

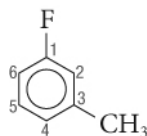
Section 1.3: Aromatic Hydrocarbons

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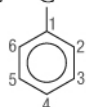
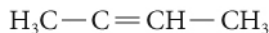
1. (a) The structure has two simple substituents, so it can be named a substituted benzene. Number the carbon atoms to give the substituents the lowest numbers. This compound is 1-ethyl-3-methylbenzene.

(b) Treat the benzene ring as the substituent. The alkane chain is a pentane with two substituents, the methyl group and the benzene ring. Number the carbon atoms to give the substituents the lowest numbers. Therefore, this compound is 3-methyl-2-phenylpentane.

2. (a) First, draw the benzene ring and number the carbon atoms. Next, add the substituents as indicated in the name: a fluorine atom on carbon 1 and a methyl group on carbon 3. The structure of 1-fluoro-3-methylbenzene is



(b) First, draw the parent alkene, but-2-ene. Next, add the benzene ring to the second carbon atom. The structure of 2-phenylbut-2-ene is



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1. (a) The structure is a benzene ring with one substituent, the chlorine atom. This compound is chlorobenzene.

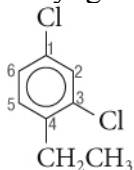
(b) The structure is a benzene ring with one substituent, the methyl group. This compound is methylbenzene.

(c) Treat the benzene ring as the substituent. The alkene chain is ethene, so this compound is phenylethene.

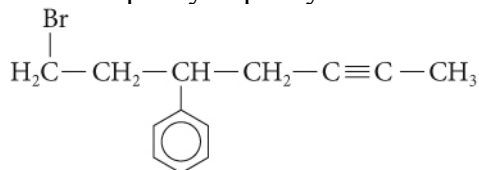
(d) The structure has two simple substituents, so it can be named a substituted benzene. Number the carbon atoms to give the two methyl groups the lowest numbers. This compound is 1,3-dimethylbenzene.

(e) The structure has two substituents, one bromine atom and one pentyl group, so it can be named a substituted benzene. Number the carbon atoms to give the substituent groups the lowest numbers. This compound is 1-bromo-2-pentylbenzene.

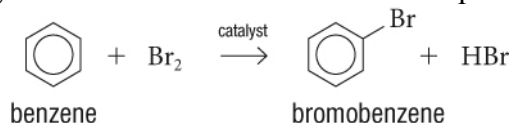
2. (a) First, draw the benzene ring and number the carbon atoms. Next, add the substituents as indicated in the name: two chlorine atoms on carbon 1 and carbon 3, and an ethyl group on carbon 4. The structural formula of 1,3-dichloro-4-ethylbenzene is



(b) First, draw the parent alkyne, hept-2-yne. Next, add the benzene ring to the fifth carbon atom and the bromine atom to the seventh carbon atom. The structural formula of 7-bromo-5-phenylhept-2-yne is:

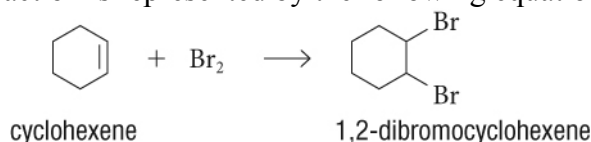


3. (a) Benzene will undergo a substitution reaction in which a hydrogen atom is replaced by a bromine atom. The reaction is represented by the following equation:

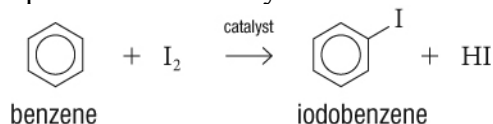


In general, aromatic compounds are much less reactive than alkenes but more reactive than alkanes. The substitution reaction of benzene is likely, particularly in the presence of a catalyst.

(b) If the organic reactant was cyclohexene instead of benzene, an addition reaction will occur. Cyclohexene is more reactive than benzene, and reacts more like an alkene. The reaction is represented by the following equation:

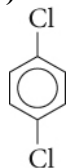


4. Iodobenzene may be produced by the substitution reaction of benzene with iodine in the presence of a catalyst. The reaction is represented by this equation:



5. (a) The proper IUPAC name for paradichlorobenzene is 1,4-dichlorobenzene.

(b) The structure of paradichlorobenzene, or 1,4-dichlorobenzene, is:



(c) Answers may vary. Sample answer: The product is still labelled as paradichlorobenzene because this traditional name has been used for a while and it is still being used. I think it is a good idea to have products labelled with their IUPAC names, because use of the IUPAC naming system is becoming worldwide. People can tell the structure of the compound from the IUPAC name because the positions of atoms or groups are numbered. The prefix *para-* of the traditional name may not be as convenient as the use of the number 1,4 to indicate positions.

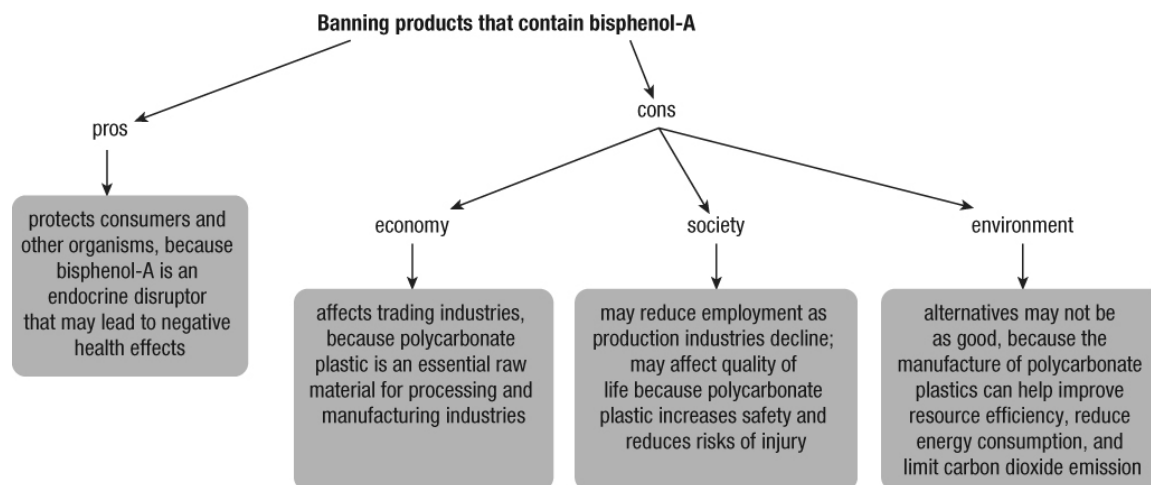
6. (a) (i) The product of the reaction of cyclohexene and hydrogen bromide is bromocyclohexane.

(ii) The products of the reaction of benzene and chloroethane are ethylbenzene and hydrogen chloride.

(b) These two reactions are different because of the different reactivities of the reactants. Cyclohexene is more reactive than benzene and reacts more like an alkene. The C=C double bond is a relatively reactive bond so that an addition reaction is a typical reaction for alkenes. So, cyclohexene undergoes an addition reaction with hydrogen bromide, a hydrogen halide, to produce bromocyclohexane.

Benzene is less reactive and reacts more like an alkane, since its aromaticity makes the double bonds more chemically stable. So, benzene undergoes a substitution reaction with chloroethane, an alkyl halide, to produce ethylbenzene, an alkylbenzene, and hydrogen chloride.

7. Answers may vary. Answers should include the benefits and drawbacks of bisphenol-A. Students' answers could be a flow chart identifying the pros and cons of banning products containing bisphenol-A, with respect to the impacts that this might have on economy, society, and environment. Sample answer: Bisphenol-A is a building block of polycarbonate plastic. Polycarbonate is a strong, durable, transparent plastic that is used in various products such as food and drink containers, optical data storage discs, bulletproof glass, and safety equipment.



8. Answers may vary. Students' answers should emphasize the idea that testing has identified benzene as a carcinogen and implicated it in other health problems. As the hazards of benzene have become known, many of its commercial uses have been discontinued. Greener alternatives that are less toxic, such as synthetic hydrocarbon fluids, liquid silicone, and liquid carbon dioxide, are now used for drycleaning.