

41 80 Properties of alcohols and phenols: Hydrogen bonding: The structure around the oxygen atom of an alcohol or phenol is similar to that in water and is sp^3 hybridized.

Formation of alcohols and phenols result when hydrogen atom in a hydrocarbon, aromatic and aliphatic compounds respectively, is replaced by -OH group. Alcohols and phenols have much higher boiling points as compared to similar alkanes and alkyl halides. Alcohols and phenols, like water, can form hydrogen bonds. Phenol also belongs to the alcohol family and are alcohols with aromatic rings. It is a colourless and volatile flammable liquid generated by the natural fermentation of sugars and is an intoxicating ingredient of wine, whisky, beer, spirits, and other drinks. Alcohol is an organic compound whose molecule contains 1 or more hydroxyl groups fastened to a carbon atom. It is also used as an industrial solvent and as a fuel. The most common industrial alcohol is Methanol. Phenol is a toxic white crystalline solid acquired from coal tar and is used in chemical manufacturing industry. It is also used as a disinfectant. Phenol is an organic compound with a hydroxyl group linked directly to a benzene ring. Phenol It is an aromatic hydrocarbon and a white crystalline solid which is flammable and has a strong odour. Its molecular formula is C_6H_5OH . Nature Alcohols are aliphatic hydrocarbons i. Phenol Phenols are aromatic hydrocarbons i. Applications Alcohol Alcohol is used in alcoholic beverages like wine, whisky and beer. It is utilized to produce methylated spirit meth which is used as a combustible material in certain stoves and lamps, especially the ones made for camping. It is also used to get rid of ink from non-porous surfaces for e. Methylated spirit is used as a cleaning agent, especially for glass cleaning purposes. Alcohol is also used as a fuel which is much more efficient than natural fossil fuels like petrol. Phenol Phenol is used as an antiseptic. Phenol Phenols produce white precipitate with bromine water of 2,4,6-tribromophenol.

Chapter 2 : Revision Notes on Alcohols, Phenols and Ether | askITians

Alcohols, Phenols, Thiols, and Ethers The functional group of alcohols and phenols is the hydroxyl group (-OH). The general structure of an alcohol is R-OH, where R represents any alkyl group.

More than 50 organic compounds have been isolated from the oil that gives rise to the characteristic odor of a rose. One of the most abundant of these compounds is known by the common name citronellol. Use the systematic nomenclature to name this alcohol, which has the following structure. Click here to check your answer to practice problem 6 Methanol, or methyl alcohol, is also known as wood alcohol because it was originally made by heating wood until a liquid distilled. Methanol is highly toxic, and many people have become blind or died from drinking it. Ethanol, or ethyl alcohol, is the alcohol associated with "alcoholic" beverages. It has been made for at least years by adding yeast to solutions that are rich in either sugars or starches. The yeast cells obtain energy from enzyme-catalyzed reactions that convert sugar or starch to ethanol and CO₂. Brandy, rum, gin, and the various whiskeys that have a higher concentration of alcohol are prepared by distilling the alcohol produced by this fermentation reaction. Most people are intoxicated at blood alcohol levels of about 0. An increase in the level of alcohol in the blood to between 0. The method of choice for determining whether an individual is DUI driving under the influence or DWI driving while intoxicated is the Breathalyzer, for which a patent was issued to R. The chemistry behind the Breathalyzer is based on the reaction between alcohol in the breath and the chromate or dichromate ion. One of these ampules is used a reference. The other is opened and the breath sample to be analyzed is added to this ampule. The extent to which the color balance between the two ampules is disturbed is a direct measure of the amount of alcohol in the breath sample. Measurements of the alcohol on the breath are then converted into estimates of the concentration of the alcohol in the blood by assuming that mL of air exhaled from the lungs contains the same amount of alcohol as 1 mL of blood. Measurements taken with the Breathalyzer are reported in units of percent blood-alcohol concentration BAC. In most states, a BAC of 0. This corresponds to a blood-alcohol concentration of 0. Ethanol is oxidized to CO₂ and H₂O by the alcohol dehydrogenase enzymes in the body. Many alcoholics are malnourished, however, because of the absence of vitamins in the calories they obtain from alcoholic beverages. Solubilities of Alcohols As a general rule, polar or ionic substances dissolve in polar solvents; nonpolar substances dissolve in nonpolar solvents. They are often said to be immiscible literally, "not mixable" in water. Alcohols, as might be expected, have properties between the extremes of hydrocarbons and water. When the hydrocarbon chain is short, the alcohol is soluble in water. As the hydrocarbon chain becomes longer, the alcohol becomes less soluble in water, as shown in the table below. One end of the alcohol molecules has so much nonpolar character it is said to be hydrophobic literally, "water-hating". The other end contains an -OH group that can form hydrogen bonds to neighboring water molecules and is therefore said to be hydrophilic literally, "water-loving". As the hydrocarbon chain becomes longer, the hydrophobic character of the molecule increases, and the solubility of the alcohol in water gradually decreases until it becomes essentially insoluble in water. Solubilities of Alcohols in Water Formula.

Alcohols vs Phenols. There are aliphatic and aromatic compounds in organic chemistry, which share the same functional groups. But their properties may differ from each other due to the aromaticity or the aliphatic nature.

Properties[edit] Phenol is an organic compound appreciably soluble in water, with about The sodium salt of phenol, sodium phenoxide , is far more water-soluble. One explanation for the increased acidity over alcohols is resonance stabilization of the phenoxide anion by the aromatic ring. In this way, the negative charge on oxygen is delocalized on to the ortho and para carbon atoms through the pi system. Resonance structures of the phenoxide anion In support of the second explanation, the pKa of the enol of acetone in water is However, the situation changes when solvation effects are excluded. Phenolate esters are more stable toward hydrolysis than acid anhydrides and acyl halides but are sufficiently reactive under mild conditions to facilitate the formation of amide bonds. Tautomerism[edit] Phenol-cyclohexadienone tautomerism Phenol exhibits keto-enol tautomerism with its unstable keto tautomer cyclohexadienone, but only a tiny fraction of phenol exists as the keto form. Phenol therefore exists essentially entirely in the enol form. Under normal circumstances, phenoxide is more reactive at the oxygen position, but the oxygen position is a "hard" nucleophile whereas the alpha-carbon positions tend to be "soft". An image of a computed electrostatic surface of neutral phenol molecule, showing neutral regions in green, electronegative areas in orange-red, and the electropositive phenolic proton in blue. Phenol water phase diagram: Certain combinations of phenol and water can make two solutions in one bottle. By this general approach, many groups can be appended to the ring, via halogenation , acylation , sulfonation , and other processes. Phenol reacts with dilute nitric acid at room temperature to give a mixture of 2-nitrophenol and 4-nitrophenol while with concentrated nitric acid, more nitro groups get substituted on the ring to give 2,4,6-trinitrophenol which is known as picric acid. Aqueous solutions of phenol are weakly acidic and turn blue litmus slightly to red. Phenol is easily neutralized by sodium hydroxide forming sodium phenate or phenolate, but being weaker than carbonic acid , it cannot be neutralized by sodium bicarbonate or sodium carbonate to liberate carbon dioxide. This is an example of the Schotten-Baumann reaction: Compared to most other processes, the cumene process uses relatively mild synthesis conditions, and relatively inexpensive raw materials. However, to operate economically, there must be demand for both phenol, and the acetone by-product. ExxonMobil developed a process in which benzene is hydroalkylated to cyclohexylbenzene. This latter product is oxidized to a hydroperoxide and then cleaved to phenol and cyclohexanone. Cyclohexanone is an important reaction intermediate for making nylon. Phenol is also a recoverable byproduct of coal pyrolysis. Condensation with acetone gives bisphenol-A , a key precursor to polycarbonates and epoxide resins. Condensation of phenol, alkylphenols, or diphenols with formaldehyde gives phenolic resins , a famous example of which is Bakelite. Partial hydrogenation of phenol gives cyclohexanone , a precursor to nylon. Nonionic detergents are produced by alkylation of phenol to give the alkylphenols , e. Medical[edit] Phenol once was widely used as an antiseptic, its use pioneered by Joseph Lister see History section. From the early s to the s it was used as a soap, known as carbolic soap. Concentrated phenol liquids are commonly used for permanent treatment of ingrown toe and finger nails, a procedure known as a chemical matrixectomy. The procedure was first described by Otto Boll in Since that time it has become the chemical of choice for chemical matrixectomies performed by podiatrists. Phenol is also used as a preservative in some vaccines. It is a component of industrial paint strippers used in the aviation industry for the removal of epoxy, polyurethane and other chemically resistant coatings. Coal tar remained the primary source until the development of the petrochemical industry. In , the French chemist Auguste Laurent obtained phenol in pure form. Lister decided that the wounds themselves had to be thoroughly cleaned. He then covered the wounds with a piece of rag or lint [39] covered in phenol, or carbolic acid as he called it. The skin irritation caused by continual exposure to phenol eventually led to the introduction of aseptic anti-septic, germ-free techniques in surgery. Lister experimented with cloths covered in carbolic acid after studying the works and experiments of his contemporary, Louis Pasteur in sterilizing various biological media. He theorized that if germs could be killed or prevented, no infection would occur. Lister reasoned that a chemical

could be used to destroy the micro-organisms that cause infection. Having heard of these developments and having himself previously experimented with other chemicals for antiseptic purposes without much success, Lister decided to try carbolic acid as a wound antiseptic. He had his first chance on August 12, 1867, when he received a patient: Ordinarily, amputation would be the only solution. However, Lister decided to try carbolic acid. After setting the bone and supporting the leg with splints, Lister soaked clean cotton towels in undiluted carbolic acid and applied them to the wound, covered with a layer of tin foil, leaving them for four days. When he checked the wound, Lister was pleasantly surprised to find no signs of infection, just redness near the edges of the wound from mild burning by the carbolic acid. Reapplying fresh bandages with diluted carbolic acid, the boy was able to walk home after about six weeks of treatment. Now, for the first time, patients with compound fractures were likely to leave the hospital with all their limbs intact –” Richard Hollingham, *Blood and Guts: A History of Surgery*, p. 10. Almost one in every two patients died. After antiseptic surgery was introduced in the summer of 1867, there were only six deaths in forty cases. The mortality rate had dropped from almost 50 per cent to around 15 per cent. It was a remarkable achievement –” Richard Hollingham, *Blood and Guts: Second World War*[edit] The toxic effect of phenol on the central nervous system, discussed below, causes sudden collapse and loss of consciousness in both humans and animals; a state of cramping precedes these symptoms because of the motor activity controlled by the central nervous system. Phenol injections were given to thousands of people. Maximilian Kolbe was also killed with a phenol injection after surviving two weeks of dehydration and starvation in Auschwitz when he volunteered to die in place of a stranger. Approximately one gram is sufficient to cause death. This compound is ingested from the plants the beaver eats. Long-term or repeated exposure of the substance may have harmful effects on the liver and kidneys. Department of Health and Human Services states the fatal dose for ingestion of phenol is from 1 to 32 g. This is particularly important if the phenol is mixed with chloroform a commonly used mixture in molecular biology for DNA and RNA purification. Phenol is also a reproductive toxin causing increased risk of abortion and low birth weight indicating retarded development in utero. Phenols The word phenol is also used to refer to any compound that contains a six-membered aromatic ring, bonded directly to a hydroxyl group -OH. Thus, phenols are a class of organic compounds of which the phenol discussed in this article is the simplest member.

Chapter 4 : Difference Between Alcohol and Phenol | Difference Between

explain why phenols are more acidic than alcohols. explain, in terms of inductive and resonance effects, why a given substituted phenol is more or less acidic than phenol itself. write equations for the reactions of given alcohols and phenols with strong bases, such as sodium hydride and sodium amide.

Lower alcohols are colourless liquids, members from C₅ to C₁₁ are oily liquids and higher members are waxy solids. The hydroxyl groups in alcohols can form H-bonds with water, so alcohols are miscible with water. The solubility decreases with increase in molecular mass. Boiling points of alkanes are higher than expected because of the presence of intermolecular hydrogen bonding in the polar molecules. These are colourless liquids or crystalline solids but become coloured due to slow oxidation with air. Phenol is also called carbolic acid. Because of the presence of polar -OH bond, phenols form intermolecular H-bonding with other phenol molecules and with water. Acid strength of alcohols Electron releasing group increases electron density on oxygen to decrease the polarity of O-H bond. Phenol is more acidic than alcohols due to stabilisation of phenoxide ion through resonance. Presence of electron withdrawing group increases the acidity of phenol by , stabilising phenoxide ion while presence of electron releasing group decreases the acidity of phenol by destabilising phenoxide ion. The introduction of acetyl CH₃CO- group in phenols is known as acetylation. Acetylation of salicylic acid produces aspirin. As a result, the bond cleavage becomes easy. Greater the number of alkyl groups present, more will be the reactivity of alcohol. Thus, the relative order of reactivity of the alcohols is justified. Acidic catalyst converts hydroxyl group into a good leaving group. Since, the rate determining step is the formation of carbocation, the ease of dehydration is Mechanism Step I Formation of protonated alcohol Step II Formation of carbocation Step III Formation of ethene by elimination of a proton In dehydration reaction, highly substituted alkene is the major product and if the major product is capable of showing cis-trans isomerism, trans-product is the major product. A common reagent that selectively oxidises a primary alcohol to an aldehyde and no further is pyridinium chlorochromate pCC. Reactions of Phenols i Electrophilic substitution reactions The -OH group attached to the benzene ring activates it towards electrophilic substitution at ortho and para positions. This is because o-nitrophenol is steam volatile due to intramolecular hydrogen bonding while p nitrophenol is less volatile due to intermolecular hydrogen bonding which causes the association of molecules. It is prepared as follows. It is obtained by destructive distillation of wood. Drinking of methanol causes blindness. It is used In the preparation of various beverages containing different percentages. Dihydric Alcohols These are generally called glycols because of their sweet taste. Methods of Preparation Physical Properties 1. It is a colourless, syrupy liquid with sweet taste. Because of its tendency of formation of H-bonds, it is miscible with H₂O and ethanol but not with ether. Chemical Properties It gives all the general reactions of -OH group. The per-iodic acid cleavage of 1,2-glycols is sometimes called Malaprade reaction. Method of Preparation It is obtained as a by product in saponification reaction. It is a colourless, odourless, viscous and hygroscopic liquid. It is sweet in taste and steam volatile. It is soluble in water but insoluble in ether. Due to excessive H-bonding, it is highly viscous and has high boiling point. Some of its specific reactions are: Glyceryl trinitrate or tri nitroglycerine, when adsorbed on Kieselguhr is known as dynamite. Mixture of TNG and cellulose trinitrate is called blasting gelatin. With HIO₄ periodic acid. Ethers Ethers are the organic compounds in which two alkyl or aryl groups are attached to a divalent oxygen. These also exhibit chain isomerism and metamerism. Physical Properties of Ethers Ethers are polar but insoluble in H₂O and have low boiling point than alcohols of comparable molecular masses because ethers do not form hydrogen bonds with water. Structure of Ether The hybridisation of O atom in ethers is sp³ tetrahedral and its shape is V-shape. Chemical Reactions of Ether i Reaction with HX Ethers with two different alkyl groups are also cleaved in the same manner and results in the formation of a primary halide or smaller and less complex alkyl halide by S_N2 mechanism. Uses of Ethers 1. Dimethyl ether is used as refrigerant and as a solvent at low temperature. Diethyl Ether is used as an anaesthesia in surgery.

Chapter 5 : Practice Questions - Alcohols and Phenols

*Questions pertaining to alcohols and phenols If you're seeing this message, it means we're having trouble loading external resources on our website. If you're behind a web filter, please make sure that the domains *blog.quintoapp.com and *blog.quintoapp.com are unblocked.*

Quantification[edit] A method for phenolic content quantification is volumetric titration. An oxidizing agent, permanganate , is used to oxidize known concentrations of a standard solution, producing a standard curve. The content of the unknown phenols is then expressed as equivalents of the appropriate standard. Some methods for quantification of total phenolic content are based on colorimetric measurements. Total phenols or antioxidant effect can be measured using the Folin-Ciocalteu reaction. Results are typically expressed as gallic acid equivalents GAE. Ferric chloride FeCl_3 test is also a colorimetric assay. Lamaison and Carnet have designed a test for the determination of the total flavonoid content of a sample AlCl_3 method. Antioxidant effect assessment[edit] In vitro measurements Other tests measure the antioxidant capacity of a fraction. The reaction may be monitored spectrophotometrically. The reactivity of the various antioxidants tested are compared to that of Trolox , which is a vitamin E analog. Other antioxidant capacity assays that use Trolox as a standard include the diphenylpicrylhydrazyl DPPH , oxygen radical absorbance capacity ORAC , ferric reducing ability of plasma FRAP assays or inhibition of copper-catalyzed in vitro human low-density lipoprotein oxidation. Dichlorofluorescein is a probe that is trapped within cells and is easily oxidized to fluorescent dichlorofluorescein DCF. A pro phenoloxidase can also be recovered from the insect. Occurrences in prokaryotes[edit] Orobol can be found in *Streptomyces neyagawaensis* an Actinobacterium. The proteobacterium *Pseudomonas fluorescens* produces phloroglucinol , phloroglucinol carboxylic acid and diacetylphloroglucinol. Occurrences in fungi[edit] Phenolic acids can be found in mushroom basidiomycetes species. Other compounds like atromentin and telephoric acid can also be isolated from fungi in the Agaricomycetes class. Orobol , an isoflavone , can be isolated from *Aspergillus niger*. Aryldialkylphosphatase also known as organophosphorus hydrolase, phosphotriesterase, and paraoxon hydrolase uses an aryl dialkyl phosphate and H_2O to produce dialkyl phosphate and an aryl alcohol. Occurrences in lichen[edit] Gyrophoric acid , a depside , and orcinol are found in lichen. Phlorotannins , for instance eckol , are found in brown algae. Vidalenolone can be found in the tropical red alga *Vidalia* sp.

Chapter 6 : organic chemistry - Differences between phenols and alcohols - Chemistry Stack Exchange

I know phenols are more acidic as compared to alcohols, but are they considered different from alcohols?. Sure, you can study something as a subset, but are phenols considered a subset of alcohols, or are they considered as completely different from alcohols?

Objectives After completing this section, you should be able to explain why the boiling points of alcohols and phenols are much higher than those of alkanes, ethers, etc. **Key Terms** Make certain that you can define, and use in context, the key terms below. **Boiling Points** The chart below shows the boiling points of the following simple primary alcohols with up to 4 carbon atoms: These boiling points are compared with those of the equivalent alkanes methane to butane with the same number of carbon atoms. The boiling points of the alcohols increase as the number of carbon atoms increases. The patterns in boiling point reflect the patterns in intermolecular attractions. **Hydrogen bonding** Hydrogen bonding occurs between molecules in which a hydrogen atom is attached to a strongly electronegative element: In alkanes, the only intermolecular forces are van der Waals dispersion forces. Hydrogen bonds are much stronger than these, and therefore it takes more energy to separate alcohol molecules than it does to separate alkane molecules. This is the main reason for higher boiling points in alcohols. **The effect of van der Waals forces** Boiling points of the alcohols: Hydrogen bonding is not the only intermolecular force alcohols experience. There are also van der Waals dispersion forces and dipole-dipole interactions. The hydrogen bonding and dipole-dipole interactions are much the same for all alcohols, but dispersion forces increase as the alcohols get bigger. These attractions get stronger as the molecules get longer and have more electrons. This increases the sizes of the temporary dipoles formed. This is why the boiling points increase as the number of carbon atoms in the chains increases. It takes more energy to overcome the dispersion forces, and thus the boiling points rise. **Comparison between alkanes and alcohols:** Even without any hydrogen bonding or dipole-dipole interactions, the boiling point of the alcohol would be higher than the corresponding alkane with the same number of carbon atoms. Compare ethane and ethanol: Ethanol is a longer molecule, and the oxygen atom brings with it an extra 8 electrons. Both of these increase the size of the van der Waals dispersion forces, and subsequently the boiling point. The lengths of the two molecules are more similar, and the number of electrons is exactly the same. **Solubility of alcohols in water** Small alcohols are completely soluble in water; mixing the two in any proportion generates a single solution. However, solubility decreases as the length of the hydrocarbon chain in the alcohol increases. At four carbon atoms and beyond, the decrease in solubility is noticeable; a two-layered substance may appear in a test tube when the two are mixed. Consider ethanol as a typical small alcohol. In both pure water and pure ethanol the main intermolecular attractions are hydrogen bonds. In order to mix the two, the hydrogen bonds between water molecules and the hydrogen bonds between ethanol molecules must be broken. However, when the molecules are mixed, new hydrogen bonds are formed between water molecules and ethanol molecules. In addition, there is an increase in the disorder of the system, an increase in entropy. This is another factor in deciding whether chemical processes occur. Consider a hypothetical situation involving 5-carbon alcohol molecules. The -OH ends of the alcohol molecules can form new hydrogen bonds with water molecules, but the hydrocarbon "tail" does not form hydrogen bonds. This means that many of the original hydrogen bonds being broken are never replaced by new ones. In place of those original hydrogen bonds are merely van der Waals dispersion forces between the water and the hydrocarbon "tails. Even allowing for the increase in disorder, the process becomes less feasible. As the length of the alcohol increases, this situation becomes more pronounced, and thus the solubility decreases. An important example is salt formation with acids and bases. Alcohols, like water, are both weak bases and weak acids. It is convenient to employ sodium metal or sodium hydride, which react vigorously but controllably with alcohols: By this we mean that the equilibrium position for the proton-transfer reaction Equation lies more on the side of ROH and O⁻H as R is changed from primary to secondary to tertiary; therefore, tert-butyl alcohol is considered less acidic than ethanol: This seeming contradiction appears more reasonable when one considers what effect solvation or the lack of it has on equilibria expressed by Equation In solution, the larger anions of alcohols, known as alkoxide ions, probably

are less well solvated than the smaller ions, because fewer solvent molecules can be accommodated around the negatively charged oxygen in the larger ions: Acidity of alcohols therefore decreases as the size of the conjugate base increases. They do this by polarization of their bonding electrons, and the bigger the group, the more polarizable it is. Also see Section A, which deals with the somewhat similar situation encountered with respect to the relative acidities of ethyne and water. Chemical Reactions of Alcohols involving the O-H bond of Compounds with Basic Properties Alcohols are bases similar in strength to water and accept protons from strong acids. An example is the reaction of methanol with hydrogen bromide to give methyloxonium bromide, which is analogous to the formation of hydroxonium bromide with hydrogen bromide and water: Acidity of Phenol Compounds like alcohols and phenol which contain an -OH group attached to a hydrocarbon are very weak acids. Alcohols are so weakly acidic that, for normal lab purposes, their acidity can be virtually ignored. However, phenol is sufficiently acidic for it to have recognizably acidic properties - even if it is still a very weak acid. A hydrogen ion can break away from the -OH group and transfer to a base. For example, in solution in water: Phenol is a very weak acid and the position of equilibrium lies well to the left. Phenol can lose a hydrogen ion because the phenoxide ion formed is stabilised to some extent. The negative charge on the oxygen atom is delocalised around the ring. The more stable the ion is, the more likely it is to form. One of the lone pairs on the oxygen atom overlaps with the delocalised electrons on the benzene ring. This overlap leads to a delocalization which extends from the ring out over the oxygen atom. As a result, the negative charge is no longer entirely localized on the oxygen, but is spread out around the whole ion. Spreading the charge around makes the ion more stable than it would be if all the charge remained on the oxygen. However, oxygen is the most electronegative element in the ion and the delocalized electrons will be drawn towards it. That means that there will still be a lot of charge around the oxygen which will tend to attract the hydrogen ion back again. That is why phenol is only a very weak acid. Why is phenol a much stronger acid than cyclohexanol? To answer this question we must evaluate the manner in which an oxygen substituent interacts with the benzene ring. As noted in our earlier treatment of electrophilic aromatic substitution reactions, an oxygen substituent enhances the reactivity of the ring and favors electrophile attack at ortho and para sites. It was proposed that resonance delocalization of an oxygen non-bonded electron pair into the pi-electron system of the aromatic ring was responsible for this substituent effect. A similar set of resonance structures for the phenolate anion conjugate base appears below the phenol structures. The resonance stabilization in these two cases is very different. An important principle of resonance is that charge separation diminishes the importance of canonical contributors to the resonance hybrid and reduces the overall stabilization. The contributing structures to the phenol hybrid all suffer charge separation, resulting in very modest stabilization of this compound. On the other hand, the phenolate anion is already charged, and the canonical contributors act to disperse the charge, resulting in a substantial stabilization of this species. The conjugate bases of simple alcohols are not stabilized by charge delocalization, so the acidity of these compounds is similar to that of water. An energy diagram showing the effect of resonance on cyclohexanol and phenol acidities is shown on the right. Since the resonance stabilization of the phenolate conjugate base is much greater than the stabilization of phenol itself, the acidity of phenol relative to cyclohexanol is increased. Supporting evidence that the phenolate negative charge is delocalized on the ortho and para carbons of the benzene ring comes from the influence of electron-withdrawing substituents at those sites. In this reaction, the hydrogen ion has been removed by the strongly basic hydroxide ion in the sodium hydroxide solution. Acids react with the more reactive metals to give hydrogen gas. Phenol is no exception - the only difference is the slow reaction because phenol is such a weak acid. Phenol is warmed in a dry tube until it is molten, and a small piece of sodium added. There is some fizzing as hydrogen gas is given off. The mixture left in the tube will contain sodium phenoxide. Acidity of Substituted Phenols Substitution of the hydroxyl hydrogen atom is even more facile with phenols, which are roughly a million times more acidic than equivalent alcohols. This phenolic acidity is further enhanced by electron-withdrawing substituents ortho and para to the hydroxyl group, as displayed in the following diagram. The alcohol cyclohexanol is shown for reference at the top left. It is noteworthy that the influence of a nitro substituent is over ten times stronger in the para-location than it is meta, despite the fact that the latter position is closer to the hydroxyl group. Furthermore additional nitro groups have an

additive influence if they are positioned in ortho or para locations. The trinitro compound shown at the lower right is a very strong acid called picric acid. Formulas illustrating this electron delocalization will be displayed when the "Resonance Structures" button beneath the previous diagram is clicked.

Chapter 7 : Alcohols and phenols questions (practice) | Khan Academy

In this chapter, we examine the chemistry of the alcohol family of compounds. Alcohols can undergo a wide variety of reactions, and because of this reactivity and because they can be prepared in a number of different ways, alcohols occupy an important position in organic chemistry. The discussion.

Death Maru Chemistry lab report Name: Identification and reaction of alcohols and phenol Objective: To study the physical and chemical properties of alcohol and phenol. Test tubes , water bath , distilled water , ethanol, 2- propanol , t-butanol , phenol , Lucas reagent , sulphuric acid , potassium dichromate , sodium metal , phenolphthalein indicator , iron III chloride CAUTION: A Solubility test 1. If the substances dissolves were observed , and your observation was recorded on the table. Test tube no 1 was labeled as ethanol , the following test tube no 2, 3, 4 were labeled as 2-propanol, t-butanol and phenol. B Lucas test 1 1ml of ethanol , 2-propanol , t-butanol and phenol were added into four separated dry , labeled test tubes. The appearances of cloudiness indicated a reaction. C Oxidation reaction of alcohol 1 2ml of ethanol and 0. D Iron III chloride test 1 5 drops of sample were placed into separate clean , dry test tubes to be tested. A purple colour indicated the presence of phenol. Alcohols are soluble in water. This is due to the hydroxyl group in the alcohol which is able to form hydrogen bonds with water molecules. Alcohols with a smaller hydrocarbon chain are very soluble. As the length of the hydrocarbon chain increases, the solubility in water decreases. With four carbon in the hydrocarbon chain and higher, the decrease in solubility becomes visible as the mixture forms two immiscible layers of liquid. The reason why the solubility decreases as the length of hydrocarbon chain increases is because it requires more energy to overcome the hydrogen bonds between the alcohol molecules as the molecules are more tightly packed together as the size and mass increases. Ethanol and 2-propanol is easy to dissolve , In case of tert-butyl alcohol the alkyl group is branched and has less surface area. Indeed , t-butanol is the most miscible in water. Phenol is insoluble in water because of the presence of benzene ring. The phenyl group in phenol is nonpolar and hydrophobic so it is insoluble in water. This test is used to distinguish between water-soluble primary, secondary, and tertiary alcohols. Some alcohols react with $ZnCl_2$ in an acidic aqueous solution to give an alkyl chloride. The Lucas test involves a substitution reaction, where the $-OH$ group of the alcohol is replaced by a Cl atom. The mechanism of this reaction involves a carbocation intermediate: Then a Cl^- ion adds to the positively charged carbon atom. The result is the alcohol is converted to a chlorinated alkane, with the Cl occupying the spot that the $-OH$ was in. Since tertiary carbocation are much more stable than primary or secondary carbonations, tertiary alcohols will react readily with the Lucas reagent. Secondary alcohols will react slowly usually in minutes. Primary alcohols will not react much at all, since a primary carbocation is so unstable. Therefore, Tertiary alcohols t-butanol react immediately. The test tube will get hot, and because the chloride is insoluble two layers may be apparent, or a cloudy dispersion forms. Secondary alcohols 2-propanol will become cloudy in 5 to 10 minutes. After heating slightly, gives the white layer within 10 min. Primary alcohols ethanol give no reaction at all. Primary alcohols can be oxidized to either aldehydes or carboxylic acids depending on the reaction conditions. Secondary alcohols are oxidised to ketones. There is no reaction whatsoever. In this experiment , potassium dichromate is added as an oxidizing agent to determine whether the alcohol will undergo oxidation or not. The orange-yellow color is due to the CrO_2 ion. This reagent will oxidize primary and secondary alcohols and, in turn, becomes reduced. The chromium in dichromate is reduced to chromic ion, Cr. A greenish colored solution results. This color change from orange-yellow to green serves as an indicator for the presence of a primary or secondary alcohol. A primary alcohol is oxidized first to an aldehyde, which will be further oxidized to an acid. For phenol oxidation , phenols are easily oxidized despite the absence of a hydrogen atom on the hydroxyl bearing carbon. Hence , oxidized water become a dark brown color associated with increased toxicity. Through the experiment ,ethanol , 2 propanol and phenol show positive result and undergoes changes of color. Iron chloride III test: Iron chloride III is used to identify the presence of phenol. In organic chemistry it is very common to see molecules comprised mainly of a carbon backbone with functional groups attached to the chain. The functional groups within a molecule need to be identified when naming. Ethanol is the primary

alcohol ; 2-propanol is the secondary alcohol ; t- butanol is the tertiary alcohol.

Chapter 8 : Alcohols, Phenols, Thiols, and Ethers

Chapter 3 Alcohols, Phenols, and Ethers 2 3 Alcohols 4 The Hydroxy (OH) Functional Group The hydroxyl group (OH) is found in the alcohol and phenol functional groups. (Note: that's not the.

Chapter 9 : Alcohols, Phenols and Ethers - Science for Kids | Mocomi

The product of alcohol oxidation depends on whether the starting alcohol is a primary, secondary or tertiary alcohol. Oxidation of methanol is unique amongst alcohols as the eventual products of methanol oxidation are water and carbon dioxide.