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## Organic chemistry reactions practice grade 12

The acidity of carboxylic acids Carboxylic acids Carboxylic acids and salt formation Formation Formation of the extracts 9.7 Di: A. Savin Back to Top 9.1 Introduction to Compounds containing oxygen In this chapter you will be presented to the main organic functional groups for these compounds and the IUPAC suffix which is used to name these compounds. While you do not formally appoint complete structures, you should be able to identify functional group. The IUPAC names. For example, an alcohol is an organic compound with a hydroxyle functional group of all alcohols, we often represent alcohol from the general formula ROH, where R is an alchil group. The IUPAC nomenclature guidelines use the suffix '-ol' to indicate simple compounds containing alcohol. An example is ethanol (CH3CH2OH). Figure 9.1 Common organic functional groups containing oxygen. The IUPAC suffixes used in naming simple organic molecules are noted in the chart Back to Top 9.2 Alcohols and Phenols Classification of Al attached to the -OH group. Alcohol can be grouped into three classes on this basis. A primary alcohol (1st) is one in which the Carbon atom (red) with the OH group is attached to another carbon atom (fed) with the OH group is attached to another carbon atom (fed) with the OH group is attached to two other carbon atom (fed) with the OH group is attached to another carbon atom (fed) with the OH group is attached to another carbon atom (fed) with the OH group is attached to two other carbon atom (fed) with the OH group is attached to another carbon atom (fed) with the carbon atoms (in blue). Its general formula is R3COH. Alcohols properties can be considered water derivatives (H2O; also written as HOH). Like the H-O-H bond in water, the R-O-H bond in water, the R-O-H bond in water, the R-O-H bond in water derivatives (H2O; also written as HOH). Like the H-O-H bond in water derivatives (H2O; also written as HOH). Like the H-O-H bond in water, the R-O-H bond in water derivatives (H2O; also written as HOH). the coupling of hydrogen (Figure 9.2). Figure 9.2). Figure 9.2 Intermolecular binding of hydrogen in methanol. OH groups of alcohol molecules make it possible to pair hydrogen. We remember that physical properties are largely determined by the type of intermo-molecular binding points. Table 9.1 Comparison of the Mass and boiling points Molar Alkanes are non-popular and are therefore only associated with relatively weak London dispersion forces (LDF). Alkani boiling points are so low that all these molecules are gas at room temperature. As alcohols have the compounds that contain a functional group of alcohol, also methanol (with only one carbon atom) is a liquid at room temperature. As alcohols have the compounds that contain a functional group of alcohol, also methanol (with only one carbon atom) is a liquid at room temperature. As alcohols have the compounds that contain a functional group of alcohol, also methanol (with only one carbon atom) is a liquid at room temperature. significantly higher than comparable molar hydrocarbons. The boiling point is an approximate measure of the amount of energy needed to separate a liquid molecule from its nearest neighbors. If molecules interact through the bonding of hydrogen, a relatively large amount of energy needed to separate a liquid molecule from its nearest neighbors. If molecules interact through the bonding of hydrogen, a relatively large amount of energy needed to separate a liquid molecule shave more carbons, they also have higher boiling points. This is because molecules can have more than one type of intermolecular interaction. In addition to the bonding of hydrogen, also alcohol molecules have LDF which occur between the non-polari portions of molecules have been with alkanes, an increased amount of LDF in alcohol containing molecules also causes the rise of the boiling point. In addition to forming hydrogen bonds with themselves, alcohols can also engage in a hydrogen bond with water molecules (Figure 9.3) Thus, while hydrocarbons are insoluble in water decreases; molecules become more like hydrocarbons and less like water. 1-decanol alcohol We often find that the boundary line of solubility in a family of organic compounds occurs at four or five carbon atoms. Figure 9.3 Hydrogen binding between methanol on decules and water molecules represents the solubility of methanol molecules and water molecules. The hydrogen binding between methanol molecules and water molecules represents the solubility of methanol on the simplest glycols, one of the simplest glycols, has two main commercial uses. It is used as a raw material in the manufacture of polyester fibres and for antifreeze formulations. Adding two or more groups -OH to a hydrocarbon substantially increases the boiling point is compared to ethanol that has a boiling point is often oated as a cooling agent in antifreeze formulations. For example, for ethylene glycol, the boiling point is often oated as a cooling substance useful for automotive engines. Figure 9.4 properties of the Glycol. ethylene glycol is often oated as a cooling agent in antifreeze mixtures due to its low freezing point and high boiling point. and high boiling point. ethylene glycol is poisonous to humans and other animals, and must be carefully handled and disposed of correctly. as a clear liquid with a sweet goto, it can lead to accidental ingestion, especially from pets, or can be deliberately used as a murder weapon. ethylene glycol is difficult to detect in the body and causes symptoms, including inebriation, severe diarrhea and vomiting, which can be confused with other diseases or diseases. its metabolism produces calcium oxalate, which crystallizes in the brain, heart, lungs and kidneys, harming them; depending on the level of exposure, the accumulation of poison in the body may last weeks or months before causing death, but death by acute kidney failure may cause within 72 hours if the individual does not receive appropriate medical treatment for poisoning. some antifreeze mixtures of ethylene glycol contain an embittering agent, such as denatonium, to discourage accidental or deliberate consumption. typical antifreeze mixtures also contain a fluorescent green coloring that makes it easier to find and clean antifreeze spills. phenols as they are slightly acidic in water. similar to the acid-base neutralization reactions of double shift, react with aqueous sodium hydroxide (naoh) to form a salt and a water. ArOH(aq) + NaOH(aq) inanimate objects such as furniture or floors.) The first widely used antiseptic was phenolic. Joseph Lister used it for antiseptic surgery in 1867. Phenol is toxic to humans, however, and can cause severe burns when applied to the search for safer antiseptics, a number of which were found. Figure 9.6 An operation in 1753 of surgery before antiseptics were used. The image is painted by Gaspare Traversi. Currently, phenol is used only in very small concentrations in some over-the-counter medical products as chloasittic throat spray. Figure 9.7 Phenol is still used in low concentrations in some medical formulations such as cloasiptic. The most complex compounds containing functional phenolic groups are commonly found in nature, especially as plant natural products. For example, some of the main metabolites found in green tea are the compounds of polyphenol catechin, represented in figure 9.8A by epigallocatechin gallate (ECGC) and epicatechin gallate (ecgc) and epicat cannabidiol (CBD) are also phenolic compounds (Fig 9B.) Figure 9.8 Natural products derived from plants that contains many biologically active phenolic compounds, including the hallucinogenic compounds (Fig 9B.) Figure 9.8 Natural products derived from plants that are thought to provide some of the benefits for anti-aging health attributed to green tea contains many biologically active phenolic compounds, including the hallucinogenic compounds such as epigallocatechin gallate (ECGC) and epicatechin gallate (ECGC) and epic Answers has a -OH group and only 2 carbon atoms; 1-hexanol has a -OH group for 6 carbon atoms and is therefore more similar to a hydrocarbon (nonpolar) than ethanol. 1-hexanol has a carbon chain longer than 1-butanol and therefore more LDF that contribute to a higher boiling point. Respond to the following exercises without consulting tables in the text. Arrange these alcohols to increase the boiling point: 1-butanol waxes and industrial use. Properties of Ethers The ties C - O in ethers are associated with hydrogen bonds while ether molecules cannot form hydrogen bonds with other ether molecules. For example, the diethyl ether (CH3CH2OCH2CH2CH2CH3) has a boiling point of 34.6o C while n-butanol, (CH3CH2CH2CH2CH2OH,) a four carbon alcohol, has a boiling piont of 117.7o C Ethers can form hydrogen bonds with water, however, since water containing up to 3 carbon atoms required for H-bonding. Thus, ethers can form hydrogen bonds with water, however, since water containing up to 3 carbon atoms required for H-bonding. with an increase in the number of carbon atoms. The relative increase in the portion of hydrocarbons, ethers are considerably the least reactive common class of organic solvents and, in fact, can be used as a solvent to dissolve non-polar molecules to mild polar molecules to mild polar molecules to mild polar molecules to more carbon atoms. The relative increase in the portion of hydrocarbons, ethers are probably the least reactive common class of organic solvents and, in fact, can be used as a solvent to dissolve non-polar molecules to mild polar molecules. Besides, ethers are very unreactive. In fact, except for alkanes, cycloalkanes and fluorocarbons, ethers are very unreactive. compounds. Thus, smaller ethers, such as diethyl ether (CH3CH2CH2CH2CH2CH2CH3) are widely used by organic chemicals as solvents for a variety of organic reactions. The inert nature of ethers compared to alcohol is undoubtedly due to the absence of the O-H reactive bond. To your health – Ethers and us In the middle of 1800 and early 1900 the diethyl ether was used as anaesthetic during surgery, largely replacing chloroform due to reduced toxicity. A general anesthetic acts on the brain to produce unconscious andgeneral to feel or pain. diethyl ether (ch3ch2och2ch2ch3) was the first general anesthetic to be commonly oato. diethyl ether is relatively safe because there is a fairly wide gap between the dose that produces aanesthetics, including compounds containing halogenated halogenated fluorine, and halogenated ethers, desflurane, isoflurane, isoflurane, isoflurane and sevoflurane. Halogenated, isoflurane and sevoflurane and sevoflurane. natural products and can have unique biological activities. In fact, some very large compounds that contain multiple ethers, called polyethylene called brevatoxins. Brevatoxin A is depicted in Figure 9.10 Symptoms of this poisoning include vomiting and nausea and a variety of neurological symptoms such as unleashed speech. Figure 9.10 Neurotoxic poison of crustaceans. The dinoflaggelato, Karina brevis, shown on the top left is the causative agent of the harmful algal blooms of the red tide. These seaweed blooms of the red tide (on the upper right) that occur near San Diego, CA. K. brevis produces a class of polyethylenes called brevatoxins. Brevatoxin A is depicted as an example. Filter the feeding clams and the muscles become contaminated with dinoflaggelate and can cause poisoning by neurotoxic crustaceans if eaten. Red tides can have serious economic costshow much fish and crustaceans must be closed until the levels of toxin in commercial products return to acceptable levels. Back to Top Aldeids and Chetons are characterized the presence of a carbonyl group (C=O), and their reactivity can generally be understood by recognizing that carbonyl carbon contains a positive partial charge (δ+) and carbonyl oxygen contains a negative partial charge (δ-). Aldehydes are generally more reactive than ketones usually attached to another carbonyl group is a chemically organic functional group consisting of a double-bond carbonyl group is a chemically organic functional group carbonyl group is a chemically organic functional group consisting of a double-bond carbonyl group is a chemically organic functional group carbonyl group is a chemical group carbonyl group is a chemical group carbonyl group is a chemical group carbonyl group carbonyl group is a chemical group carbonyl group carbony entering something deep make sure to understand that the C=O entity is known as the "carbon group" while the members of this group are called "carbon components". As discussed before, we understand that oxygen has two usual pairs of electrons hanging around. These electrons make oxygen more electrons partially positive (or electrons hanging around. These electrons hanging around. These electrons partially positive (or electron love") and partially positive (or electron love") and partially positive oxygen (nucleophile = "nucleo or proton love"). Polarization is indicated by a tiny delta and a positive or negative or negative or negative superscript depending on the atom. For example, carbon would have δ+ and δ oxygen. Aldeidi and Aldeidi Chetoni properties In aldehydes, the carbonyl group has a hydrogen atom attached to it along with a second hydrogen atom or, more commonly, a group of hydrocarbons that could be an alkyl group or one containing benzene rings. Below are some examples of aldeids Note that everyone has exactly the same end to the molecule. All that differs is the complexity of the other carbon group attached. When you are writing formulas for these, the aldehyde group (the groupwith the hydrogen atom attached) is always written as -cho – never as coh. couldbe confused with an alcohol. Ethanal, for example, is written as CH3CHO; methanol as HCHO. Cheers In ketones, the carbonyl group has two carbon groups attached. Once again, these can be either alkyl groups or those containing benzene rings. Note that ketones never have a hydrogen atom attached to the carbonyl group. Propanone is normally written CH3COCH3. Boiling Points and Solubility Methanal, also known as formaldenyde, (HCHO) is a gas at room temperature nearby. Larger aldeids and ketones are liquids, with rising boiling points as molecules become larger. The size of the boiling point is regulated by the strengths of the intermodal forces thus increases the size of temporary dipoles that are set. That's why they increase boiling points as the number of carbon atoms increases in chains regardless of whether you're talking about aldehydes or ketones. Dipole-Dipole attractions: Both aldeids and ketones are polar molecules of similar size hydrocarbons, which have only dispersion forces. It is interesting to compare three molecules of similar size. They have similar lengths, and similar numbers (although not identical) of electrons. The polarization of carbonyl groups also affects the boiling point of aldehydes and ketones which is higher than of hydrocarbons of similar mass compounds, but containing different types of functional groups. Note that the compounds that have stronger intermittent forces have higher boiling points. Alkanes < Aldehydes Chetoni < Alcohols Table 9.2 Comparison of Boiling Points and ketones are therefore equal to that of alcohols and ethers. The formaldehyde (HCHO), acetaldehyde (CH3CHO), and acetone ((CH3)2CO) are soluble in water. While the carbon chain increases in length, solubility in water decreases. The solubility in water decreases. The solubility boundary line takes place at about four carbon atoms per oxygen atom. All aldeids and ketones are also widespread in nature and are often combined with other functional groups. Some examples of natural molecules containing an aldehyde or a functional ketone group are displayed in the following two figures. The compounds in Figure 9.11 are found mainly in plants or microorganisms and those in nature are generally pure enantiomeriously, although different sources can produce different enantimers. For example, the carvone is found as its levorotatory (R)-enantiomer in spearmint oil, while, caraway seeds contain dextrorotatory (S)-enantiomer. In this case the change of perceived perfume and ketones are known for their sweet and sometimes pungent smells. The smell comes from vanilla extractthe molecule disappears. Similarly, benzaldehyde provides a strong scent of almonds. Due to their pleasant aldehyde and ketones fragrances containing molecules are often found in perfumes. However, not all fragrances are pleasant. In particular, 2-Heptanone provides a part of the perfume sharpened by blue cheese and (R)-Muscone is part of the musk smell by the Himalaya moss deer. Finally, ketones manifest in many important hormones such as progesterone (a male sex hormone) and testosterone (a male sex hormone). Note how subtle differences in the structure can cause drastic changes in biological activity. The ketone functionality also comes in the anti-inflammatory steroid, Cortisone. Figure 9.11 Examples of aldehyde and ketone containing molecules isolated from plant sources. For your health: Dianabol Steroids are formed in the human body as a by-product of lipid metabolism. The two common metabolities produced in man are ketonecontaining, acetoacetic acid and alcohol metabolite, B-hydroxybutirrate. Acetone is also produced as acetoacetic acid breaker product. Acetone can then be excreted from the body through urine or as a volatile product through the lungs. Normally, ketones are not released into the bloodstream in appreciable quantities. For example, the normal concentration of acetone in the human body is less than 1 mg/100 mL of blood. Instead, ketones that are produced during the metabolism of lipids within the cells are usually completely oxidized and broken into carbon dioxide and water. This is because glucose is the primary source of energy, since the brain barrier blocks transportlarge molecules of lipids. However, during periods of hunger, when glucose is not available, or in some diseases states where glucose metabolism is disregarded, such as uncontrolled can cause a dangerous condition of these molecules to the blood increase to higher levels to provide an alternative energy source for the brain. However, since acetoacetic acid and β-hydroxybutirate acid contain functional groups of carboxylic acid, the addition of these molecules to the blood causes the acidification that if left uncontrolled can cause a dangerous condition called chetoacidosis Chetoacidosis can be a threatening life event. Steroids can be easily detected, as acetone is excreted in urine. In severe cases, the smell of acetone can also be noticed on the breath. Returning to Top 9.5 Carboxylic Acids and Esters Carboxylic Acids and Esters Carboxylic Acids can be easily recognized as they have a carbon carbon is also directly attached as part of a functional ether group. The properties of carboxylic acids and esters of carboxylic acids are organic compounds that incorporate a functional ether group. The properties of carboxylate ion. Factors influencing the acidity of carboxylic acids and esters of carboxylic acids are organic compounds that incorporate a functional ether group. The properties of carboxylate ion. Factors influencing the acidity of carboxylic acids are organic compounds that incorporate a functional ether group. Exterior An ester is an organic compound that is a derivative of a carboxylic acid in which the hydrogen atom of the hydrogen atom of the hydrogen atom would make ita carboxylic acid. The foreign naming passages together with two examples are shown below. The boiling points, melting points, melting points and solubility carboxylic acids can form hydrogen bond dimers that increase their boiling points which are lower that of similar sized alcohols (Table 9.3). Foreigners, like aldehydes and ketones and ketones and ketones, are polar molecules. However, their dipole-dipole interactions are weaker than those of aldehydes and ketones and ketones and are unable to form hydrogen bonds. Thus, their boiling points are higher than ethers and lower than aldehydes and ketones and ketones and ketones and similar-sized ketones. Low molecular carboxylic acids that vary in carbon their boiling points are higher than ethers and lower than aldehydes and ketones and similar-sized ketones. Low molecular carboxylic acids that vary in carb containing compounds, short-chain carboxylic acids tend to be soluble in water due to their ability to form hydrogen bonds. As the length of the carboxylic acids of similar size. Carboxylic acids typically have unpleasant, pungent and even rancid odors. The smell of vinegar, for example, is due to ethanic acid (also known as acetic acid). The smell of unwashed gyms and socks is largely caused by butaneic acid isfor the other hand, have pleasant aromas and are responsible for the aroma of many fruitsflowers. Esters can also have fruity flavors. Practice to the gluing of hydrogen (there is no intermlecular hydrogen bond with CH3CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2CH3.) Carboxylic acid, formic acid, both as a chemical defense and as an attack to subdue prey (Figure 9.13A). A diluted solution of acetic acid (5%) is found in vinegar and is responsible for the acid and pungent taste. Acetic acid are used in the cosmetic industry. PABA which is produced by plants, fungi and bacteria is a common component of food and is connected in structure to the folate of vitamin. In 1943 PABA was patented as one of the first compounds used in the manufacture of solar cream. However, its use fell out of favor since the mid-1980s due to concerns that can increase UV cell damage as well as contribute to allergies. Glycolic acid is the smallest of the mid-1980s due to concerns that can increase UV cell damage as well as contribute to allergies. Glycolic acid is the smallest of the mid-1980s due to concerns that can increase UV cell damage as well as contribute to allergies. used as a chemical peel to reduce facial scar from acne. Figure 9.13 Sources and usescarboxylic acids. (A) Formal acid is the defense toxin used by the ants of the Formicidae family. Photos of Muhammad Mahdi Karim (B) Aceto is a 5% solution of acetic acid. The photo on the left shows various flavors of vinegar in a market in France. Photo by Georges Seguin (C) Citric acid is a common component of fruit, providing a sour taste. The photo on the lemons of André Karwath (D) para-Aminobenzoic Acid (PABA) is a carboxylic acid commonly found in plants and food crops, including whole grain. It was patented in 1943 for its use in solar protection products. However, due to safety and allergic response problems, the use of PABA has been discontinued for this purpose. Photo Suncreen provided by HYanWong (E) Glycolic acid is commonly used in cosmetics as a chemical peel used to reduce scarring from acne. in the photo on the left is the treatment before and on the right after several treatments of glycolic acid. Glycolic acid. Glycolic study provided by Jaishree Sharad. The admirers are easily synthesized and of course abundant contributing to the flavors and strawberries are caused by esters, as well as the sweet aroma of rum. Figure 9.14 The fruity and pleasant aroma of esters is located in (A) the winter green oil, (B) the aroma of pineapple, and (C) the sweetness of rum. Photo of (A) Gaultheria procumbens, the manufacturer of wintergreen oil is provided by: LGPL (B) pineapple photos provided by: LGPL (B) pineapple photos of rum provided by: Cavity and (C) Photos of rum provided by: LGPL (B) pineapple photos provided by: LGPL (B) pineapple photos provided by: LGPL (B) pineapple photos of rum provided by: LGPL (B) pineapple photos provided by: LGPL (B) pineapple photos provided by: LGPL (B) pineapple photos of rum provided by: LGPL (B) pineapple photos Oxygen-Containing Composites Alcohol s Alcohol functional groups be involved in different types of reactions with other functions and the section, we will discuss two main types of reactions and the sections with other functional groups be involved in replacement and re Dehydration reactions In Chapter 8, we learned that alcohols can be formed by alkyd hydration during added reactions. We also learned that the opposite reaction can alkyd and a water molecules through the dehydration process (or water removed from molecules through the dehydration process (or water molecules through the dehydration process (or water removed from molecules through the dehydration process (or water molecules through the dehydration process (or water molecules through the dehydration during added reactions. In these cases, alkene will form in the most substitutive position (carbon that has more carbon attached, option 1 and option 2. In option 1, alkene is formed with carbon that has more hydrogen attached. So, option 1 will be the main reaction product. and option 2 will be the minor product. Alcohol elimination reactions using small 10 alcohol can also be used to produce ethers. To produce an ether rather than alcheno, the reaction temperature must be reduced and the reaction must be made with excess alcohol in the reaction mixture. For example: 2 CH3CH2-OH + H2SO4 130 oC CH3CH2-OH + H2SO4 150 oC CH2=CH2 + H2O In this reaction alcohol must be used in excess and temperature should be kept around 413 K. If alcohol is not used in excess orthe temperature is higher, alcohol will preferably undergo dehydration to produce alkenes, the dehydration fections. Remember in redox reactions, the component of the reaction that is oxidized is losing electrons (leo) while the molecule receiving electrons is reduced (ger.) in organic reactions, the flow of electrons usually follows the flow of hydrogen atoms. Thus, the molecule that earns electrons and is the oxidized component. the monecule that earns electrons usually follows the flow of hydrogen atoms. Thus, the molecule that loses hydrogen is typically losing electrons is in phase of reduction, for alcohol, primary and secondary alcohols, on the oxidized component. the molecule that earns electrons is in phase of reduction. for alcohol, primary and secondary alcohols, on the oxidized component. can be a metal or another organic molecule. in the reaction, the reaction, the exidizing agent is the molecule that is reduced or accepts the electrons, are removed from the molecule by the exidizing agent. the reactions of alcohol oxidation, hydrogen from alcohol and a hydrogen that is attached to carbon that has alcohol and a hydrogen that is attached, along with their electrons, are removed from the molecule by the exidizing agent. The reactions of alcohol oxidation, hydrogen from the molecule by the exidizing agent. the formation of an aldehyde. in the case of a secondary alcohol, the result is the formation of a ketone. Note that for a tertiary alcohol, that carbon attached to the functional alcohol group does not have a hydrogen atom that is attached to the function carbon carbon innewly formed aldehyde. This molecule can undergo a secondary oxidation reaction with an oxidizing agent and water, to add another oxygen atom and remove the atom of hydrogen carbonyl. This results in the formation of a carboxylic acid. methanol is poisonous enough for humans. ingestion of just 15 ml of methanol toxicity is that we have liver enzymes that catalyze its oxidation to formaldehyde, the simplest member of the aldehyde family: formaldehyde reacts quickly with the components of the toxicity of methanol. Organic and biochemical equations are often written showing only organic reagents and products. In this way, we focus attention on the material and organic starting product, rather than or the balance of complicated equations. ethanol is oxidized in the liver to acetaldehyde: acetaldehyde is in turn oxidized to acetaldehyde is in turn oxidized to acetic ethanol water. Even so, ethanol is potentially toxic to humans. the rapid ingestion of 1 pt (about 500 ml) of pure ethanol would kill most people each year—often those engaged in a kind of drinking contest. ethanol is freely intersected in the brain, where it depresses the respiratory control center, resulting in the insufficient breathing muscles in the lungs and therefore suffocation. Ethanol is believed to act on the membranes of nerve cells, causing a decrease in speech, thought, cognition andjudgment. strophile alcohol is usually a 70% aqueous solution of isopropil alcohol. has high steam pressure, and its rapid evaporation from the skin produces a cooling effect. is toxic when ingested but, forms first an aldehyde and further oxidation forms a carboxylic acid. This alcohol has the OH group on a carbon atoms, so it is a tertiary alcohol, to three other carbon atom for the oxidation for the oxidation for the oxidation for the oxidation forms a carboxylic acid. This alcohol has the OH group on a carbon atoms, so it is a tertiary alcohol. No reaction occurs. write "no reaction" after the arrow. Back to the list of the best Aldeids and Chetons In this section, aldehydes and ketones. These include oxidation to produce a coarboxylic acid. This is because the carbon atom still maintains a hydrogen atom that can be removed and replaced with an oxygen atom. The ketones on the other hand do not contain a hydrogen atom linked to the carbon atom. Thus, they cannot undergo further oxidation. As mentioned above, ketones that are exposed to an oxidizing agent will have no reactions Reduction reactions Reduction reactions. For example, with aldehyde, ethanol is obtained primary, primary alcohol, Note that this is a simplified equation in which [H] means "hydrogen from a reduction of a ketone, such as propanone will give you a secondary alcohol, Reduction of an aldehyde leads to a primary alcohol. Reduction of a ketone, such as propanone will give you a secondary alcohol, like 2-propanol: The reduction of a ketone leads to a primary alcohol. Addition Reactions with Alcohols Aldehydes and ketones can react with alcohol functional groups in addition (combination) reactions. These types of reactions are common in nature and are very important in the process of cyclicization of sugar molecules of the body. When an alcohol adds to a ketone the result is called an hemiacetal; when an alcohol adds to a ketone the main macromolecules of the body. When an alcohol adds to a ketone the result is called an hemiacetal; when an alcohol adds to a ketone the result is called an hemiacetal. In the above reaction, the B: refers to a general base that is present in the solution and can act as a proton acceptant. In this reaction, a general basis activates alcohol in the reaction (alcohol oxygen is then charged negatively, because it transports the extra electron from hydrogen. Now it can act as a nucleophile and attack the carbonyl group. Carbonyl oxin will extract a hydrogen from a general acid present in the solution. In this diagram, the general acid is indicated as H-A. This forms an alcohol where the carbon group of aldehyde or ketone used to be. The original alcoholic group now looks like a functional ether group at the same time. If that carbon also has hydrogen linked to it, it has from the aldehyde or ketone used to be. The original alcoholic group now looks like a functional ether group at the same time. If that carbon also has hydrogen linked to it, it has from the aldehyde or ketone used to be. and is definedHemiacetal. If the central carbon is linked to two other carbon atoms (drawn R1 and R3 above) in addition to the oxygen atoms, the molecule was born from a ketali. The prefix 'hemi' (half) is used in every term because, as we will soon see, a second addition of an alcoholic nucleophile may occur, resulting in species called acetali and ketali. The prefix 'hemi' (half) is used in every term because, as we will soon see, a second addition of an alcoholic nucleophile may occur, resulting in species called acetali and ketali. The prefix 'hemi' (half) is used in every term because, as we will soon see, as second addition to the oxygen atoms, the molecule was born from a ketone and is called emiketal. spontaneously (without catalyst or enzyme present), especially in the case of simple sugar molecules. Due to the spontaneity of reactions, they are also very reversible: hemiacetal or Ketali When a hemiacetal (or emiketal) is subjected to nucleophile attack by a second molecule of alcohol, the result is called acetal (or ketale). While the formation of a hemiacetal from an alcehol (pass 2 above) is a nucleophilic addition, the formation of an acetal from a hemiacetal from an alcehol (pass 1 above) is a nucleophilic addition, the formation of an acetal from an alcehol (pass 2 above) is a nucleophilic addition, the formation of an acetal from an alcehol (pass 2 above) is a nucleophilic acetal (pass 3 above) is a nucleophilic acetal (pass 3 above) is a nucleophilic acetal (pass 3 above) is a nucleophilic acetal (pass 4 above) is a nucleophilic acetal (pass 4 above) is a nucleophilic acetal (pass 4 above) is a nucleophilic acetal (pass 5 above) is a nucleophilic acetal (pass 5 above) is a nucleophilic acetal (pass 5 above) is a nucleophilic acetal (pass 6 above) is a nucleoph occurs in the second step does not spontaneously occur and is not easily reversible. Within biological systems, an enzyme would be required for the formation of acetal or ketal. The reverse reaction would result in of acetal or ketal using hydrolysis or entrywater in the molecule. Practice problems: Return to higher carboxylic acids Using the definition of an acid as "substance that gives protons (hydrogen) to other things", carboxylic acids are acidic because hydrogen in the -COOH group to a water molecules. In solution in water, a hydrogen ion is transferred from the -COOH group to a water molecules. In solution in water, a hydrogen ion the -COOH group to a water molecules. For example, with ethanic acid (as shown below), you get an ethanoate ion formed along with a hydronium ion, H3O+. CH3COOH + H2O typically CH3COO- + H3O+ This reaction is reversible and, in the case of ethanic acid, except that they tend to be rather slower, 2CH3COOH(ag) + Mg(s) + H2 In the above reaction, diluted ethanic acid reacts with magnesium cacid reacts with magnesium tape, the reaction is less vigorous than the same reaction with hydrochloric acid, but with magnesium powder, both are so fast that you probably would not notice much difference. Example of problem: Write an equation for each reaction is less vigorous than the same reaction with hydrochloric acid, but with magnesium powder, both are so fast that you probably would not notice much difference. Example of problem: Write an equation for each reaction with hydrochloric acid, but with magnesium tape, the reaction is less vigorous than the same reaction with hydrochloric acid, but with magnesium tape, the reaction is less vigorous than the same reaction with hydrochloric acid, but with magnesium tape, the reaction is less vigorous than the same reaction with hydrochloric acid, but with magnesium tape, the reaction is less vigorous than the same reaction with hydrochloric acid, but with magnesium tape, the reaction is less vigorous than the same reaction with hydrochloric acid, but with magnesium tape, the reaction with hydrochloric acid (CH2CH2COOH) in water (H2O) neutralization of propyonic acid with aqueous sodium hydroxide (NaOH) Solution: Propionate acid ionizes in water to form a propionate acid with aqueous sodium hydroxide (NaOH) Solution: Propionate acid with an alcohol in the presence of a strong acid, or in the presence of an enzyme, if in biological systems. In the esterification reaction, butyl acetate can be made from acetic acid and 1-butanol. A commercially important esterification reaction is the polymerization of condensation, in which a reaction occurs between a dihydric acid and a dihydric alcohol (diol), with the elimination of water. This reaction produces an ester containing a free carboxylic group (not reacted) at one end and a free alcohol group at the other end. Further condensation reaction produces an ester containing a free carboxylic group (not reacted) at one end and a free alcohol group at the other end. Further condensation reactions then occur, producing polyester molecules make excellent fibers and are used in many fabrics. A knitted polyester tube, which is biologically inert, can be used in surgery to replace sections of sick blood vessels. PET is used to make pop soda bottles and other drinks. It also forms in films called Mylar. When magnetically coated, Mylar tape is used in audio and video cassettes. Synthetic arteries can be made of PET, polytetrafluoroethylene and other polymers. Practice problems: Complete the following reactions: Hydrolysis of strangers The reverse reaction of foreign formation can be used for the distribution of esters in a carboxylic acid and alcohol. These reactions require the incorporation of the ester, and is therefore called reaction of foreign formation can be used for the distribution of esters in a carboxylic acid and 1butanol. The reaction is reversible and does not go to completion. Practice problems: Return to Top 9.7 The hydroxyl group (OH) has the OH group on a carbon atom attached to another carbon atom, A secondary alcohol (2°) (R2CHOH) has the OH group on a carbon atom atom atom. attached to two other carbon atoms; and a tertiary alcohol (3°) (R3COH) has the OH group on a carbon atom attached to three other carbon atom attached to three other carbon atoms are soluble in water. Many alcohols can be synthesized from alchene hydration. Common alcohols include methanol, ethanol and isopropyl alcohol. Methanol is guite poisonous. It can cause blindness or even death. Ethanol can be prepared by fermentation. It is alcohol in alcoholic beverages. Sometimes, without scruples bootleggers, they sell methanol to suspicious customers. In both cases, the results are often tragic. When the water is removed from an alcohol in a dehydration phase, the result is an alchena or an ether, depending on the reaction conditions. Primary alcohols are oxidized to ketones. Tertiary alcohols are oxidized to ketones are oxidized to ketones. Tertiary alcohols are oxidized to ketones. Tertiary alcohols are not easily oxidized. Alcohol containing two OH groups on adjacent carbon atoms are called glycol. The phenolicsare compounds that have the OH group attached to an aromatic ring. Ethers (ROR', ROAr, ArOAr) arewhere an oxygen atom is combined with two organic groups. Ether molecules have no group oh and therefore no hydrogen molecules have an oxygen atom and can engage in a hydrogen bond, is omnipresent in organic compounds. is found in carbohydrates, fats, proteins, nucleic acids, hormones and vitamins, critical organic compounds for life systems. the carbonyl group is the distinctive feature of aldehydes and ketones, in aldehydes and ketones, both bonds available on carbon acromation of primary alcohols. aldehydes and be further oxidized to a carboxylic acid. steroids are prepared for oxidation of secondary alcohols. The oxidizing agents of the micide oxidize aldehydes to carboxylic acids to form acetals and ketals, the formation of a catalyst and can move both forward and reverse. Hemiacetals and hemiketals, respectively. These reactions occur without the addition of a catalyst and can move both forward and reverse. Hemiacetals and hemiketals, respectively. These reactions occur without the addition of a catalyst and can move both forward and reverse. Hemiacetals and hemiketals, respectively. is called a dehydration reaction. These reactions require a catalyst or enzyme to cause them to happen, the reverse reaction that breaks the acetal to form the amycetal and alcohol, requires the addition of a molecule of water and is called hydrolysis, a carboxylic acid (rcooh) that breaks the acetal to form the amycetal and alcohol, requires the addition of a molecule of water and is called hydrolysis, a carboxylic acid (rcooh) that breaks the acetal to form the amycetal and alcohol, requires the addition of a molecule of water and is called hydrolysis, a carboxylic acid (rcooh) that breaks the acetal to form the amycetal and alcohol, requires the addition of a molecule of water and is called hydrolysis. aldehyde with the same number of carbon atoms. Since aldehydes are formed by primary alcohols, these alcohols are also a starting material for carboxylic acids have strong odours, often unsettling. They are highly polar molecules and bicarbonates to form carbon dioxide gas and acid salt. The strangers are pleasant compounds that are responsible for fragrances of flowers and fruits. They have lower boiling points than similar carboxylic acids because, although foreign molecules are somewhat polar, they cannot engage in a hydrogen bond. However, with water, esters can engage in bond with hydrogen; Consequently, low molar mass esters are soluble in water. Foreigners can be synthesized by extermination, in which carboxylic acid and alcohol are combined in acidic conditions Extended are neutral compounds that undergo hydrolysis, a reaction with water. In acidic conditions, hydrolysis is essentially the reverse of extermination. Figure 9.15 Summary of important reactions with oxygen. Back to top 9.8 References: Farmer, S, Reusch, W, Alexander, E,. and Rahim, A. (2016) Organic Chemistry. Libretexts. Available at: 3A\_The\_Basics\_of\_GOB\_Chemistry (Ball\_et\_al)/14%3A\_Organic\_Chemistry (With\_a\_Biological\_Emphasis\_(Soderberg) Antigelo. (2017, 5 January). In Wikipedia, free encyclopedia. Retrieved 06:07, April 21, 2017, from Glicole etilene. (2017, 4 April). In Wikipedia, free encyclopedia. Retrieved 06:09, April 21, 2017, from Glicole etilene. (2017, 4 April). In Wikipedia, free encyclopedia. Retrieved 06:09, April 21, 2017, from Glicole etilene. (2017, 4 April). In Wikipedia, free encyclopedia. Retrieved 06:09, April 21, 2017, from Glicole etilene. (2017, 4 April). In Wikipedia, free encyclopedia. Retrieved 06:09, April 21, 2017, from Glicole etilene. (2017, 4 April). In Wikipedia, free encyclopedia. Retrieved 06:09, April 21, 2017, from Glicole etilene. (2017, 4 April). In Wikipedia, free encyclopedia. Retrieved 06:09, April 21, 2017, from Glicole etilene. 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