THE VIDEO TEXTBOOK OF GENERAL CHEMISTRY (FARMER)

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Book: The Video Textbook of General Chemistry (Farmer)

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Licensing

A detailed breakdown of this resource's licensing can be found in ***Back Matter/Detailed Licensing****.*

CHAPTER OVERVIEW

1: Definitions, Units, and Significant Figures

1.1 Fundamental Definitions in Chemistry (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video defines and discusses some of the basic concepts in chemistry, such as atoms, molecules, observations, hypothesis, experiment, theory, and scientific method. These concepts are used as the foundation for beginning to learn chemistry.

Link to Video

Fundamental Definitions in Chemistry: https://youtu.be/SBwjbkFNkdw

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- Prof. Steven Farmer (Sonoma State University)

1.2 Different Definitions of Matter (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how matters is defined in chemistry. A pure substance is made up of a single type of atom or molecule. A mixture is a substance composed of two or more different types of atoms or molecules. Pure substances can be broken down in to two types an element or a compound. Mixtures can be broken into two types: heterogeneous and homogeneous.

Link to Video

Different Definitions of Matter: https://youtu.be/qi_qLHc8wLk

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- Prof. Steven Farmer (Sonoma State University)

1.3 Different Definitions of Changes (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Changes can be classified two different ways. In a physical change the atoms or molecules do not change their composition. A chemical change alters the composition of the atoms or molecules.

Link to Video

Different Definitions of Changes: https://youtu.be/OiLaMHigCuo

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1.4 Different Definitions of Properties (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Properties can be classified two different ways. A substance displays a physical property without changing its composition. A substance displays a chemical property only by changing its composition. Another way properties can be classified: An intensive property is independent of the amount of substance. An extensive property is dependent on the amount of the substance.

Link to Video

Different Definitions of Properties: https://youtu.be/n7UwjQJGh9Y

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1.5 International System of Units (SI Units) (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The system of measurements used by scientists is based on the metric system and is called the International System of Units (SI). Some basic units are meters, kilograms and seconds. SI units use Prefix Multipliers

Link to Video

International System of Units (SI Units): https://youtu.be/Invma3QrCYQ

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1.6 Units of Temperature (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Temperature is a measure of kinetic energy in matter. The Fahrenheit scale (^{o}F) is used in the US. The Celsius (^{o}C) scale is defined as water freezing at 0 ^{o}C and boiling at 100 ^{o}C. This Kelvin scale avoids zero or negative temperatures by assigning 0 K to the lowest possible temperature.

Link to Video

Units of Temperature: https://youtu.be/DTPo0HDMz3o

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1.7 Converting Between Units (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Dimensional analysis: Units can be multiplied, divided, and canceled just like an algebraic quantity. A conversion factor is a fractional quantity used to convert one unit to another.

Link to Video

Converting Between Units: https://youtu.be/wSaOh48k8Wg

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1.8 Significant Figures (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video defines Significant figures (SF's) and discusses how to find the number of SF's in a number or after a calculation. Rules for rounding and scientific notation is also discussed.

Link to Video

Significant Figures: https://youtu.be/E-OAkZglfO8

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CHAPTER OVERVIEW

10: Electron Configuration of Atoms

Thumbnail: Electron shell diagram for Sodium, the 19th element in the periodic table of elements. (CC BY-SA; 2.5; Pumbaa)

10.1 Electron Configuration of Atoms (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The electron configuration of an atom represents all of the orbital subshells in it that contains electrons. The quantum number n refers to rows in the periodic table. The quantum number l refers to columns in the periodic table. Remember that the n numbering begins with 1 for s, 2 for p 3 for d blocks, and 4 for f. The number of electrons contained in a subshell are shown using a superscript. 3d6 means that there are 6 electrons in the 3d subshell.

Link to Video

Electron Configuration of Atoms: https://youtu.be/LlY-O3-bfnk

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10.2 Definition of Valence Electrons (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

For a main group atoms, the s & p electrons past the noble gas core are called the valence electrons. Valence electrons are important in forming bonds and ions. How many valence electrons does C and S have? C = $[He]2s^{2}2p2$ C has 4 valence electrons. S = $[Ne]3s^{2}3p^{4}$ S has 6 valence electrons.

Link to Video

Definition of Valence Electrons: https://youtu.be/_ldxOYwM2VM

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10.3 Electron Configuration of Transition Metals (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Because of the relative energy levels atoms with $3d^4$ and $3d^9$ will steal an s electron to become $3d^5$ and $3d^{10}$ respectively. This is to gain a ½ filled or whole filled d subshell. This means that the electron configuration of Cr is $[Ar]4s^13d^5$ and not $[Ar]\,4s^23d^4$. Also, the electron configuration of Cu is $[Ar]4s^13d^{10}$ and not $[Ar]\,4s^23d^9$.

Link to Video

Electron Configuration of Transition Metals: https://youtu.be/HzpfE0fk_E0

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10.4 Writing Quantum Number from Electron Configurations (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When writing quantum numbers for electrons in a specific subshell it is important to remember that the values of n and l are given in the orbital designation. Ml can be found be drawing the individual orbitals in a subshell and inserting electrons. Ms is still either +1/2 or -1/2 but remember their assignment follows Hund's rule and the Pauli exclusion principal.

Link to Video

Writing Quantum Number from Electron Configurations: https://youtu.be/SoUhs2_YnKU

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10.5 Determining Magnetic Properties from Orbital Diagrams (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Electron spins determine the magnetic properties of an atom. Diamagnetic atom or ion: All the electrons are paired and the individual magnetic effects cancel out. Is only true for atoms whose electron configuration contains completely filled subshells. Paramagnetic atom or ion: Has one or more unpaired electrons. The material is attracted to a magnetic field. Contains unfilled subshells.

Link to Video

Determining Magnetic Properties from Orbital Diagrams: https://youtu.be/lun_w5VKD8k

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10.6 Electron Configurations of Anions (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

In most cases, anions are formed when atoms gain electrons giving them an electron configuration like a noble gas.

Link to Video

Electron Configurations of Anions: https://youtu.be/Eg6ZwdNCQrM

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10.7 Electron Configurations of Cations

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Electrons are generally removed from main group elements to give a noble gas Electron configuration. Remember to remove electrons from the subshell on the right.

Link to Video

Electron Configurations of Cations: https://youtu.be/Y--6wNGD5Hk

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10.8 Understanding Core Electrons (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The noble gas notation represents many core electrons which are not being shown. It is important to be able able to consider these electrons.

Link to Video

Understanding Core Electrons: https://youtu.be/kTqjfMf9B90

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CHAPTER OVERVIEW

11: The Periodicity of Atomic Properties

11.1 Zeff and Electron Shielding (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

As the n value of the subshell of the electron increases the distance between the nucleus and the electron also increases. This means that the as n increases the interaction between the proton and electrons decreases. Electrons in orbitals closer to the nucleus shield the nucleus from electrons further away. The effective nuclear charge, Zeff, that an electron feels depends on the actual nuclear charge, Z, and the screening ability of other electrons in the atom. This video helps to define the periodic tend of Zeff.

Link to Video

Z_{eff} and Electron Shielding: https://youtu.be/uRXqGwgWPyI

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11.2 Atomic Radius (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Atomic Radius is half the distance between neighboring atoms. A covalent radius is one half the distance between the nuclei of two atoms joined by a single covalent bond. An ionic radius is based on the distance between the nuclei of ions joined by an ionic bond in a crystalline solid. As Zeff increases the atomic radius of an atom decreases because of the increased interaction between the nucleus and the outermost electrons.

Atomic radius decreases going across the periodic table to the right.

Why? Nuclear charge increases. Electrons with the same n value do not effectively shield each other so overall Zeff increases.

Atomic radius increases going down a group because the as higher n values increases the distance between the nucleus and the outermost electrons also increase.

Link to Video

Atomic Radius: https://youtu.be/ZYKB8SNrGVY

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11.3 Ionization Energy (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The ionization energy is the energy needed to remove an electron from an atom in the gas phase. T he first ionization energy, I1, is the energy required to remove an electron from a neutral atom in its ground state. The second ionization energy, I2, is the energy needed to strip an electron from a gaseous ion with a charge of 1+. It is possible keep removing electrons to produce a third, fourth ect. Ionization energies. Each succeeding ionization requires more energy. For the second ionization you are removing a negatively charged e- from a positive charge. In general, as Zeff increases there is stronger interaction between the nucleus and the electrons. This means as Zeff increases the ionization energy also increases.

Link to Video

Ionization Energy: https://youtu.be/k7j-u02ifzo

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11.5 General Trends of the Elements (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Metals tend to have low ionization energies and low electron affinities = Tendency to form cations.

Nonmetals have high ionization energy and high electron affinity = tendency to form anions.
Noble Gases have high ionization energy and low electron affinity = unreactive

Link to Video

General Trends of the Elements: https://youtu.be/Fm7huNVSSw0

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11.4 Electron Affinity (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Is the energy released (-sign) or absorbed (+sign) when an electron is attached to a gas-phase atom to form an anion. Atoms with large negative EA are said to have high electron affinities. This means they tend to gain electrons easily. If the sign on EA is positive, energy must be supplied to attach the electron. Metals prefer to give up electrons so they have a positive electron affinity. Atoms with large positive EA are said to have low electron affinities. This means they tend to resist gaining electrons.

Link to Video

Electron Affinity: https://youtu.be/M5MsRM2Xtds

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CHAPTER OVERVIEW

12: Lewis Structures and Bonding

12.10 Bond Lengths (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Expanded Valence shells: Element in groups 13-18 with n greater than 2 can have up to 12 electrons in their valence because the presence d subshells. Lewis symbols of an expanded valence element can be written by using LPE like two unpaired electrons. If one electron is used then the other must be used.

Link to Video

Bond Lengths: https://youtu.be/9xn04FNkq9I

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12.11 Bond Energies (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Bond-dissociation energy, D, is the energy required to break a mole of covalent bonds in a gaseous species. Bond strength increases with increasing ΔEN in a series of related molecules.
Bond strength increases with bond order for bonds between the same 2 atoms.

Link to Video

Bond Energies: https://youtu.be/Prc6fbLXi5M

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12.12 Estimating Enthalpy of Reaction from Bond Energies (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The enthapy of a reaction can be estimated by look at the bonds broken and formed during a reaction. This follows the equation: Hrxn = SumDH’s(bonds broken) -SumDH’s(bonds formed). The reaction is exothermic because the bond formed are stronger than the bonds broken.

Link to Video

Estimating Enthalpy of Reaction from Bond Energies: https://youtu.be/SsuIRTeR0Jw

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12.13 Shapes of Molecules (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The shapes of molecules can be estimated using Valence-Shell Electron-Pair Repulsion (VSEPR) Theory. Electron groups repel each other and assume orientations about an atom to minimize repulsions. Electron groups can be either bonds or lone pair electrons (LPE). Covalent bonds and LPE on a central atom are as far apart as possible to minimize electron-electron repulsion. Electron-electron repulsions determine molecular geometry. Bond angles, the angles between adjacent atoms.

Link to Video

Shapes of Molecules: https://youtu.be/FUuI83PPua8

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12.14 Sample Molecular Shape Problems (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The video shows multiple examples were a Lewis structure is used to estimate the molecular geometry of a molecule using VSEPR theory.

Link to Video

Sample Molecular Shape Problems: https://youtu.be/Gnd1hFCh8tA

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12.1 Electronegativity (Video)

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Video Topics

Electronegativity (EN): A measure of an atom's ability to compete for electrons with other atoms to which it is bonded. Electronegativity depends on an atom's ability to attract electrons (related to EA) and the ability of an atom to hold onto electrons (related to IE). EN follows the same trends as IE and EA in that it increases as we travel to the right and up on the periodic table. An important exception to this trend is that noble gases have relatively low electronegativity.

Link to Video

Electronegativity: https://youtu.be/3Pe0iShCdhM

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12.2 Types of Bonds (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

There are three main types of bonds: Ionic Bond: A purely ionic bond is the attraction between a cation and an anion. Electrons are completely transferred from one species to another. Ionic bonds form only when one reactant loses an electron readily (low IE, metal) and the other reactant gains an electron readily (high EA, nonmetal). The electronegativities of the bonded atoms are very different. Covalent Bond: In a purely covalent bond electrons are shared equally by two atoms. (Ex. H2, Cl2) The electronegativities of the bonded atoms are very similar. A0-B0 each atom is neutral compared each other. Polar Covalent Bond: Electrons are shared but not equally between two atoms. In this case the electrons in the bond are closer to the more electronegative element.

Link to Video

Types of Bonds: https://youtu.be/ovekQEs-KCg

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12.3 Lewis Theory of Bonding (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Gilbert Lewis in the period 1916-1919 put forth a proposal about chemical bonding. He believed that atoms bond to each other to obtain electron configurations similar to noble gases. The fundamental ideas of Lewis's theory are: 1) Valence electrons play a fundamental role in bonding.
2) Sometimes electrons are transferred to form an ionic bond. 3) Sometimes electrons are shared to form covalent bonds. 4) Electrons are transferred such that each atom acquires a stable electron configuration. This usually is a noble gas configuration on with eight electrons also called an octet.
Lewis structure: A combination of Lewis symbols that represent the transfer or sharing of electrons.

Link to Video

Lewis Theory of Bonding: https://youtu.be/TZ6C5_k-SPs

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12.4 Lewis Structures of Ionic Compounds (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Lewis Structures of Ionic Compounds (Metal to Nonmetal) can be represented by first drawing the Lewis symbol for each element. The show the movement of electrons to form full electron subshells. Losing an electron creates a positive charge while gaining an electron creates a negative charge. The cations and anions form ionic bonds. In an ionic compound the elements should have have an electron configuration similar to a noble gas.

Link to Video

Lewis Structures of Ionic Compounds: https://youtu.be/oJ9975tmjc0

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12.5 Lewis Structure of Molecules (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Molecular compounds contain covalent bonds in which two atoms share one or more pairs of electron (Nonmetal to Nonmetal). Each atom in a Lewis structure requires eight valence electrons. Lone pair electrons: An electron pair not involved in bonding. First, draw the Lewis symbol of each element. Then connect unpaired electrons to form bonds. Each unpaired electron in a Lewis symbol should form a bond. There should be no unpaired electrons remaining when you finish.

Link to Video

Lewis Structure of Molecules: https://youtu.be/xWiFCqA9Ur0

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12.6 General Rules for Writing Lewis Structures (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

A Central Atom is bonded to two or more other atoms. A Terminal Atom is bonded to only one other atom. H atoms are always terminal Central atoms generally have the lowest EN of the given elements. Structures tend to be compact. Try to have one central atom with all the other elements attached to it. Try to avoid rings.

Link to Video

General Rules for Writing Lewis Structures: https://youtu.be/S4niJRA6vj4

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12.7 Lewis Structure of Charged Molecules (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The sum of the FC of atoms must equal the charge of the overall molecule.
A Negative FC is usually on the most EN element. A Positive FC is usually on the least EN element. Sometimes the central atom contains the charge. The Lewis structure of a charged species can be found by either adding or removing electrons from the initial Lewis symbols.

Link to Video

Lewis Structure of Charged Molecules: https://youtu.be/pTkziPtvMYU

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12.8 Resonance Structures (Video)

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Video Topics

Resonance: A molecule has more than one valid Lewis structure. None of the structures is truly correct. The true structure is called a resonance hybrid. It a combination of all three structures. The bonds are a mixture of single and double bonds. The two negative charges are spread equally over the three oxygens. Resonance structures arise whenever there is a question about which of two or three atoms contribute a multiple bond to achieve an octet of electrons about a central atom. Note! Resonance structures differ only in the assignment of electron pair position, never atom positions.

Link to Video

Resonance Structures: https://youtu.be/aSP0D72MKe4

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12.9 Expanded Valence Shell Bonding (Video)

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Video Topics

Expanded Valence shells: Element in groups 13-18 with n greater than 2 can have up to 12 electrons in their valence because the presence d subshells. Lewis symbols of an expanded valence element can be written by using LPE like two unpaired electrons. If one electron is used then the other must be used.

Link to Video

Expanded Valence Shell Bonding: https://youtu.be/Y4fBdOJBSHI

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CHAPTER OVERVIEW

13: Hybrid and Molecular Orbitals

13.1.1 Valence Bond Method And sp3 Hybridization (Video)

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Video Topics

Valence Bond Method: Describes covalent bonding in terms of atomic orbitals. Covalent bonds forms when the orbitals of two atoms overlap and are occupied by a pair of electrons.The shapes of the orbitals come from the wave functions discussed in quantum numbers. Hybridization: The reforming of atomic orbitals into hybrid orbitals. Hybridization results in greater orbital overlap and stronger bonds and explains observed molecular shapes. s + 3 p → 4 sp^3 orbitals. The term sp^3 shows that the hybrid orbitals are 25% s and 75 % p.

Link to Video

Valence Bond Method & sp^3 Hybridization: https://youtu.be/2hxKLGWQ5EQ

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13.1.2 sp2 Hybridization (Video)

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Video Topics

sp^2 hybridization: s + px + py + pz → pz + 3 sp^2 hybrid orbitals . Only two of the three hybrid orbitals are used for hybridization. One p orbitals remains. The term sp^2 means the hybrid orbitals are 1/3 s and 2/3 p. Hybrid orbitals from both carbons form the C-C and C-H single bonds. The left over p orbitals overlap to form the double bond.

Link to Video

sp^2 Hybridization: https://youtu.be/EepTvePnfBA

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13.1.3 sp Hybridization (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

sp hybridization: s + px + py + pz → pz + py + 2 sp hybrid orbitals. The hybrid orbitals are 50% s and 50% p. Hybrid orbitals from form single bonds. The left over p orbitals overlap to form the double bond.

Link to Video

sp Hybridization: https://youtu.be/epQXzG9WDRw

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13.1.4 Expanded Octet Hybridization (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Expanded Octet Hybridization: Expanded octet shapes use d orbitals in their hybridization. s + 3 p + 1 d → 5 sp3d hybrid orbitals These hybrid orbitals orientate to form the trigonal bipyramidal shape. s + 3 p + 2 d → 6 sp3d2 hybrid orbitals. These hybrid orbitals orientate to form the octahedral shape

Link to Video

Expanded Octet Hybridization: https://youtu.be/1WpxXcKl_Io

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13.1.5 Determining the Hybridization of an Atom (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The hybridization of an atom in a molecule is determined by counting the number of electron group around it. Remember a single, double, or triple bond are all counted as one electron group. A set of lone pair electrons is also counted as one electron group. Remember we counted electron groups for VSEPR so hybridization is related to molecular geometry.

Link to Video

Determining the Hybridization of an Atom: https://youtu.be/1Zw2avbLw7Q

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13.2.1 Sigma and Pi Bonds (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Two types of covalent bonds: sigma-bonds and pi-bonds. A single covalent bond is a sigma bond. Sigma bonds are commonly formed by the overlap of hybrid orbitals. A double covalent bond is a sigma and a pi bond. Pi bonds are always made by the overlap of unhybridized p orbitals. A triple covalent bond is a sigma bond plus two pi bonds.

Link to Video

Sigma (s) and Pi (p) Bonds: https://youtu.be/VZxqI7ai38k

13.2.2 Determining Orbital Overlap for Covalent Bonding (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Sigma bonds form from the overlap of a hybrid orbital from an atom and either a s orbital from a hydrogen atom or a hybrid orbital from another atom. Pi bonds form from the side to side overlap of a p orbital from each atom. Lone pair electrons are contained in hybrid orbitals

Link to Video

Determining Orbital Overlap for Covalent Bonding: https://youtu.be/P6PExjfuBcs

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13.3.1 Molecular Orbital Theory (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Molecular Orbital Theory: When two atoms approach each other to form a bond their individual atomic orbitals combine to form molecular orbitals (MO’s). MO's are still determined by wave functions. Molecular orbitals can hold 2 e- and the electron spin must be opposite. In H2, when the 2 s orbitals approach each other the waves have constructive interference (Addition) to form a bonding molecular orbital-□1s. The sigma1s MO is lower in energy than the 1s orbital. The s orbitals can also have destructive interference (Subtraction) to form an antibonding molecular orbital sigma1s*. Sigma1s* is higher in energy than the 1s orbital. The number of MO formed is equal to the number of atomic orbitals combined. MO’s are filled following Hund’s rule and the Pauli Exclusion Principle just like orbital diagrams.

Link to Video

Molecular Orbital Theory: https://youtu.be/XgtOG0ezw78

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13.3.2 Molecular Orbital Bonding for Second Row Elements (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Second row elements: MO's created with p atomic orbitals are more complex. Each element has a 2s and 3 2p atomic orbitals in their valence. 6 p atomic orbitals combine to create 6 molecular orbitals. The p orbitals form both sigma & pi molecular orbitals. The energy level for sigma 2p & pi 2p are very similar and can change position depending on the Z values of the atoms involved.

Link to Video

Molecular Orbital Bonding for Second Row Elements: https://youtu.be/A_5Xa3sK_YE

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CHAPTER OVERVIEW

14: Intermolecular Forces and Phase Changes

14.1 The Thermodynamics of Phase Changes (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The amount to heat required to cause a substance to change temperature follows the equation: q = mCdT. Where q is the heat change in J. m is the mass of the substance in grams. dT is the change in temperature (TF - TI) in oC. C is the specific heat of the substance in J/goC/. Some heat changes do not involve a temperature change (isothermal). These changes involve a change of state in a substance. Heat of reaction (qrxn): The quantity of heat exchanged between a system and its surroundings when a chemical reaction occurs. Enthalpy of reaction (dH) in J/mol. The amount of heat absorbed or given off per mole of reactant Exothermic: dH is negative, qrxn is negative, and the reaction gives off heat to the surroundings. Endothermic: dH is positive, qrxn is positive, and the reaction absorbs heat from the surrounding. Melting point: Conversion of solids into liquids: Endothermic = dHofusion Freezing point : Conversion of liquids into solids: Exothermic = -dHofusion Sublimation: Conversion of solids into gases: Endothermic = dHosub Deposition: Conversion of gases into solids: Exothermic = -dHosub Boiling point : Conversion of liquids into gases: Endothermic = dHovap Condensation: Conversion of gases into liquids: Exothermic = -dHovap

Link to Video

The Thermodynamics of Phase Changes: https://youtu.be/Uf2mAuP1BZY

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14.2.1 Ionic Intermolecular Force (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Ionic IMF: Electrostatic attractions between cations and anions in an ionic compound. A metal bonded to a non-metal. In some cases we can compare the relative strength of ionic IMF's. Ionic IMF's increase as the charge on the ions increase. The attraction between a positive charge and a negative charge increases as they come closer together. Ionic IMF's increase as the ionic radii for the ions decreases. Ionic radius increases as we go to the left and down on the periodic table. So, the ionic IMF of an atom tends to increase as we go up and to the right on the periodic table.

Link to Video

Ionic Intermolecular Force: https://youtu.be/Tsb19TGGwdA

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14.2.2 Dipole Intermolecular Force (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Bond dipole moment. Electronegativity (EN) is a measure of an atoms ability to hold the electrons in a bond. EN increases as we go up and to the right other periodic table. The electron pair in a polar covalent bond is not shared equally. EN 0. If A is more EN than B then A^{δ}--B^{δ}+. A molecule’s dipole moment is approximately the vector sum of its bond dipole moments. A nonpolar molecule can have polar bonds oriented so that the vector sum of the bond dipole moments is 0. Polar molecules have a stronger intermolecular force than non-polar molecules because of the charge separation.

Link to Video

Dipole Intermolecular Force: https://youtu.be/ACq_95SIBck

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14.2.3 Hydrogen Bonding Intermolecular Force (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Hydrogen Bonding: A special case of dipole interaction. The molecule must contain an O-H, N-H, or F-H bond. A hydrogen bond is formed when an H atom bonded to one highly EN atom is simultaneously attracted to a highly EN atom in a neighboring molecule. $^{\delta}$+H-F$^{\delta}$- $^{\delta}$+HF$^{\delta}$- $^{\delta}$+H-F$^{\delta}$-

Link to Video

Hydrogen Bonding Intermolecular Force: https://youtu.be/92rbjSpHbr0

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14.2.4 Dispersion Intermolecular Force (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Even non-polar molecules have some kind of intermolecular force. Non-polar molecules are surrounded by an electron cloud. There is a slight probability that the cloud will shift to one side creating a momentary dipole in the molecule. This allows the molecules to have a slight intermolecular force called dispersion. Because the electron cloud becomes larger as the molecular weight of a molecule increases, so do the dispersion forces. Molecular Weight ↑ Dispersion Forces ↑

Link to Video

Dispersion Intermolecular Force: https://youtu.be/RCRTcIEQ-Hk

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14.2.5 Determining the Strongest Intermolecular Force for a Molecule (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses the step needed to determine the strongest intermolecular force in a compound.

What is the strongest IMF that a molecule has? Is the molecule ionic? Metal-Nonmetal es = ionic IMF Does the molecule contain an H-F, H-N, or H-O bond? Yes = H-bonding Is the molecule Polar? Yes = Dipole Otherwise dispersion forces

Link to Video

Determining the Strongest Intermolecular Force for a Molecule: https://youtu.be/yFGLmoR6GIs

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14.2 Intermolecular Forces (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Liquids and solids are held by cohesive forces between molecules. These forces are called intermolecular forces (IMF's). IMF's affect the physical properties of a compound. Solids are greater than Liquids are greater than Gases. As the IMF's increase the boiling point and melting point of a compound tend to increase. There are four main types of IMF's: Ionic, H-bonding, dipole, and dispersion

Link to Video

Intermolecular Forces: https://youtu.be/nDUqGjcqQME

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4.4 Balancing Complex Chemical Equations

4.4 Balancing Complex Chemical Equations: https://youtu.be/7Jzb9XAHOJw

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14.3.1 Surface Tension, Viscosity, and Melting Point (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Surface tension: A molecules in the interior of a liquid have more IMF interactions than molecules on the surface of a liquid. Molecules in the interior of a liquid are more stable than those on the surface. Surface tension is created because molecules on the surface would rather be in the interior. IMF ↑ Surface Tension ↑. Viscosity: Intermolecular forces create internal friction in a liquid. IMF ↑ Viscosity ↑. As the intermolecular forces of a liquid increases the viscosity tends to increase. IMF ↑ Melting Point ↑.

Link to Video

Surface Tension, Viscosity, & Melting Point: https://youtu.be/OgKDGrdTRRM

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14.3.2 Vapor Pressure and Boiling Point (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Vapor Pressure: The pressure exerted by a vapor in dynamic equilibrium with its liquid. At room temperature some of the molecules of a liquid will have enough energy to enter a gaseous state. This represents the process of evaporation. If the liquid is not in a container, eventually all of liquid molecules will enter a gaseous state. If the liquid is in a container, eventually a point will be reached where the gaseous molecules start to condense back to the liquid state. High vapor pressure at room temperature: Volatile Low vapor pressure at room temperature: Nonvolatile As the intermolecular forces of a liquid increase, the vapor pressure tends to decrease. IMF ↑ Vapor Pressure ↓ Boiling point: When the vapor pressure greater than the applied pressure. As the vapor pressure of a liquid decreases the boiling point tends to increase. Vapor Pressure ↓ Boiling Point ↑ As the intermolecular forces of a liquid increases the boiling point tends to increase. IMF ↑ Boiling Point ↑

Link to Video

Vapor Pressure & Boiling Point: https://youtu.be/4QtcdpfRO1M

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14.4 The Clausius-Clapeyron Equation (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

As the temperature of a liquid increases the vapor pressure also increases. This relationship is shown by the Clausius-Clapeyron Equation. This equation allows for a vapor pressure of a liquid to be calculated at a new temperature. Ln(P2/P1) = -dHovap/R(1/T2 – 1/T1) Temperatures are in Kelvin. R is the gas law constant 8.3145 J/Mol K. dHovap is the heat of vaporization of the liquid in J/Mol. The units for dHovap must be in J to match the units in R. P is the vapor pressure of the liquid. P can be in any unit of pressure.

Link to Video

Determining the Products for Precipitation Reactions: https://youtu.be/r0kYeZVuTAM

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4.11 Determining the Net Ionic Equation for a Precipitation Reaction

4.11 Determining the Net Ionic Equation for a Precipitation Reaction: https://youtu.be/AMJz1Sdz8IA

14.5 Phase Diagrams (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Major Phases = Solid, Liquid and Gas. A phase diagram is a graphical representation of the different phases of a substance which exist at different temperatures and pressures. Temperature is on the x axis and pressure is on the y axis of the graph. The different regions of the diagram correspond to the different phases. Low pressure and High temperature = Gas High pressure and Low temperature = Solid High pressure and High temperature = Liquid The lines in a phase diagram correspond to the different phase changes. These are called the Sublimation, Fusion, and Vaporization lines. Supercritical Fluid: An ambiguous phase with properties of liquids and gases. The critical point is at the end of the vaporization line. Triple point: The convergence of the sublimation, fusion, and vaporization lines. All three phases exist at the same time under at a specific triple point pressure (P¬TP) and triple point temperature (TTP). Normal Boiling Point: The temperature at which the Liquid/Gas phase transition occurs at 1 atm. Normal Freezing Point: The temperature at which the Solid/Liquid phase transition occurs at 1 atm. Normal Sublimation Point: The temperature at which the Solid/Gas phase transition occurs at 1 atm.

Link to Video

Phase Diagrams: https://youtu.be/op1v7PaMsmU

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CHAPTER OVERVIEW

16: Chemical Kinetics

16.10 Zero-Order Reactions (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The zero order rate law expression is: $[A]_t = -kt + [A]_0$
t = time in seconds
$[A]_0$ = initial concentration of A
$[A]_t$ = concentration of A at time t

This video contains the solution to the following question:

For a zero order reaction. If the initial $[N_2O_2]$ is 0.10 M what would be the final $[N_2O_2]$ after 160 seconds?

Link to Video

Zero-Order Reactions: https://youtu.be/64i7uYsVsSs

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16.11.1 Reaction Mechanism (Slow step followed by fast step) (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to determine the rate law expression from elementary processes when the Reaction Mechanism is made up of a slow step followed by fast step.

Link to Video

Reaction Mechanism (Slow step followed by fast step): https://youtu.be/L3Q7JiTvE00

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16.11.2 Reaction mechanism (Fast reversible first step followed by a slow step) (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to determine the rate law expression from a reaction mechanism made up of a fast reversible step followed by a slow step.

Link to Video

Reaction mechanism (Fast reversible first step followed by a slow step): https://youtu.be/wlkmYC3tQvQ

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16.11 Elementary Processes (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Why do rate laws not follow stoichiometry? Because reactions often proceed by a series of simple steps called elementary processes. Reaction mechanism: The sequence of simple steps (elementary processes) by which an overall reaction occurs. For an elementary process the rate law is given by the stoichiometry.

Link to Video

Elementary Processes: https://youtu.be/tzC7a4oxdgg

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16.12 Transition State Theory (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Why do some reactions proceed faster than others? Between the reactants and the products lies a transition state. The species in the transition state is called an activated complex. The activated complex is a mixture of the reactant and the product. The activated complex is unstable and requires the input of energy to create. This energy is called the energy of activation (E_a) and typically has the units of kJ/mol. E_a represents an energy barrier that must be overcome. The relative ease of formation of the activated complex determines the rate law constant (k) for a reaction.

Link to Video

Transition State Theory: https://youtu.be/xmWDhq89b38

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16.13 Collision Theory of Kinetics (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

For a bimolecular reaction Rate is related to:
1) Probability collisions occur with E is greater than Ea
2) #collisions/unit time

3) Probability collisions occur with proper order

This video discusses how these concepts are combined to produce a rate law expression.

Link to Video

Collision Theory of Kinetics: https://youtu.be/k4_5hB9nvH4

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16.14 The Arrhenius Equation (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

From collision theory we get: Rate = CPe^{-Ea}/RT[A][BC]
These relations are summarized by The Arrhenius Equation k = Ae^{-Ea}/RT
The Arrhenius Equation shows that k changes with Ea and T
To look at how k changes with temperature use the integrated form of the Arrhenius equation.
Ln(k2/k1) = (Ea/R)(1/T1 - 1/T2)

This video contains the solution to the followed problem:

If k = 2.15 x 10-8 1/M·s at 650 K and the activation energy is 182 kJ/mol what would be k at 700 K?

Link to Video

The Arrhenius Equation: https://youtu.be/qu3x0z8sqjw

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16.15 Catalysts (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

A catalyst provides an alternative reaction pathway of lower activation energy.

This means E_a decreases so k increases and the rate increases.

Link to Video

Catalysts: https://youtu.be/E7IzSXUCQq0

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16.16 Graphing Using the Arrhenius Equation (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Taking the logarithm of both sides of the Arrhenius Equation produces the linear form.
k = Ae-Ea/RT
ln(k) = -Ea/RT + ln(A)
y = ln(k)
m = Slope = -Ea/R
x = 1/T
b = ln(A)

Running a series of experiments where a reaction’s k values are determined at a series of different temperatures provides a means of experimentally determining Ea and A for the reaction.
Graphing ln(k) vs. 1/T provides a graph with a negative slope. In this graph the y-intercept is equal to ln A and the slope is equal to (-Ea/R)
Thus, the E_a of the reaction is: $E_a = –(\text{slope})(R)$

This video contains a set of data points which can be graphed to determine Ea and A for a sample reaction.

Link to Video

Graphing Using the Arrhenius Equation: https://youtu.be/xA_4YE3s0Ac

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16.16 Graphing Using the Arrhenius Equation (Video) is shared under a not declared license and was authored, remixed, and/or curated by LibreTexts.

16.1 Introduction to Chemical Reaction Kinetics (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The area of chemistry that is concerned with the speeds, or rates, of reaction is called kinetics.
Thermodynamic tells us about spontaneity of reaction. Will the reaction go?
But thermodynamics tells us nothing about how quickly a reaction will proceed to equilibrium.
Reaction Rates: The rate of a chemical reaction is related to the rate at which product is produced or a reactant is used up.
Rate = [Product produced] / unit time
Reactions rates usually have the units M/s but can be other units that represent amount/time such as g/min or mol/hr.

Link to Video

Introduction to Chemical Reaction Kinetics: https://youtu.be/uNAXYYQRYhU

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16.2 Average Reaction Rates (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Because the rate changes as the reaction proceeds what we are actually calculating is the average rate for the given time period.
Rate of appearance of product = ▯ [P]t2 - [P]t1/ t2 - t1
Rate of disappearance of reactant = [R]t2 - [R]t1/ t2 - t1
The rate of reaction is independent of stoichiometry.
Average rates cannot be used to find concentrations at a different time.
Average rates can be used to find information about other species in the reaction at the given time. Stoichiometry from the reaction is key.

Link to Video

Average Reaction Rates: https://youtu.be/jc6jntB7GHk

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16.3 Instantaneous Rates (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The instantaneous rate of a reaction is the reaction rate at any given point in time.
Rate of reaction is = - 1/r d[R]/dt
An instantaneous rate is defined as the negative slope of the line on this graph. As the period of time used to calculate an average rate of a reaction becomes shorter and shorter, the average rate approaches the instantaneous rate.

Link to Video

Instantaneous Rates: https://youtu.be/GGOdoIzxvAo

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16.4 Initial Rates and Rate Law Expressions (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

For the reaction A + B - C: Rate of reaction = k[A]m[B]n m & n are independent of the reaction equation. The reaction order must be found experimentally. They cannot be found from reaction stoichiometry. m and n are found using a series of experiments where the concentrations of reactants are changed and the initial reaction rates are measures. This videos contains an example problem where m & n are found for a reaction.

Link to Video

Initial Rates and Rate Law Expressions: https://youtu.be/VZl5dipsCEQ

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16.5.1 Example Using the First-Order Integrated Rate Law Equation (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains the solution to the following question: If k for the decomposition of $(CH_2)_2O$ is 2.05 x 10^{-4} 1/s and the initial concentration is 0.050 M how long would it take for the concentration to drop to 0.010 M?

Link to Video

Example Using the First-Order Integrated Rate Law Equation: https://youtu.be/fLY6MtNl9-g

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16.5 The First-Order Integrated Rate Law Equation (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

First-order integrated rate law equation: Ln[A](t) = -kt + Ln[A](0)
Has line form y = mx + b
Where slope = -k
Typically we use a variation of the first-order integrated rate law equation for calculations.
ln {[A]t/[A]0} = -kt
Allows us to find k in lab

Link to Video

The First-Order Integrated Rate Law Equation: https://youtu.be/_JskhfxBAMI

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16.6 Half-life for First-Order Reactions (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Half-life is the time required for one-half of a reactant to be consumed. When $t = t_{1/2}$, $[A]t = 1/2[A]0$
We can find $t_{1/2}$ for the 1^{st} order rate expression
$\ln\{[A]t/[A]0\} = -kt$
$\ln(1/2) = -kt_{1/2}$
$-0.693 = -kt_{1/2}$
$t_{1/2} = 0.693/k$
This means that $t_{1/2}$ and k are related and $t_{1/2}$ does not depend on $[A]_0$

Link to Video

Half-life for First-Order Reactions: https://youtu.be/mBMOq0305W0

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16.7 Rate of Radioactive Decay (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

For radioactive decay the rate constant k is called the decay constant. All living things are in equilibrium with ^{14}C in the atmosphere. When something dies it stops absorbing ^{14}C and the present ^{14}C starts to undergo beta decay. The half-life ^{14}C decay is 5.73 x 10^3 years. Rate of radioactive decay is measured in disintegrations per minute per gram (d/min•g). In living things ^{14}C activity is measured to be 14 (d/min•g). This video contains an example problem where carbon dating is used to predict the age of an item.

Link to Video

Rate of Radioactive Decay: https://youtu.be/YSKtRMQN5qg

Attribution

- Prof. Steven Farmer (Sonoma State University)

16.8 Second-Order Integrated Rate Law Equation (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The second order integrated rate law equation is: 1/[A]t = kt + 1/[A]0
It has form y = mx + b where slope = k. This video contains the solution to the following problem:

If k for the HI reaction is 0.50 1/M·s and the initial concentration of HI is 0.010 M what will be the concentration of HI after 198 s?

Link to Video

Second-Order Integrated Rate Law Equation: https://youtu.be/hMSgk2Rm2xA

Attribution

- Prof. Steven Farmer (Sonoma State University)

16.9 Half-life for Second-Order Reactions (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The second order half-life equation is: $t_{1/2}$ = 1/k[A]0. This means that $t_{1/2}$ is dependent on the initial concentration of reactant.

This videos contains the solution to the following questions; What is $t_{1/2}$ for the HI reaction if $[HI]_0$ = 0.10 M?

Link to Video

Half-life for Second-Order Reactions: https://youtu.be/h2CjY-Fi7RI

Attribution

- Prof. Steven Farmer (Sonoma State University)

CHAPTER OVERVIEW

19: Buffers and Titrations

Thumbnail: (CC BY-SA-NC; Anonymous by request)

19.10 How to Make a Buffer of a Specific pH (Video)

19.10 How to Make a Buffer of a Specific pH: https://youtu.be/KGT6-nv9peg

19.1 The Common Ion Effect (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Adding the salt of the conjugate base to a solution of a weak acid decreases the $\{H_3O^+\}$. The video contains a sample problem where the pH of a weak acid is calculated with and without the presence of its conjugate base.

Link to Video

The Common Ion Effect: https://youtu.be/I_o84fAFRyA

Attribution

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19.2 Determining pH in Buffer Solutions (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

In a buffer solution, the pH values change very slightly with the addition of an acid or a base.

Buffers are used to control the pH of a solution.

This video discusses how Le Chatlier's principal allows a buffer to uses use up any H_3O^+ or ^{-}OH added to only provide a slight change to the pH.

Link to Video

Determining pH in Buffer Solutions: https://youtu.be/7nlARohUP9s

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19.3 Using the Henderson Hasselbalch Equation (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When trying to make a buffer of a specific pH or when looking at the change of pH during the addition of H_3O^+ or ^-OH to a buffer solution use the Henderson Hasselbalch equation.

$pH = pK_a + \text{Log}\ [\{CB\}/\{A\}]$

A = Acid

CB = Conjugate Base

This video contains examples where the Henderson Hasselbalch equation is used to calculate the pH of a buffer solution.

Link to Video

Using the Henderson Hasselbalch Equation: https://youtu.be/kGQDtZfletg

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19.3 Using the Henderson Hasselbalch Equation (Video) is shared under a not declared license and was authored, remixed, and/or curated by LibreTexts.

19.4 The Buffer Region (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

A buffer is only effective when the pH of the solution is within plus or minus 1 of the pKa of the weak acid.

The weak acid $HC_2H_3O_2$ has: $pK_a = 4.74$. A buffer created using this weak acid would be effective between the pH of 3.74 and 5.74.

For a buffer to work {A} ~ {CB}. This is why a buffer works best when the pH is near the pK_a of the acid.

Link to Video

The Buffer Region: https://youtu.be/s5H_S_vmdlk

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19.5 The Change in pH with the Addition of a Strong Acid to a Buffer (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains the sample problem below were the pH of a buffer is calculated after the addition of a known amount of a strong acid.

Say you have a 1.00 L of an acetic acid / sodium acetate buffer. If the initial {HAc} is 0.700 M and the initial {Ac^-} is 0.600 M.

What would be the pH if 10.0 mL of a 1.0 M HCl solution is added?

Link to Video

The Change in pH with the Addition of a Strong Acid to a Buffer: https://youtu.be/FOrT8GwrzgA

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19.6 The Change in pH with the Addition of a Strong Base to a Buffer (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains the sample problem below were the pH of a buffer is calculated after the addition of a known amount of a strong base.

Say you have a 1.00 L of an acetic acid / sodium acetate buffer.

If the initial {HAc} is 0.700 M and the initial {Ac$^-$} is 0.600 M.

What would be the pH if 10.0 mL of 1.0 M NaOH was added to the buffer?

Link to Video

The Change in pH with the Addition of a Strong Base to a Buffer: https://youtu.be/g772o-SpG18

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19.7.1 Initial pH for a Strong Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video is the first of a series of theoretical calculation for a titration of a strong acid with a strong base.

You start with 50.0 mL of a 0.100 M solution of HCl.

What is the initial pH?

Because HCl is a strong acid we can say:

$\{HCl\} = \{H_3O^+\} = 0.100$ M

So the pH can be found directly

pH = -Log{0.100 M} = **1.00**

Link to Video

Initial pH for a Strong Acid/Strong Base Titration: https://youtu.be/wp3QFchYasM

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19.7.1 Initial pH for a Strong Acid/Strong Base Titration (Video) is shared under a not declared license and was authored, remixed, and/or curated by LibreTexts.

19.7.2 pH after the addition of 10 ml of Strong Base (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example where the pH of a strong acid is calculated after the addition of 10 ml of a strong base

You start with 50.0 mL of a 0.100 M solution of HCl.

Calculate the pH after the addition of 10 mL of a 0.100 M NaOH solution:

Link to Video

pH after the addition of 10 ml of Strong Base: https://youtu.be/_cM1_-kdJ20

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19.7.3 pH Just Before the Equivalence Point in a Strong Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example where the pH just before equivalence point of a strong acid / strong base titration is calculated.

You start with 50.0 mL of a 0.100 M solution of HCl.

Calculate the pH after the addition of 49 mL of a 0.100 M NaOH solution:

Link to Video

pH Just Before the Equivalence Point in a Strong Acid/Strong Base Titration: https://youtu.be/9V1BWr1Yveo

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19.7.4 pH at the Equivalence Point in a Strong Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example where the pH at the equivalence point of a strong acid / strong base titration is calculated.

You start with 50.0 mL of a 0.100 M solution of HCl.

Calculate the pH after the addition of 10 mL of a 0.100 M NaOH solution:

Link to Video

pH at the Equivalence Point in a Strong Acid/Strong Base Titration: https://youtu.be/7POGDA5Ql2M

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19.7.5 pH After the Equivalence Point in a Strong Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example where the pH just after equivalence point of a strong acid / strong base titration is calculated.

You start with 50.0 mL of a 0.100 M solution of HCl.

Calculate the pH after the addition of 51 mL of a 0.100 M NaOH solution:

Link to Video

pH After the Equivalence Point in a Strong Acid/Strong Base Titration: https://youtu.be/DKQEignpxLQ

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19.7.6 Summary of the pH Curve for a Strong Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains the summary of the different parts for a titration of a strong acid with a strong base.

At the start, you can find the initial pH by using:

$\text{pH} = -\text{Log}\{H_3O^+\}$

Before the equivalence point, subtract mol ^-OH added from mol H_3O^+ initial to find # mol H_3O^+ remaining. Then divide by V_{total} to find $\{H_3O^+\}$.

At the equivalence point pH = 7

After the equivalence point, subtract mol H_3O^+ initial from

mol ^-OH added to find # mol ^-OH remaining. Then divide by V_{total} to find $\{^-OH\}$.

Link to Video

Summary of the pH Curve for a Strong Acid/Strong Base Titration: https://youtu.be/hBo5w9uJt-c

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19.7 Introduction to the pH Curve for a Strong Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Titration is the gradual interaction of an acid or base. We will be looking at how the pH of a solution changes during a strong acid / strong base titration.

Important points:

Starting point: Mol of added $^{-}OH = 0$. The pH is completely determined by the molarity of the strong acid.

Before the equivalence point:

Mol of added ^{-}OH < Mol of H_3O^+.

Subtract mol ^{-}OH from Mol H_3O^+ to find the # Mol H_3O^+ remaining.

Divide by the V_{total} to find $\{H_3O^+\}$

Equivalence point: Mol of added ^{-}OH = Mol of H_3O^+.

At the equivalence point of a strong acid / strong base titration the pH = 7.

After the equivalence point:

Mol of added ^{-}OH > Mol of H_3O^+.

Subtract mol H_3O^+ from Mol ^{-}OH to find the # Mol ^{-}OH remaining.

Divide by the V_{total} to find $\{^{-}OH\}$

Link to Video

Introduction to the pH Curve for a Strong Acid/Strong Base Titration: https://youtu.be/kaObZtyKvsw

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19.8.1 pH at the Start of a Weak Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example problem where pH at the start of a weak acid / strong base titration is calculated.

If we have 50. mL of a 0.100 M $HC_2H_3O_2$ solution:

$HC_2H_3O_2$ = HAc

$C_2H_3O_2^-$ = Ac^-

Ka = 1.80×10^{-5}

What is the initial pH?

Link to Video

pH at the Start of a Weak Acid/Strong Base Titration: https://youtu.be/AtdBKfrfJNg

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19.8.2 pH Before the Equivalence Point of a Weak Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example problem where pH at the start of a weak acid / strong base titration is calculated.

If we have 50. mL of a 0.100 M $HC_2H_3O_2$ solution:

$HC_2H_3O_2$ = HAc

$C_2H_3O_2^-$ = Ac^-

Ka = 1.80 x 10^{-5}

What is the initial pH?

Link to Video

pH Before the Equivalence Point of a Weak Acid/Strong Base Titration: https://youtu.be/znpwGCsefXc

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19.8.3 pH at the Halfway Point of a Weak Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example problem where pH at the ½ way point of a weak acid / strong base titration is calculated.

If we have 50. mL of a 0.100 M $HC_2H_3O_2$ solution:

Calculate the pH after the addition of 25 mL of a 0.100 NaOH solution:

$HC_2H_3O_2$ = HAc

$C_2H_3O_2^-$ = Ac^-

Ka = 1.80×10^{-5}

pKa = 4.74

Link to Video

pH at the Halfway Point of a Weak Acid/Strong Base Titration: https://youtu.be/EYCj9TYMB4I

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19.8.4 pH at the Equivalence Point of a Weak Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example problem where pH at the equivalence of a weak acid / strong base titration is calculated.

If we have 50. mL of a 0.100 M $HC_2H_3O_2$ solution:

Calculate the pH after the addition of 50 mL of a 0.100 NaOH solution:

$HC_2H_3O_2$ = HAc

$C_2H_3O_2^-$ = Ac^-

Ka = 1.80×10^{-5}

pKa = 4.74

Link to Video

pH at the Equivalence Point of a Weak Acid/Strong Base Titration: https://youtu.be/RuSr1z6F0To

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19.8.5 pH After the Equivalence Point of a Weak Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example problem where pH after the equivalence of a weak acid / strong base titration is calculated.

If we have 50. mL of a 0.100 M $HC_2H_3O_2$ solution:

Calculate the pH after the addition of 60 mL of a 0.100 NaOH solution:

$HC_2H_3O_2$ = HAc

$C_2H_3O_2^-$ = Ac^-

$Ka = 1.80 \times 10^{-5}$

pKa = 4.74

Link to Video

pH After the Equivalence Point of a Weak Acid/Strong Base Titration: https://youtu.be/KHXPJIsxoLE

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19.8.6 Summary of the pH Curve of a Weak Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The video contains a summary of the important points of Weak Acid / Strong Base Titration Curve

Remember of the mol of strong base added = 0 then the pH is determined by the K_a equilibrium of the weak acid.

If the mol of strong base added < mol of weak acid initial then convert to mols and used the Henderson Hasselbalch equation.

When mol of strong base = mol weak acid you are at the equivalence point. The pH is determined by the concentration of the conjugate base.

If the mol of strong base added > mol of weak acid initial then you are past the equivalence point. The pH is determined by the concentration of the remaining $^{-}$OH.

Link to Video

Summary of the pH Curve of a Weak Acid/Strong Base Titration: https://youtu.be/hY8X727AiG0

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19.8 Introduction to the pH Curve for a Weak Acid/Strong Base Titration (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

We can say for every one mole of ^{-}OH that is added, one mole of weak acid is used and one mole of conjugate base is made.

$$\mathbf{HW + H_2O \Leftrightarrow H_3O^+ + W^-}$$

There are four points on this curve that are especially important

1) The pH before titration begins:

0 mol ^{-}OH has been added. The pH is determined by the K_a equilibrium of the weak acid.

2) The pH at the midpoint of the titration:

Mol ^{-}OH added = ½ mol weak acid initial

Or mol weak acid = mol conjugate base

pH = pK_a of the weak acid.

3) The pH at the equivalence point:

Mol ^{-}OH added = mol weak acid initial

The weak acid has been completely converted to its conjugate base.

The pH is determined by the K_b reaction of the conjugate base.

4) Beyond the equivalence point:

Mol ^{-}OH added > mol weak acid initial

Because the amount of ^{-}OH produced by the K_b reaction is small we can say:

$\{^{-}OH\}$ = mol of unreacted ^{-}OH / V_{total}

Link to Video

Introduction to the pH Curve for a Weak Acid/Strong Base Titration: https://youtu.be/Vs5O-HNYo8g

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19.9 Comparison of Strong Acid/Strong Base and Weak Acid/Strong Base pH Curves (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The video contains a Comparison of Strong Acid/Strong Base and Weak Acid/Strong Base pH Curves

Some Points:

1) The initial pH of a SA/SB titration curve is lower.

2) The buffer region in the WA/SB titration curve is +/- 1 of the pKa for HAc. pKa = 4.74.

3) In the WA/SB titration curve, the pH > 7 at the equivalence point.

4) In a SA/SB titration curve, the pH = 7 at the equivalence point.

5) In both titration curves the pH rises quickly after the equivalence point is reached.

Link to Video

Comparison of Strong Acid/Strong Base and Weak Acid/Strong Base pH Curves: https://youtu.be/AcXqhyKDkiM

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CHAPTER OVERVIEW

2: Atoms, Isotopes, and Mols

2.10 Conversions Between Grams, Mol, and Atoms (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video shows the relation ship between grams, mols, and number of atoms of a given sample of an element. Molar mass and Avogadro's Number are used to convert between these factors.

Link to Video

Conversions Between Grams, Mol, & Atoms: https://youtu.be/rOvErpAnoCg

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2.11 Periodic Law in the Periodic Table (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Periodic Law: When elements are arranged in order of increasing mass, certain sets of properties recur periodically. The periodic table can be broken into different areas including: nonmetals, metals, transition metals, and metalloids. This video also discusses how to determine in which area a given element lies.

Link to Video

Periodic Law in the Periodic Table: https://youtu.be/ciJYvhRF5i4

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2.12 Different Groups in the Periodic Table

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The periodic table is arranged to that elements with similar properties lie in the same column. Many of these groups are given special names. This video discusses the different groups of the periodic table and their predictable characteristics.

Link to Video

Different Groups in the Periodic Table: https://youtu.be/b8mJoOKTfKU

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2.13 Predicting the Charge of Atoms Using the Periodic Table (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Some elements in the periodic table have predictable charges. This video discusses how to determine the charge on these elements.

Link to Video

Predicting the Charge of Atoms Using the Periodic Table: https://youtu.be/pTMTooTI4jQ

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2.1 Fundamental Experiments in Chemistry (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Many concepts in chemistry are based on key experiments. Some of these experiments are discussed in this videos. In particular, Lavoisier's experiments determined the Law of Conservation of Mass which says mass is not gained or lost during a chemistry reaction. Proust's experiments came up with the Law of Definite Proportions which says elements will be in the same proportions in a given compound. J.J. Thomson discovered the electron and determined that it has a negative charge. Rutherford's experiment with gold foil led to the Theory of a Nuclear Atom.

Link to Video

Fundamental Experiments in Chemistry: https://youtu.be/IhqqLGKmah4

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2.2 The Nuclear Atom (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The theory of the nuclear atom can be summarized in a few basic ideas. Protons have a positive charge, neutrons are neutral, and electrons are negatively charged. Protons and neutrons can concentrated in the nucleus and make almost all of mass of the atom.

Link to Video

The Nuclear Atom: https://youtu.be/eqoyZuv1tWA

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2.3 How Elements Are Represented on the Periodic Table (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video give a very short introduction to the meaning of the elemental symbols on the periodic table. Also, this video talks about the relationship between atomic number and the elements.

Link to Video

How Elements Are Represented on the Periodic Table: https://youtu.be/ik6ZsaSyISo

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2.4 Ions of Atoms (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how the number of protons and electrons in an atom can be used to find its formal charge.

Link to Video

Ions of Atoms: https://youtu.be/mh71O8g40Kc

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2.5 Isotopes of Elements (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video defines the chemical concepts of isotopes. Isotopes of an element have different mass numbers.

Link to Video

Isotopes of Elements: https://youtu.be/GhjLKMefo0M

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2.6 Determining the Number of Electrons, Protons, and Neutrons in an Atom

Chapter 2.6 Determining the Number of Electrons, Protons, and Neutrons in an Atom: https://youtu.be/EKEv40XhI24

2.6 Determining the Number of Electrons, Protons, and Neutrons in an Atom (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses the relationship between the atomic symbol and the number of electrons, protons, and neutrons in the atom. The number of electrons, protons, and neutrons in an atom or atomic ion can be determined from its symbol:

Link to Video

Determining the Number of Electrons, Protons, and Neutrons in an Atom: https://youtu.be/EKEv40XhI24

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2.7 Mass Numbers and Atomic Mass of Elements (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Atomic masses in the periodic table are reported in atomic mass units (AMU). This unit is also called a Dalton and can be represented by the symbol u. The atomic masses of the periodic table are all based of the mass of a Carbon-12 atom.

Link to Video

Mass Numbers and Atomic Mass of Elements: https://youtu.be/Bg8yBFSBuqs

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2.8 Finding the Averaged Atomic Weight of an Element (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Averaged Atomic Weight of an element is determined by the number of isotopes of the element and their relative abundance.

Link to Video

Finding the Averaged Atomic Weight of an Element: https://youtu.be/bmP6Gr9zJiQ

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2.9 Determining the Molar Mass of a Molecule (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how the molar masses of elements in the periodic table are determined. The concept of the mol is introduced along with Avogadro's Number.

Link to Video

Determining the Molar Mass of a Molecule: https://youtu.be/wOjQjZqX7l8

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CHAPTER OVERVIEW

20: Solubility Products

20.10 Solubility of Complex Ions (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Complex ions: Another way to dissolve partially soluble salts is by forming a complex.

A complex ion is a polyatomic cation or anion composed of a central metal ion to which other groups called ligands are bonded.

For **$[Fe(CN)_6]^{4-}{}_{(aq)}$**

Fe^{2+} is the central ion and ^{-}CN is the ligand

The equilibrium constant for creating a complex ion is called a formation constant (K_f)

$Fe^{2+}{}_{(aq)} + 6\ {}^{-}CN_{(aq)} \Leftrightarrow [Fe(CN)_6]^{4-}{}_{(aq)}$

$K_f = 1 \times 10^{37}$

Because K_f is very large the equilibrium lies far to the right.

Because the complex ion is charged, it is usually water-soluble.

This video contains examples, which shows how the formation of a complex can cause an insoluble salt to dissolve. Also, the concentration of a metal cation after complexation is calculated.

Link to Video

Solubility of Complex Ions: https://youtu.be/f4pkKDg2XTA

Attribution

- Prof. Steven Farmer (Sonoma State University)

4.11 Determining the Net Ionic Equation for a Precipitation Reaction

4.11 Determining the Net Ionic Equation for a Precipitation Reaction: https://youtu.be/AMJz1Sdz8IA

20.1 Definition of a Solubility Product (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Solubility product: A measure of how soluble an insoluble salt is in water.

Salt is defined as a metal and a non-metal bond together using ionic bonds.

Salts are considered partially soluble salts if they do not disassociate 100% in an aqueous solution.

The equilibrium of an insoluble salt and its ions in a saturated solution is called a solubility product.

For the insoluble salt: $AgBr_{(s)} \Leftrightarrow Ag^{+}_{(aq)} + Br^{-}_{(aq)}$

The equilibrium expression is: $K_{sp} = \{Ag^{+}\}\{Br^{-}\}$

Link to Video

Definition of a Solubility Product: https://youtu.be/VzxSmH_iwHE

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- Prof. Steven Farmer (Sonoma State University)

20.2 Finding the Solubility of a Salt (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The K_{sp} expression can be used to find the molar solubility of a salt (s). From this, the concentration of the insoluble salt's ions in a saturated solution can be determined.

For a saturated solution of $CaF_{2(s)}$, find the molar solubility if $K_{sp} = 5.3 \text{ x } 10^{-9}$. Also, find $\{Ca^{2+}\}$ and $\{F^-\}$ at equilibrium.

$CaF_{2(s)} \Leftrightarrow Ca^{2+}_{(aq)} + 2\ F^-_{(aq)}$

$-s \qquad\qquad s \qquad\qquad 2\ s$

$K_{sp} = \{Ca^{2+}\}\{F^-\}^2 = \{s\}\{2s\}^2 = 4s^3$

$K_{sp} = 4s^3$

$s = (5.3 \text{ x } 10^{-9}/4)^{1/3} = \mathbf{1.1 \text{ x } 10^{-3}\ M}$

$\{Ca^{2+}\} = s = \mathbf{1.1 \text{ x } 10^{-3}\ M}$

$\{F^-\} = 2\ s = \mathbf{2.2 \text{ x } 10^{-3}\ M}$

This video contains examples of determining the solubility of a salt (s) if given the solubility product (K_{sp})

Link to Video

Finding the Solubility of a Salt: https://youtu.be/98BuldrICXM

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4.4 Balancing Complex Chemical Equations

4.4 Balancing Complex Chemical Equations: https://youtu.be/7Jzb9XAHOJw

20.3 Finding Ksp from Ion Concentrations (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

If this concentration of an insoluble salt's ions in a saturated solution is know, the Ksp of the salt can be calculated.

A saturated solution of $PbI_{2(s)}$ was shown to have a $\{I^-\} = 2.4 \times 10^{-3}$ M. What is K_{sp} for $PbI_{2(s)}$?

$PbI_{2(s)}$ « $Pb^{2+}_{(aq)} + 2\ I^-_{(aq)}$

-s s 2s

$\{I^-\} = 2s = 2.4 \times 10^{-3}$ M

$\mathbf{\{I^-\}/2 = s}$

s = $\mathbf{1.2 \times 10^{-3}}$ **M**

$K_{sp} = \{Pb^{2+}\}\{I^-\}^2 = (s)(2s)^2$

$K_{sp} = 4s^3 = 4(1.2 \times 10^{-3})^3$

$\mathbf{K_{sp} = 6.9 \times 10^{-9}}$

Link to Video

Finding Ksp from Ion Concentrations: https://youtu.be/a8nhlJk8UX0

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20.4 The Common Ion Effect in Solubility Products (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The presence of a common ion greatly decreases the solubility of a salt.

For the solubility of insoluble salt $CaF_{2(s)}$.

$CaF_{2(s)} \Leftrightarrow Ca^{2+}_{(aq)} + 2\ F^{-}_{(aq)}$

The common ions are Ca^{2+} and F^{-}. These can be introduced as a soluble salt such as $Ca(NO_3)_{2(s)}$ or $NaF_{(s)}$.

If we add a $NaF_{(aq)}$ solution to a saturated solution of $CaF_{2(aq)}$ we are adding $F^{-}_{(aq)}$ to the equilibrium.

Le Chatlier's principal says the equilibrium will shift left.

This means that solid $CaF_{2(s)}$ will form (Precipitate) and the $\{Ca^{2+}\}$ will decreases.

This video contains examples of determining the solubility of a salt (s) if given the solubility product (K_{sp}) and the concentration of a common ion of the salt.

Link to Video

The Common Ion Effect in Solubility Products: https://youtu.be/_P3wozLs0Tc

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20.5 Determining if a Precipitate forms (The Ion Product) (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

We are interested in knowing if a precipitate forms if we mix two solutions that contain both of the common ions of an insoluble salt.

To find this out we find $Q_{sp,}$ which is also called the ion product.

$\mathbf{AB_{(s)} \Leftrightarrow A^{+}_{(aq)} + B^{-}_{(aq)}}$

Q_{sp} is the non-equilibrium concentration of the insoluble salt's ion plugged into the solubility product.

If $\mathbf{Q_{sp} > K_{sp}}$, The solution is supersaturated, the equilibrium must shift left and form a precipitate to reach equilibrium.

If $\mathbf{Q_{sp} < K_{sp}}$ The solution is unsaturated and no precipitate forms.

If $\mathbf{Q_{sp} = K_{sp}}$ the solution is saturated.

This video contains examples of determining if a precipitate will form through the calculation of Q_{sp}.

Link to Video

Determining if a Precipitate forms (The Ion Product): https://youtu.be/Naf7PoHPz8Y

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20.6 Removal of an Ion from Solution Using Precipitation (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

A metal can almost be completely removed from the solution by precipitation though the formation of an insoluble salt. This video contains examples, which show how this process can occur.

Link to Video

Removal of an Ion from Solution Using Precipitation: https://youtu.be/VW0bhcs84I4

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20.7 The Separation of Two Ions by a Difference in Solubility (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

To metal cation dissolved in an aqueous solution can be separated through precipitation by adding an anion, which form an insoluble salt with both metal cations. This video contains examples, which show how this process can occur.

Link to Video

The Separation of Two Ions by a Difference in Solubility: https://youtu.be/TWfnhLZnFcc

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20.8 Solubility Products and pH (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Because the anion of many insoluble salts are bases, such as ^{-}OH or the conjugate base of a weak acid (**$CaCO_3$, FeS, $Mg(OH)_2$**), many insoluble salts become very soluble in acidic pH. This video discuses why this occurs.

Link to Video

Solubility Products and pH: https://youtu.be/XJ0s5SATZgQ

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20.9 pH and the Precipitation of Insoluble Salts (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Because $^{-}$OH is often found in insoluble salts, pH plays an important part in determining if a precipitate will form.

This video contains an example, which uses a given pH to determine if an insoluble hydroxide salt precipitates.

Link to Video

pH and the Precipitation of Insoluble Salts: https://youtu.be/YDejxVh7vxw

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CHAPTER OVERVIEW

21 Electrochemistry

Thumbnail: Schematic of Zn-Cu galvanic cell. (CC BY-SA 3.0; Ohiostandard).

21.1 Redox Reactions (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

During a redox reaction, one species is oxidized and another is reduced. This involves the transfer of electrons. Loss of electrons means oxidation. The oxidation half reaction produces electrons. The species that loses the electrons is called the reducing agent. Gain of electrons means reduction.

The reduction half reaction uses electrons. The species that gains the electrons is called the oxidizing agent.

Link to Video

Redox Reactions: https://youtu.be/1v3yaaR_nHc

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21.2 Balancing a Redox Reaction in Acidic Conditions (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example of balancing a redox reaction in acidic conditions.

Steps to balancing a redox reaction in an acid solution:

1) Separate the overall reaction into the 2 ½ reactions.

2) Balance each ½ reaction for atoms in this order:

Atoms other than H and O

O atoms by adding H_2O

H atoms by adding H^+

3) Balance each 1/2 reaction for electric charge using e-.

4) Combine the two ½ reactions such that the number of e- on each side of the reaction arrow will be the same.

5) Simplify the reaction by removing species that are the same on each sides.

Link to Video

Balancing a Redox Reaction in Acidic Conditions: https://youtu.be/IB-fWLsI0lc

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21.3 Electrochemical Cells (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

To investigate electrode potentials, we create an electro-chemical cell. Galvanic cells: Electrochemical cells that produce electrical current. Each 1/2 reaction in a redox reaction is used to create a 1/2 cell.

There are 2 Kinds of interactions:

1) Metal ions gain electrons to become solid metal on the electrode.

This is the reduction 1/2 reaction.

2) The metal on the surface of the electrode loses electrons and enters solution to become an ion.

This is the oxidation 1/2 reaction.

Electrons are generated at the anode and are pushed to the cathode. For the two 1/2 cell reactions to occur, the electrodes must be connected by a wire to allow for electron flow. A voltmeter can be used instead of a wire to measure the electron flow. To compensate for the movement of electrons there must be a corresponding flow of ions. For this to occur the two 1/2 cells are connected by a salt bridge. A salt bridge is usually a gel which contains an ionic species such KNO_3. Once all of the parts are connected there is the possibility for electron flow. The difference in the electrode potentials between the anode and the cathode 1/2 reactions is called the cell voltage. It can also be called the cell potential or the electromotive force (emf), and is represented by the symbol $\mathbf{E_{cell}}$.

The unit of cell voltage is a volt (V).

Link to Video

Electrochemical Cells: https://youtu.be/nyS1BQ2ZVIg

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21.4 Cell Diagrams (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Cell diagrams: Shows the components of an electrochemical cell in a symbolic way. The electrode at which the oxidation occurs (anode) is placed at the left side. A single line / is used to show the change in phase.

Then the solution in contact with the anode. A double line // shows the boundary between the two 1/2 cells. Then the solution in contact with the cathode, a single line, and then the cathode electrode.

For the reaction: $\mathbf{Zn_{(s)} + Cu^{2+}_{(aq)}}$ ® $\mathbf{Cu_{(s)} + Zn^{2+}_{(aq)}}$

The cell diagram would be: $\mathbf{Zn_{(s)}/Zn^{2+}_{(aq)}\ //Cu^{2+}_{(aq)}/\ Cu_{(s)}}$

We can measure E_{cell} but we are interested in measuring the ½ cell potential (E°) for each 1/2 reaction. The ° means all species are 1 M and at 1 atm.

$$\mathbf{E^{\circ}cell = E^{\circ}(cathode) + E^{\circ}(anode)}$$

Link to Video

Cell Diagrams: https://youtu.be/IKqOAfivem8

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21.5 The Standard Hydrogen Electrode (SHE) (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The Standard Hydrogen Electrode (SHE)

The **SHE** is the standard 1/2 cell reaction against which all other are measured.

It uses a platinum electrode with the following half reaction $\mathbf{2\ H^{+} + 2\ e^{-}\ /\ H_{2(g,\ 1\ bar)}}$

$E^{o} = 0$ V for this half reaction . The half cell diagram for the SHE is Pt ï $H_{2(g,\ 1\ bar)}$ ï H^{+} úú

Link to Video

The Standard Hydrogen Electrode (SHE): https://youtu.be/GS-SE7IDDtY

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21.6 Electrode Potentials and ECell (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Electrode Potentials and E_{Cell}

If the E° of the anode and cathode half reactions are known, the E° for the electrochemical cell can be calculated using the equation: E°cell = E°(cathode) + E°(anode)

Note! As Eo becomes more positive the process becomes stronger

This video contains an example of calculating E° for electrochemical cells and half reactions.

Link to Video

Electrode Potentials and ECell: https://youtu.be/zeeAXleT1c0

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21.7 The Nernst Equation (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

E_{cell} at non-standard concentrations can be found using the the Nernst Equation

$E_{cell} = E°_{cell} - (0.0592\ V / N)\mathrm{Log}Q$

To find the value of Q you must plug the given concentrations into the equilibrium expression for the reaction.

N is the number of electrons transferred in the balanced half reaction.

Link to Video

The Nernst Equation: https://youtu.be/x1wijHu1zXY

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21.8 Electroplating (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Electroplating is the process of adding voltage to an electrochemical cell to cause a solid metal to form. Like in the half reaction: $\mathbf{Ag^{+}_{(aq)} + e^{-} \text{->} Ag_{(s)}}$

In order find the amount of solid metal deposited, we must be able to measure the number of electrons added.

Using the equation: Current = amperes = charge / time = Coulombs / sec

Coulombs are related to the mols of e^- added.

F = Faraday constant = 96,485 C/mol $\mathbf{e^-}$ this is the charge on a mol of electrons

If a known current is applied to a half reaction for a given amount of time, the number of grams of metal deposited can be calculated.

Link to Video

Electroplating: https://youtu.be/yrNuWNleYAg

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CHAPTER OVERVIEW

22: Gibbs Free Energy

22.10 Relating Grxn and Kp (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

There is a relationship between G° and K_p as shown by the equation G°rxn = - RT LnKp

R = 8.314 J/mol K

T = Temperature in K

K_p = Equilibrium constant in atm.

Remember that the units on $G°_{rxn}$ must be J/mol for this calculation due to the presence of the constant R.

This video contains an example problem which uses this equation.

Link to Video

Relating Grxn and Kp: https://www.youtube.com/watch?v=T-OYNTYN__4

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22.11 The Van't Hoff Equation (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The equation $G°_{rxn} = - RT \text{Ln}K_p$ shows that there is a relationship between K_p and T.

This is expressed by the van't Hoff equation: $\text{Ln}(K_2/K_1) = (H°/R)(1/T_1 - 1/T_2)$

T is in Kelvin

H° is the enthalpy of the reaction and need to have the units J/mol due to the presence of the constant R.

R = 8.314 J/mol K

This video contains an example problem which uses this equation.

Link to Video

The Van't Hoff Equation: https://www.youtube.com/watch?v=4vk6idAXp_A

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22.12 Relating G and Ecell (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

G and E_{cell} are related by the equation: $G^\circ = -NFE^\circ_{cell}$

G° = Gibbs free energy in J/mol

N = number of electrons transferred in the reaction

F = Faraday constant = 96,485 C/mol e-

E°cell = Volt

Remember (V)(C) = J

Positive E°_{cell} → Negative G° → Spontaneous

Negative E°_{cell} → Positive G° → Non-Spontaneous

The video contains an example problem where G° for a reaction is calculation from a given E°cell.

Link to Video

Relating G and Ecell: https://youtu.be/49KhN73HVM8

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22.1 Spontaneity (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Spontaneous process: A process that once started no eternal action is needed to make the process continue.

Non-spontaneous process: A process, which will not occur unless an external action is continuously applied.

If a process is spontaneous, the reverse process is non-spontaneous. Reactions can be spontaneous or non-spontaneous. It was originally though that a process which gives off energy (exothermic) was spontaneous. Because there are spontaneous endothermic reactions spontaneity must not entirely determined by enthalpy H.

Link to Video

Spontaneity: https://youtu.be/Z2WjDU-LAq4

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22.2 Entropy (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Entropy (S) is a measure of disorder. The units on S are usually kJ/mol K or J/mol K.

S a change in entropy.

If S is positive, the system is becoming more disordered.

If S is negative, the system is coming less disordered (more ordered)

Disorder can be driving force as seen when 2 gasses mix. H = 0 but the reaction still occurs so there is some energy loss

This video contains multiple examples of processes with a positive S and processes with a negative S. The video also discusses to make this determination.

Link to Video

Entropy: https://youtu.be/dkanY87VsjY

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22.3 The Entropy of a Phase Transition (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The entropy of a phase transition can be calculated using the equation: $S_{tr} = H_{tr}/T_{tr}$

H_{tr} = Enthalpy of transition (kJ/mol)

T = Temperature of the transition (K)

S_{tr} = Entropy of transition (kJ/(mol K))

This means that the entropy of a phase transition is directly related to the enthalpy of the phase transition.

This video contains sample calculations using this equation.

Link to Video

The Entropy of a Phase Transition: https://youtu.be/gU1MpAuJoUU

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22.4 Calculating the Entropy of Reaction using S (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

S° for a reaction can be found by using the equation: **S° = (Sum of nS°products) - (Sum of S nS°reactants)**

Remember, S° for an element in its natural state is not zero.

This video contains a sample calculation using this equation.

Link to Video

Calculating the Entropy of Reaction using S: https://youtu.be/FK3DnMTJ0Ks

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22.5 The Definition of Gibbs Free Energy (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The spontaneity of a reaction is related to H_{rxn} and S_{rxn}

Second law of thermodynamics: All spontaneous processes produce an increase in the entropy of the universe $S_{univ} = S_{sys} + S_{sur} > 0$

From this we can derive the equation for Gibbs free energy change (kJ/mol): $G = H - TS$

Remember we want $S_{univ} > 0$ so:

$G < 0$ If G is negative, the reaction is spontaneous.

$G > 0$ If G is positive, the reaction is non-spontaneous.

$G = 0$ If $G = 0$, the reaction is at equilibrium

Link to Video

The Definition of Gibbs Free Energy: https://youtu.be/iuWkcHUh-1o

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22.6 Determining if a Reaction is Spontaneous (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Depending on the signs on the enthalpy and entropy of the process they can be: spontaneous at all temperatures, spontaneous at low temperatures, spontaneous at high temperatures, or non-spontaneous at all temperatures.

Case	**H**	**S**	**G**	**Result**
1	-	+	-	Spontaneous at all Temp
2	-	-	-/+	Spontaneous at low temp
3	+	+	-/+	Spontaneous at high temp
4	+	-	+	Non-Spontaneous at all temp

This video contains multiple examples on how to make this determination.

Link to Video

Determining if a Reaction is Spontaneous: https://youtu.be/rGFzI_LcddU

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22.7 Calculating Gibbs Free Energy (Grxn) for a Reaction (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains an example problem of determining G_{rxn} from H_{rxn} and S_{rxn}.

Link to Video

Calculating Gibbs Free Energy (Grxn) for a Reaction: https://youtu.be/wmreE6zeFQo

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22.8 Calculating the Temperature at Which a Reaction Becomes Spontaneous (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

For processes, which are spontaneous at high temperature or spontaneous at low temperatures, there is a specific temperature where the transition to spontaneous is made.

The reaction starts to become spontaneous when $G = 0$

So using the equation: $G = H - TS$ and setting $G = 0$

$0 = H - TS$

Or

$TS = H$

$T = H/S$

This video contains an example problem, which calculates the temperature at which a reaction becomes spontaneous.

Link to Video

Calculating the Temperature at Which a Reaction Becomes Spontaneous: https://youtu.be/bdu9EApkg_s

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22.9 Calculating Grxn using Gf (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

G° for a reaction can be found using the equation: $G°_{rxn}$ = (Sum of $nG°_f$ products) - (Sum $nG°_f$ reactants)

Where $G°_f$ for elements in their standard states is zero

This video contains an example problem using this equation.

Link to Video

Calculating Grxn using Gf: https://youtu.be/qdw0Kmjukmg

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CHAPTER OVERVIEW

3: Molecules, Molecular Formula Calculations, and Nomenclature

Thumbnail: Spinning Buckminsterfullerene (C_{60}). *(CC BY-SA 3.0; unported; Sponk).*

3.1 Molecular and Ionic Compounds (Video)

Chapter 3.1 Molecular and Ionic Compounds: https://youtu.be/zJejgCll1bw

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3.2 Molecular Formulas (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Molecular Formulas are written with the symbols for the elements followed by subscripts to indicate the number of each atom present in the molecule.

Molecular formulas can be used to create conversion factors which allow for the determination of the number of individual atoms present in a given sample of a compound.

Link to Video

Molecular Formulas: https://youtu.be/yBffLt2Y6Ck

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3.4 Molar Masses of Compounds (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The molar mass (also call molecular weight) of a compound is equal to the sum of the molar masses of its atoms. Molecular weight can be used for the conversion between mols and grams for a molecule.

Link to Video

Molar Masses of Compounds: https://youtu.be/PhOqgNNv78s

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3.5 Percent Composition (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Molecular formulas can also be expressed as a percent composition of each element in a compound. This video discusses how to find the percent composition of elements in a given compound.

Link to Video

Percent Composition: https://youtu.be/HNS6lItns10

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3.6 Determining the Mass of a Specific Element in a Sample Using Percent Weight (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Percent weights can be used to find the mass of a specific element in a given sample of a molecule. This video shows sample calculations for this conversion.

Link to Video

Determining the Mass of a Specific Element in a Sample Using Percent Weight: https://youtu.be/BT1QBzALWOc

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3.7 Empirical Formulas (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Empirical Formulas give the simplest whole number ratio of the atoms in the molecule. This video discusses how to find the empirical formula for a given molecular formula.

Link to Video

Empirical Formulas: https://youtu.be/UqHI3gmgQOA

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3.8 Determining Empirical and Molecular Formulas from Percent Composition (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The empirical formula of a compound can be obtained from the percent compositions of its elements. This video discusses the steps required to find an empirical formula from percent compositions. Also, the molecular formula of a compound can be determined if the molecular weight is given.

Link to Video

Determining Empirical and Molecular Formulas from % Composition: https://youtu.be/E-MxBYw1TSI

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3.9 Combustion Analysis (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

During a combustion analysis, an compound containing carbon, hydrogen, or oxygen is combusted to create CO_2 and H_2O. The masses of the CO_2 and H_2O produced can be used to determine the empirical formula of the combusted compound.

Link to Video

Combustion Analysis: https://youtu.be/A7ZjM9U5XAc

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CHAPTER OVERVIEW

3.3 Nomenclature of Inorganic Compounds

Thumbnail: Two small test tubes held in Spring Clamps. (CC BY-SA 3.0; Amitchell125).

3.3.1 Things to Consider in Inorganic Nomenclature (Video)

3.3.1 Things to Consider in Inorganic Nomenclature: https://youtu.be/YHkGQ3s5O3s

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3.3.2 Polyatomics (Video)

3.3.2 Polyatomics: https://youtu.be/kTSPkzDcntA

3.3.3 Using the Inorganic Nomenclature Flow Chart (Video)

3.3.3 Using the Inorganic Nomenclature Flow Chart: https://youtu.be/bQS52VvMjt0

3.3.4 Nomenclature of Metals (Video)

3.3.4 Nomenclature of Metals: https://youtu.be/zVhGxYTgRk0

3.3.5 Nomenclature of Transition Metals (Video)

3.3.5 Nomenclature of Transition Metals: https://youtu.be/gIaRpko0A_A

3.3.6 Nomenclature of Nonmetals (Video)

3.3.6 Nomenclature of Nonmetals: https://youtu.be/VgHCrtpDWJk

3.3.7 Nomenclature of Positively Charged Polyatomics (Video)

3.3.7 Nomenclature of Positively Charged Polyatomics: https://youtu.be/hCLzNT6wS4c

3.3.8 Nomenclature of Acids (Video)

3.3.8 Nomenclature of Acids: https://youtu.be/in46UUzmSO4

3.3.9 Drawing Inorganic Compounds from their Name (Video)

3.3.9 Drawing Inorganic Compounds from their Name: https://youtu.be/YuaSrtkxqQM

CHAPTER OVERVIEW

4: Balancing Reactions, Limiting Reactant Problems, and Determining Net Ionic Equations

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4.10 Determining the Products for Precipitation Reactions (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

During a precipitation reaction, also called a double substitution reaction, the ions of two soluble ionic compounds recombine to form an insoluble ionic compound and a precipitate (solid) forms. This video discusses how to determining the molecular formula of the precipitate given the ionic species present in the reactants. In particular, combining different charged species to create a neutral compounds will be discussed.

Link to Video

Determining the Products for Precipitation Reactions: https://youtu.be/r0kYeZVuTAM

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4.11 Determining the Net Ionic Equation for a Precipitation Reaction

4.11 Determining the Net Ionic Equation for a Precipitation Reaction: https://youtu.be/AMJz1Sdz8IA

4.11 Determining the Net Ionic Equation for a Precipitation Reaction (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The net ionic equation represents a precipitation reaction in its simplest form. This video discusses how to determine the complete ionic equation and net ionic equation from a balanced precipitation reaction equation. As part of this process, the spectator ions are determined.

Link to Video

Determining the Net Ionic Equation for a Precipitation Reaction: https://youtu.be/AMJz1Sdz8IA

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4.1 Introduction to Chemical Reaction Equations (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video defines a chemical reaction equation. It also introduces the concept of balancing a reaction and defines stoichiometry.

Link to Video

Introduction to Chemical Reaction Equations: https://youtu.be/5mjawuf7K2Q

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4.2 Balancing Combustion Reactions (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Combustion reactions are some of the easiest to balance. This video defines a combustion reaction and then goes over how to change the reaction stoichiometry to balance the reaction.

Link to Video

Balancing Combustion Reactions: https://youtu.be/yE3bHIEslJc

Attribution

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4.4 Balancing Complex Chemical Equations

4.4 Balancing Complex Chemical Equations: https://youtu.be/7Jzb9XAHOJw

4.3 Balancing Reactions Which Contain Polyatomics (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Balancing reactions which contain polyatomics can be particularly difficult. This video discusses how to adjust the stoichiometry of a reaction which utilizes polyatomics to achieve balance.

Link to Video

Balancing Reactions Which Contain Polyatomics: https://youtu.be/i0ORKYt90Z0

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4.4 Balancing Complex Chemical Equations (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Balancing a chemical reaction can be difficult if the reaction is complex. Often, it takes some trial and error. This video provides some basic rules which can be applied to any reaction. By adjusting the reaction's stoichiometry using these rules balancing a complex reaction is possible.

Link to Video

Balancing Complex Chemical Equations: https://youtu.be/7Jzb9XAHOJw

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4.5 Finding Mols and Masses of Reactants and Products Using Stoichiometric Factors (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses finding the mols and masses of reactants and products of a reaction by using stoichiometric factors (Mol Ratios). A reaction's stoichiometry can be used to create mole ratio conversion factor which link reactants and products. These types of calculation are a simplified version of the Limiting Reactant Problems which will come later.

Link to Video

Finding Mols and Masses of Reactants and Products Using Stoichiometric Factors (Mol Ratios): https://youtu.be/74mHV0CZcjw

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4.6 Introduction to Limiting Reactant Problems (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Limiting reactant problems are considered on of the fundamental concepts of general chemistry. This video presents the steps required to solve a limiting reactant problem in a simplified manner. When mixing two or more reactants sometimes one will be used up before the others. The one which is used up is called the limiting reactant. The limiting reactant determines the maximum amount of product which can be formed during a reaction.

Link to Video

Introduction to Limiting Reactant Problems: https://youtu.be/LZdWBvkXRDU

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4.7 Determining the Limiting Reactant and Theoretical Yield for a Reaction (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Limiting reactant problems are considered on of the fundamental concepts of general chemistry. This video presents the steps required to determine the limiting reactant of a reaction and the theoretical yield. When mixing two or more reactants sometimes one will be used up before the others. The one which is used up is called the limiting reactant. The limiting reactant determines the maximum amount of product which can be formed during a reaction which is called the theoretical yield. The limiting reactant is determined by using mole ratio conversion units obtained from the reaction's stoichiometry.

Link to Video

Determining the Limiting Reactant and Theoretical Yield for a Reaction: https://youtu.be/HmDm1qpNUD0

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4.8 How Much of the Excess Reactant Remains after a Reaction (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

A variation of limiting reactant problems involves determining how much of the non-limiting reactant remains after a reaction. This is done by generating mole ratio conversion unit created by from reaction's stoichiometry. By determining how much of the non-limiting reactant is used during the reaction the amount of excess can be determined.

Link to Video

How Much of the Excess Reactant Remains after a Reaction: https://youtu.be/K2II-QuBsKs

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4.9 Predicting the Solubility of Ionic Compounds (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to predict if a given ionic compound is soluble or insoluble in water. Solubility rules make these prediction based on the species making up the ionic compound. If the ionic compound is soluble it will disassociate in water to form strong electrolyte aqueous solution.

Link to Video

Predicting the Solubility of Ionic Compounds: https://youtu.be/U3QNwnfmvGU

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CHAPTER OVERVIEW

5: Acid/Base Reactions and Molarities

Chapter 5.1 Definition of Strong/Weak Acids and Bases (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The video discusses the difference between strong and weak acids or bases. It also discusses how to identify if an acid or bases is strong or weak. Strong acids or bases are considered strong electrolytes. Weak acids or bases only partially ionize in water. Ammonia can react with water to produce hydroxide.

Link to Video

Definition of Strong/Weak Acids & Bases: https://youtu.be/gN2l8H_AWGU

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Chapter 5.2 Acid/Base Neutralization Reactions and Net Ionic Equations (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to determine the neutralization reaction and net ionic equation for a given acid/base reaction. Typically, acid / base reactions produce water or a weak acid as a product. When finding a net ionic equation for acid / base neutralizations, we do not disassociate H2O(l) or weak acids. Ions not involved in the reaction are called spectator.

Link to Video

Acid/Base Neutralization Reactions & Net Ionic Equations: https://youtu.be/gDS93ySeF80

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Chapter 5.3 Calculations Involving Molarity (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Remember a solute is dissolved in a solvent to produce a solution. So, If NaCl is dissolved in water to create a solution: NaCl is the solute and Water is the solvent. Molarity is a measure of the concentration of a solute in a solution. Molarity is abbreviated M. The units are M or mol of solute / Liters of solution.

Link to Video

Calculations Involving Molarity (M): https://youtu.be/TVTCvKoSR-Q

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Chapter 5.4 Calculations Involving Dilution (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Dilution is the process of decreasing a solution’s concentration by adding more solvent. Dilution calculation allow for the new molarity of a solution to be calculated at the addition of solvent.

Link to Video

Calculations Involving Dilution: https://youtu.be/Yq3cNk29_Ao

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Chapter 5.5 Concentration of Ions in Solution from a Soluble Salt (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Soluble salts can disassociate to produce higher concentrations of ions in solution. The molecular formula of the soluble salts can provide conversion factors to convert mol of soluble salt in solution into mol of ions in solution.

Link to Video

Concentration of Ions in Solution from a Soluble Salt: https://youtu.be/qsekSJBLemc

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Chapter 5.6 Calculations Involving Titrations (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Titrations are used to determine the unknown concentration of an acid or base. The titrant (known concentration) is added to the analyte (unknown concentration) from a buret. At the equivalence point (EP), the exact amount of titrant has been added to complete the reaction with the analyte according the balanced chemical equation

Link to Video

Calculations Involving Titrations: https://youtu.be/GuGusTXmEbE

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Chapter 5.7 Limiting Reactant Problems Using Molarities (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

> **Video Topics**
>
> Concentrations (Molarities) of reactants can be used to find the number of mols of reactants. This information can be used to determine the limiting reactant and the theoretical yield for a given reaction.

> **Link to Video**
>
> **Limiting Reactant Problems Using Molarities:** https://youtu.be/eOXTliL-gNw

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CHAPTER OVERVIEW

6: Gases

Thumbnail: Motion of gas molecules. The randomized thermal vibrations of fundamental particles such as atoms and molecules—gives a substance its “kinetic temperature.” Here, the size of helium atoms relative to their spacing is shown to scale under 1950 atmospheres of pressure. (CC BY-SA 3.0; Greg L).

6.10 Dalton’s Law of Partial Pressures (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Dalton's law of partial pressures says that For a mixture of 2 ideal gases, A and B: The total pressure = PA + PB. Where PA is the partial pressure of A and PB is the partial pressure of B. The partial pressure of a gas is also related to the mol fraction of the gas. In this video Dalton's law of parital pressure is defined along with the concept of a mol fraction. A sample problem using these concepts is discussed.

Link to Video

Dalton's Law of Parital Pressures: https://youtu.be/y5-SbspyvBA

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6.10 Dalton’s Law of Partial Pressures (Video) is shared under a not declared license and was authored, remixed, and/or curated by LibreTexts.

6.11 Collecting a Product Gas over Water (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When a reaction produces gas as a product it is usually collected over water. To find information about the captured gas Dalton's law of partial pressures and the ideal gas law equation is typically used. Because water evaporates it also produces a partial pressure called a vapor pressure. This video contains a sample problem involving these concepts.

Link to Video

Collecting a Product Gas over Water: https://youtu.be/zFuy3t81vjQ

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6.12 Kinetic-Molecular Theory of Gases (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The kinetic-molecular theory of gases is related to the idea that gas molecules have a certain amount of kinetic energy. The kinetic energy of a gas is related to its pressure because pressure is created from the collision of the gas on the walls of a container. There is a relationship between the velocity of a gas and its molar mass shown by the equation Urms= (3RT/M)1/2. Where Urms is the root-mean-square speed of the gas in Meters/second. T is the temperature of the gas in Kelvin. M is the molar mass of the gas in kg/mol. This video contains a sample problem, which discusses these concepts.

Link to Video

Kinetic-Molecular Theory of Gases: https://youtu.be/9f83XAYfXAg

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6.13 Graham’s law of Diffusion and Effusion (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Diffusion is the gradual mixing of the molecules of two or more gases owing to their molecular motions. Effusion is the escaping of gas molecules through a small opening into an empty compartment. Graham's law says that (Rate of effusion gas 1 / Rate of effusion gas 2) = (M of gas 2/ M of gas 1)1/2 M = molar mass of the gases. Also, the units for the rate of effusion are not defined. Virtual any unit can be used including mol/unit of time, mol, or meters.This video contains a sample problem, which discusses these concepts.

Link to Video

Graham’s law of Diffusion and Effusion: https://youtu.be/9HO-qgh-iGI

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6.1 Common Properties of Gases (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Gaseous molecule tend to have similar features. This video discusses these features including being non-metals, having a low molecular weight, are easily compressed, and are mostly make up of empty space.

Link to Video

Common Properties of Gases: https://youtu.be/vewL8v9d-Ho

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6.2 Defining Gas Pressure (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Gas Pressure is defined as pressure exerted by a gas on the walls of a container is due to collisions. This video defines gas pressure and discusses the common types of units to measure pressure. A manometer and barometer are also defined.

Link to Video

Defining Gas Pressure: https://youtu.be/_CRn3cFs2CI

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6.3 Boyle’s Law (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Boyle’s Law says that for a fixed amount of gas at a constant temperature, gas volume is inversely proportion to gas pressure. This video discusses Boyle's Law and shows a sample problem involving Boyle's Law.

Link to Video

Boyle’s Law: https://youtu.be/lu86VSupPO4

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6.4 Charles’s Law (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Charles’s Law says that for the volume of a fixed amount of gas at constant pressure is directly proportional to its temperature in K. This video discusses Charles's Law and shows a sample calculation using it. Also, the Kelvin temperature scale and the concept of absolute zero are defined. Lastly, this video shows how Charles's Law is capable of predicting absolute zero.

Link to Video

Charles’s Law: https://youtu.be/NBf510ZnlR0

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6.5 Avogadro’s Law (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Avogadro’s Law says that at a fixed temperature and pressure, the volume of a gas is directly proportion to the amount of gas. Avogadro's Law is defined in this video along with standard temperature and pressure. A sample problem is shown.

Link to Video

Avogadro’s Law: https://youtu.be/dRY3Trl4T24

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6.6 The Ideal Gas Law Equation (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The ideal gas law equation can be used to provide information about a gas produced during an equation. In the example discussed in this video, a reaction produces a gas. Using a limiting reactant like calculation the number of mols of gas produced is determined. From this the pressure of the gas created during the reaction is found.

Link to Video

The Ideal Gas Law Equation: https://youtu.be/rHGs23368mE

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6.7 Ideal Gas law Equation and Reaction Stoichiometry (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The ideal gas law equation can be used to provide information about a gas produced during an equation. In the example discussed in this video, a reaction produces a gas. Using a limiting reactant like calculation the number of mols of gas produced is determined. From this the pressure of the gas created during the reaction is found.

Link to Video

Ideal Gas law Equation and Reaction Stoichiometry: https://youtu.be/8pPlW8MRhgI

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6.8 Second Type of Ideal Gas Law Problems (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

In the second major type of ideal gas law problems a new value of P, V, n or T is found after a gas undergoes a change. State 1 (P1, V1, T1, n1) to State 2 (P2, V2, T2, n2). The gas law constant R is not used during this calculation so the units of pressure and volume can be variable. However, the temperature still need to be in Kelvin. The calculation an be simplified if any of the variables are held constant during the change. A sample problem is discussed in this video.

Link to Video

Second Type of Ideal Gas Law Problems: https://youtu.be/WQDJOqddPI0

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6.9 Density and the Molar Mass of Gases (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The ideal gas law equation can be manipulated to show the relationship between the density of a gas and the molecular weight of the gas. The equation is d = MP/RT, d is the density of the gas in g/L, M is the molar mass of the gas in g/mol, P is pressure of the gas in ATM and R is the gas law constant. The equation shows that as the density of gas increases as the molar mass increases. This videos contains a sample calculation using this equation.

Link to Video

Density and the Molar Mass of Gases: https://youtu.be/gnkGBsvUFVk

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CHAPTER OVERVIEW

7: Thermochemistry

Thumbnail: Dancing Flames of burning charcoal in the dark (CC BY-SA 3.0; Oscar via Wikipedia).

7.1 Definitions in Thermochemistry (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Thermochemistry is the branch of chemistry concerned with heat effects accompanying chemical reactions Focuses on the system's transfer of energy between a system and its surroundings. The system is the part of the universe chosen for study and the surroundings are the rest of the universe outside the system. Heat: energy transferred between a system and its surrounds as a result of temperature difference. This video contains a detailed discussion on these and other definitions.

Link to Video

Definitions in Thermochemistry: https://youtu.be/nh6-bvbfu0c

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7.2 The Movement of Heat in a Substance (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Heat is defined as energy transferred between a system and its surrounds as a result of temperature difference. Heat flows from a high temp body to a low temp body.The amount to heat required to cause a substance to change temperature follows the equations q = mCsΔT. Where q is the heat change in J, m is the mass of the substance in grams ΔT is the change in temperature (TF - TI) in °C and Cs is the specific heat of the substance in J/g°C. This video contains a sample problem, which discusses these concepts.

Link to Video

The Movement of Heat in a Substance: https://youtu.be/gaJQYke-lVY

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7.3 Enthalpy of Reaction (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The amount of heat absorbed or given off per mole of reactant is defined as the Enthalpy of reaction (ΔH) in kJ/mol. ΔH = q of the reaction / mol reactant. If a reaction is Exothermic its ΔH is negative, q of reaction is negative, and the reaction gives off heat to the surroundings. If a reaction is endothermic ΔH is positive, q of reaction is positive, and the reaction absorbs heat from the surrounding. This video contains a sample problem, which involves Enthalpy of reaction.

Link to Video

Enthalpy of Reaction: https://youtu.be/z2KUaIEF9qI

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7.4 Conservation of Energy: The Movement of Heat between Substances (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The Law of conservation of energy says that the total energy between a system and its surroundings must remain constant. This means heat lost by a system is gained by its surroundings and vice versa. This idea is expressed by the equation q of the system = - q of the surroundings. Using this equation the moment of heat between two different bodies can be calculated. Also the final temperature of the combination can be found. This video contains a sample problem, which involves these concepts.

Link to Video

Conservation of Energy: The Movement of Heat between Substances: https://youtu.be/pGEYy-pNHBg

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7.5 Conservation of Energy: Bomb Calorimetry

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The Law of conservation of energy allows for the Heat of reactions for combustions to be found using bomb calorimetry. When the combustion reaction occurs, chemical energy is converted to thermal energy and this energy is transferred to the bomb following the equation $qrxn = -qcalorim$. This calculation involves enthalpy and the $q = mCs\Delta T$ equation. This video contains a sample problem, which involves these concepts.

Link to Video

Conservation of Energy: Bomb Calorimetry: https://youtu.be/SSNZGgwYBsQ

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7.6 Conservation of Energy: Coffee Cup Calorimetry (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Coffee cup calorimetry is a variation of bomb calorimetry which uses a Styrofoam cup. This type of calorimetry is commonly used in general chemistry labs. The cup Isolates the system so you only have to look at the liquids inside. The main difference with bomb calorimetry is that specific heat and the weight of the material in the cup must be determined.

Link to Video

Conservation of Energy: Coffee Cup Calorimetry: https://youtu.be/FwQcc17PN0k

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7.7 Hess’s Law (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Hess’s law involves the idea that we can find ΔHrxn for a given reaction by combining the ΔHrxn of two or more other reactions. If we multiply a reaction by a number the ΔHrxn is also multiplied by this number. Reversing a reaction changes the sign on ΔHrxn. If we add two or more reactions together then ΔHrxn for the overall reaction will be the sum of each individual ΔHrxn. This video contains a sample problems, which involves Hess's Law

Link to Video

Hess’s Law: https://youtu.be/hisUr1fikFU

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7.8 Definition of Heat of Formation Reactions (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Standard enthalpies of formation ΔHfo is the enthalpy change that occurs in the formation of one mole of a substance from the reference form of the elements. Reference forms of elements: All metal and transition metals are all monoatomic solids Fe(s), Na(s), Halogens, F2(g), Cl2(g), Br2(l), H2(g), O2(g), N2(g), C(graphite). This video contains a sample problem, which involves these concepts.

Link to Video

Definition of Heat of Formation Reactions: https://youtu.be/A20k0CK4doI

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7.9 Calculating DH° using DHf° (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The enthalpy of an unknown reaction can be found using the equation: ΔH° = Sum of VΔHf°(product) - Sum of VΔHf° (reactants). ΔHf is the enthalpy of formation for a given species. V is the stoichiometric coefficient of the species from the balanced reaction. Remember that ΔHf° = 0 for elements in their reference states. This video contains a sample problem, which involves these concepts.

Link to Video

Calculating H° using Hf°: https://youtu.be/Y3aJJno9W2c

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CHAPTER OVERVIEW

8: Electromagnetic Radiation

8.1 Electromagnetic Radiation

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Electromagnetic radiation is a form of energy transmission in which electric and magnetic fields are propagated as waves through space. Light has properties of both waves and particles. Light waves have a wavelength which is the distance between the tops of two successive wave crests. Light has frequency. The frequency is the number of wavelengths that pass a point in a given time. The wavelength and frequency of a light wave are inversely related. This video contains a sample problem, which involves these concepts.

Link to Video

Electromagnetic Radiation: https://youtu.be/TZy7a69pP-w

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8.2 Energy of a Photon (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The smallest quantity of light is a photon. The energy of a photon depends on its frequency following the equation Ephoton = (h)(frequency) or Ephoton = hC/wavelength. Where h is Planck's constant This means that the highest energy photons have a high frequency and low wavelength.

Link to Video

Energy of a Photon: https://youtu.be/6swES9-eAAE

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8.3 The Photoelectric Effect (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The photoelectric effect: Electrons are ejected from the surface of a metal when struck with light. In 1905, Einstein proposed that electromagnetic radiation has particle-like qualities and these particles, called photons, have a characteristic energy. The energy of the photon must equal or exceed a threshold value (Ework) for an electron to be ejected. This value is called the work function of the metal. This video contains a sample problem, which involves these concepts.

Link to Video

The Photoelectric Effect: https://youtu.be/mxBMxJLauQk

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8.5 The Bohr Atom (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Rutherford’s model of a nuclear atom does not indicate how electrons are arranged. In 1913 Niels Bohr explained how an electron can orbit a hydrogen (1 e-) atom. 1) Electrons move in circular orbits about the nucleus. 2) Electrons have only a fixed set of allowed orbits, called stationary states. The energy the electron has at each of these states is related to the equation. En = -Rh / n2. Where Where Rh = 2.18 x 10-18 J and n is an integer value: 1, 2, 3, 4... The variable n is related to the distance the electron is away from the nucleus. These concepts allow for the calculation of the wavelength of photon ejected when an electron drops from a higher n to a lower n value. Also, when a photon is absorbed the new n value of an electron can be calculated. This video contains a sample problem, which involves these concepts.

Link to Video

The Bohr Atom: https://youtu.be/GuFQEOzFOgA

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8.4 The de Broglie Equation (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The same way Einstein theorized that light has the properties of a particle, de Broglie theorized that particles have the properties of waves. The de Broglie wavelength is the wavelength associated with any moving object which follows the equation wavelength = h/mu. Where (m) is the mass of the object in kg and (u) is the speed of the object in m/s. This video contains a sample problem, which involves these concepts.

Link to Video

The de Broglie Equation: https://youtu.be/pz0zMHWtK7Q

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CHAPTER OVERVIEW

9: Quantum Numbers

9.1 Introduction to Quantum Numbers (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

In 1927 Schrödinger put forth the idea that the wavelike properties of an electron could be described by mathematical equations called wave functions. These wave functions were used to create orbitals which are probability distribution map showing where the electron is likely to be found. Quantum numbers are a way of describing the orbitals and electrons contained in an atom. There are 4 unique quantum numbers for every electron in an atom. 1) Principal quantum number (n) which defines the electrons distance from the nucleus. 2) Orbital angular momentum (l) which defines the type of orbital subshell 3) ml is the magnetic quantum number which defines a specific orbital 4) The fourth quantum number (ms) refers to the electron spin of each electron.

Link to Video

Introduction to Quantum Numbers: https://youtu.be/07JpBeaPxL8

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9.2 Principal quantum number (n) and Orbital angular momentum (l): The Orbital Subshell (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Principal quantum number (n). This number can be any positive, nonzero integral value. As (n) increases the energy of the orbital decreases and the distance from the nucleus increases. This is the same n value that we saw with the Bohr atom. Orbital angular momentum (l). Defines the type of orbital subshell. An orbital subshell can contain multiple orbitals of the same type. Possible values for l are: (l) can be zero or any positive integer but not larger than (n-1). l = 0, 1, 2, 3, 4, ….(n-1). This video contains a sample problem, which involves these concepts.

Link to Video

Principal quantum number (n) & Orbital angular momentum (l): The Orbital Subshell: https://youtu.be/ms7WR149fAY

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Chapter 9.4 Summary of the Rules for Quantum Numbers (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The rules for quantum numbers are: (n) can be any positive, nonzero integral value. (l) can be zero or any positive integer but not larger than (n-1). l = 0, 1, 2, 3, 4, ….(n-1) (ml) values follow the equation. -l, +1, +2, +3, +l (ms) can be +1/2 or -1/2. It is common question to ask if a given set of quantum number follows these rule. This video contains multiple examples of this type of question.

Link to Video

Summary of the Rules for Quantum Numbers: https://youtu.be/nRsRZUsOBzE

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Chapter 9.3 Magnetic Quantum Number (ml) and Spin Quantum Number (ms) (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The value ml is the magnetic quantum number. The possible ml values follow the equation: -l, +1, +2, +3, +l. The ml's values represent the orbitals in a subshell which actually contain electrons. Because each orbital (ml) value can contain 2 electrons we can see how many electrons can be contained in a particular orbital subshell. The value ms is called the spin quantum number. ms refers to the electron spin of each electron. This can be +1/2 or -1/2.

Link to Video

Magnetic Quantum Number (m_l) & Spin Quantum Number (m_s): https://youtu.be/gbmGVUXBOBk

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Chapter 9.5 Assigning 4 Quantum Numbers to Electrons in Subshells (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When assigning quantum number to electrons in a given subshell the value of n and l are given in the orbital designation. When assigning valuses for ml and ms it is important to remember their values are also affected by other rules. Pauli Exclusion Principle: When two electrons occupy the same orbital (ml) their spins must be paired. +1/2 and –1/2 Hund's rule: Fill each orbital (ml) in a subshell with one electron first before putting two electrons in the same orbital. (Keep spins parallel) This video contains multiple examples of assigned quantum number to electrons in a given orbital designation.

Link to Video

Assigning 4 Quantum Numbers to Electrons in Subshells: https://youtu.be/4InLAl31aE0

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CHAPTER OVERVIEW

Chapter 15: The Properties of Solutions

Thumbnail: Nile red solution. Image use with permission (CC BY-SA 3.0; Armin Kübelbeck).

15.10 Finding the Molecular Weight of an Unknown using Colligative Properties (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

You can use BP elevation, FP depression, or osmotic pressure to find the molecular weight of an unknown compound. This video contains a sample problem of this idea.

Link to Video

Finding the Molecular Weight of an Unknown using Colligative Properties: https://youtu.be/faSk2REYy74

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15.11.1 Finding the Vapor Pressure of a Solution (Nonionic-Nonvolatile Solute) (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

A nonionic-nonvolatile solute will cause the vapor pressure of the solvent to decrease. Because the solute is nonvolatile it will not create a vapor pressure of its own. Examples are: sugar, caffeine, fats, and proteins.

Raoult's Law Pa = XaPao
Pa = Vapor pressure of solution
Xa = Mol fraction of the solvent
Pao = Vapor pressure of the pure solvent
Raoult’s Law says that the vapor pressure of a solvent tends to decrease when it is part of a solution. Pa less than Pao.

Link to Video

Finding the Vapor Pressure of a Solution (Nonionic-Nonvolatile Solute): https://youtu.be/WLceQuRlsPU

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15.11.2 Finding the Vapor Pressure of a Solution (Ionic-Nonvolatile Solute) (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

An ionic-nonvolatile solute will also cause the vapor pressure of the solvent to decrease.
Because the solute is nonvolatile it will not create a vapor pressure of its own.
However, we will need to adjust our calculations to account for the Van’t Hoff factor of the solute (i). Examples are salts such as NaCl or NaOH.

Raoult's Law Pa = XaPao

Pa = Vapor pressure of solution
Xa = Mol fraction of the solvent
Pao = Vapor pressure of the pure solvent

Link to Video

Finding the Vapor Pressure of a Solution (Ionic-Nonvolatile Solute): https://youtu.be/sRBaRXsql9s

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15.11.3 Finding Vapor Pressure of a Solution (Nonionic-Volatile Solute) (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

A nonionic-volatile solute will also cause the vapor pressure of the solvent to decrease. However, because the solute is volatile it will also have a vapor pressure. To find the overall vapor pressure of the solution the vapor pressure of the solute and the solvent must be combined.

Raoult's Law Pa = XaPao
Pa = Vapor pressure of a liquid in a solution
Xa = Mol fraction of the liquid in the solution
Pao = Vapor pressure of the pure solvent
Because the solute is volatile we must consider the vapor pressure of both the solute and the solvent. Psolution = Psolute + Psolvent .

Link to Video

Finding Vapor Pressure of a Solution (Nonionic-Volatile Solute): https://youtu.be/s06fzZZtLl0

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15.11 Introduction to the Vapor Pressure of a Solution (Raoult’s Law) (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The methods for calculating the vapor pressure of a solution are dependent on the characteristics of the solute. A nonionic-nonvolatile solute will cause the vapor pressure of the solvent to decrease. Because the solute is nonvolatile it will not create a vapor pressure of its own. Examples are: sugar, caffeine, fats, and proteins. An ionic-nonvolatile solute will also cause the vapor pressure of the solvent to decrease. Because the solute is nonvolatile it will not create a vapor pressure of its own. However, we will need to adjust our calculations to account for the Van’t Hoff factor of the solute (i). Examples are salts such as NaCl or NaOH. A nonionic-volatile solute will also cause the vapor pressure of the solvent to decrease. However, because the solute is volatile it will also have a vapor pressure. To find the overall vapor pressure of the solution the vapor pressure of the solute and the solvent must be combined. These calculations will all involve Raoult’s Law.

Raoult's Law Pa = XaPao
Pa = Vapor pressure of solution
Xa = Mol fraction of the solvent
Pao= Vapor pressure of the pure solvent
Raoult’s Law says that the vapor pressure of a solvent tends to decrease when it is part of a solution. Pa less than Pao.

Link to Video

Introduction to the Vapor Pressure of a Solution (Raoult’s Law): https://youtu.be/YZ5vTzUe0yg

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15.1 The Miscibility of Liquids (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When two liquids are soluble in each other they are called miscible. When mixed they will form a single heterogeneous solution. When two liquids are insoluble in each other they are called immiscible. When mixed they will eventually form two homogeneous solutions i.e. two layers. Two liquids should mix if they have the same intermolecular forces. This means that the molecule in one liquid has roughly the same interaction with the molecule in the other liquid as it does with itself. If the interaction L1-L2 about the same (L1-L1 and L2-L2) then the liquids will be miscible. If the interaction L1-L2 less than (L1-L1 or L2-L2) then the liquids will be immiscible.

Link to Video

The Miscibility of Liquids: https://youtu.be/J-pDm8xs_to

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15.2 Why do Ionic Solids Dissolve in Water (Ion-Dipole IMF)? (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When an ionic compound is dissolved in water a special interaction occurs. The ionic bonds are broken and the ionic species in the compound are separated. For sodium chloride, the Na+ ion becomes surrounded by the negative side of multiple water molecules and the Cl- ions are surrounded by the positive side of multiple water molecules. This interaction is called an ion-dipole intermolecular force, which is considered one of the strongest. During the reaction, the ionic bonds in sodium chloride are broken and replaced by the ion-dipole intermolecular forces present in the sodium chloride /water solution. Because the ion-dipole interactions are stronger than the ionic bonds, the products of the reaction (the sodium chloride/water solution) are in a more stable, lower energy state the reactants (solid sodium chloride and liquid water).The enthalpy change associated with the hydration of ions is called the enthalpy of solvation. The enthalpy of solvation is often exothermic.

Link to Video

Why do Ionic Solids Dissolve in Water (Ion-Dipole IMF)?: https://youtu.be/yz1Ml0Q8b_I

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15.3 Measures of Concentration (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discussed the wide variety of measures of concentration used in chemistry. Remember a solute is dissolved in a solvent to create a solution.
Molarity = Mol solute / Volume of solution (mol/L) or (M)
Mol fraction = Xsolute = Mol solute / Mol total (unitless)
Molality = Mol solute / Mass solvent (kg) (mol/kg) or (m)
Parts by mass = (Mass solute / Mass solution) x Multiplication factor (unitless)
Mass percent MF = 100
Parts per million (ppm) MF = 106
Parts per billion (ppb) MF = 109
Percent by volume = (Volume of solute / Volume of Solution) X 100 (unitless)

Link to Video

Measures of Concentration: https://youtu.be/RjMGaUpkg8g

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15.4 Converting Units of Concentration (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Each unit of concentration is a different way of representing the same number. Being able to convert from one unit of concentration to another is an important skill. This video goes over a sample problem for conversion of units of concentration.

Link to Video

Converting Units of Concentration: https://youtu.be/MG5CZOrazRA

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15.5 Why do Gases Dissolve in Water? (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Water (H_2O) is a polar molecule while many gases (O_2 & N_2) are nonpolar. Because gases do dissolve in water, there must be some kind of intermolecular force between them. The permanent dipole in water causes polarization in the O_2 molecule. As the negative side of a water molecule approaches the O_2 molecule, the electrons surrounding the O_2 molecule are pushed away creating an induced dipole. Now there is an interaction between the negative side of the water molecule and the positive side of the O_2 molecule. This is called a Dipole-Induced Dipole intermolecular force.

Link to Video

Why do Gases Dissolve in Water?: https://youtu.be/_pRlZXcCQ64

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15.6 Henry's Law (The Solubility of Gases in Solvents) (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

The solubility of gases in a solvent follows: Sgas = KPgas. Sgas = Concentration of gas (Mol / L or M) K = Henry's law constant (M / atm) Pgas = Partial pressure of gas

Link to Video

Henry's Law (The Solubility of Gases in Solvents): https://youtu.be/fiJZCGpArJI

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15.7 Colligative Properties in Solutions (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Properties dependent on the concentration of solute particles are called colligative properties. The Van't Hoff factor (i) compensates for the fact that some compounds dissolve to more than one particle. i = 1 for non-electrolytes. Sugar, alcohol For strong electrolytes (ionic compounds) (Metal bonded to a Non-metal). i = number to ions created when the electrolyte is dissolved

Link to Video

Colligative Properties in Solutions: https://youtu.be/mkHyVNswGog

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15.8 Osmotic Pressure (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Osmosis is the movement of water molecules across a semi-permeable membrane from a region of high concentration to a region of lower concentration until a state of equilibrium is reached.
Osmotic pressure is the pressure applied by a solution to prevent the inward flow of water across a semi-permeable membrane.
pi = iMRT
pi = Osmotic pressure (atm)
M = Molarity of solute (Mol/L or M)
R = 0.08205 L atm/Mol K
T = Temperature in K

Link to Video

Osmotic Pressure: https://youtu.be/uYQxI4mi3DA

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15.9 Boiling Point Elevation and Freezing Point Depression (Video)

This project was preformed to supply **Libretext Authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When a solute is dissolved in a solvent the BP is elevated and the FP is lowered.
This effect comes from dilution.
dTf = iKfm
dTb = iKbm
dT is the change in BP or FP or (Tsolution - Tsolvent)
K is a constant C/m
Kb should be positive and Kf should be negative.
m is the molality of the solute

Link to Video

Boiling Point Elevation and Freezing Point Depression: https://youtu.be/0MZm1Ay6LhU

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CHAPTER OVERVIEW

Chapter 17: Dynamic Equilibrium

17.10 Converting Kc to Kp (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Equilibrium constants can be expressed as a partial pressure of reactants and products (Kp). Concentration and partial pressure can be related using the ideal gas law PV = nRT KP = KC(RT)n gas R = 0.08205 L atm/mol K T = Temp in K n gas = Stoic. Coefficients of the gaseous products - Stoic. Coefficients of the gaseous reactant.

Link to Video

Converting K_c to K_p: https://youtu.be/_2WVnlqXrV4

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17.11 Converting Kp to Kc (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains the solution to the following question: For the reaction $CO_{(g)}$ + $Cl_{2(g)}$ -> $COCl_{2(g)}$ If the equilibrium partial pressures at 0 ^{o}C are: 1.2 x 10^{2} atm $COCl_2$; 5.0 x 10^{-4} atm CO and 4.0 x 10^{-4} atm Cl_2 what is K_c?

Link to Video

Converting K_p to K_c: https://youtu.be/WK_5qOEIgms

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17.12 Relationships Involving Equilibrium Constants (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When a reaction equation is reversed the Kc is inverted When the coefficients in a balanced equation are multiplied by a common factor we raise the equilibrium constant to the corresponding power. When the coefficients in a balanced equation are divided by a common factor we take the corresponding root of the equilibrium constant. When individual equations are added, their equilibrium constants are multiplied to obtain the equilibrium constant for the overall reaction. This video contains multiple examples using these ideas.

Link to Video

Relationships Involving Equilibrium Constants: https://youtu.be/2vZDpXX1zr0

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17.1 Introduction to Dynamic Equilibrium (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Two opposing processes taking place at equal rates. Some reactions are reversible For the reaction: $N2_{(g)} + 3\ H_{2(g)}$ - $2\ NH_{3(g)}$ We must now consider that the reverse reaction is also taking place: $2\ NH_{3(g)}$ - $N_{2(g)} + 3\ H_{2(g)}$ As we mix N_2 and H_2 the forward reaction occurs but as NH_3 is formed the reverse reaction starts to occur. With time the forward reaction starts to slow due to decreasing concentration of N2 and H2 and the reverse reaction speeds up due to the increasing concentration of NH_3. When the rates of the two reactions equal each other dynamic equilibrium occurs. This fact is expressed as: Kc = $\{NH_3\}_2 = 3.6 \times 10^8$ @ 298 K $\{N_2\}\{H_2\}_3$ This ratio is called the equilibrium constant expression and it is equal to a number, which is constant for the reaction (Kc). Some consequences 1) Once DE is reached the amounts of reactants and products remain the same. 2) In no case is any of the reacting species completely consumed. The equilibrium concentration of $N_{2(g)}$ was found to be 1.0×10^{-4}.

Link to Video

Introduction to Dynamic Equilibrium: https://youtu.be/4AJbFuzW2cs

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17.2 Determining the Equilibrium Expression (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains multiple examples of how to determine the equilibrium expression for a given reaction.

Link to Video

Determining the Equilibrium Expression: https://youtu.be/ZK9cMIWFerY

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17.3.1 Le Châtelier’s Principle (Changing Concentrations) (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Link to Video

Le Châtelier’s Principle (Changing Concentrations): https://youtu.be/o9jP1yF6E1U

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17.3.2 Le Châtelier’s Principle (Changes in Pressure or Volume) (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

When the volume is reduced or the pressure is increased, the reaction shifts in the direction that produces the fewest mols of gas. If the volume is increased or the pressure is decreased, the reaction shifts in the direction that produces the most mols of gas. $N_{2(g)}$ + 3 $H2_{(g)}$ - 2 $NH_{3(g)}$ Which way will the reaction shift to reach equilibrium if the volume is decreased or pressure is increased? The side with the least mols of gas is favored. 4 VS 2 so the reaction goes right Which way will the reaction shift to reach equilibrium if the volume is increased or the pressure is decreased? 4 VS 2 so the reaction goes left

Link to Video

Le Châtelier’s Principle (Changes in Pressure or Volume): https://youtu.be/fHlFTtn2gxU

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17.3.3 Le Châtelier’s Principle (Changes in Temperature) (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

Treat an exothermic reactions as having heat as a product and endothermic reactions as having heat as a reactant. Adding or removing heat is like changing a reactant or product. Heat + $N_{2(g)}$ + 3 $H_{2(g)}$ -> 2 $NH_{3(g)}$ H = + 100 kJ/mol H is positive so the reaction is endothermic. Treat the reaction as if heat is a reactant. Which way will the reaction shift to reach equilibrium if the reaction temperature was increased? The reaction shifts right. Decreasing the reaction temp? Reaction goes left.

Link to Video

Le Châtelier’s Principle (Changes in Temperature): https://youtu.be/-P5uGuJZ-r8

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17.3 Le Châtelier’s Principle (Video)

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Video Topics

If a chemical system at equilibrium experiences a change in concentration, temperature, volume, or pressure, then the reaction shifts to counteract the imposed change and a new equilibrium is established. Le Châtelier’s Principle says that if apply some stress to an equilibrium the reaction will shift in the direction that relieves this stress.

Link to Video

Le Châtelier’s Principle: https://youtu.be/pENk3XYFP98

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17.4 What Does K Tell us About a Reaction? (Video)

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Video Topics

A large K greater than 1010 means the reaction goes to virtual completion. A small K less than 10^{-10} means the reaction does not occur to any significant extent. $N_{2(g)} + O_{2(g)}$ -> 2 $NO_{(g)}$ $\{NO\}_2 = KC = 4.7 \times 10^{-31} \{N_2\}\{O_2\}$ This means very little $NO_{(g)}$ is present.

Link to Video

What Does K Tell us About a Reaction?: https://youtu.be/39-456o3O_4

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17.5 Using the Reaction Quotient (Q) (Video)

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Video Topics

The reaction quotient Q determines the direction a reaction must go to get to equilibrium. $N_{2(g)}$ + $O_{2(g)}$ - 2 $NO_{(g)}$ For the above reaction if we start with only N_2 and O_2 the reaction must go the right of make NO. If we start with only NO the reaction must go to the left to make N_2 and O_2. To find the direction of change first find the reaction quotient Q. Find Q by plugging the initial reaction concentrations into the equilibrium expression. If Q less than K the reaction goes to the right If Q more than K the reaction goes to the left If Q = K the system is at equilibrium

Link to Video

Using the Reaction Quotient (Q): https://youtu.be/_J04fgRs7QU

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17.6 Using Q to Find Equilibrium Concentrations (Video)

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Video Topics

This video contains the solution to the following question. A solution is initially 1.0 M of HCN. Kc = 6.2×10^{-10} Find the equilibrium concentrations of CN^- and H_3O^+.

Link to Video

Using Q to Find Equilibrium Concentrations: https://youtu.be/-sbeII65Z7w

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17.7 Finding Equilibrium Concentrations for Reactions with a Small K Value (Video)

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Video Topics

This video contains the solution to the following question. A solution is initially 1.0 M of HCN. K_c = 6.2 x 10^{-10}. Find the equilibrium concentrations of CN^- and H_3O^+.

Link to Video

Finding Equilibrium Concentrations for Reactions with a Small K Value: https://youtu.be/EyCZTyJvrj8

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17.8 Using ICE Tables to find Eq. Concentrations and Kc (Video)

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Video Topics

To set up an ICE table using the following steps. 1) Set up a row with the known concentrations of each species in the reaction. 2) Find the change in concentration for the species of interest. 3) Using stoichiometry find the changes which must have occurred in the other species. 4) Sum up the columns to find the Eq. concentrations. 5) Plug these values into the equilibrium expression to find KC.

Link to Video

Using ICE Tables to find Eq. Concentrations & Kc: https://youtu.be/vGQWZHlNWyM

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17.9 Using ICE Tables to find Kc (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains the solution to the following question. For the reaction: 2 $SO_{2(g)}$ + $O_{2(g)}$ -> 2 $SO_{3(g)}$ Assume we mix 1.5 M of $SO_{2(g)}$ and 2.0 M of $SO_{3(g)}$ and allow the reaction to reach Eq. If the concentration of $SO_{3(g)}$ at Eq. is 1.0 M. What is the Eq. concentration of all species? What is KC for the reaction?

Link to Video

Using ICE Tables to find Kc: https://youtu.be/CwQmO4M2s64

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CHAPTER OVERVIEW

Chapter 18: Acid / Base Chemistry

18.10 Predicting the Results of an Acid/Base Reaction (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to predict the results of an acid/base reaction by comparing Ka’s.

For a given Bronsted acid/base reaction there will an acidic species on either side of the arrow.

The equilibrium will favor the side with the weakest acid.

K_a’s, pK_a’s or structural features can be used to determine the weakest acid.

$\mathbf{HF_{(aq)} + HS^-_{(aq)} \Leftrightarrow F^-_{(aq)} + H_2S_{(aq)}}$

K_a for HF = 7.2×10^{-4}

K_a for H_2S = 1×10^{-7}

H_2S is the weaker acid therefore the equilibrium will lie to the right.

So $\{H_2S\} > \{HS^-\}$ and $\{F-\} > \{HF\}$

Link to Video

Predicting the Results of an Acid/Base Reaction: https://youtu.be/4zI4k6DZ83k

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18.11 Ions as Acids and Bases (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to calculate the pH of a solution contains the conjugate of a weak acid or the conjugate acid of a weak base.

The salts of a group one metals and the conjugate base of a weak acid are basic

Chloride and bromide salts of the conjugate acid of a weak base are acidic.

Link to Video

Ions as Acids and Bases: https://youtu.be/XYAGNonPSow

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18.12 Solving for Ka or Kb (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to calculate the K_a of a weak acid if given the $\{H_3O^+\}$ or the K_b of a weak base if give the $\{^-OH\}$.

Link to Video

Solving for Ka or Kb: https://youtu.be/i2n5mcrowow

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18.13 Polyprotic Acids (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to calculate the pH of a polyprotic acid.

Polyprotic acids: Have more than one ionizable H atoms

H_2S, H_2CO_3, H_3PO_4, H_2SO_4, H_2SO_3

Link to Video

Polyprotic Acids: https://youtu.be/y7DTjgrcP-0

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18.15 pH Indicators (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses pH indicator and how they are used.

Indicators are usually weak acids

The acid and its conjugate base have different colors

$HIn_{(aq)} + H_2O_{(l)} \leftrightarrow H_3O^+_{(aq)} + In^-_{(aq)}$

By le Chatelier's principal

Adding H^+ shifts the equilibrium to the left. The acid color appears.

Adding ^-OH reduces H_3O^+ and the equilibrium shifts right. The base color appears.

When $\{HIn\} = \{In^-\}$ and intermediate color appears.

This occurs when pH = pKa.

The color change occurs of a range of pH = pKa +/- 1

Acid color pH < pKa -1

Intermediate color pH = pKa

Base color pH > pKa + 1

Link to Video

pH Indicators: https://youtu.be/1IqzUa5lABs

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18.1 Definitions of Acids and Bases (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses the different definitions of acids and bases used in chemistry.

Arrhenius Theory of acids and bases

Acids increases $\{H^+\}$ when dissolved in water. H^+ is called a hydrogen ion or proton.

Bases increases $\{^-OH\}$ when dissolved in water. ^-OH is called the hydroxide ion

This theory has problems because it neglects NH_3 as a base and does not consider the solvent H_2O.

Brøsted-Lowry theory of acids and bases

Acid: Proton donor

Base: Proton acceptor

Lewis Definition of acids and bases

Lewis Acid = Accepts an electron pair to form a bond

Lewis Base = Donates an electron pair to form a bond

Link to Video

Definitions of Acids and Bases: https://youtu.be/r8reN0CSIHw

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18.2 Acid/Base Equilibria (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how acids and bases are involved in equilibria.

The constants K_a and K_b are defined and discussed.

Link to Video

Acid/Base Equilibria: https://youtu.be/Y5Khh8JHOJA

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18.3 Self-Ionization of Water (Kw) (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how water is involved in acid and base equilibria. Also, the equilibrium for the **self-ionization of water (K_w)**

Substances (H_2O) that can act as an acid or base are called amphiprotic

In all Acid/Base reactions water is present.

Because water is amphiprotic it an break up into hydronium and hydroxide ions.

Self-ionization:

$K_w = \{H_3O^+\}\{^-OH\} = 1.0 \text{ x } 10^{-14}$ @ 25^O C

K_w = ion product of water.

In pure water

$\{H_3O^+\} = \{^-OH\} = 1.0 \text{ x } 10^{-7}$ M

This is the requirement of neutrality.

H_3O^+ and ^-OH are always in Eq. with each other.

Link to Video

Self-Ionization of Water (Kw): https://youtu.be/RMpO0rqUnFg

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18.4 How is the Kw Equilibrium Affected by the Addition of Acids or Bases? (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how the Kw equilibrium is affected by the addition of acids or bases?

$\mathbf{H_2O_{(l)} + H_2O_{(l)} \Leftrightarrow H_3O^+_{(aq)} + {}^-OH_{(aq)}}$

H_3O^+ and ^-OH are always in Eq. with each other.

By Le Châtelier's principle

If we increase $\{H_3O^+\}$ by adding an acid we decrease $\{^-OH\}$.

If we increase $\{^-OH\}$ by adding a base we decrease $\{H_3O^+\}$.

Link to Video

How is the Kw Equilibrium Affected by the Addition of Acids or Bases?: https://youtu.be/lPDojb3CXCI

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18.5 Introduction to pH (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video defines pH and contains examples of how to calculate pH.

Because of the small concentration of H_3O^+ we use pH to measure acidity.

$\text{pH} = -\log\{H_3O^+\}$

Likewise we can say

$\text{pOH} = -\log\{^-OH\}$

Because: $K_w = \{H_3O^+\}\{^-OH\} = 1.0 \times 10^{-14}$

We can say: $pK_w = \text{pH} + \text{pOH} = 14.0$

Because at neutrality : $\{H_3O^+\} = \{^-OH\} = 1.0 \times 10^{-7}$ M

Neutral pH = 7

pH > 7 Basic or alkaline

pH < 7 Acidic

Link to Video

Introduction to pH: https://youtu.be/pQOa3bb5YEE

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18.6 Calculating pH in Strong Acid or Strong Base Solutions (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video discusses how to the pH of a strong acid or strong base solution.

What is the $\{^{-}OH\}$ in a 0.10 M solution of HCl?

HCl is a strong acid so 100% dissociation

$(0.10\ M)(1\ mol\ H_3O^+/1mol\ HCl) = 0.10\ M\ H_3O^+$

$K_w = \{H_3O^+\}\{^{-}OH\} = 1.0 \times 10^{-14}$

$\{^{-}OH\} = K_w/\{H_3O^+\}$

$\{^{-}OH\} = 1.0 \times 10^{-14} / 0.10\ M$

$= 1.0 \times 10^{-13}\ M$

Link to Video

Calculating pH in Strong Acid or Strong Base Solutions: https://youtu.be/NNTptn7hV2s

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18.7 Conjugate Acid-Base Pairs (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video defines conjugate acid-base pairs and how to determine them.

During a reaction using a Bronsted acid and base, a new acid and base are formed.

Conjugate acid-base pair: Two species who differ from each other by one hydrogen ion.

Every reaction between a Bronsted acid and a Bronsted base involves two conjugate acid-base pairs.

There is an acid and a base on each side of the reaction arrow.

Link to Video

Conjugate Acid-Base Pairs: https://youtu.be/pPrp3xEQef4

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18.8 Calculating the pH of Weak Acids and Weak Bases (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains examples of calculating the pH of Weak Acids and Weak Bases

The strength of a weak acid can be measured by K_a or pK_a.

As K_a increases the acid strength increases

$$\mathbf{HA_{(aq)} + H_2O_{(l)} \Leftrightarrow A^-_{(aq)} + H_3O^+_{(aq)}}$$

As pK_a decreases the acid strength increases

The strength of a weak base can be measured by K_b or pK_b.

As K_b increases and pK_b decreases the base strength increases

Link to Video

Calculating the pH of Weak Acids and Weak Bases: https://youtu.be/zr1V1THJ5P0

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18.9 Solving when X is not Small (Video)

This project was preformed to supply **Libretext authors** with videos on General Chemistry topics which can be used to enhance their projects. Also, these videos are meant to act as a learning resource for **all General Chemistry students**.

Video Topics

This video contains examples of calculating the pH of a weak acid without making an assumption that X is small.

Link to Video

Solving when X is not Small: https://youtu.be/l9JjHN-OuFE

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