Synthesis

(n) The wick burns at a higher temperature than ethanol and hexane, and thus will not burn until all the liquid has completely burned and the heat is used to evaporate the fuel.
(o) The products in both reactions are the same. Alcohols are liquids and are more easily transported and stored than the smaller hydrocarbons, which are generally gases. Gases must be compressed into liquids for storage. Compressed gases are dangerous.

3.9 ALDEHYDES AND KETONES

TRY THIS ACTIVITY: WHERE'S THE CUP?

(Page 213)

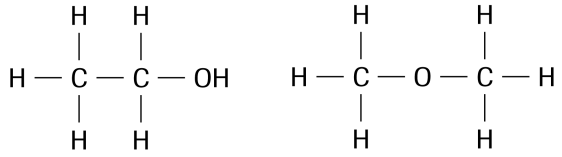
(a) The bottom of the Styrofoam cup "disappears" as it is dissolved by the acetone.
(b) The IUPAC name for acetone is propanone. Acetone is polar due to its carbonyl group, and also nonpolar due to its alkyl groups. This characteristic makes acetone miscible with both polar and nonpolar substances.
(c) Since Styrofoam dissolved in acetone, it probably has both polar and nonpolar characteristics.

SECTION 3.9 QUESTIONS

(Pages 213–214)

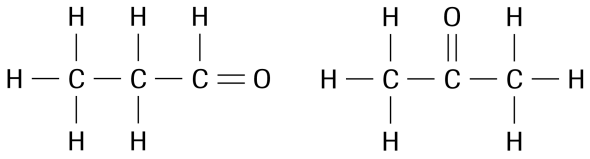
Understanding Concepts

1. In order of increasing boiling points: B, A, C. This order is predicted because A (1-propanone) contains a carbonyl group (with a polar double bond), making it more polar than B (propane), which gives A a higher boiling point than B. C (1-propanol) contains a hydroxyl group, which can hydrogen bond with other molecules, giving C a higher boiling point than A or B.
2. In increasing order of solubility: C, A, B. C (butane) is a nonpolar hydrocarbon and is less soluble in water than A (the ketone) and B (the alcohol). A has a polar carbonyl group, making it more soluble in water than C, but it is less soluble than B, which has a hydroxyl group that allows it to hydrogen bond.
3. (a)



alcohol ether

(b)



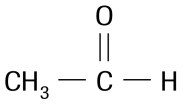
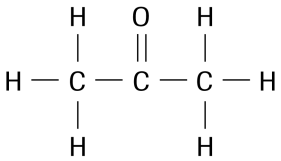
aldehyde ketone

(c)

Organic family	**Functional group**
alcohol	hydroxyl group
ether	oxygen bonded to two alkyl groups
aldehyde	carbonyl group at the end of the carbon chain
ketone	carbonyl group in the interior of the carbon chain

4. Student answers for the examples will vary.

Front:

Family name and general formula	Examples		
	IUPAC name	Common name	Structural formula
Aldehydes R–CHO	ethanal	acetaldehyde	
Ketones R-C(O)–R′	propanone	acetone	

Back:

Family	Characteristic properties	Characteristic functional groups	Intermolecular forces
Aldehydes	boiling points intermediate between hydrocarbons and alcohols of similar size; soluble in polar and nonpolar solvents	carbonyl group at end of carbon chain	van der Waals forces; no hydrogen bonding but highly polar carbonyl group produces strong intermolecular forces
Ketones	boiling points intermediate between hydrocarbons and alcohols of similar size; soluble in polar and nonpolar solvents	carbonyl group in interior of carbon chain	van der Waals forces; no hydrogen bonding but highly polar carbonyl group produces strong intermolecular forces

Making Connections

5. Examples include acetone, wood alcohol, rubbing alcohol, formaldehyde, natural gas, barbecue gas, lighter fluid, and glycerin.
6. (a) methanal
   (b) Formaldehyde is a flammable, poisonous, colourless gas with a suffocating odour. It readily polymerizes into paraformaldehyde, a white solid that can be formed into candles and used for fumigating rooms. Formalin, the preservative used in biological materials, is a solution of formaldehyde in water, with a small amount of methanol added.

       Other fluids used as preservatives include alcohol (the standard is 70–75% ethanol, or 40–50% 2-propanol); Zenker's fluid (containing mercury(II) chloride, glacial acetic acid, potassium dichromate, and sodium sulfate in water).
7. [Sample Answer] Several chemists wanted to test the effect of pheromones on humans. They placed small samples of male human pheromones under the chair seats of a number of chairs in a lecture hall just before the audience was allowed in. Members of the audience were free to sit where they chose. As the chemists had predicted, each of the "pheromone" seats was selected by a female. What are the odds of that? There are reportedly colognes and perfumes available that contain potent concentrations of human pheromones, instead of the usual extracts of flowers and fruits, which are better designed to attract insects and birds.