC{\equiv}CCH_3 + 4\ O_{2(g)} \rightarrow 3\ CO_{2(g)} + 2\ H_2O_{(g)}$
   (d) $CH_3CH_2CH{=}CHCH_2CH_3 + 9\ O_{2(g)} \rightarrow 6\ CO_{2(g)} + 6\ H_2O_{(g)}$

TRY THIS ACTIVITY: TESTING FATS AND OILS

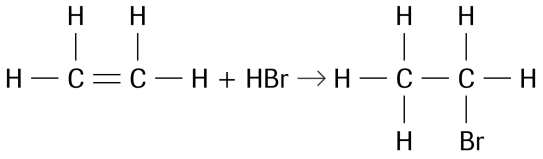
(Page 189)

(a) The samples that contained only saturated carbon chains (i.e., no unsaturated bonds) do not turn potassium permanganate solution brown. All of these samples were oils (liquids at room temperature).
(b) Experimentally, the samples that turn potassium permanganate brown contain unsaturated carbon chains. Generally, the fats (solids at room temperature) contain saturated carbon chains.
(c) The more solid the sample is at room temperature, the more likely it is that the sample contains saturated carbon chains; the more liquid the sample is at room temperature, the more likely it is that the sample contains unsaturated carbon chains.

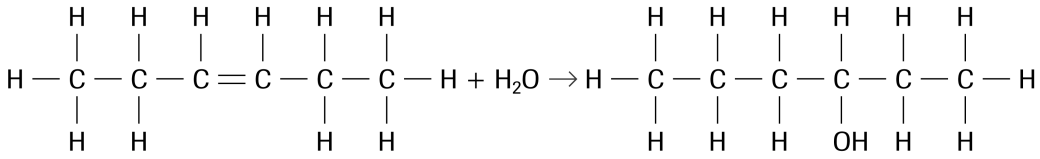
PRACTICE

(Page 190)

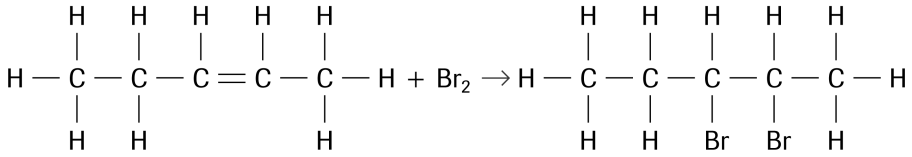
6. (a)



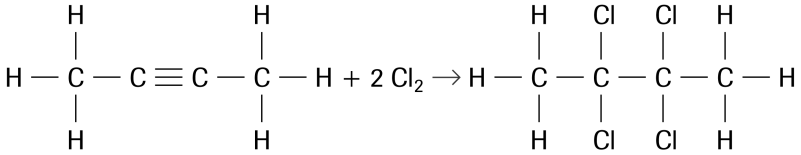
(b)



(c)



(d)



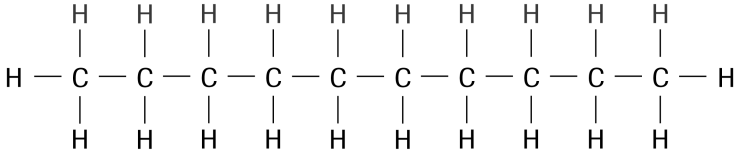
7. 1-heptene, 2-heptene, and 3-heptene

SECTION 3.1 QUESTIONS

(Pages 190–191)

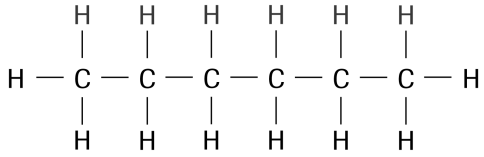
Understanding Concepts

1. (i) Carbon atoms can share electrons to form covalent bonds. (ii) Carbon atoms can form four bonds. (iii) Carbon atoms can form covalent bonds with other carbon atoms. Therefore, they can join other carbon atoms to form straight chains, branched chains, or ring structures.
   Example: decane



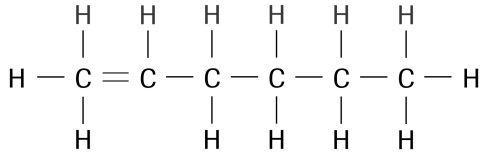
2. (a) Alkenes contain one or more carbon–carbon double bonds.
   (b) Alkynes contain one or more carbon–carbon triple bonds.

3. Double and triple bonds are readily converted to single bonds. Thus, the presence of double or triple bonds in alkenes and alkynes makes them more reactive than alkanes, which have only single bonds.
4. saturated hydrocarbon:



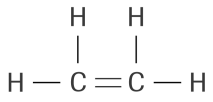
hexane

unsaturated hydrocarbon:

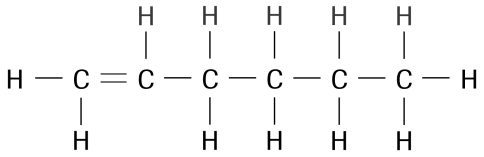


1-hexene

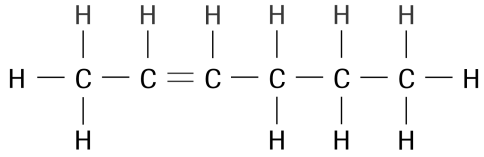
5. Since a single carbon atom cannot form a carbon–carbon double bond, no alkene with a single carbon exists. The smallest alkene is therefore ethene, which contains two carbon atoms.



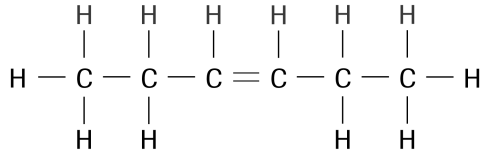
6.



1-hexene

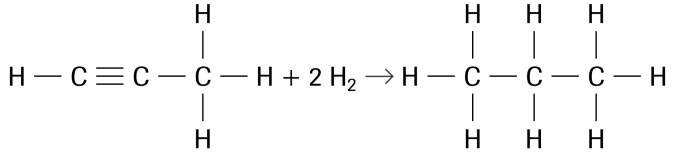


2-hexene

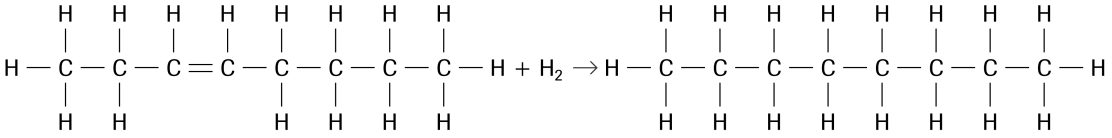


3-hexene

7. There is no ambiguity in the location of the double bond: in ethene, the double bond can only be between the two carbon atoms; and in propene, the double bond is between the middle carbon atom and one of the carbon atoms on either side. In both cases, the structure is the same.
8. The correct name is 2-pentene because the carbon chain is numbered so that the lowest number indicates the location of the double bond. The carbon chain of this molecule should be numbered in the opposite direction.
9. $2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$
10.



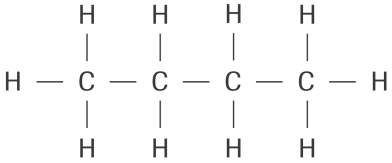
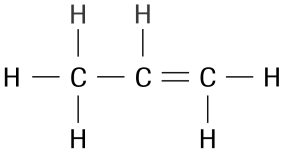
11.



3-octene hydrogen octane

12. Student answers for the examples will vary.

Front:

Family name and general formula	Examples		
	IUPAC name	**Common name**	**Structural formula**
Alkanes C_nH_{n+2}	butane	lighter fluid	
Alkenes C_nH_n	propene	propylene	
Alkynes C_nH_{n-2}	ethyne	acetylene	

Back:

Family	Characteristic properties	Characteristic functional groups	Intermolecular forces
Alkanes	smaller molecules are gases at room temperature, larger molecules tend to be liquids or soft solids; soluble in nonpolar solvents; generally unreactive	no functional groups; all C–C bonds are saturated	van der Waals forces
Alkenes	smaller molecules are gases at room temperature, larger molecules tend to be liquids or soft solids; soluble in nonpolar solvents; undergo addition reactions	C=C	van der Waals forces
Alkynes	smaller molecules are gases at room temperature, larger molecules tend to be liquids or soft solids; soluble in nonpolar solvents; undergo addition reactions	C≡C	van der Waals forces

Making Connections

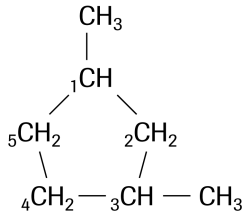
13.

	Common name	Use
ethene	ethylene	reactant in the manufacture of antifreeze
propene	propylene	raw material in making plastic
ethyne	acetylene	fuel for welding torches

14. Methane is a major component of natural gas, and is used as fuel in homes for cooking and heating, and in schools for gas burners. Ethane is also a component of natural gas. Propane is a fuel used in gas barbecues. Butane is a fuel used in cigarette lighters. Pentane and hexane are used in dry-cleaning solvents, naphtha gas, and camping fuel. Pentane–decane are components of gasoline for cars. These alkanes are suitable for use as fuels because they all combust readily and their combustion reactions are highly exothermic.
15. Global warming refers to an observed increase in average global temperatures. Some scientists suggest that this effect is caused by the increase in concentrations of carbon dioxide in the atmosphere. Carbon dioxide gas seems to trap infrared radiation emitted and reflected by Earth. The cause of the increase in carbon dioxide levels may be the combustion of hydrocarbons, producing carbon dioxide and water.
16. When the lighter is "flicked," the spark wheel rubs against the piece of flint, creating a spark. The spark ignites the butane gas coming out of the gas tank through the flame nozzle. The lighter cap must be open to have a flame. If the cap is closed, the flame is extinguished.

Extension

17. Student answers may vary. Hydrocarbons may form ring structures of several carbon atoms, some with double bonds. Two examples are 1,3-dimethylcyclopentane



and methylbenzene (more commonly called toluene), in which a methyl group is attached to a six-carbon ring structure with a unique arrangement of double bonds.