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Naming aromatic compounds worksheet with answers pdf

In order to continue to enjoy our site, we ask you to confirm your human identity. Thank you very much for your cooperation. Learning Goals Recognize aromatic compounds from structural formulas. Name the aromatic compounds given formulas. Write formulas for aromatic compounds given their names. Historically, benzene-like substances were called aromatic hydrocarbons because they had distinctive aromas. Today, an aromatic compound is any compound that contains a benzene ring or has certain benzene-like properties (but not necessarily a strong aroma). You can recognize the aromatic compounds in this text by the presence of one or more benzene rings in their structure. Some representative aromatic compounds and their uses are listed in the table(1), where the benzene ring is represented as C6H5. Table(1): Some representative aromatic compounds Name Typical Structure Uses aniline C6H5-NH2 starting material for the synthesis of dyes, drugs, resins, varnishes, perfumes; solvent, vulcanization of benzoic rubber acid C6H5-COOH food preservative, starter material for the synthesis of dyes and other organic compounds; treatment of bromobenzene tobacco C6H5-Br starting material for the synthesis of many other aromatic compounds, solvent, additive to the engine oil nitrobenzene C6H5-NO2 starting material for the synthesis of aniline, solvent for cellulose nitrate; C6H5-OH disinfectant shoe polish soaps and phenol, starter material for the synthesis of resins, drugs and other organic compounds toluene C6H5-CH3 solvent, gasoline octane booster; starting material for the synthesis of benzoic acid, benzaldehyde and many other organic compounds Example (PageIndex(1)) What compounds are aromatic? Solution The compound has a ring of benzene (with a chlorine atom substituted for one of the hydrogen atoms); it is aromatic. The compound is cyclical, but it does not have a benzene ring; it is not aromatic. The compound has a ring of benzene (with a group of propyl substituted for one of the hydrogen atoms); it is aromatic. The compound is cyclical, but it does not have a benzene ring; it is not aromatic. Exercise – PageIndex(1)) What compounds are aromatic? In the International Union of Pure and Applied Chemistry (IUPAC) system, aromatic hydrocarbons are designated as benzene derivatives. The figure(1) shows four examples. In these structures, it does not matter that the only substitute is written at the top, side or bottom of the ring: a hexagon is symmetrical, and therefore all positions are equivalent. (1) Figure: Some benzene derivatives. These compounds are called usually with the group that replaces a hydrogen atom named as a group of substitutes: Cl as chloro, Br as bromo, I as iodo, NO2 as nitro, and CH3CH2 as ethyl. Although some compounds are mentioned exclusively by IUPAC names, some are more frequently noted by common names, as shown in the table(1). When there is more than one the corners of the hexagon are no longer equivalent, so we must designate the relative positions. There are three possible disubstituted benzenes, and we can use numbers to distinguish them (Figure PageIndex(2)). We begin to number to the carbon atom to which one group is attached and count towards the carbon atom that carries the other group of stituting by the shortest path. Figure(2): The three isomeric dichlorobenens in the figure(2), the common names are also used: the prefix ortho (o-) for 1,2-disubstitution, meta (m-) for 1,3-disubstitution, and para (p-) for 1,4-disubstitution. The names of the substitutes are listed in alphabetical order. The first substitute is given the lowest number. When a common name is used, the carbon atom that bears the group responsible for the name receives the number 1: Exercise - (PageIndex(2)) Name each compound using the common name and name of IUPAC. Sometimes an aromatic group is found as a substitute linked to a non-aromatic entity or another aromatic ring. The group of atoms remaining when a hydrogen atom is removed from an aromatic compound is called the aryl group. The most common aryl group is derived from benzene (C6H6) by removing a hydrogen atom (C6H5) and is called a group of phenyl, pheno, an old name for benzene. Some common aromatic hydrocarbons consist of fused benzene rings, rings that share a common side. These compounds are called polycyclic aromatic hydrocarbons (PAHs). The three examples presented here are the colorless and crystalline solids usually obtained from coal tar. Naphthalene has a pungent smell and is used in mothballs. Anthracene is used in the manufacture of certain dyes. Steroids, a large group of natural substances, contain the structure of phenanthrene. The intense heating required for the distillation of coal tar results in the formation of PAH. For many years, workers at coal tar refineries have been known to be susceptible to a type of skin cancer known as tar cancer. Surveys have shown that a number of PAHs are carcinogenic. One of the most active carcinogenic compounds, benzopyrene, is found in coal tar and has also been isolated from cigarette smoke, car exhaust and charcoal-grilled steaks. It is estimated that more than 1,000 t of benzopyrene are released into the air over the United States each year. Only a few milligrams of benzopyrene per kilogram of body weight are needed to induce cancer in experimental animals. Substances containing the benzene ring are common in animals and plants, although they are more abundant in animals and plants. The can synthesize the benzene ring from carbon dioxide, water and inorganic materials. Animals cannot synthesize it, but they depend on certain aromatic compounds to survive and therefore have to get them from food. Phenylalanine, tyrosine and tryptophan (essential amino acids) and vitamins K, B2 (riboflavin) and B9 (folic acid) all contain the benzene ring. Benzene. Important drugs, some of which are shown in the table(2), also have a benzene ring. So far, we have only studied aromatic compounds containing carbon-containing rings. However, many cyclical compounds have an element other than carbon atoms in the ring. These compounds, called heterocyclic compounds, are discussed later. Some of them are heterocyclic aromatic compounds. Table(2): Some drugs that contain a benzene ring name Structure aspirin aspirinophen ibuprofen ibuprofen amphetamine sulfanilamide Briefly identify the important characteristics of an aromatic compound. What are the prefixes meta, ortho, or para? Give the name and draw the structure of a compound that illustrates each. What is a group of phenyls? Give the structure for 3-phenyloctane. Answers An aromatic compound is any compound that contains a benzene ring or has certain benzene-like properties. meta - 1,3 disubstitution; (responses vary) ortho - 1,2 para disubstitution - 1,4 disubstitution or 1-bromo-4-chlorobenzene phenyl group: C6H5 or 3-phenyloctane: Aromatic compounds contain a benzene ring or have certain benzene-like properties; for our needs, you can recognize aromatic compounds by the presence of one or more benzene rings in their structure. Exercises Is Each compound aromatic? Is each compound aromatic? Draw the structure for each compound. toluene m-diethylenbenzene 3,5-dinitrotoluene Draw structure for each compound. p-dichlorobenzene naphthalene 1,2,4-trimethylbenzene Name each compound with its name IUPAC. Name each compound with its name IUPAC. ethylbenzene isopropylbenzene o-bromotoluene 3,5-dichlorotoluene Many simple monosubstitute derivatives of benzene are systematically named by adding the name of the substitute to the benzene that is the parent. For example: If the substitute is an alkyl chain with more carbon atoms than benzene, then benzene can be treated as a substitute. The ring, in this case, is called a group of phenyl just like methyl, ethyl, etc. The phenyl group is often abbreviated to . There are also monosubstituted benzene rings that have common names. And when you name an aromatic compound with one of these rings, you should use the common name as the parent and not the benz. Here is the list of these common names: Unfortunately, there are no other options and you have to memorize these names. At least the first row as they are more common, and you will meet them all when it comes to aromatic compounds. Disubstituted derivatives of benzene disubstituted benzene rings also have common names. For example, toluene with another methyl group is called ylene. Depending on the positions of the methyls, we have ortho, meta, and para-Xylenes:For other rings with common names, start numbering the ring of the substitute that is part of the common ring so that the other groups get the smallest possible locants: Using benzene as the parent can also be encountered, even if it is what you would usually see: In general, to name an aromatic compound, you can follow these steps: Identify and name the parent. If this is not one of the common names, then use benzene. Identify and name substitutes. Number the ring to give the substitutes as few as possible. Put the substitutes in alphabetical order followed by the parent name. For example, in the ortho-dibromobenzene, numbering from the upper br goes clockwise to have a 1,2, instead of 1,6 locant order:We do the same way if there are more substitutes:If the numbering does not make a difference, then give a smaller locant to the alphabetical priority: If there are more two groups, and numbering does not make a difference, starting with the alphabetical priority and the number of the ring: 1.Give an acceptable name of IUPAC for each molecule according to the nomenclature of aromatic compounds. For some compounds, there may be more than one acceptable name. a) b) c) e) g) h) i) j) j)