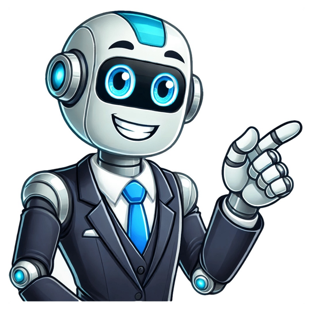

Viewing Notes: In H2SO3 Lewis structure Sulfur is least electron electronegative atom and goes in the center of the Lewis structure. When we have an H (or H2) in front of a polyatomic molecule (like CO3, SO4, NO2, etc.) we know that it's an acid. This means that the Hydrogen atoms will be attached to the outside of the oxygen molecules. Knowing this information makes it much easier to draw the Lewis structure for H2SO3. For the Lewis structure for H2SO3 you should take formal charges into account to find the best Lewis structure for the molecule. In the Lewis structure for H2SO3 there are a total of 26 valence electrons. See the Big List of Lewis Structures Transcript: This is the H2SO3 Lewis structure: sulfurous acid. The key to understanding this Lewis structure is recognizing these two H's in front attached to a polyatomic ion. That makes it an acid. And these Oxygens here, the Hydrogens will attach to the outside of the Oxygens. So we'll put our Sulfur here in the middle, it's the least electronegative. We have three Oxygens. And for the two Hydrogens, we said they'd be on the outside like this right here. We have a total of 26 valence electrons for the H2SO4 Lewis structure. We'll put 2 electrons between atoms to form the chemical bonds there. We've used 10 valence electrons. Then we'll fill the octets on the Oxygens. So you have 10, 12, 24, and then back to the center, 26. So we've used all 26 valence electrons, and everything in the structure, in the H2SO4 Lewis structure, has a full outer shell. So it looks like a pretty good Lewis structure. The thing is, when you see Sulfur, Sulfur is in period 3 on the periodic table, Sulfur can hold more than 8 valence electrons. So we really need to look at the formal charges for this molecule. When we calculate the formal charges, the Sulfur has a +1 charge, and the Oxygen has a -1 charge. So we'd like our formal charges to be as close to 0 as possible. And to do that, we can move this pair of valence electrons between the Oxygen and the Sulfur to form a double bond. By doing so, we're still only using 26 valence electrons, but now the formal charges on all of the atoms are 0. That makes for a much more stable Lewis structure for H2SO4. So if you see the Sulfur there, you'll want to check your formal charges. This is Dr. B., thanks for watching. Search our 100+ Lewis Structures Frequently Tested Lewis Structures Basic CH4, NH3, C2H4, O2, N2 Intermediate O3, BBr3, I3-, BrF5, NO Advanced SO3, H2SO4, OCN-, XeO3, ClO4- Diagrams for the bonding between atoms of a molecule and lone pairs of electrons Lewis structure of a water molecule Lewis structures – also called Lewis dot formulas, Lewis dot structures, electron dot structures, or Lewis electron dot structures (LEDs) – are diagrams that show the bonding between atoms of a molecule, as well as the lone pairs of electrons that may exist in the molecule.[1][2][3] Introduced by Gilbert N. Lewis in his 1916 article The Atom and the Molecule, a Lewis structure can be drawn for any covalently bonded molecule, as well as coordination compounds. [4] Lewis structures extend the concept of the electron dot diagram by adding lines between atoms to represent shared pairs in a chemical bond. Lewis structures show each atom and its position in the structure of the molecule using its chemical symbol. Lines are drawn between atoms that are bonded to one another (pairs of dots can be used instead of lines). Excess electrons that form lone pairs are represented as pairs of dots, and are placed next to the atoms. Although main group elements of the second period and beyond usually react by gaining, losing, or sharing electrons until they have achieved a valence shell electron configuration with a full octet of (8) electrons, hydrogen instead obeys the duplet rule, forming one bond for a complete valence shell of two electrons. Main article: Electron counting Comparison between electron dot diagrams and Lewis structure For a neutral molecule, the total number of electrons represented in a Lewis structure is equal to the sum of the numbers of valence electrons on each individual atom, not the maximum possible. Non-valence electrons are not represented in Lewis structures as they do not bond. Once the total number of valence electrons has been determined, they are placed into the structure according to these steps: Initially, one line (representing a single bond) is drawn between each pair of connected atoms. Each bond consists of a pair of electrons, so if t is the total number of electrons to be placed and n is the number of single bonds just drawn, t−2n electrons remain to be placed. These are temporarily drawn as dots, one per electron, to a maximum of eight per atom (two in the case of hydrogen), minus two for each bond. Electrons are distributed first to the outer atoms and then to the others, until there are no more to be placed. Finally, each atom (other than hydrogen) that is surrounded by fewer than eight electrons (counting each bond as two) is processed as follows: For every two electrons needed, two dots are deleted from a neighboring atom and an additional line is drawn between the two atoms. This represents the conversion of a lone pair of electrons into a bonding pair, which adds two electrons to the former atom's valence shell while leaving the latter's electron count unchanged. In the preceding steps, if there are not enough electrons to fill the valence shells of all atoms, preference is given to those atoms whose electronegativity is higher. Lewis structures for polyatomic ions may be drawn by the same method. However when counting electrons, negative ions should have extra electrons placed in their Lewis structures; positive ions should have fewer electrons than an uncharged molecule. When the Lewis structure of an ion is written, the entire structure is placed in brackets, and the charge is written as a superscript on the upper right, outside the brackets. A simpler method has been proposed for constructing Lewis structures, eliminating the need for electron counting: the atoms are drawn showing the valence electrons; bonds are then formed by pairing up valence electrons of the atoms involved in the bond-making process, and anions and cations are formed by adding or removing electrons to/from the appropriate atoms.[5] A trick is to count up valence electrons, then count up the number of electrons needed to complete the octet rule (or with hydrogen just 2 electrons), then take the difference of these two numbers. The answer is the number of electrons that make up the bonds. The rest of the electrons just go to fill all the other atoms' octets. Another simple and general procedure to write Lewis structures and resonance forms has been proposed.[6][example needed] This system works in nearly all cases, however there are 3 instances where it will not work[citation needed]. These exceptions are outlined in the table below. Exceptions The Exception How it Breaks the System How to Fix the Lewis Structure Free Radicals (molecules with unpaired valence electrons) Sum of TVe will be an odd number. Bond number will not be a whole number. Round calculated bond number down to the nearest whole number. (e.g. 4.5 bonds would round down to 4 bonds) Valence Shell Deficiency Does not break the system, must instead memorize when it occurs. BeX2, BX3, and AlX3. "X" represents Hydrogen or Halogens. When Be is bonded with 2 other atoms, or when B and Al are bonded with 3 other atoms, they do not form full valence shells. Assume single bonds and use the actual bond number to calculate lone pairs. Expanded Octet (only occurs for elements in Groups 3-8) Bond calculation will provide too few bonds for the number of atoms in the molecule. Assume single bonds, use the minimum number of bonds necessary to create the molecule. Main article: Formal charge In terms of Lewis structures, formal charge is used in the description, comparison, and assessment of likely topological and resonance structures[7] by determining the apparent electronic charge of each atom within, based upon its electron dot structure, assuming exclusive covalency or non-polar bonding. It has uses in determining possible electron re-configuration when referring to reaction mechanisms, and often results in the same sign as the partial charge of the atom, with exceptions. In general, the formal charge of an atom can be calculated using the following formula, assuming non-standard definitions for the markup used: C f = N v − U e − B n 2 {\displaystyle C_{f}=N_{v}-U_{e}-{\frac {B_{n}}{2}}} where: C f {\displaystyle C_{f}} is the formal charge. N v {\displaystyle N_{v}} represents the number of valence electrons in a free atom of the element. U e {\displaystyle U_{e}} represents the number of unshared electrons on the atom. B n {\displaystyle B_{n}} represents the total number of electrons in bonds the atom has with another. The formal charge of an atom is computed as the difference between the number of valence electrons that a neutral atom would have and the number of electrons that belong to it in the Lewis structure. Electrons in covalent bonds are split equally between the atoms involved in the bond. The total of the formal charges on an ion should be equal to the charge on the ion, and the total of the formal charges on a neutral molecule should be equal to zero. Main article: Resonance structure For some molecules and ions, it is difficult to determine which lone pairs should be moved to form double or triple bonds, and two or more different resonance structures may be written for the same molecule or ion. In such cases it is usual to write all of them with two-way arrows in between (see § Example below). This is sometimes the case when multiple atoms of the same type surround the central atom, and is especially common for polyatomic ions. When this situation occurs, the molecule's Lewis structure is said to be a resonance structure, and the molecule exists as a resonance hybrid. Each of the different possibilities is superimposed on the others, and the molecule is considered to have a Lewis structure equivalent to some combination of these states. The nitrate ion (NO−3), for instance, must form a double bond between nitrogen and one of the oxygens to satisfy the octet rule for nitrogen. However, because the molecule is symmetrical, it does not matter which of the oxygens forms the double bond. In this case, there are three possible resonance structures. Expressing resonance when drawing Lewis structures may be done either by drawing each of the possible resonance forms and placing double-headed arrows between them or by using dashed lines to represent the partial bonds (although the latter is a good representation of the resonance hybrid which is not, formally speaking, a Lewis structure). When comparing resonance structures for the same molecule, usually those with the fewest formal charges contribute more to the overall resonance hybrid. When formal charges are necessary, resonance structures that have negative charges on the more electronegative elements and positive charges on the less electronegative elements are favored. Single bonds can also be moved in the same way to create resonance structures for hypervalent molecules such as sulfur hexafluoride, which is the correct description according to quantum chemical calculations instead of the common expanded octet model. The resonance structure should not be interpreted to indicate that the molecule switches between forms, but that the molecule acts as the average of multiple forms. The formula of the nitrite ion is NO−2. Nitrogen is the least electronegative atom of the two, so it is the central atom by multiple criteria. Count valence electrons. Nitrogen has 5 valence electrons; each oxygen has 6, for a total of (6 × 2) + 5 = 17. The ion has a charge of −1, which indicates an extra electron, so the total number of electrons is 18. Connect the atoms by single bonds. Each oxygen must be bonded to the nitrogen, which uses four electrons—two in each bond. Place lone pairs. The 14 remaining electrons should initially be placed as 7 lone pairs. Each oxygen may take a maximum of 3 lone pairs, giving each oxygen 8 electrons including the bonding pair. The seventh lone pair must be placed on the nitrogen atom. Satisfy the octet rule. Both oxygen atoms currently have 8 electrons assigned to them. The nitrogen atom has only 6 electrons assigned to it. One of the lone pairs on an oxygen atom must form a double bond, but either atom will work equally well. Therefore, there is a resonance structure. Tie up loose ends. Two Lewis structures must be drawn: Each structure has one of the two oxygen atoms double-bonded to the nitrogen atom. The second oxygen atom in each structure will be single-bonded to the nitrogen atom. Place brackets around each structure, and add the charge (−) to the upper right outside the brackets. Draw a double-headed arrow between the two resonance forms. CH 3 − CH 2 − CH 2 − CH 3 CH 3 CH 2 CH 2 CH 3 {\displaystyle {\begin{matrix}{\ce {CH3-CH2-CH2-CH3}}\\{\ce {CH3CH2CH2CH3}}\end{matrix}}} Two varieties of condensed structural formula, both showing butane A skeletal diagram of butane Chemical structures may be written in more compact forms, particularly when showing organic molecules. In condensed structural formulas, many or even all of the covalent bonds may be left out, with subscripts indicating the number of identical groups attached to a particular atom. Another shorthand structural diagram is the skeletal formula (also known as a bond-line formula or carbon skeleton diagram). In a skeletal formula, carbon atoms are not signified by the symbol C but by the vertices of the lines. Hydrogen atoms bonded to carbon are not shown—they can be inferred by counting the number of bonds to a particular carbon atom—each carbon is assumed to have four bonds in total, so any bonds not shown are, by implication, to hydrogen atoms. Other diagrams may be more complex than Lewis structures, showing bonds in 3D using various forms such as space-filling diagrams. Despite their simplicity and development in the early twentieth century, when understanding of chemical bonding was still rudimentary, Lewis structures capture many of the key features of the electronic structure of a range of molecular systems, including those of relevance to chemical reactivity. Thus, they continue to enjoy widespread use by chemists and chemistry educators. This is especially true in the field of organic chemistry, where the traditional valence-bond model of bonding still dominates, and mechanisms are often understood in terms of curve-arrow notation superimposed upon skeletal formulae, which are shorthand versions of Lewis structures. Due to the greater variety of bonding schemes encountered in inorganic and organometallic chemistry, many of the molecules encountered require the use of fully delocalized molecular orbitals to adequately describe their bonding, making Lewis structures comparatively less important (although they are still common). There are simple and archetypal molecular systems for which a Lewis description, at least in unmodified form, is misleading or inaccurate. Notably, the naive drawing of Lewis structures for molecules known experimentally to contain unpaired electrons (e.g., O2, NO, and ClO2) leads to incorrect inferences of bond orders, bond lengths, and/or magnetic properties. A simple Lewis model also does not account for the phenomenon of aromaticity. For instance, Lewis structures do not offer an explanation for why cyclic C6H6 (benzene) experiences special stabilization beyond normal delocalization effects, while C4H4 (cyclobutadiene) actually experiences a special destabilization.[citation needed] Molecular orbital theory provides the most straightforward explanation for these phenomena.[original research?] Valence shell electron pair repulsion theory Molecular geometry Structural formula Natural bond orbital ^ IUPAC definition of Lewis formula ^ Zumdahl, S. (2005) Chemical Principles Houghton-Mifflin (ISBN 0-618-37206-7) ^ G.L. Miessler; D.A. Tarr (2003), Inorganic Chemistry (2nd ed.), Pearson Prentice–Hall, ISBN 0-13-035471-6 ^ Lewis, G. N. (1916), "The Atom and the Molecule", J. Am. Chem. Soc., 38 (4): 762–85, Bibcode:1916JAChS..38..762L, doi:10.1021/ja02261a002, S2CID 95865413 ^ Miburo, Barnabe B. (1993), "Simplified Lewis Structure Drawing for Non-science Majors", J. Chem. Educ., 75 (3): 317, Bibcode:1998JChEd..75..317M, doi:10.1021/ed075p317 ^ Lever, A. B. P. (1972), "Lewis Structures and the Octet Rule", J. Chem. Educ., 49 (12): 819, Bibcode:1972JChEd..49..819L, doi:10.1021/ed049p819 ^ Miessler, G. L. and Tarr, D. A., Inorganic Chemistry (2nd ed., Prentice Hall 1998) ISBN 0-13-841891-8, pp. 49–53 – Explanation of formal charge usage. Lewis Dot Diagrams of Selected Elements Lewis structures for all compounds Retrieved from " Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. So you have seen the above image by now, right? Let me explain the above image in short. H2SO3 lewis structure has a Sulfur atom (S) at the center which is surrounded by one Oxygen atom (O) and two O-H groups. There is a double bond between the Sulfur (S) & Oxygen (O) atom and a single bond between the Sulfur (S) and two O-H groups. If you haven't understood anything from the above image of H2SO3 lewis structure, then just stick with me and you will get the detailed step by step explanation on drawing a lewis structure of H2SO3. So let's move to the steps of drawing the lewis structure of H2SO3. In order to find the total valence electrons in H2SO3 molecule, first of all you should know the valence electrons present in hydrogen atom, sulfur atom as well as oxygen atom.(Valence electrons are the electrons that are present in the outermost orbit of any atom.) Here, I'll tell you how you can easily find the valence electrons of hydrogen, sulfur as well as oxygen using a periodic table. Total valence electrons in H2SO3 molecule → Valence electrons given by hydrogen atom: Hydrogen is group 1 element on the periodic table. [1] Hence the valence electron present in hydrogen is 1. You can see that only 1 valence electron is present in the hydrogen atom as shown in the above image. → Valence electrons given by sulfur atom: Sulfur is a group 16 element on the periodic table. [2] Hence the valence electrons present in sulfur is 6. You can see the 6 valence electrons present in the sulfur atom as shown in the above image. → Valence electrons given by oxygen atom: Oxygen is group 16 element on the periodic table. [3] Hence the valence electrons present in oxygen is 6. You can see the 6 valence electrons present in the oxygen atom as shown in the above image. Hence, Total valence electrons in H2SO3 molecule = valence electrons given by 2 hydrogen atoms + valence electrons given by 1 sulfur atom + valence electrons given by 3 oxygen atoms = 1(2) + 6 + 6(3) = 26. For selecting the center atom, you have to remember that the atom which is less electronegative remains at the center. (Remember: If hydrogen is present in the given molecule, then always put hydrogen outside.) Now here the given molecule is H2SO3 and it contains hydrogen atoms (H), sulfur atom (S) and oxygen atoms (O). So as per the rule we have to keep hydrogen outside. Now, you can see the electronegativity values of sulfur atom (S) and oxygen atom (O) in the above periodic table. If we compare the electronegativity values of sulfur (S) and oxygen (O) then the sulfur atom is less electronegative. So here the sulfur atom (S) is the center atom and the oxygen atom (O) is the outside atom. Now in the H2SO3 molecule, you have to put the electron pairs between the sulfur (S) & oxygen (O) atoms and between the oxygen (O) & hydrogen (H) atom. This indicates that these atoms are chemically bonded with each other in a H2SO3 molecule. Now in this step, you have to check the stability of the outer atoms. Here in the sketch of H2SO3 molecule, you can see that the outer atoms are hydrogen atoms and oxygen atoms. These hydrogen atoms and oxygen atoms are forming a duplet and octet respectively and hence they are stable. Also, in step 1 we have calculated the total number of valence electrons present in the H2SO3 molecule. The H2SO3 molecule has a total 26 valence electrons and out of these, only 24 valence electrons are used in the above sketch. So the number of electrons which are left = 26 – 24 = 2. You have to put these 2 electrons on the central sulfur atom in the above sketch of H2SO3 molecule. Now let's proceed to the next step. In this step, you have to check whether the central sulfur atom (S) is stable or not. In order to check the stability of the central sulfur (S) atom, we have to check whether it is forming an octet or not. You can see from the above picture that the sulfur atom is forming an octet. That means it has 8 electrons. And hence the central sulfur atom is stable. Now let's proceed to the final step to check whether the lewis structure of H2SO3 is stable or not. Now you have come to the final step in which you have to check the stability of lewis structure of H2SO3. The stability of lewis structure can be checked by using a concept of formal charge. In short, now you have to find the formal charge on hydrogen (H) atoms, sulfur (S) atom as well as oxygen (O) atoms present in the H2SO3 molecule. For calculating the formal charge, you have to use the following formula; Formal charge = Valence electrons – (Bonding electrons)/2 – Nonbonding electrons You can see the number of bonding electrons and nonbonding electrons for each atom of H2SO3 molecule in the image given below. For Hydrogen (H) atom:Valence electron = 1 (because hydrogen is in group 1)Bonding electrons = 2Nonbonding electrons = 0 The Lewis structure of a molecule is a two-dimensional representation that shows how the atoms are connected and the distribution of electron pairs. For H2SO3, also known as sulfurous acid, drawing its Lewis structure requires following a set of steps to ensure that the structure is valid and reflects the molecule's electronic distribution accurately. Naturally Worded Primary Topic Section with Semantic Relevance To draw the Lewis structure of H2SO3, we start by determining the total number of valence electrons available. Sulfur (S) is in group 16 of the periodic table and has 6 valence electrons, oxygen (O) is also in group 16 with 6 valence electrons, and hydrogen (H) is in group 1 with 1 valence electron. Since there are two hydrogen atoms and three oxygen atoms, the total valence electrons from hydrogen are 2*1 = 2, from oxygen are 3*6 = 18, and from sulfur is 6. This gives us a total of 2 + 18 + 6 = 26 valence electrons. We then connect the atoms with single bonds, which use 2 electrons each. The central atom in H2SO3 is sulfur, to which we connect the two hydrogen atoms and the three oxygen atoms. This initial structure uses 10 electrons (5 single bonds * 2 electrons per bond). We are left with 26 - 10 = 16 electrons to distribute. Next, we satisfy the octet rule for each atom, which states that an atom should have 8 electrons in its outer shell to be stable. For the oxygen atoms, which are connected to sulfur with single bonds, we add 6 additional electrons to each oxygen (since each oxygen already has 2 electrons from the single bond, 6 more are needed to reach 8). This accounts for 3*6 = 18 electrons. However, we have 16 electrons left, which means we can only add 6 electrons to two of the oxygens and 4 electrons to the last oxygen, or distribute them in a way that respects the total count, suggesting a structure where one oxygen might have a double bond to sulfur to account for the electron distribution correctly. AtomValence ElectronsElectrons in BondsAdditional Electrons Needed Sulfur610 (5 bonds)Needs to share to reach octet Oxygen (each)62 (1 bond)6 (to reach octet) Hydrogen (each)12 (1 bond)0 (already satisfied) It's crucial to note that in the case of H2SO3, one of the oxygens will form a double bond with sulfur to satisfy the octet rule for sulfur and to use up all the available valence electrons efficiently. This structure also reflects the molecule's ability to exhibit resonance, where the double bond can delocalize among the oxygen atoms, contributing to the molecule's stability. The correct Lewis structure of H2SO3 shows sulfur double-bonded to one oxygen and single-bonded to the other two oxygens, with each oxygen having two lone pairs of electrons except for the double-bonded oxygen which has one lone pair. The hydrogens are each single-bonded to the sulfur. This arrangement allows sulfur to expand its octet due to the availability of d-orbitals, accommodating more than 8 electrons, which is a common feature in the Lewis structures of molecules involving third-row or higher atoms. H2SO3, or sulfurous acid, has a complex Lewis structure due to the need to satisfy the octet rule for all atoms while accounting for all valence electrons. The molecule's structure involves sulfur bonded to two hydrogens and three oxygens, with one of the oxygens double-bonded to sulfur to efficiently use all valence electrons. The Lewis structure of H2SO3 demonstrates the principle of resonance, where the double bond between sulfur and one oxygen can delocalize, enhancing the molecule's stability. Sulfur's ability to expand its octet by using d-orbitals is crucial for accommodating the electrons in the molecule's structure. The distribution of electrons and the bonds in H2SO3's Lewis structure are consistent with the principles of valence bond theory and the VSEPR model, which predict the molecule's geometry and reactivity. Implications and Applications of the H2SO3 Lewis Structure Understanding the Lewis structure of H2SO3 is essential for predicting its chemical properties and reactivity. The presence of a double bond between sulfur and one of the oxygens, along with the lone pairs on the oxygens, influences the molecule's polarity and its ability to form hydrogen bonds, which are critical in understanding its behavior in aqueous solutions and its role in environmental and biological processes. The Lewis structure also helps in understanding the acid-base properties of H2SO3. As a weak acid, it donates protons (H+), a process influenced by the electron distribution and the stability of the conjugate base that forms upon deprotonation. This aspect is vital in chemical reactions where H2SO3 acts as an acid or a reducing agent, and its applications range from industrial processes to its natural occurrence in the environment, particularly in the context of acid rain formation. The total number of valence electrons in H2SO3 is calculated by adding the valence electrons from each atom: 2 (from 2 hydrogens) + 18 (from 3 oxygens) + 6 (from sulfur) = 26 valence electrons. The sulfur in H2SO3 forms a double bond with one of the oxygens to efficiently use all the available valence electrons and to satisfy the octet rule for both sulfur and oxygen, considering sulfur's ability to expand its octet. The Lewis structure of H2SO3 is crucial for understanding its chemical properties, including its acidity, reactivity, and the ability to form hydrogen bonds, all of which are influenced by the distribution of electrons and the molecular geometry predicted by the Lewis structure. In conclusion, the Lewis structure of H2SO3 is a complex representation that requires careful consideration of electron distribution, bond formation, and the satisfaction of the octet rule for all atoms involved. Understanding this structure is essential for predicting the chemical behavior and properties of sulfurous acid, which has significant implications in both industrial applications and environmental science. I'm super excited to teach you the lewis structure of H2SO3 in just 6 simple steps.Infact, I've also given the step-by-step images for drawing the lewis dot structure of H2SO3 molecule.So, if you are ready to go with these 6 simple steps, then let's dive right into it! Lewis structure of H2SO3 (or Sulfurous acid) contains the Sulfur (S) atom which is double bonded with one Oxygen (O) atom as well as single bonded with two O-H groups. The Sulfur atom has one lone pair while all the Oxygen atoms have 2 lone pairs. Let's draw and understand this lewis dot structure step by step. (Note: Take a pen and paper with you and try to draw this lewis structure along with me. I am sure you will definitely learn how to draw lewis structure of H2SO3). Here, the given molecule is H2SO3 (sulfurous acid). In order to draw the lewis structure of H2SO3, first of all you have to find the total number of valence electrons present in the H2SO3 molecule.(Valence electrons are the number of electrons present in the outermost shell of an atom). So, let's calculate this first. Calculation of valence electrons in H2SO3 Hydrogen is a group 1 element on the periodic table. [1] Hence, the valence electron present in hydrogen is 1 (see below image). Sulfur is a group 16 element on the periodic table. [2] Hence, the valence electrons present in sulfur is 6 (see below image). Oxygen is also a group 16 element on the periodic table. [3] Hence, the valence electron present in oxygen is also 6 (see below image). Hence in a H2SO3 molecule, Valence electrons given by each Hydrogen (H) atom = 1Valence electrons given by Sulfur (S) atom = 6 Valence electrons given by each Oxygen (O) atom = 6 So, total number of Valence electrons in H2SO3 molecule = 1(2) + 6 + 6(3) = 26 While selecting the atom, always put the least electronegative atom at the center. (Remember: Fluorine is the most electronegative element on the periodic table and the electronegativity decreases as we move right to left in the periodic table as well as top to bottom in the periodic table). [4] Here in the H2SO3 molecule, if we compare the sulfur atom (S), oxygen atom (O) and hydrogen atom (H), then hydrogen is less electronegative than sulfur and oxygen. But as per the rule, we have to keep hydrogen outside. So, sulfur (which is less electronegative than oxygen) should be placed in the center and the remaining oxygen atom as well as OH group will surround it. Now in the above sketch of H2SO3 molecule, put the two electrons (i.e electron pair) between each sulfur atom, oxygen atom and hydrogen atom to represent a chemical bond between them. These pairs of electrons present between the Sulfur (S), Oxygen (O) and Hydrogen (H) atoms form a chemical bond, which bonds these atoms with each other in a H2SO3 molecule. Don't worry, I'll explain! In the Lewis structure of H2SO3, the outer atoms are hydrogen atoms as well as oxygen atom. Hydrogen already has a duplet (see below image). So now, you have to complete the octet on oxygen atom (because oxygen requires 8 electrons to have a complete outer shell). Now, you can see in the above image that the oxygen atom forms an octet. Also, only 24 valence electrons of H2SO3 molecule are used in the above structure. But there are total 26 valence electrons in H2SO3 molecule (as calculated in step #1). So the number of electrons left to be kept on the central atom = 26 – 24 = 2. So let's keep these two electrons (i.e 1 electron pair) on the central atom (i.e sulfur atom). Now, let's move to the next step. In this step, we have to check whether the central atom (i.e sulfur) has an octet or not. In simple words, we have to check whether the central Sulfur (S) atom is having 8 electrons or not. As you can see from the above image, the central atom (i.e sulfur), is having 8 electrons. So it fulfills the octet rule. Now, you have come to the final step and here you have to check the formal charge on sulfur atom (S), oxygen atoms (O) as well as hydrogen atoms (H). For that, you need to remember the formula of formal charge; Formal charge = Valence electrons – Nonbonding electrons – (Bonding electrons)/2 For Hydrogen: Valence electron = 1 (as it is in group 1)Nonbonding electrons = 0Bonding electrons = 2 For Sulfur: Valence electron = 6 (as it is in group 16)Nonbonding electrons = 0Bonding electrons = 8 For Oxygen: Valence electron = 6 (as it is in group 16)Nonbonding electrons = 6Bonding electrons = 2 For Oxygen (of O-H group): Valence electron = 6 (as it is in group 16)Nonbonding electrons = 4Bonding electrons = 4 Formal charge=Valence electrons–Nonbonding electrons–(Bonding electrons)/2H=1–0–2/2=0S=6–0–8/2=+2O=6–6–2/2=-1O (of OH group)=6–4–4/2=0 So you can see above that the formal charges on sulfur is +1 and the formal charge on the oxygen atom is -1. This indicates that the above lewis structure of H2SO3 is not stable and so we have to minimize the charges to get a more stable lewis structure. This can be done by shifting the lone pair from negatively charged oxygen atoms to the positively charged sulfur atom to form a double bond. Now, in the above structure, you can see that the charges are minimized and the above lewis structure of H2SO3 is the final stable structure. Each electron pair (:) in the lewis dot structure of H2SO3 represents the single bond (|). So the above lewis dot structure of H2SO3 can also be represented as shown below. Related lewis structures for your practice:Lewis Structure of HSO4-Lewis Structure of CCl2F2Lewis Structure of C2H2Cl2Lewis Structure of NH2OHLewis Structure of HClO3 Article by; Jay RanaJay is an educator and has helped more than 100,000 students in their studies by providing simple and easy explanations on different science-related topics. With a desire to make learning accessible for everyone, he founded Knords Learning, an online learning platform that provides students with easily understandable explanations. Read more about our Editorial process. Welcome to the Science Notes and Projects site, where you'll find experiments, projects, and notes for all scientific disciplines and educational levels. We write science articles and make all kinds of printable periodic tables and science graphics.Here's the Science Notes periodic table with the official names and data for all 118 elements.Here's a comprehensive chemistry dictionary. There is a separate page for each letter so that you don't have to scroll forever. Many terms link to articles on the topic.Here are two lists for you. One covers things that glow under black light (fluorescent or phosphorescent), while the other covers things that glow when the lights go out and it's truly dark. Some items produce luminescence both ways:Things That Glow in the DarkThings That Glow Under Black LightSometimes it's just easier to have a printout of important information. These tables are available as PDF files. You can save these and print them out at your convenience:Here are some fun science projects to try:Add some humor to your life with a collection of science and math jokes. Spend a little time laughing (or groaning) at the lighter side of science. Post a reply to tell your own science joke!Chemistry JokesMath JokesPhysics JokesEngineer JokesLearn to love the triangle. Trigonometry is one of the scientist's basic tools in their mathematics toolbox. Here are a couple of useful printable reference sheets with trig relationships, special triangles and trig identities. Got requests for trig or stats content? Let us know. We both have degrees in math.Right Triangles Trigonometry FunctionsSpecial TrianglesTrig Tables – SIN, COS and TAN values PDFTrig Identities Study SheetMetals, Metalloids and NonmetalsThis periodic table shows the elements and locations of the metals, metalloids and nonmetals. It also lists the common properties of metals, metalloids and nonmetals. You can print out the table the same as any of the periodic tables on the site.List of MetalsThis is a list of the elements considered to be the metal elements along with a periodic table highlighting these elements and their common properties.List of MetalloidsThis is a list of the elements considered to be the metalloid or semimetal elements. It also contains a periodic table highlighting the metalloids and their common properties.List of NonmetalsThis is a list of all the nonmetal elements, their location on the periodic table and the properties of a nonmetal.Here are some new science projects, plus some old favorites:We've got a bunch crystal-growing projects for you. Instructions range from crystals grown with home chemicals to easy lab chemical crystals to try. I'm super excited to teach you the lewis structure of H2SO3 in just 6 simple steps.Infact, I've also given the step-by-step images for drawing the lewis dot structure of H2SO3 molecule.So, if you are ready to go with these 6 simple steps, then let's dive right into it! Lewis structure of H2SO3 (or Sulfurous acid) contains the Sulfur (S) atom which is double bonded with one Oxygen (O) atom as well as single bonded with two O-H groups. The Sulfur atom has one lone pair while all the Oxygen atoms have 2 lone pairs. Let's draw and understand this lewis dot structure step by step. (Note: Take a pen and paper with you and try to draw this lewis structure along with me. I am sure you will definitely learn how to draw lewis structure of H2SO3). Here, the given molecule is H2SO3 (sulfurous acid). In order to draw the lewis structure of H2SO3, first of all you have to find the total number of valence electrons present in the H2SO3 molecule.(Valence electrons are the number of electrons present in the outermost shell of an atom). So, let's calculate this first. Calculation of valence electrons in H2SO3 Hydrogen is a group 1 element on the periodic table. [1] Hence, the valence electron present in hydrogen is 1 (see below image). Sulfur is a group 16 element on the periodic table. [2] Hence, the valence electrons present in sulfur is 6 (see below image). Oxygen is also a group 16 element on the periodic table. [3] Hence, the valence electron present in oxygen is also 6 (see below image). Hence in a H2SO3 molecule, Valence electrons given by each Hydrogen (H) atom = 1Valence electrons given by Sulfur (S) atom = 6 Valence electrons given by each Oxygen (O) atom = 6 So, total number of Valence electrons in H2SO3 molecule = 1(2) + 6 + 6(3) = 26 While selecting the atom, always put the least electronegative atom at the center. (Remember: Fluorine is the most electronegative element on the periodic table and the electronegativity decreases as we move right to left in the periodic table as well as top to bottom in the periodic table). [4] Here in the H2SO3 molecule, if we compare the sulfur atom (S), oxygen atom (O) and hydrogen atom (H), then hydrogen is less electronegative than sulfur and oxygen. But as per the rule, we have to keep hydrogen outside. So, sulfur (which is less electronegative than oxygen) should be placed in the center and the remaining oxygen atom as well as OH group will surround it. Now in the above sketch of H2SO3 molecule, put the two electrons (i.e electron pair) between each sulfur atom, oxygen atom and hydrogen atom to represent a chemical bond between them. These pairs of electrons present between the Sulfur (S), Oxygen (O) and Hydrogen (H) atoms form a chemical bond, which bonds these atoms with each other in a H2SO3 molecule. Don't worry, I'll explain! In the Lewis structure of H2SO3, the outer atoms are hydrogen atoms as well as oxygen atom. Hydrogen already has a duplet (see below image). So now, you have to complete the octet on oxygen atom (because oxygen requires 8 electrons to have a complete outer shell). Now, you can see in the above image that the oxygen atom forms an octet. Also, only 24 valence electrons of H2SO3 molecule are used in the above structure. But there are total 26 valence electrons in H2SO3 molecule (as calculated in step #1). So the number of electrons left to be kept on the central atom = 26 – 24 = 2. So let's keep these two electrons (i.e 1 electron pair) on the central atom (i.e sulfur atom). Now, let's move to the next step. In this step, we have to check whether the central atom (i.e sulfur) has an octet or not. In simple words, we have to check whether the central Sulfur (S) atom is having 8 electrons or not. As you can see from the above image, the central atom (i.e sulfur), is having 8 electrons. So it fulfills the octet rule. Now, you have come to the final step and here you have to check the formal charge on sulfur atom (S), oxygen atoms (O) as well as hydrogen atoms (H). For that, you need to remember the formula of formal charge; Formal charge = Valence electrons – Nonbonding electrons – (Bonding electrons)/2 For Hydrogen: Valence electron = 1 (as it is in group 1)Nonbonding electrons = 0Bonding electrons = 2 For Sulfur: Valence electron = 6 (as it is in group 16)Nonbonding electrons = 0Bonding electrons = 8 For Oxygen: Valence electron = 6 (as it is in group 16)Nonbonding electrons = 6Bonding electrons = 2 For Oxygen (of O-H group): Valence electron = 6 (as it is in group 16)Nonbonding electrons = 4Bonding electrons = 4 Formal charge=Valence electrons–Nonbonding electrons–(Bonding electrons)/2H=1–0–2/2=0S=6–0–8/2=+2O=6–6–2/2=-1O (of OH group)=6–4–4/2=0 So you can see above that the formal charges on sulfur is +1 and the formal charge on the oxygen atom is -1. This indicates that the above lewis structure of H2SO3 is not stable and so we have to minimize the charges to get a more stable lewis structure. 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Read more about our Editorial process. The information on this page is ✔ fact-checked. H2SO3 Lewis structure | Image: Learnool H2SO3 (sulfurous acid) has two hydrogen atoms, one sulfur atom, and three oxygen atoms. In the H2SO3 Lewis structure, there are two single bonds and one double bond around the sulfur atom, with three oxygen atoms attached to it. The oxygen atom with a double bond has two lone pairs, the left oxygen and right oxygen atom (with which the hydrogen atom is attached) also has two lone pairs, and the sulfur atom has one lone pair. To properly draw the H2SO3 Lewis structure, follow these steps: #1 Draw a rough sketch of the structure#2 Next, indicate lone pairs on the atoms#3 Indicate formal charges on the atoms, if necessary#4 Minimize formal charges by converting lone pairs of the atoms#5 Repeat step 4 if necessary, until all charges are minimized Let's break down each step in more detail. First, determine the total number of valence electrons Periodic table | Image: Learnool In the periodic table, hydrogen lies in group 1, and both sulfur and oxygen lie in group 16. Hence, hydrogen has one valence electron, and both sulfur and oxygen have six valence electrons. Since H2SO3 has two hydrogen atoms, one sulfur atom, and three oxygen atoms, so... Valence electrons of two hydrogen atoms = 1 × 2 = 2Valence electrons of one sulfur atom = 6 × 1 = 6Valence electrons of three oxygen atoms = 6 × 3 = 18 And the total valence electrons = 2 + 6 + 18 = 26 Learn how to find: Hydrogen valence electrons, Sulfur valence electrons, and Oxygen valence electrons Second, find the total electron pairs We have a total of 26 valence electrons. And when we divide this value by two, we get the value of total electron pairs. Total electron pairs = total valence electrons ÷ 2 So the total electron pairs = 26 ÷ 2 = 13 Third, determine the central atom Here hydrogen can not be the central atom. Because the central atom is bonded with at least two other atoms, and hydrogen has only one electron in its last shell, so it can not make more than one bond. Now we have to choose the central atom from sulfur and oxygen. Place the least electronegative atom at the center. Since sulfur is less electronegative than oxygen, assume that the central atom is sulfur. Therefore, place sulfur in the center and hydrogen and oxygen on either side. And finally, draw the rough sketch Rough sketch of H2SO3 Lewis structure | Image: Learnool Here, we have a total of 13 electron pairs. And five bonds are already marked. So we have to only mark the remaining eight electron pairs as lone pairs on the sketch. Also remember that hydrogen is a period 1 element, so it can not keep more than 2 electrons in its last shell. Sulfur is a period 3 element, so it can keep more than 8 electrons in its last shell. And oxygen is a period 2 element, so it can not keep more than 8 electrons in its last shell. Always start to mark the lone pairs from outside atoms. Here, the outside atoms are hydrogens and oxygens. But no need to mark on hydrogen, because each hydrogen has already two electrons. So for top oxygen, there are three lone pairs, for left oxygen and right oxygen, there are two lone pairs, and for sulfur, there is one lone pair. Mark the lone pairs on the sketch as follows: Lone pairs marked on H2SO3 Lewis structure | Image: Learnool Use the following formula to calculate the formal charges on atoms: Formal charge = valence electrons – nonbonding electrons – ½ bonding electrons For each hydrogen atom, formal charge = 1 – 0 – ½ (2) = 0 For sulfur atom, formal charge = 6 – 2 – ½ (6) = +1 For top oxygen atom, formal charge = 6 – 6 – ½ (2) = -1 For left oxygen and right oxygen atom, formal charge = 6 – 4 – ½ (4) = 0 Here, both sulfur and oxygen atoms have charges, so mark them on the sketch as follows: Formal charges marked on H2SO3 Lewis structure | Image: Learnool The above structure is not a stable Lewis structure because both sulfur and oxygen atoms have charges. Therefore, reduce the charges (as below) by converting lone pairs to bonds. Convert a lone pair of the top oxygen atom to make a new S — O bond with the sulfur atom as follows: Lone pair of top oxygen is converted, and got the stable Lewis structure of H2SO3 | Image: Learnool In the above structure, you can see that the central atom (sulfur) forms an octet. The outside atoms (oxygens) also form an octet, and both hydrogens form a duet. Hence, the octet rule and duet rule are satisfied. Also, the above structure is more stable than the previous structures. Therefore, this structure is the stable Lewis structure of H2SO3. Next: SeO3 Lewis structure Your feedback matters. Visit our contact page. I'm super excited to teach you the lewis structure of H2SO3 in just 6 simple steps.Infact, I've also given the step-by-step images for drawing the lewis dot structure of H2SO3 molecule.So, if you are ready to go with these 6 simple steps, then let's dive right into it! 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