1. Screencasts

1.1 System of Units/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=rFS9wtB4KM0

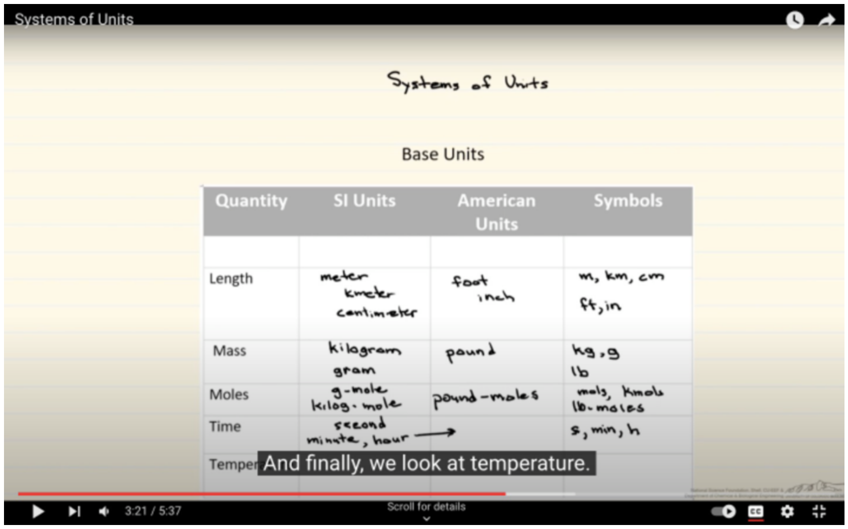

Figure 1 - System of Units by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.2 Unit Conversion (practice)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=mgR6egNSoJc

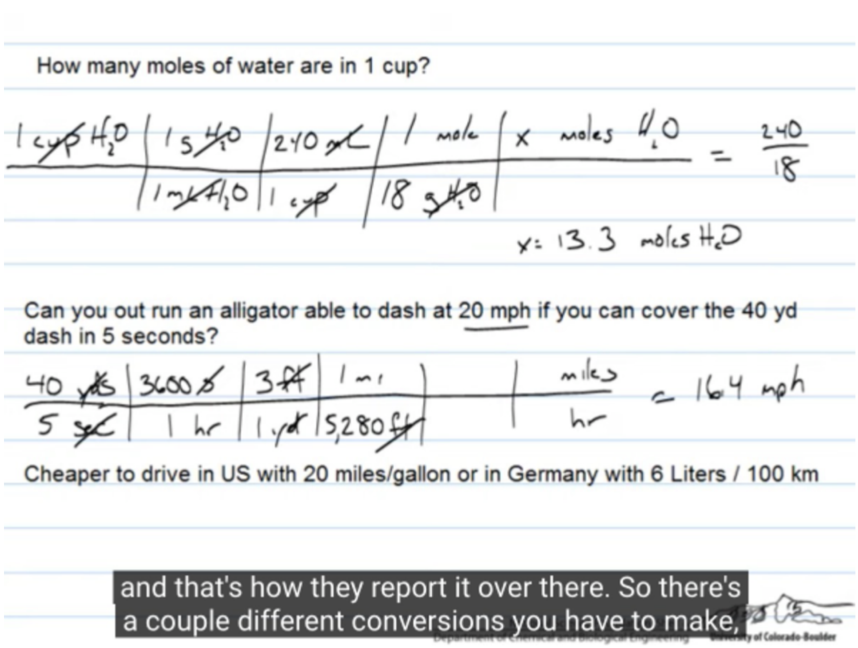

Figure 2 - Unit Conversion by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.3 Unit Conversion (Example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/IaMyHmqsTUo

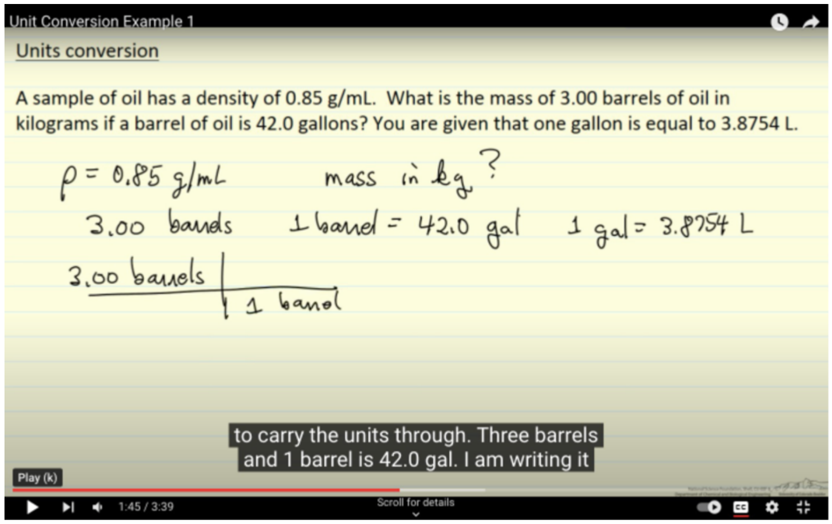

Figure 3 - Unit conversion Example by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.4 Molecular Mass/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=V5zzzzWuwzE

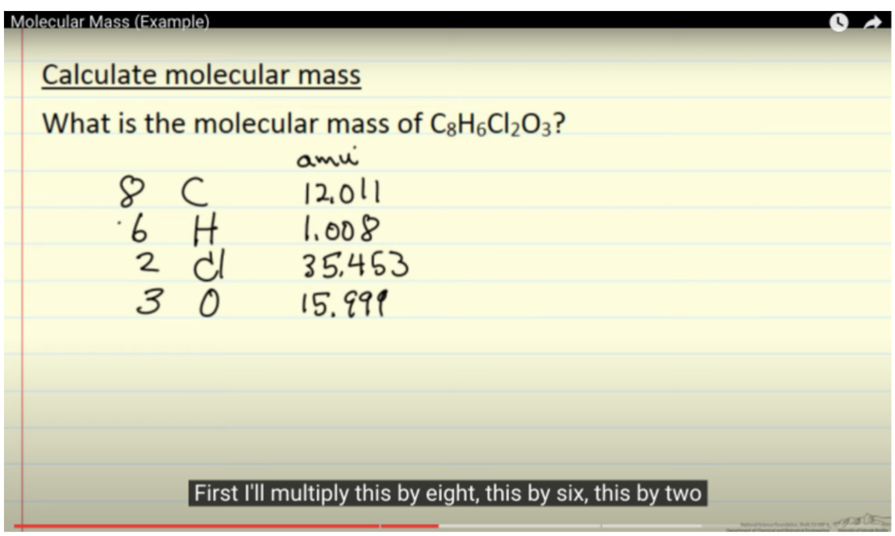

Figure 4 - Molecular Mass (Example) by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.5 Number of Subatomic particles/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=oHAuPT3Mk3Y

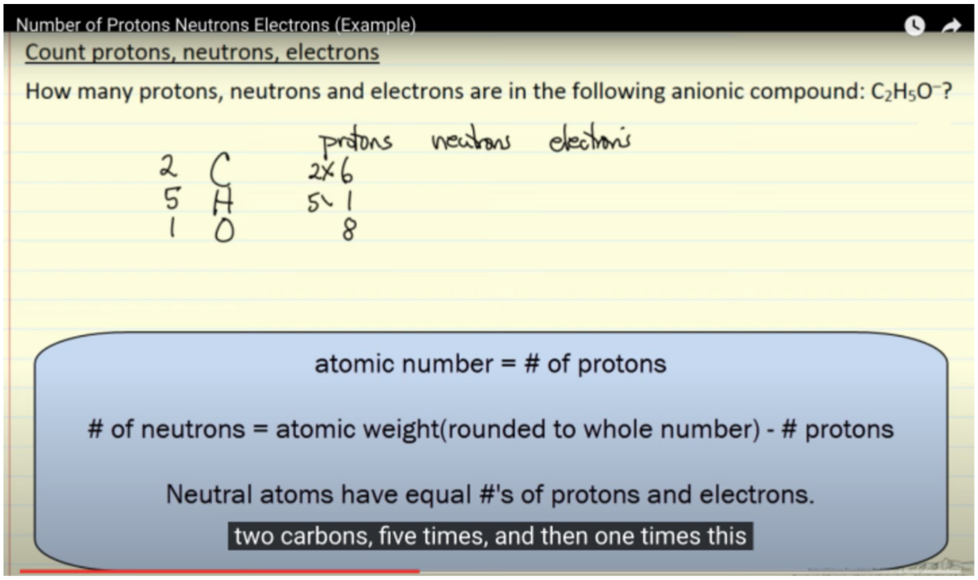

Figure 5 - Subatomic particles by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.6 Isotopic Abundance Example/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=agUT0ekqs_A

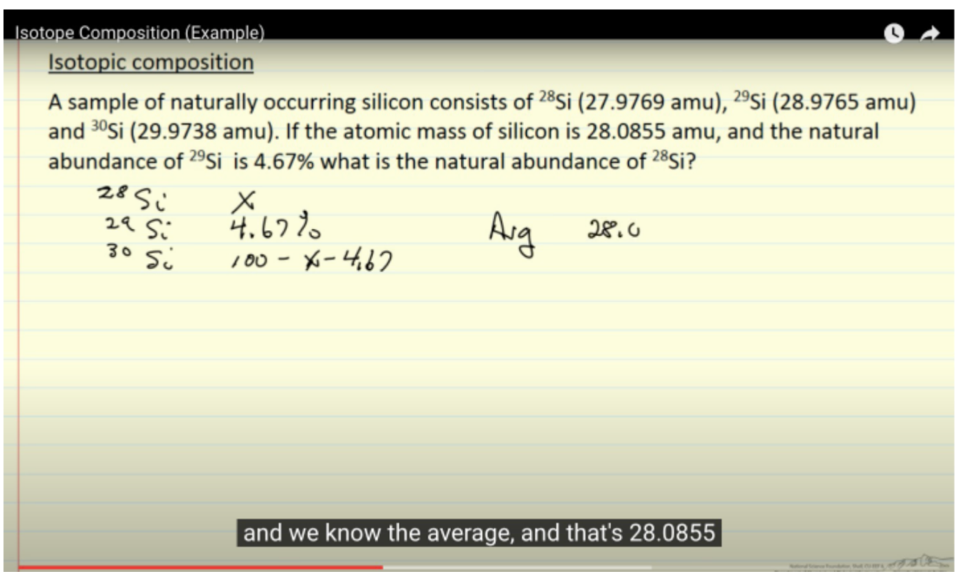

Figure 6 - Isotope composition by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.7 Empirical formula from mass percentage/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=SGyj0sySvhM

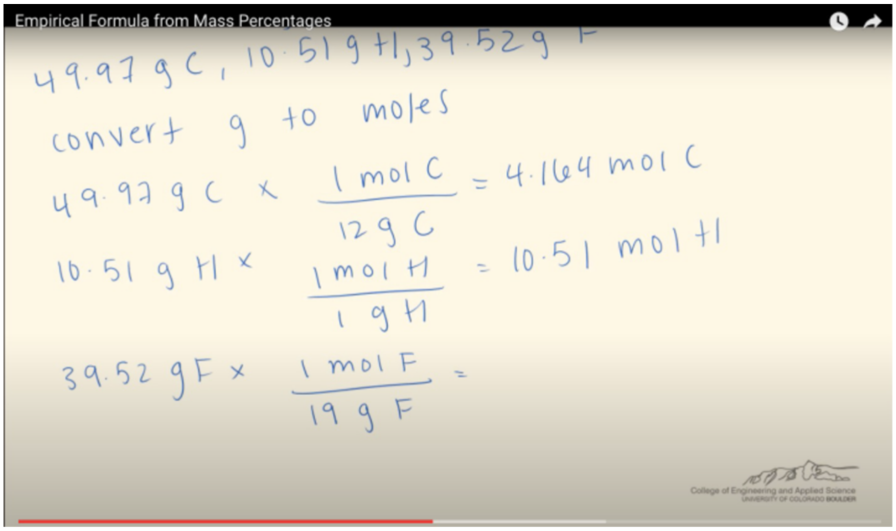

Figure 7 - Empirical formula by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.8 Empirical formula from combustion analysis example/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=aonEmARxw8M

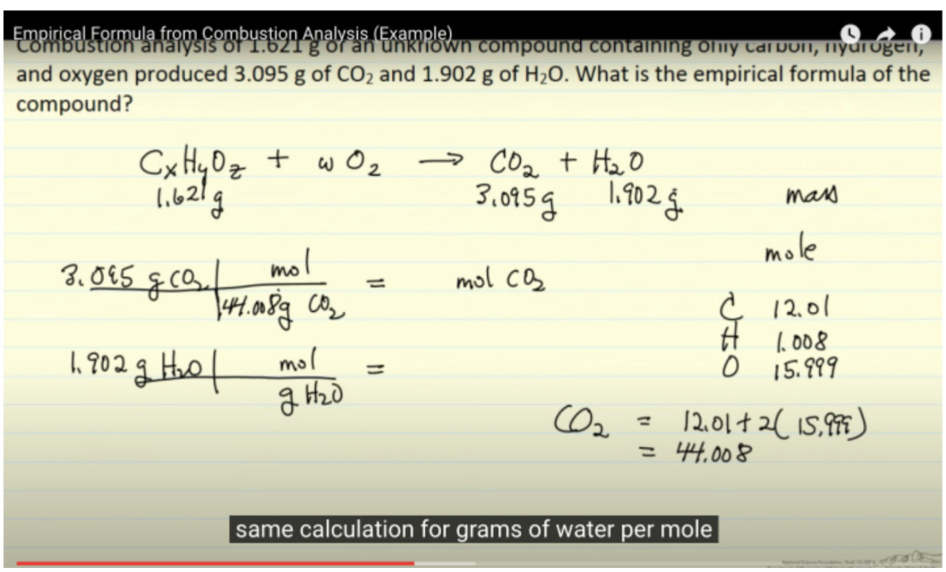

Figure 8 - Empirical formula from combustion analysis by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.9 Empirical formula from combustion analysis 2/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=tbMfvgu191Y

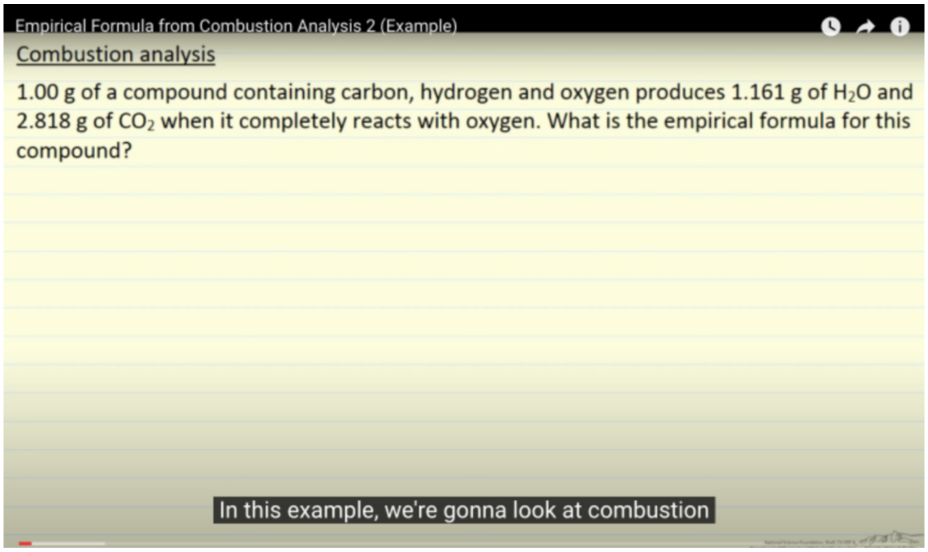

Figure 9 - Empirical formula from combustion analysis by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.10 Mass composition from molar composition/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=S4Jzn4Iyc6k

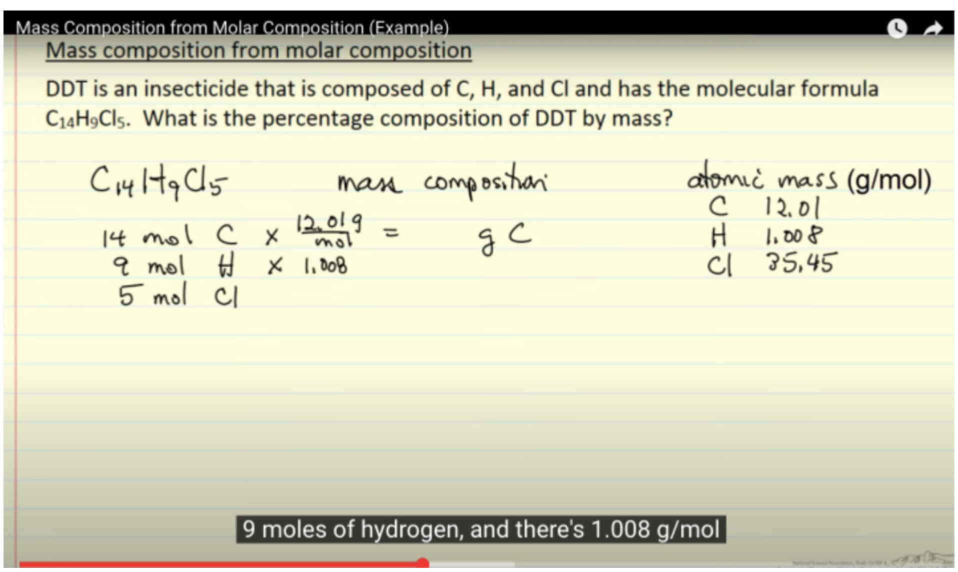

Figure 10 - Mass Composition from molar composition by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.11 Balance an equation/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=a0Gvh_JvJgY

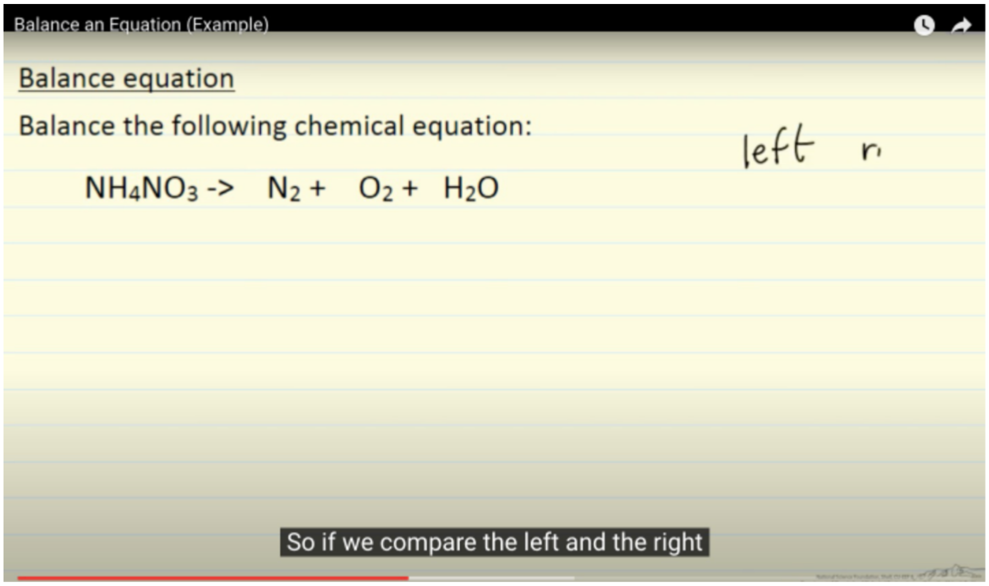

Figure 11 - Balance on Equation by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.12 Calculate the amount of reactant needad/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=zNP0-2w6qrs

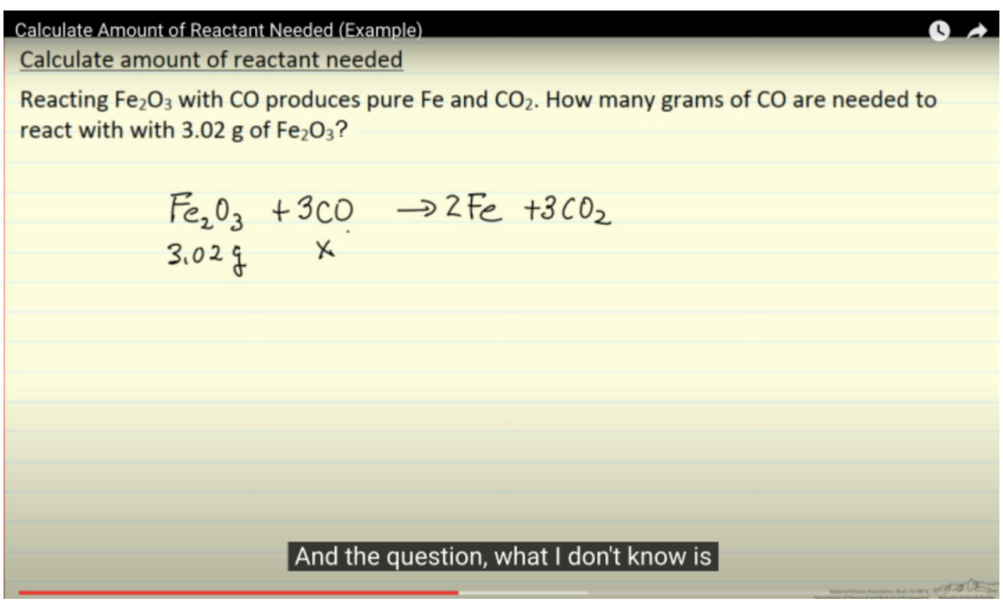

Figure 12 - Calculate the amount of reactant needed LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.13 Stoichiometry/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=e8cUyGBt8e8

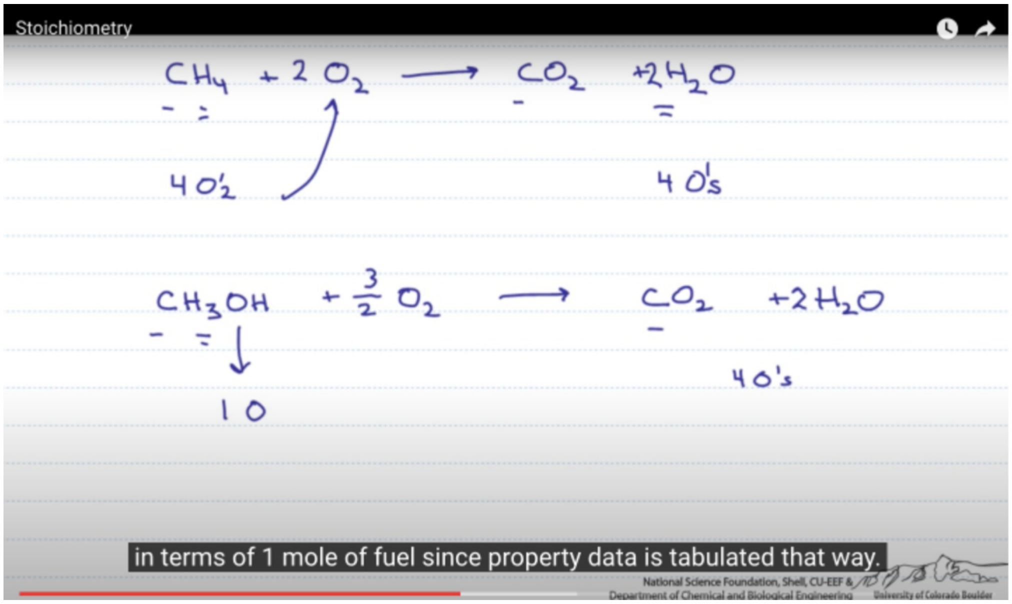

Figure 13 - Stoichiometry by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.14 Reaction stoichiometry (interactive)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=s7AYHkMbFNs

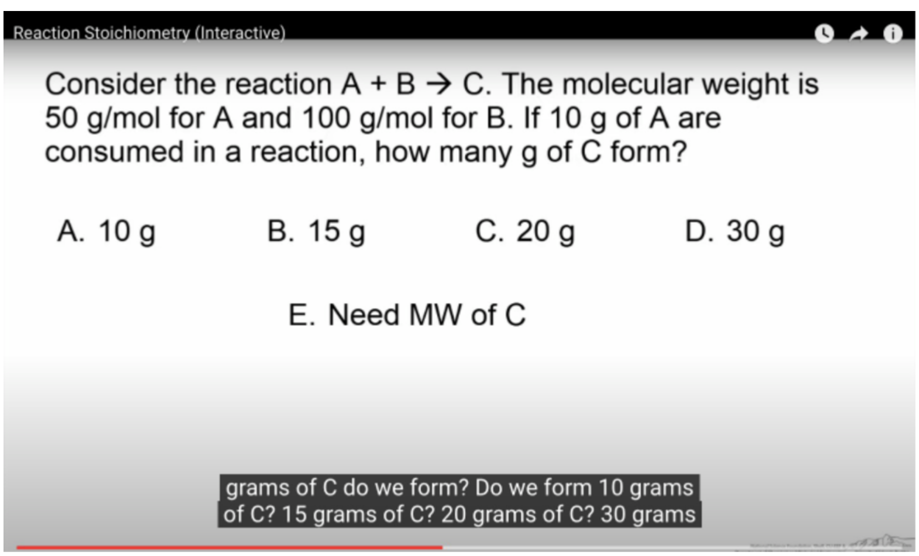

Figure 14 - Stoichiometry interactive by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.15 Calculate concentration (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=nvjoBkH8_qQ

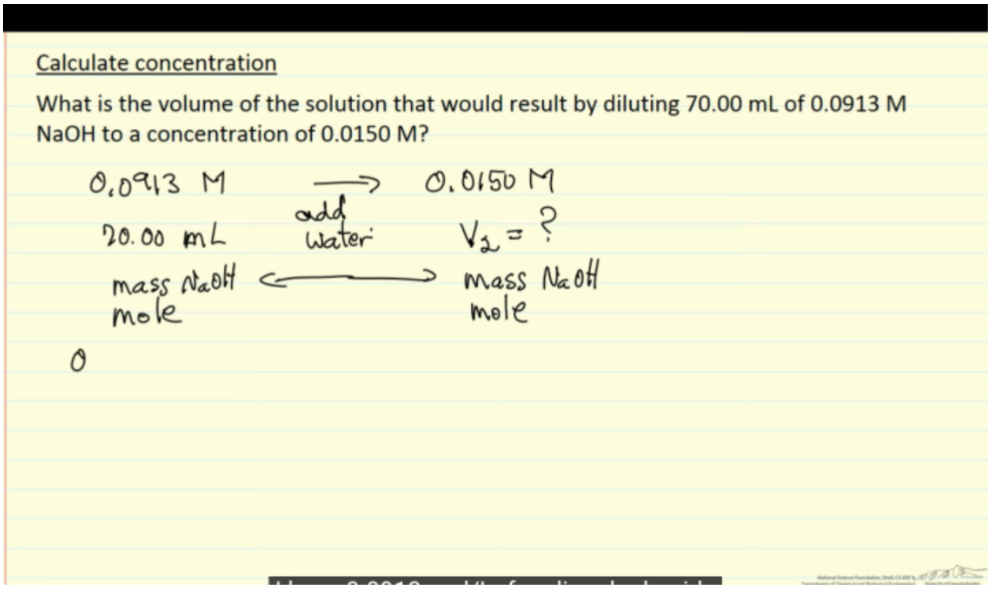

Figure 15 - Stoichiometry interactive by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.16 Calculate concentration (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=nvjoBkH8_qQ

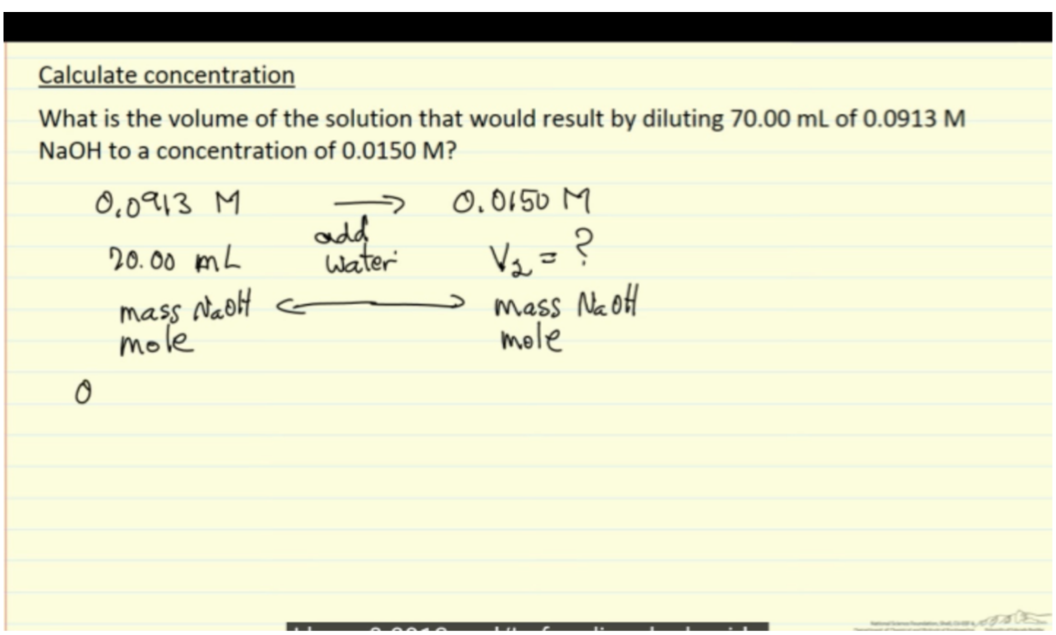

Figure 16 - Calculate concentration by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.17 - Create diluted solution (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=MybrJJdx_Gw

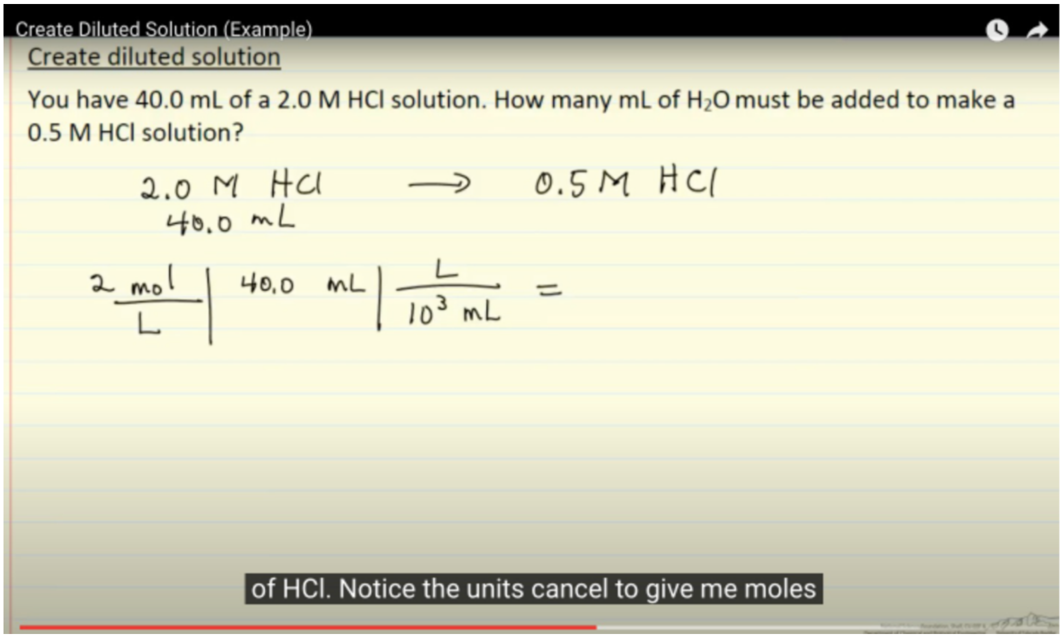

Figure 17 - Create diluted solution by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.18 - Precipitation reaction (Spectator Ions)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=R6wwIsYCR6c

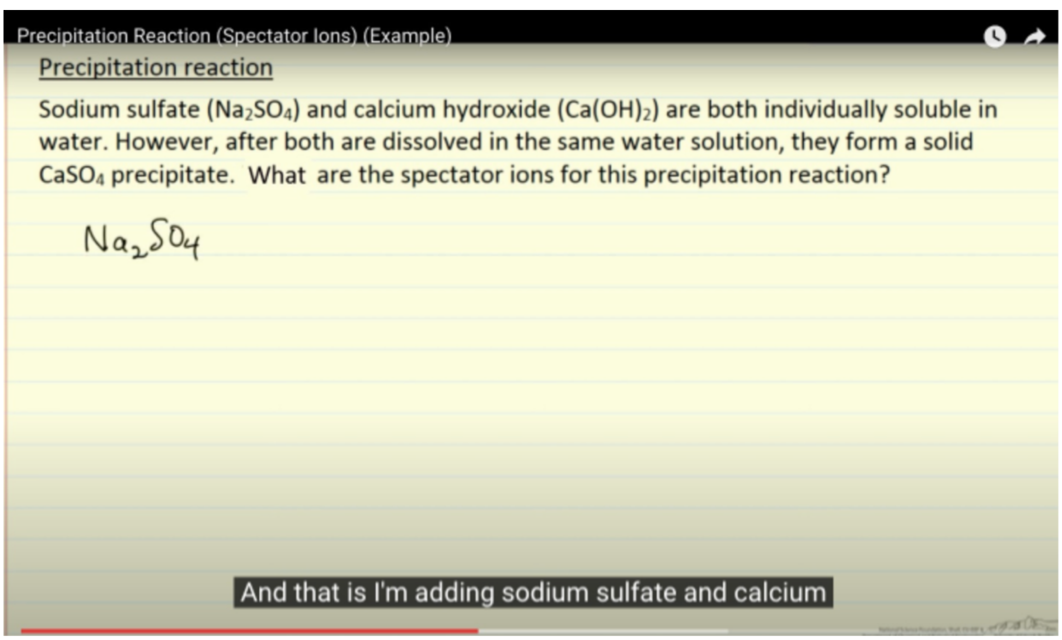

Figure 18 - Precipitation reaction by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.19 Titration (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=OZv2qi1NoPc

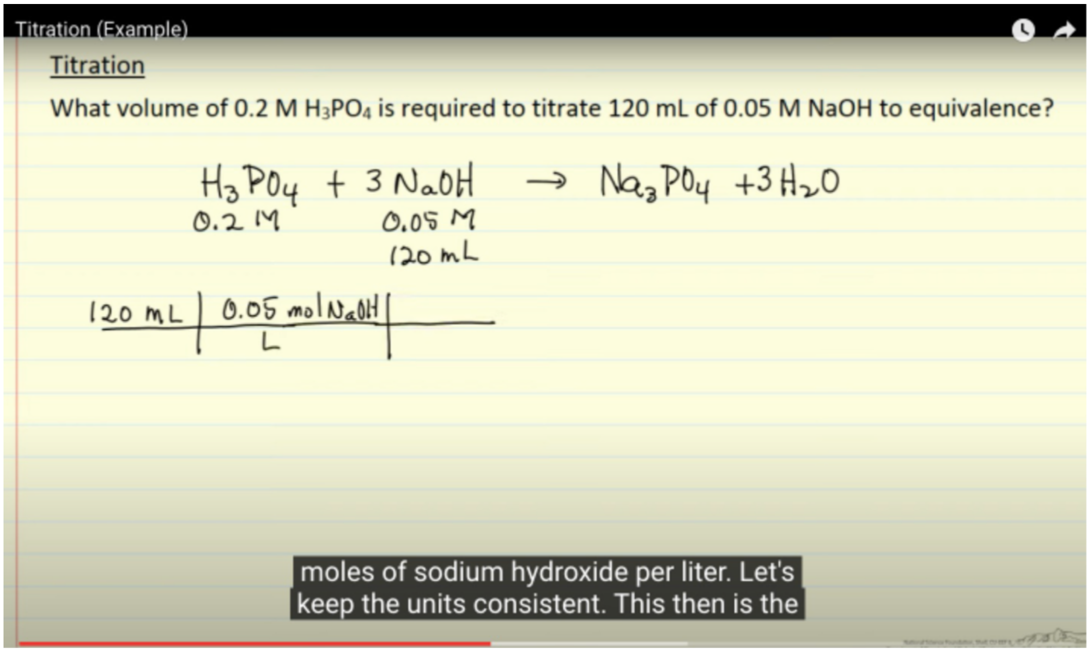

Figure 19 - Titration by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.20 Titrate Base with acid (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=h-RIXX9UnfM

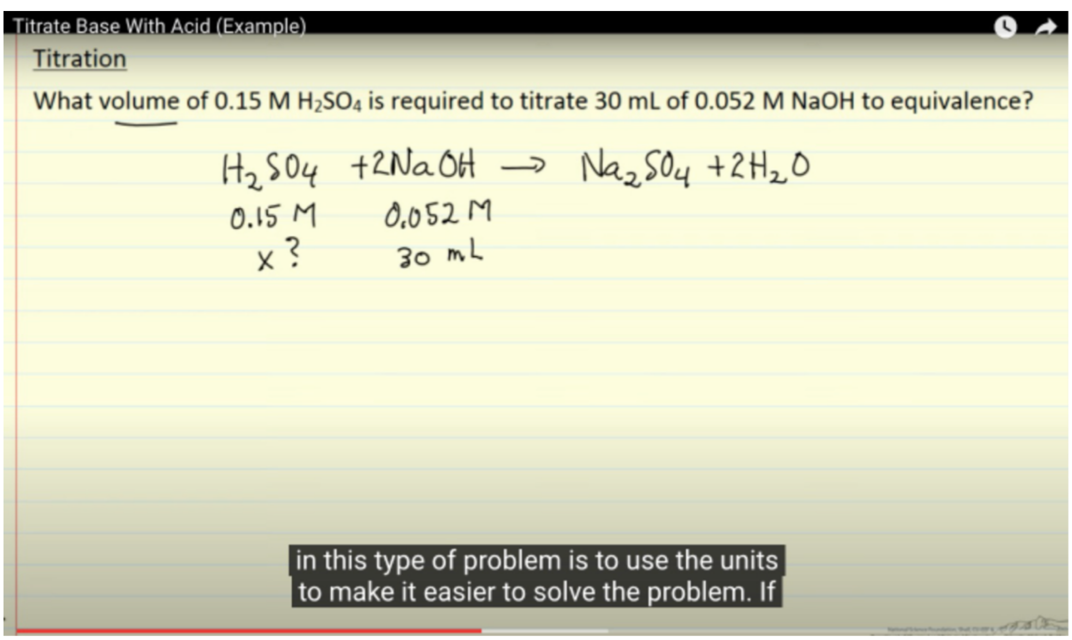

Figure 20 - Titrate base with acid by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.21 Oxidizing and reducing agents (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=142KSemCU0k

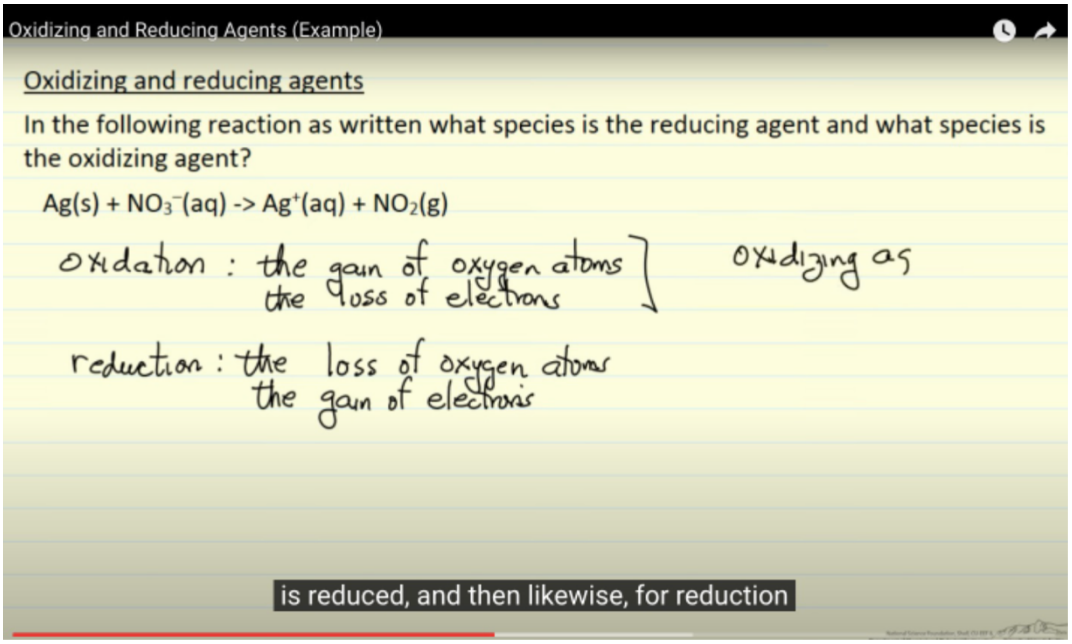

Figure 21 - Oxidizing and reducing agents by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.22 Oxidation number (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=OT9SxW8lsBg

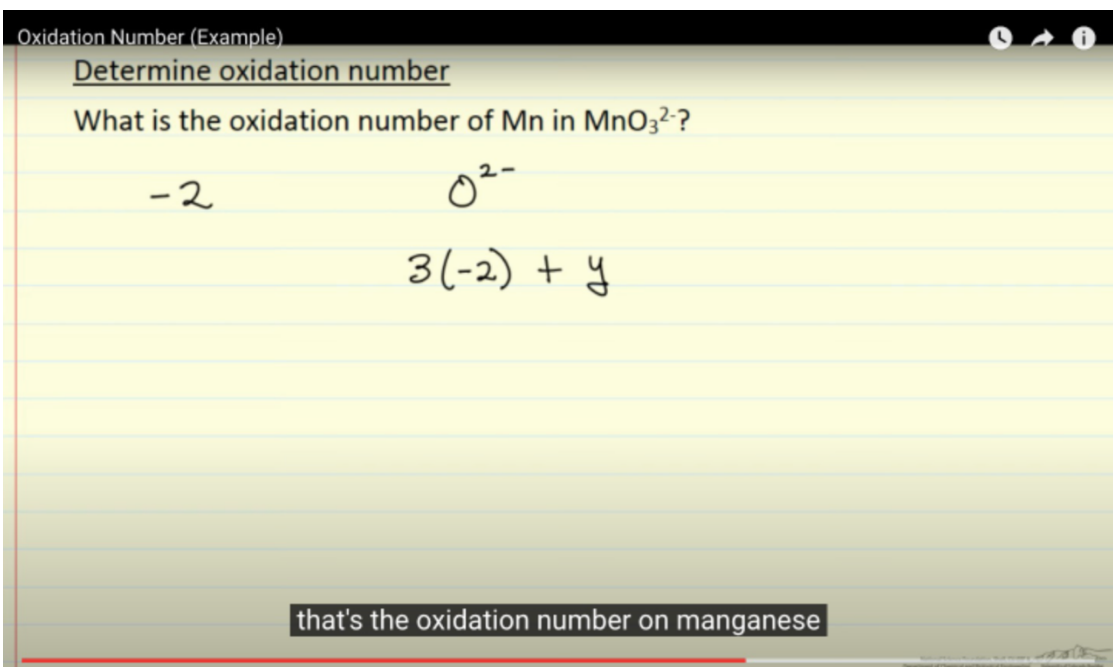

Figure 22 – Oxidation number by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.23 Oxidation number 2 (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://www.youtube.com/watch?v=-K-2f0g2wro

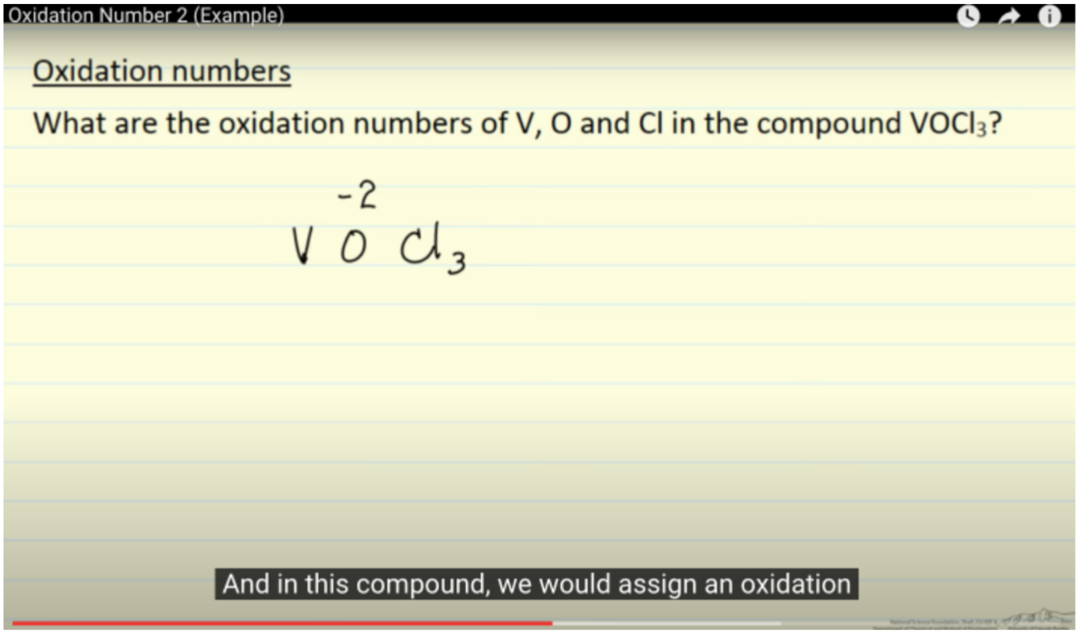

Figure 23 - Oxidation number 2 by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.24 Balance redox reaction (acidic solution)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/EE8fjXiX-Lc

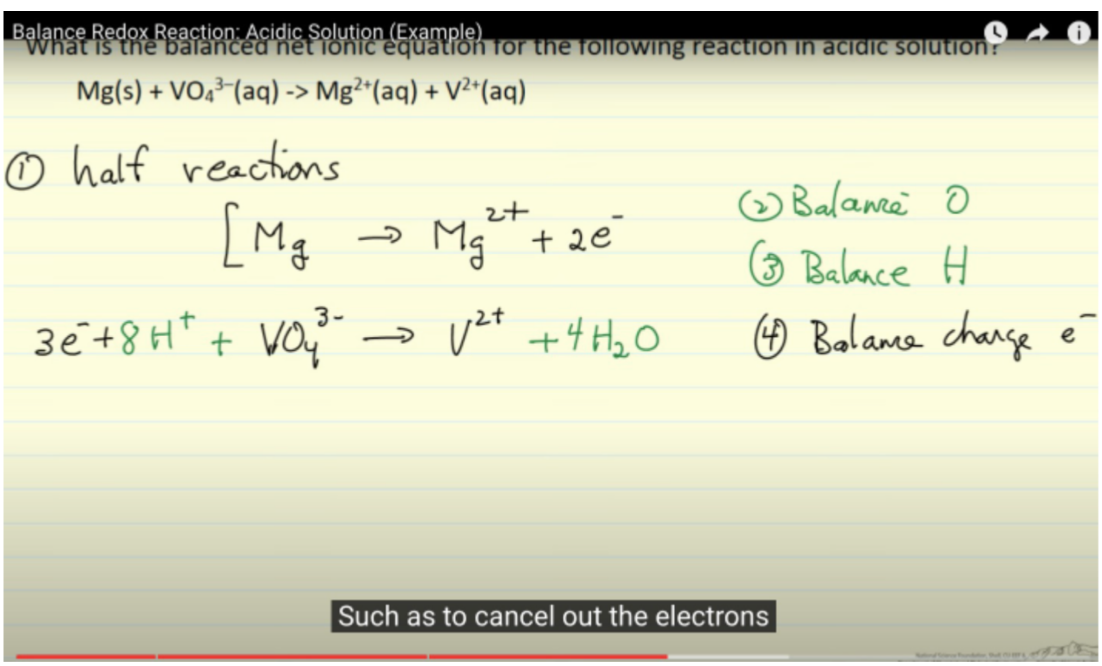

Figure 24 - Balance redox reaction by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.25 Balance redox reaction (acidic solution 2)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/94T84t8Xjzw

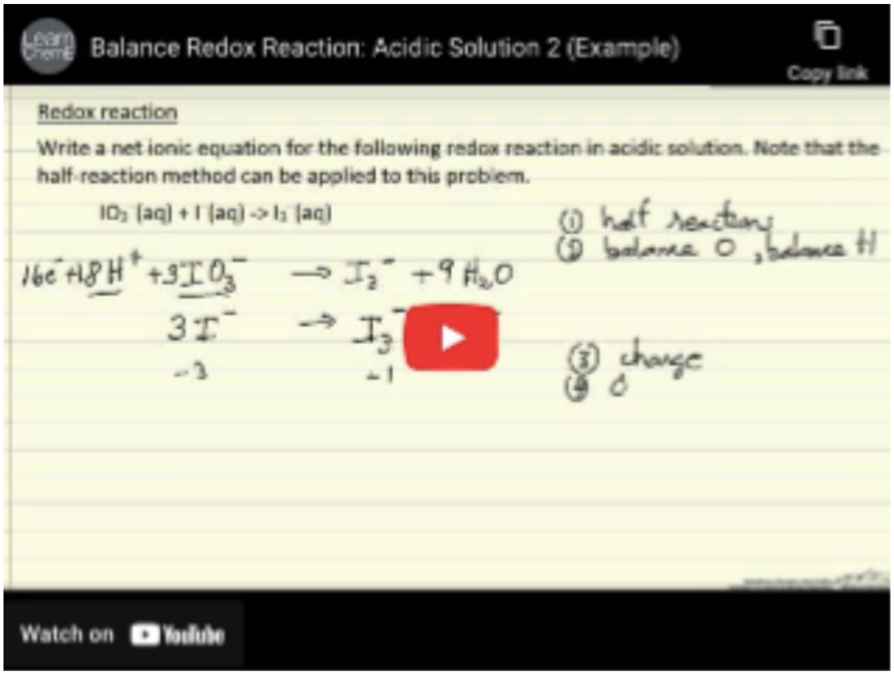

Figure 25 - Balance redox reaction by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.26 Balance redox reaction (basic solution)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/bCQt0rVJe8c

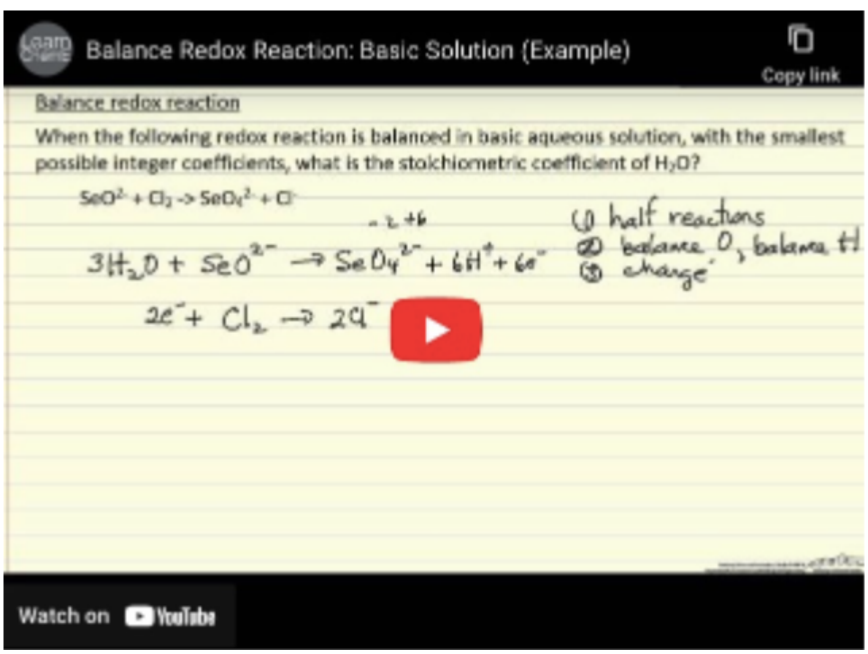

Figure 26 - Balance redox reaction by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.27 Ideal gas properties (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/cBTaIZFIEG4

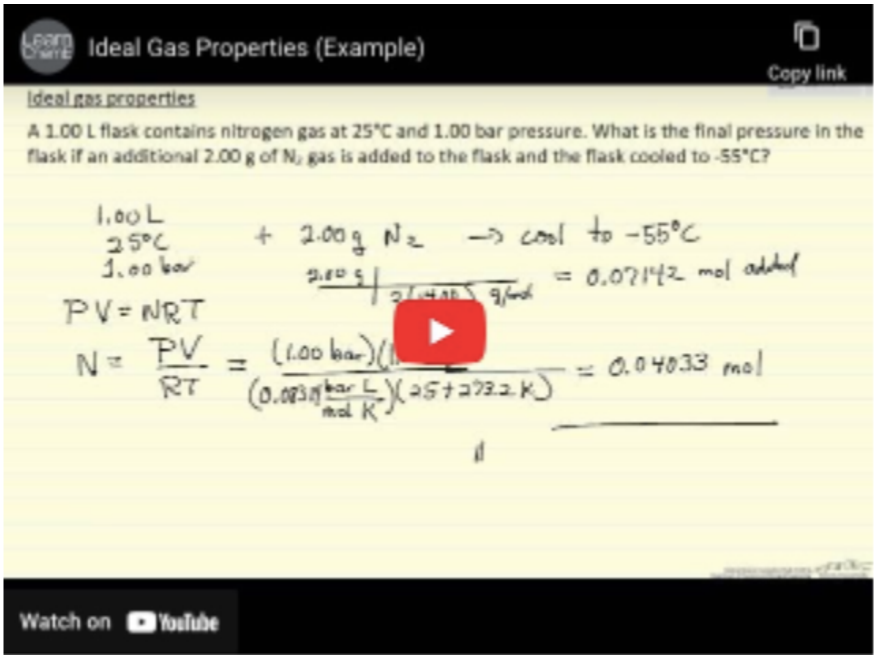

Figure 27 - Ideal gas properties by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.28 Ideal gas law example/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/IgUS4_0m9Zc

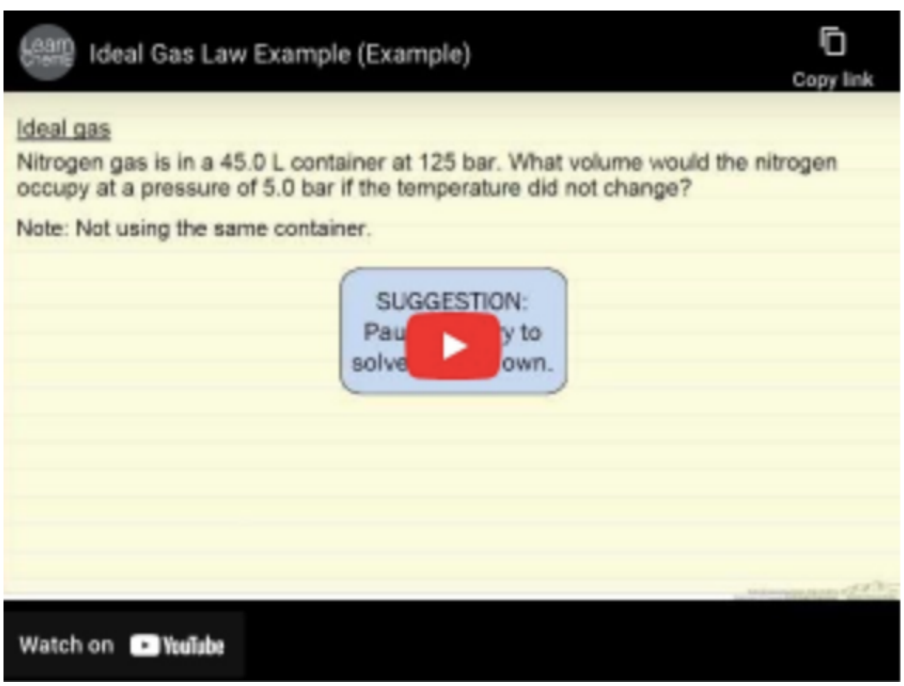

Figure 28 - Ideal gas law example by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.29 Molar mass of a gas/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/mF8RdjDiuu8

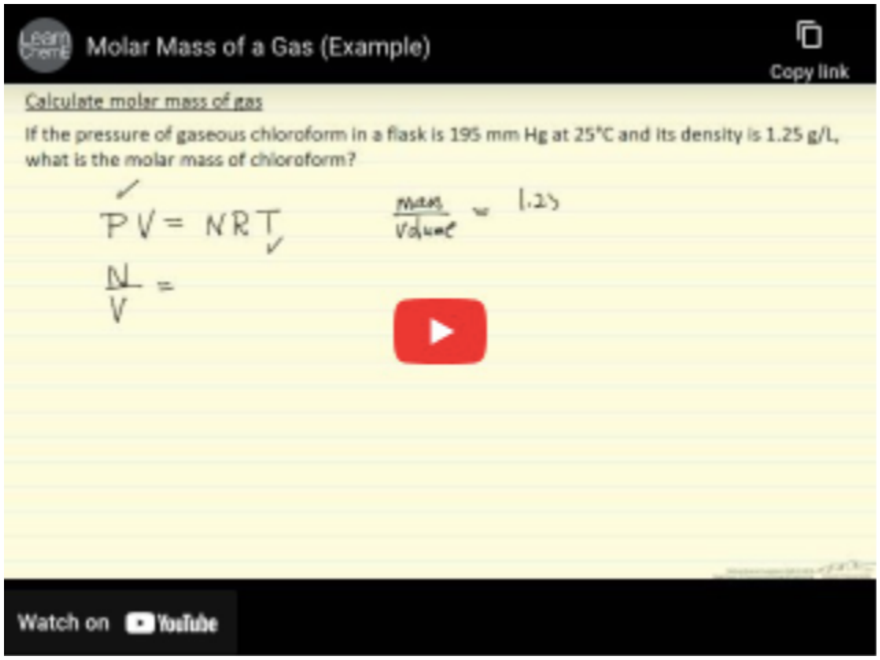

Figure 29 - Molar mass of a gas by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.30 Gas density/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/EhPxE3La_Zg

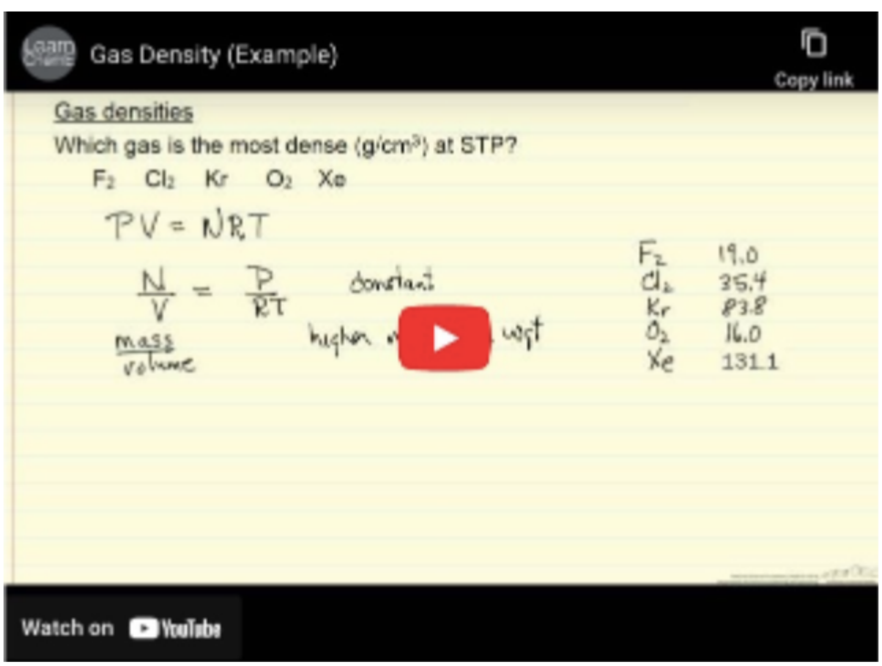

Figure 30 - Gas density by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.31 Partial pressure/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/iCTnUFIakNo

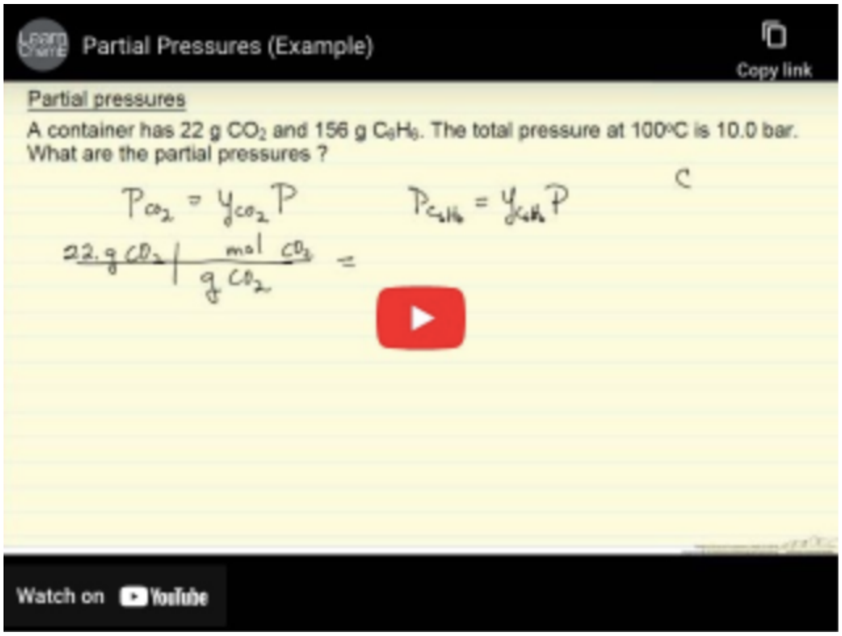

Figure 31 - Partial pressure reaction by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.32 Amount of gas product formed/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/LXYdJN1V_p0

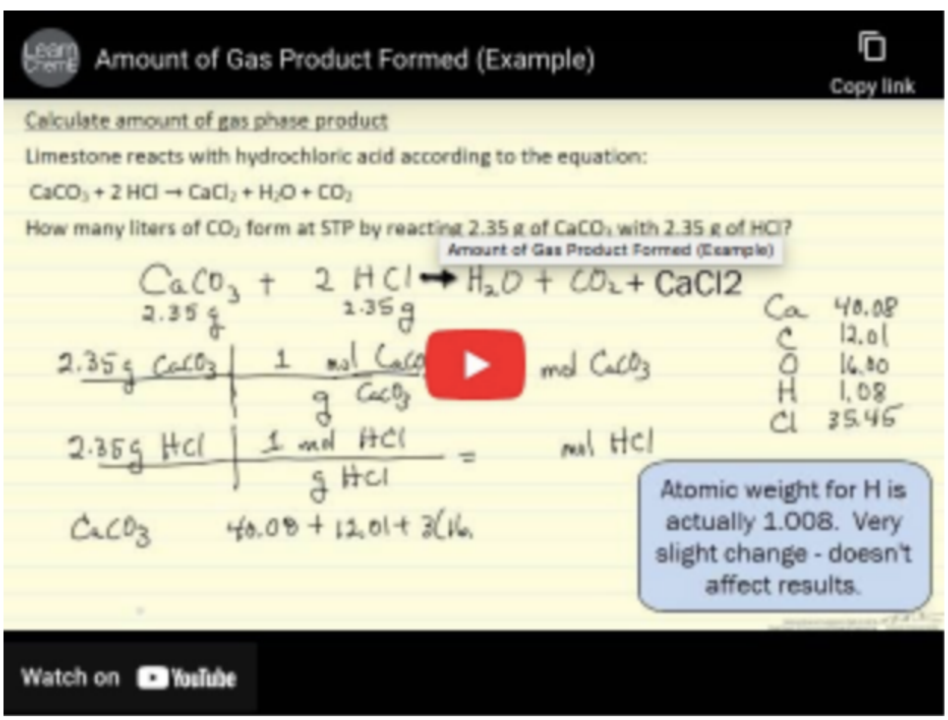

Figure 32 - Amount of gas formed by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.33 Changes in enthalpy and internal energy/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/W0zUnmr9r4U

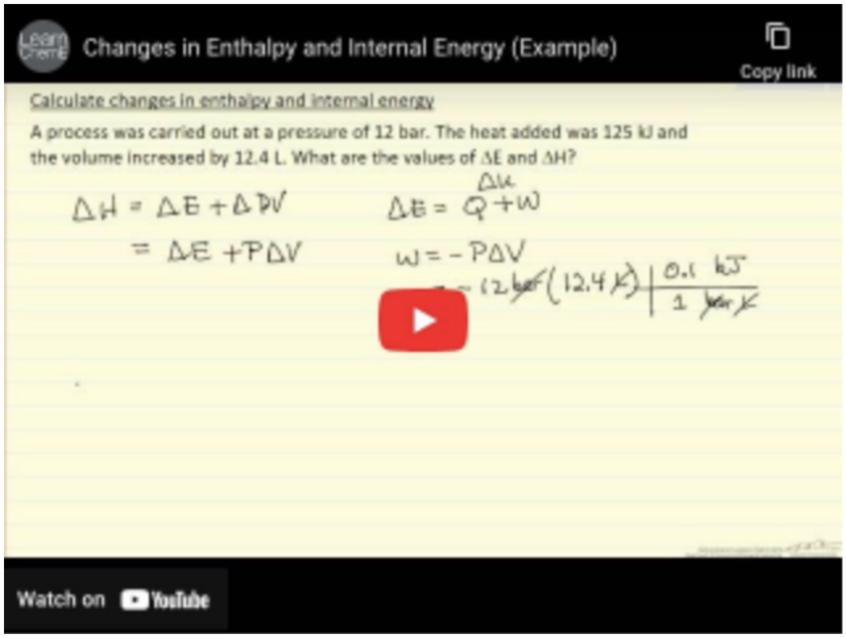

Figure 33 - Changes in enthalpy and internal energy by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.34 Enthalpy and internal energy changes/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/p_mmzNtqidI

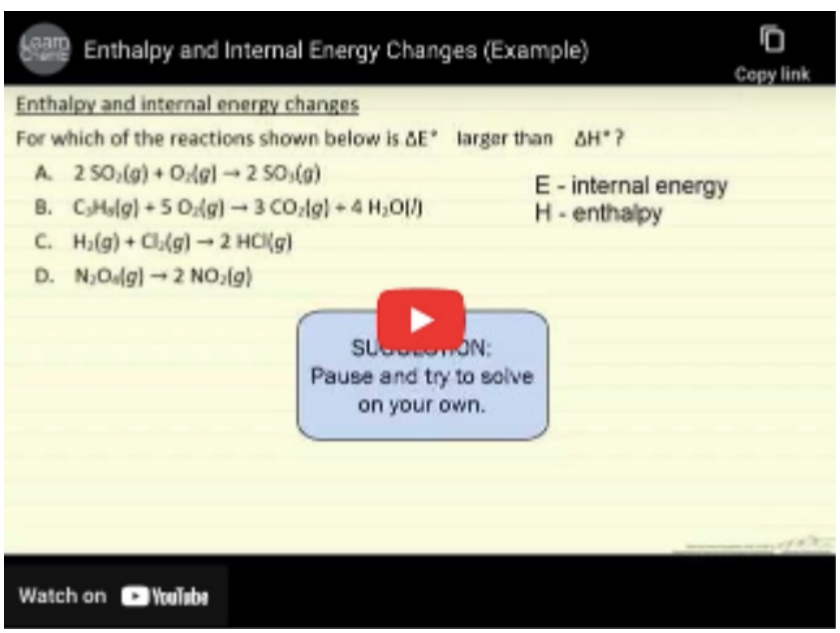

Figure 34 - Enthalpy and internal energy changes by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.35 Heat absorbed during a reaction/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/D3Vh4eVN87M

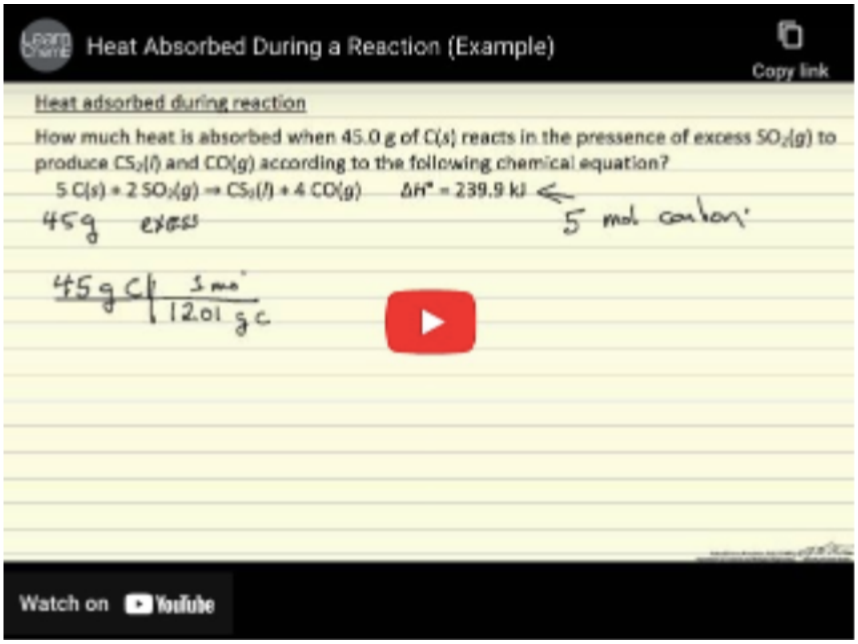

Figure 35 - Heat absorbed during a reaction by LearnChemE is licensed under CC BY-SA 4.0-LearnChemE

1.36 Heat of reaction/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/gYZroO3mAlw

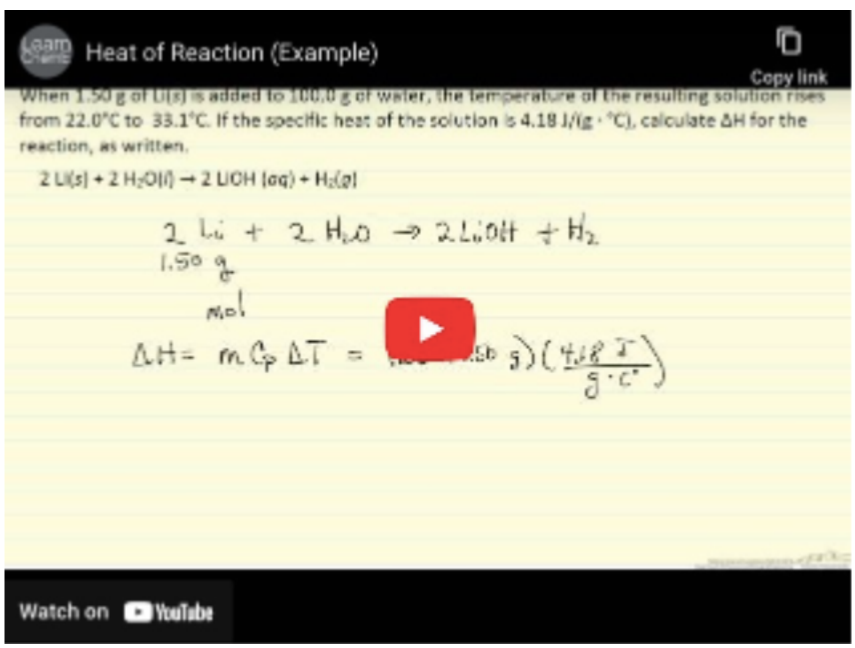

Figure 36 - Heat of Reaction reaction by LearnChemE is licensed under CC BY-SA 4.0-LearnChemE

1.37 Hess's law/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/OHptjNxKNXs

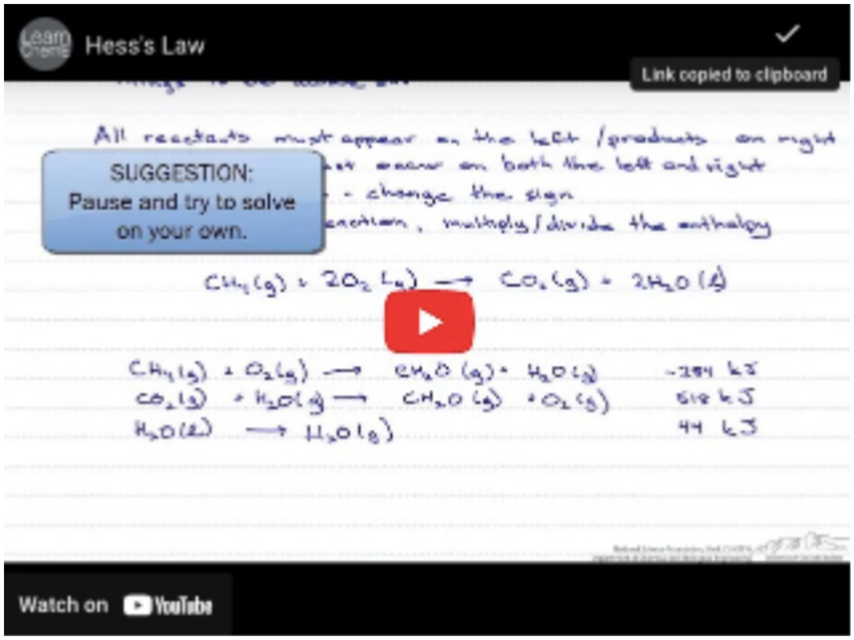

Figure 37 - Hess's law by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.38 Heat of reaction (Hess's law)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/e5J8oNMFRtE

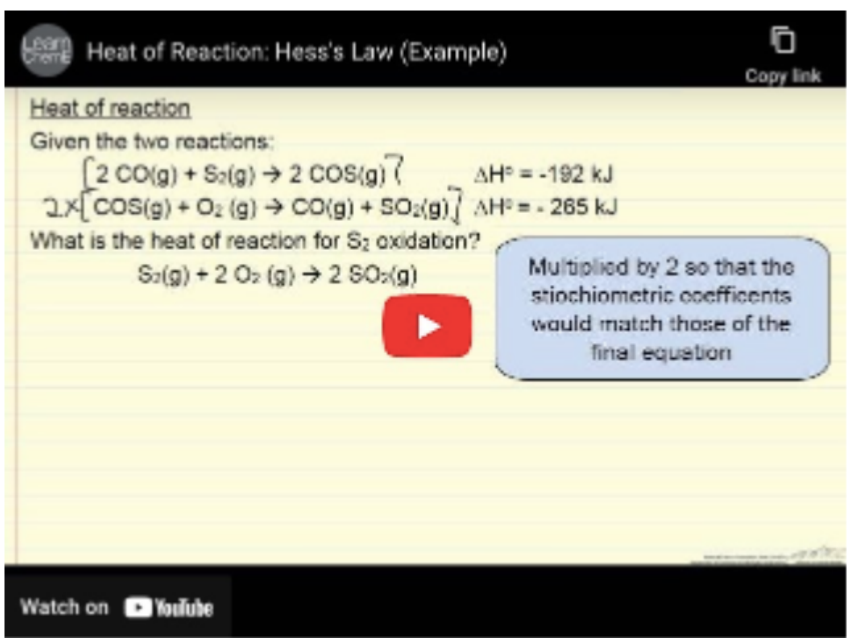

Figure 38 - Heat of reaction by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.39 Heat of reaction (Hess's law 2)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/gohO4DIpqQE

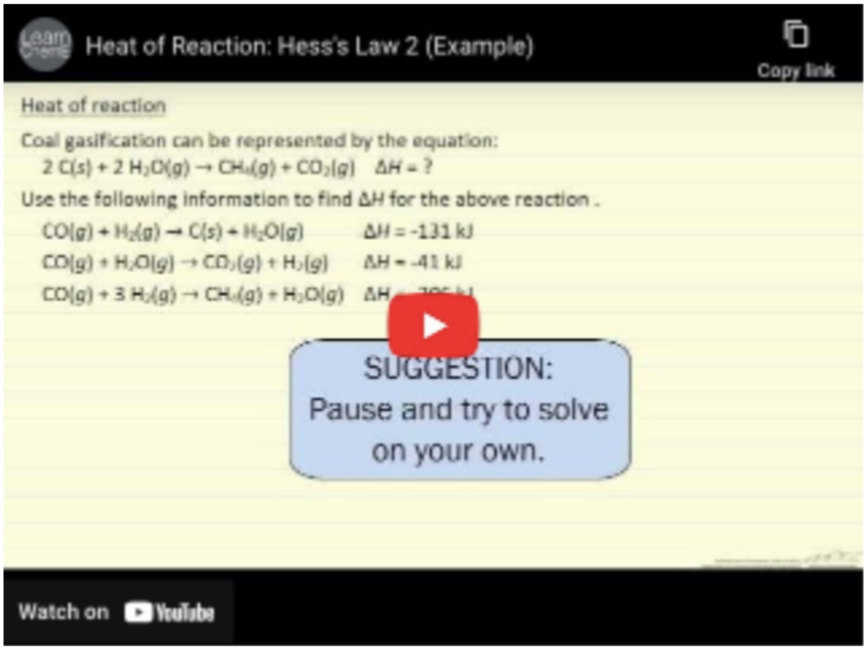

Figure 39 - Heat of reaction by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.40 Lewis structure (octet rule)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/gQ7Uwd4NZXk

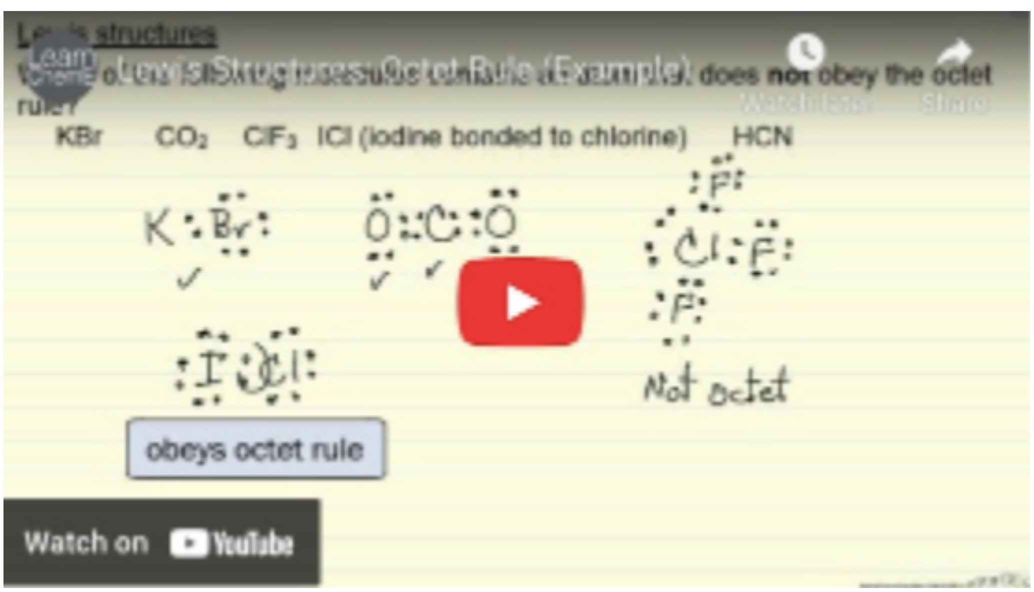

Figure 40 - Lewis structure by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.41 Lattice Energy/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/ConTsQHnN6Q

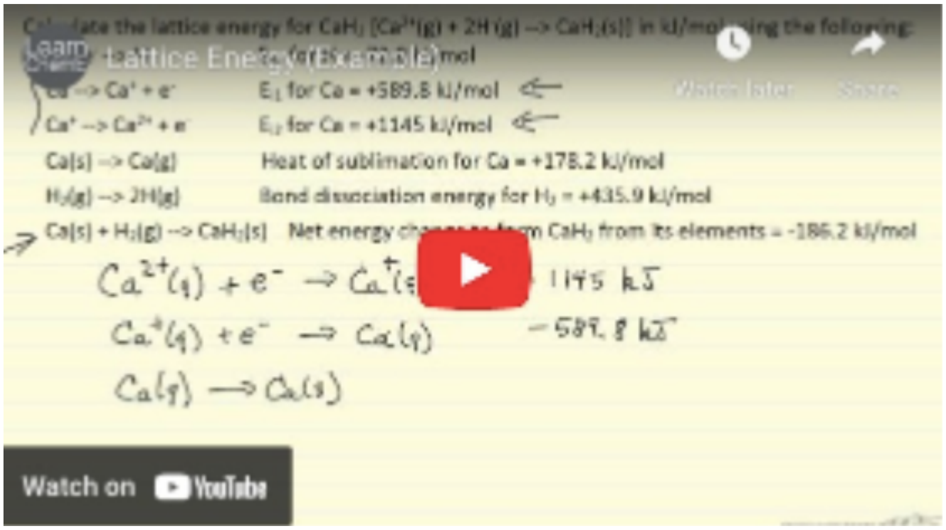

Figure 41 - Lattice energy by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.42 Lewis dot structure example/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/cMubkwFUEDA

Figure 42 - Lewis dot structure by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.43 Lewis dot structure (molecular geometry)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/V1iM_GwTlys

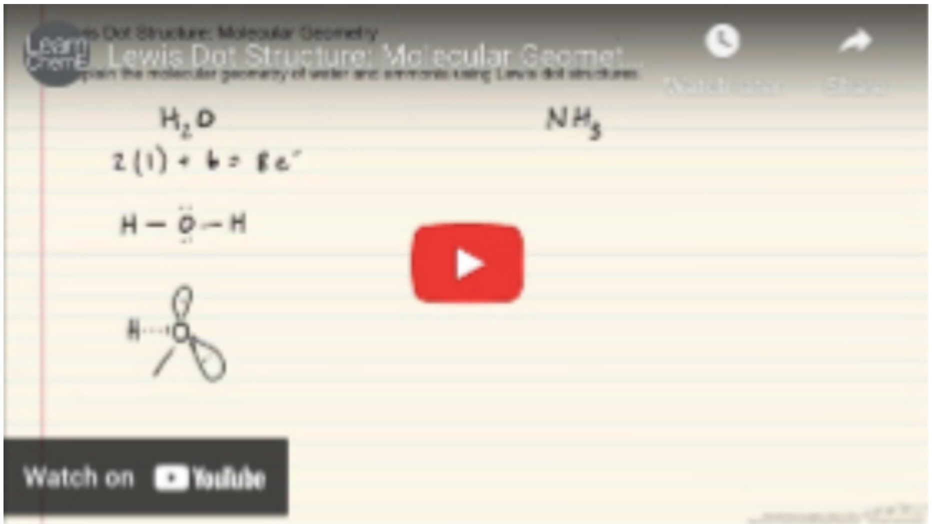

Figure 43 - Lewis dot structure by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.44 Lewis dot structure (triple bond)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/6WkIC9e_M10

Figure 44 - Lewis dot structure by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.45 Formal Charge/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/_wYtocFdgGc

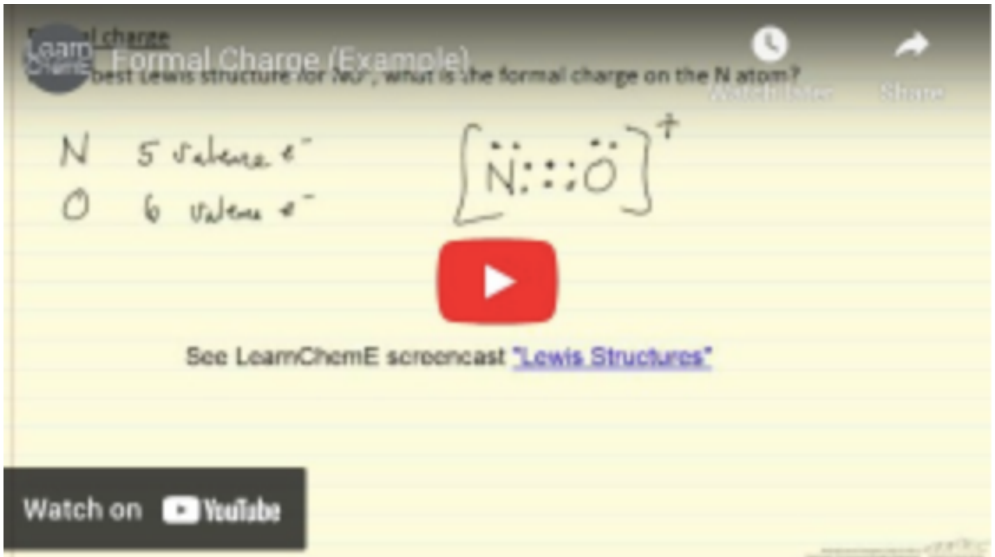

Figure 45 - Formal charge by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.46 Determining favored resonance structure/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/lLhTrWvGrZ8

Figure 46 - Determining favored resonance structure by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.47 Molecular shape (VSEPR)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/vZ2Im4bxa4M

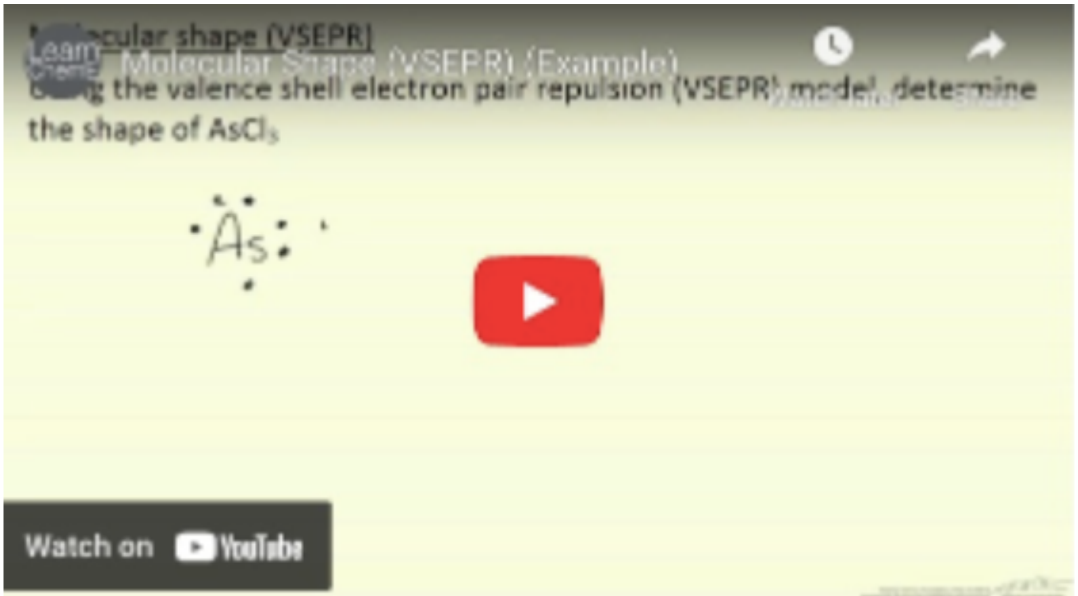

Figure 47 - VSEPR by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.48 Molecular geometry/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/Cc88wFkW_aA

Figure 48 - Molecular geometry by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.49 Which molecule is non-polar?/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/_-nNBt19yTA

Figure 49 - Which molecule is non-polar? by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.50 Ranking vapor pressure/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/Fd6eqNyPSgI

Figure 50 - Ranking vapor pressure by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.51 Heat of vaporization from vapor pressure/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/OGAxPWUB8H8

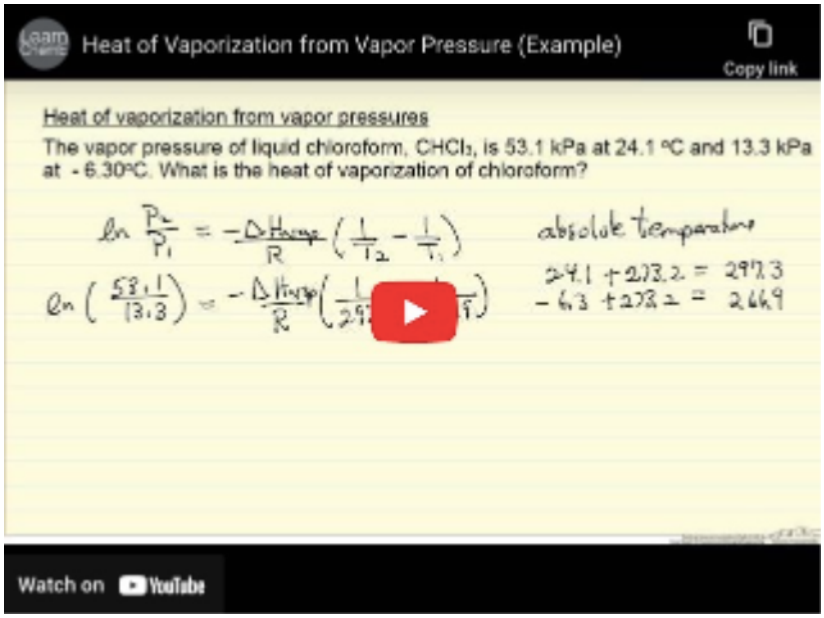

Figure 51 - Heat of Vaporization by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.52 Boiling point from PVT diagram/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/jZESbugbnWw

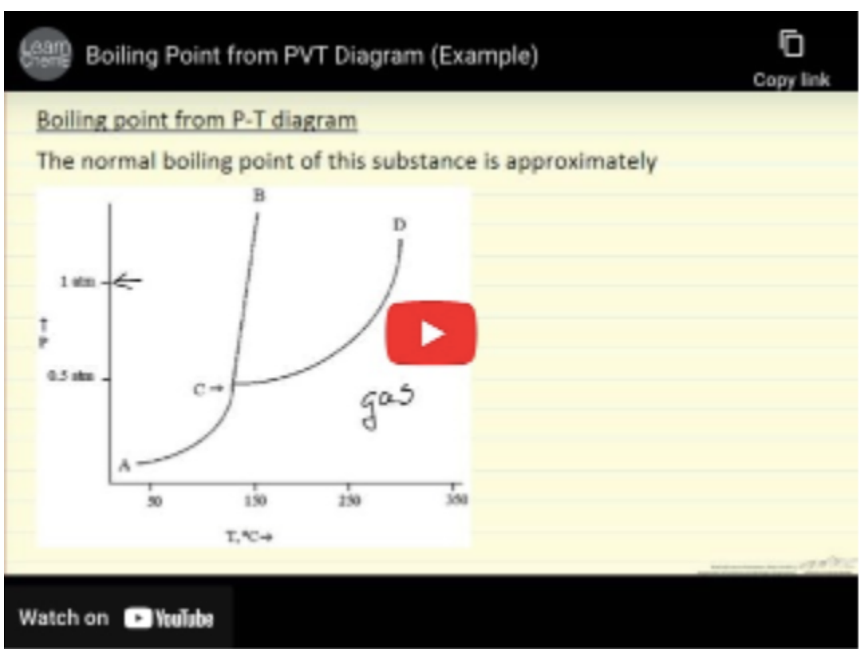

Figure 52 - Boiling point from PVT by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.53 Density of Iron (example)/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/s8MHZQpZOjc

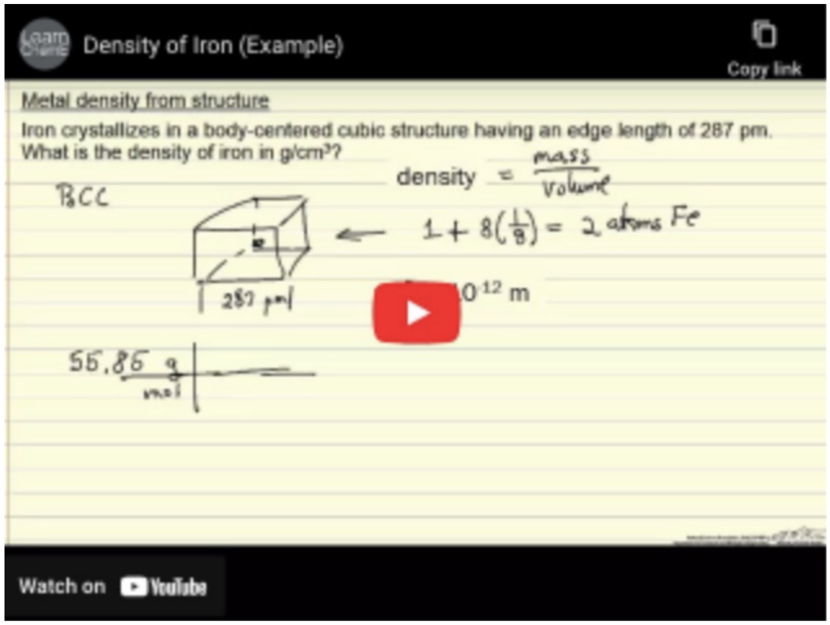

Figure 53 - Density of iron by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

1.54 Density of an element/LearnChemE (**CC BY-SA 4.0 DEED**)

https://youtu.be/Cwdef3TIOtE

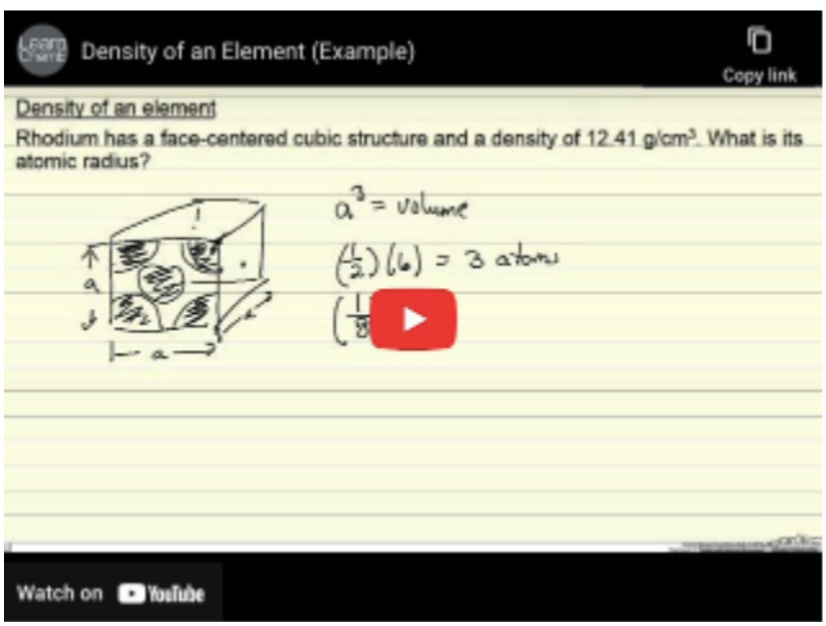

Figure 54 - Density of an element by LearnChemE is licensed under CC BY-SA 4.0- LearnChemE

2. Textbook Mapping

2.1 Chapter 1: Matter, measurements, and problem solving **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/01%3A_Matter_Measurement_and_Problem_Solving

Figure 55 - Text: Chapter 1: Matter, measurements, and problem solving, by Libretext, CC BY-NC-SA 4.0- Author:Tro

2.2 Chapter 2: Atoms and Elements **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/02%3A_Atoms_and_Elements

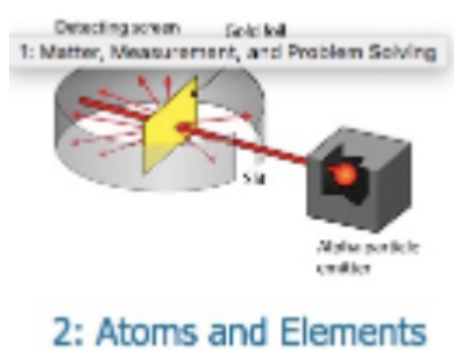

Figure 56 - Text: Chapter 2: Atoms and Elements, by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.3 Chapter 3: Molecules, Compunds and Chemical Equations **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/03%3A_Molecules_Compounds_and_Chemical_Equations

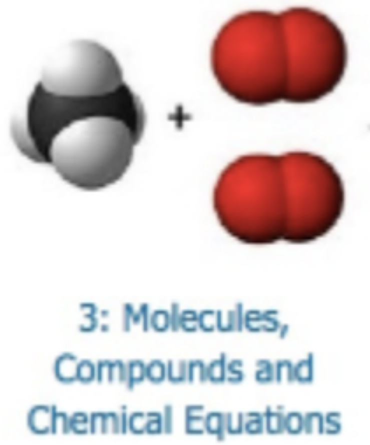

Figure 57 - Text: Chapter 3: Molecules, Compunds and Chemical Equations , by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.4 Chapter 4: Chemical Reactions and aqueous solution **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/04%3A_Chemical_Reactions_and_Aqueous_Reactions

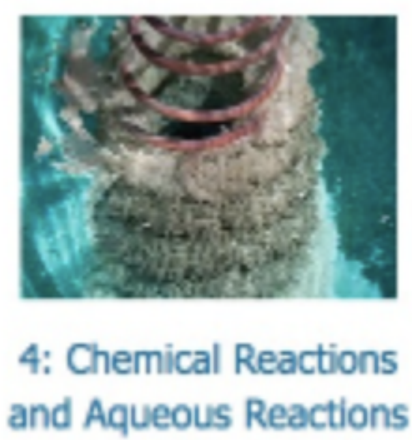

Figure 58 - Text: Chapter 4: Chemical Reactions and aqueous solution , by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.5 Text: Chapter 5: Gases **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/05%3A_Gases

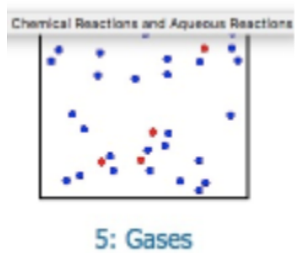

Figure 59 - Text: Text: Chapter 5: Gases , by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.6 Chapter 6: Thermochemistry **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/06%3A_Thermochemistry

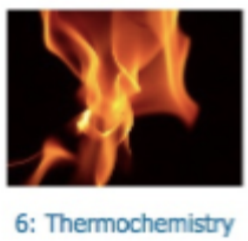

Figure 60 - Text: Chapter 6: Thermochemistry , by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.7 Chapter 7: The Quantum Mechanic Model of the Atom **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/07%3A_The_Quantum-Mechanical_Model_of_the_Atom

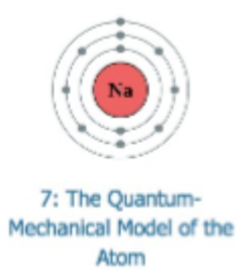

Figure 61 - Text: Chapter 7: The Quantum Mechanic Model of the Atom , by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.8 Chapter 8: Periodic Properties of the Elements **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/08%3A_Periodic_Properties_of_the_Elements

Figure 62 - Text: Chapter 8: Periodic Properties of the Elements, by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.9 Chapter 9: Chemical Bonding I - Lewis Structure **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/09%3A_Chemical_Bonding_I-_Lewis_Structures_and_Determining_Molecular_Shapes

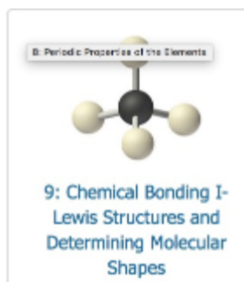

Figure 63 - Text: Chapter 9: Chemical Bonding I - Lewis Structure , by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.10 Chapter 10: Chemical Bonding I - Valence Bond Theory and Molecular Orbital Theory **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/10%3A_Chemical_Bonding_II-_Valance_Bond_Theory_and_Molecular_Orbital_Theory

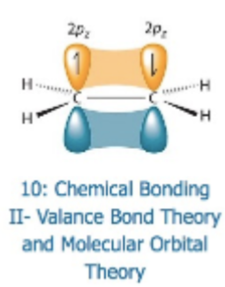

Figure 64 - Text: Chapter 10: Chemical Bonding I - Valence Bond Theory and Molecular Orbital Theory, by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.11 Chapter 11: Liquids, Solids, and intermolecular forces **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/11%3A_Liquids_Solids_and_Intermolecular_Forces

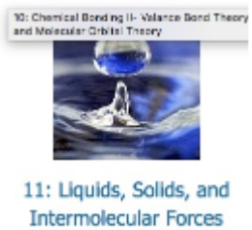

Figure 65 - Text: Chapter 11: Liquids, Solids, and intermolecular forces, by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.12 Chapter 12: Solids and Modern Material **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/12%3A_Solids_and_Modern_Materials

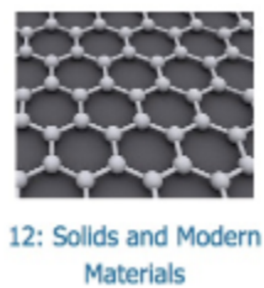

Figure 66 - Text: Chapter 12: Solids and Modern Material, by Libretext, CC BY-NC-SA 4.0 Author:Tro

2.13 Chapter 13: Solutions **(CC BY-NC-SA 4.0)**

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/13%3A_Solutions

Figure 67 - Text: Chapter 13: Solutions , by Libretext, CC BY-NC-SA 4.0 Author:Tro

3. PhET Simulations

3.1 PhET Simulation: Atomic Interaction **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/atomic-interactions

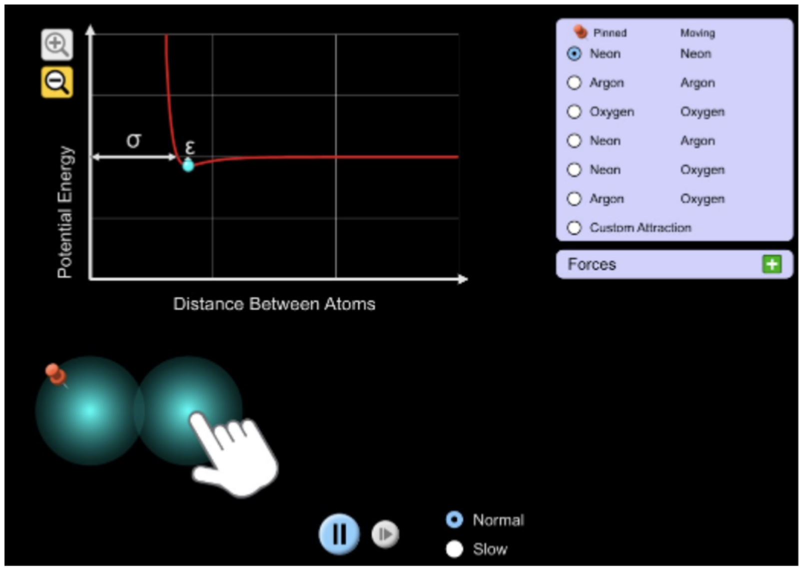

Figure 68 – Atomic interaction, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.2 PhET Simulation: Build a Nucleus **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/build-a-nucleus

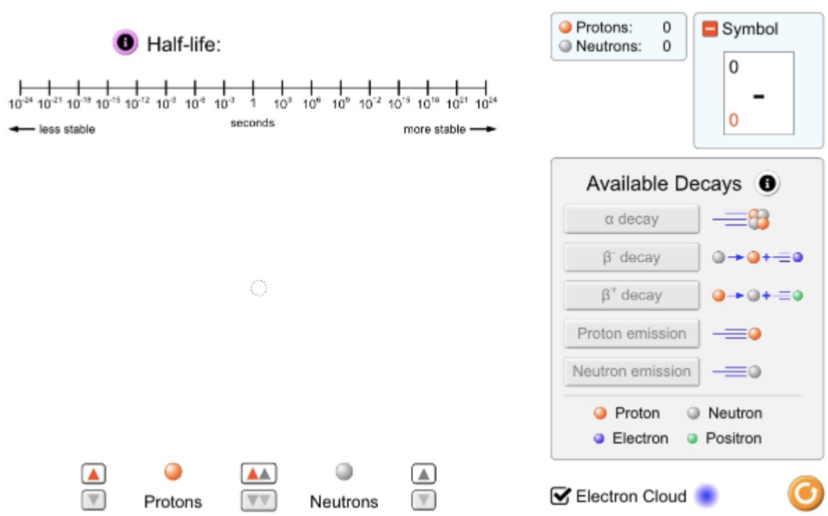

Figure 69 - Build a Nucleus, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.3 PhET Simulation: Density **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/density

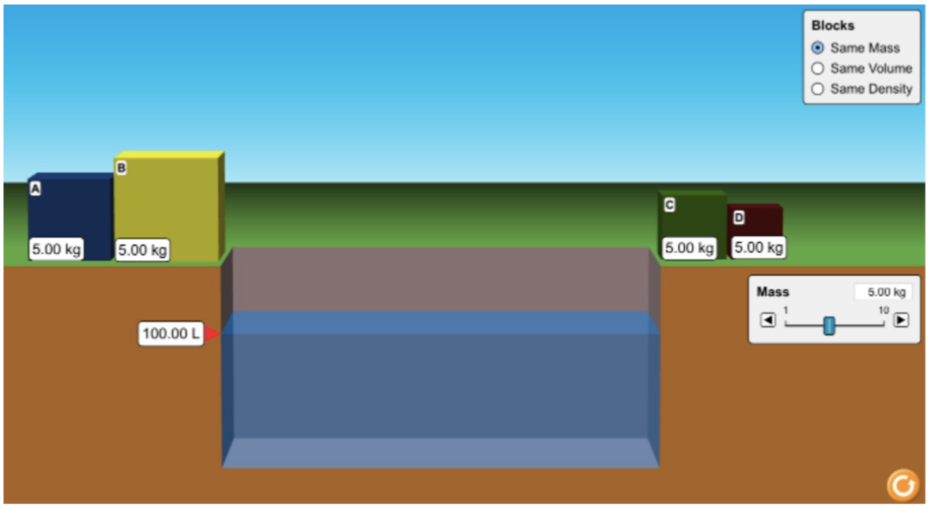

Figure 70 – Density, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.4 PhET Simulation: Normal Modes **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/normal-modes

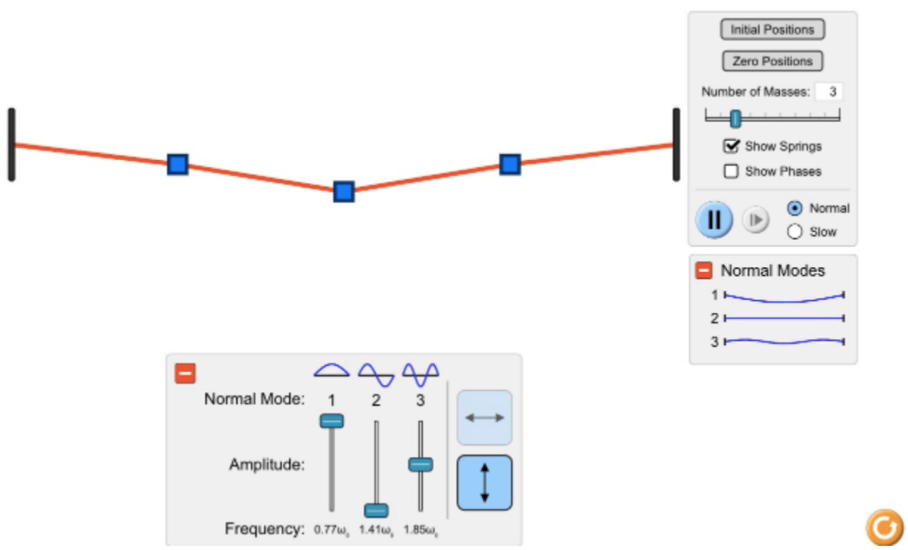

Figure 71 – Normal modes, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.5 PhET Simulation: Fourier Making Waves **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/fourier-making-waves

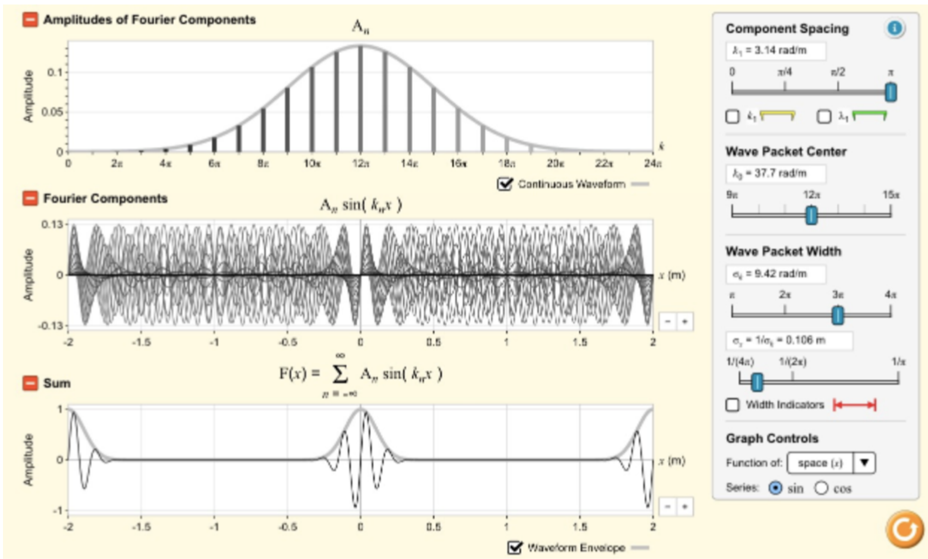

Figure 72 - Fourier Making Waves, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.6 PhET Simulation: Wave Interference **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/wave-interference

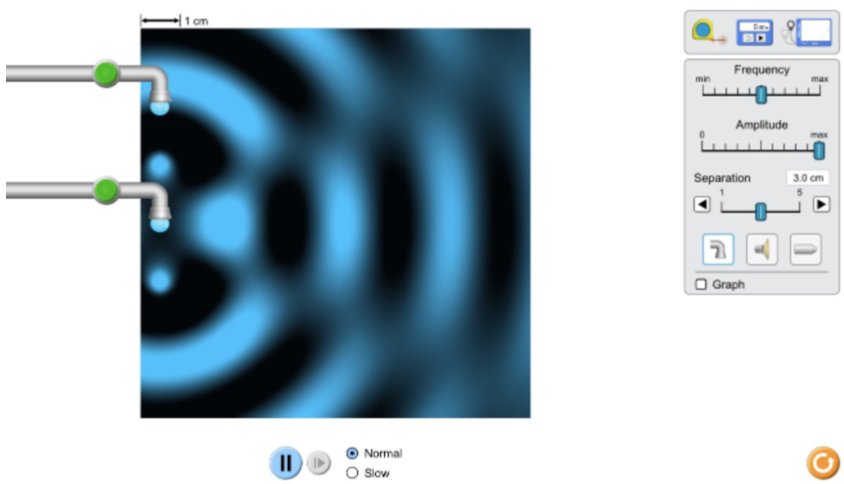

Figure 73 – Wave interference, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.7 PhET Simulation: collision-lab **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/collision-lab

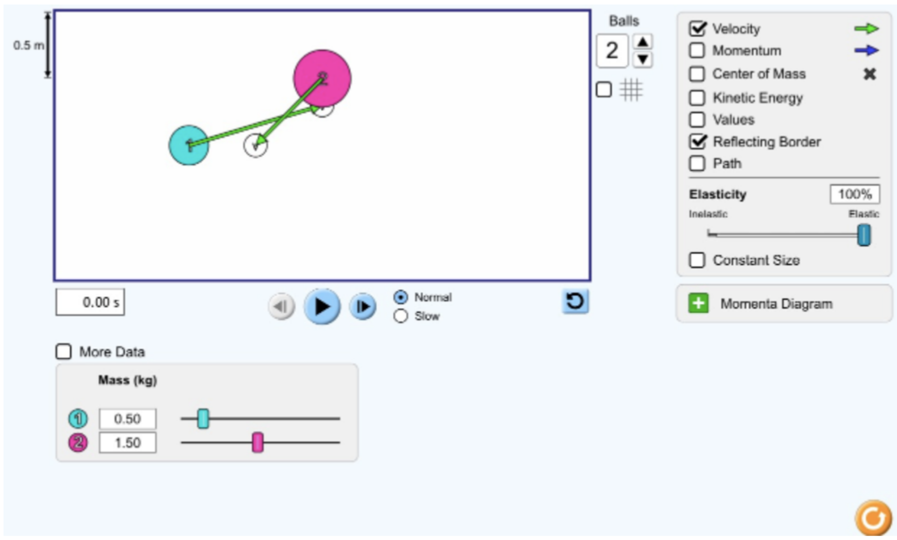

Figure 74 – Collision lab, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.8 PhET Simulation: build-a-molecule **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/build-a-molecule

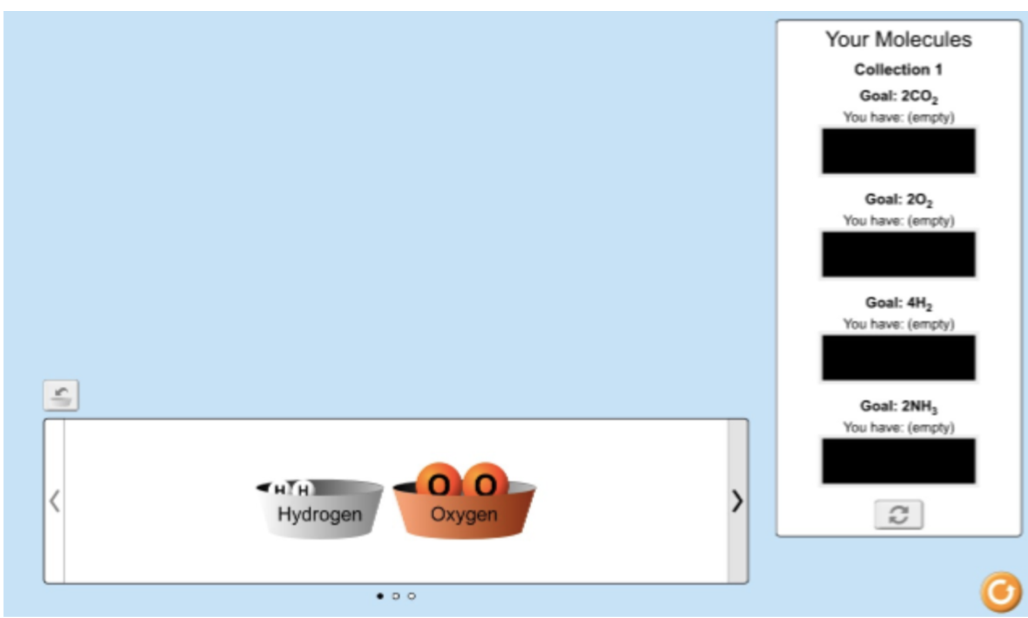

Figure 75 – Build a molecule, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.9 PhET Simulation: vector-addition **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/vector-addition

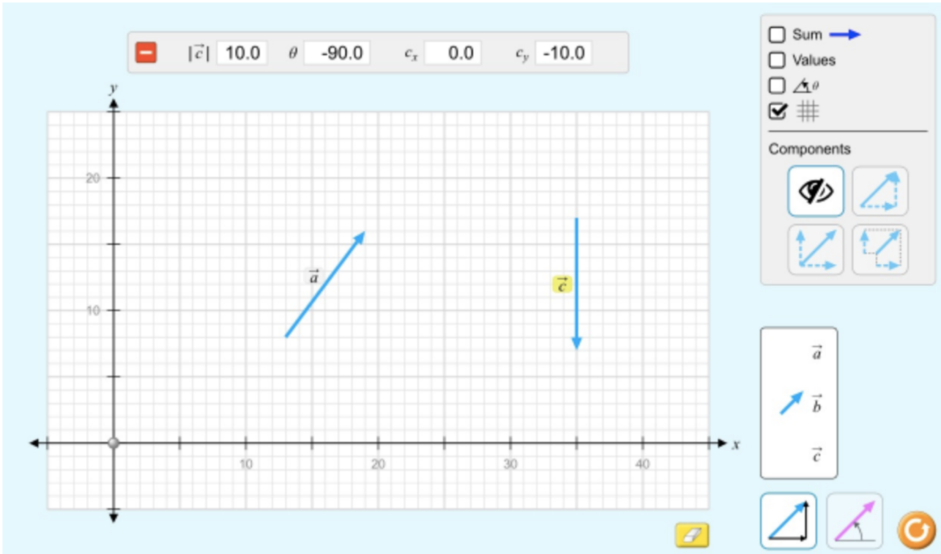

Figure 76 – Vector addition, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.10 PhET Simulation: curve-fitting **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/curve-fitting

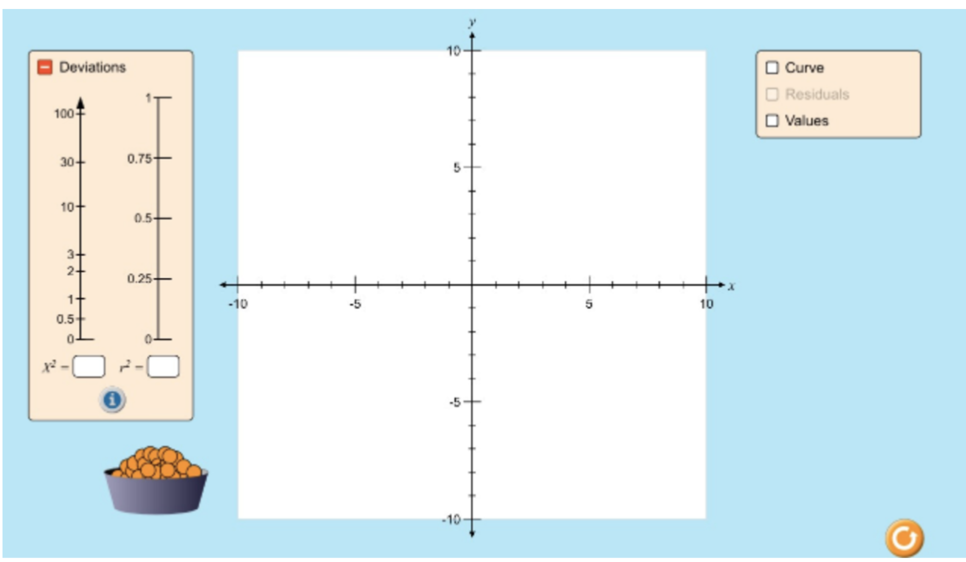

Figure 77 – Curve fitting, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.11 PhET Simulation: gravity-force-lab-basics **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/gravity-force-lab-basics

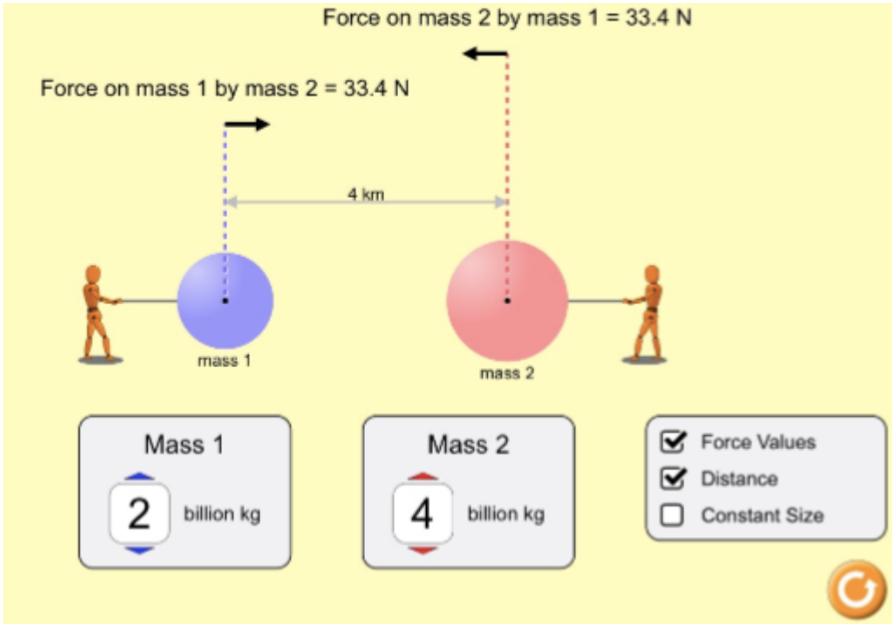

Figure 78 - gravity-force-lab-basics, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.12 PhET Simulation: waves-intro **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/waves-intro

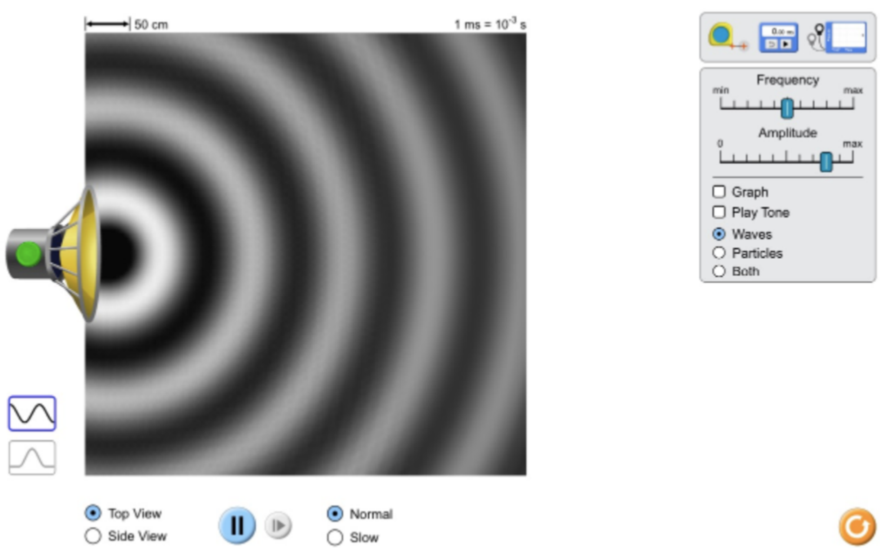

Figure 79 – Waves intro, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.13 PhET Simulation: diffusion **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/diffusion

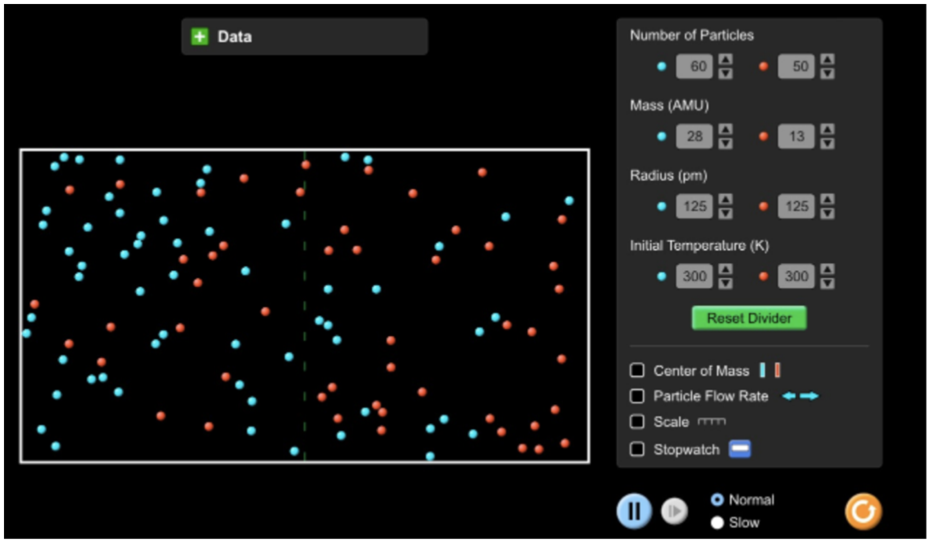

Figure 80 – Diffusion, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.14 PhET Simulation: gas-properties **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/gas-properties

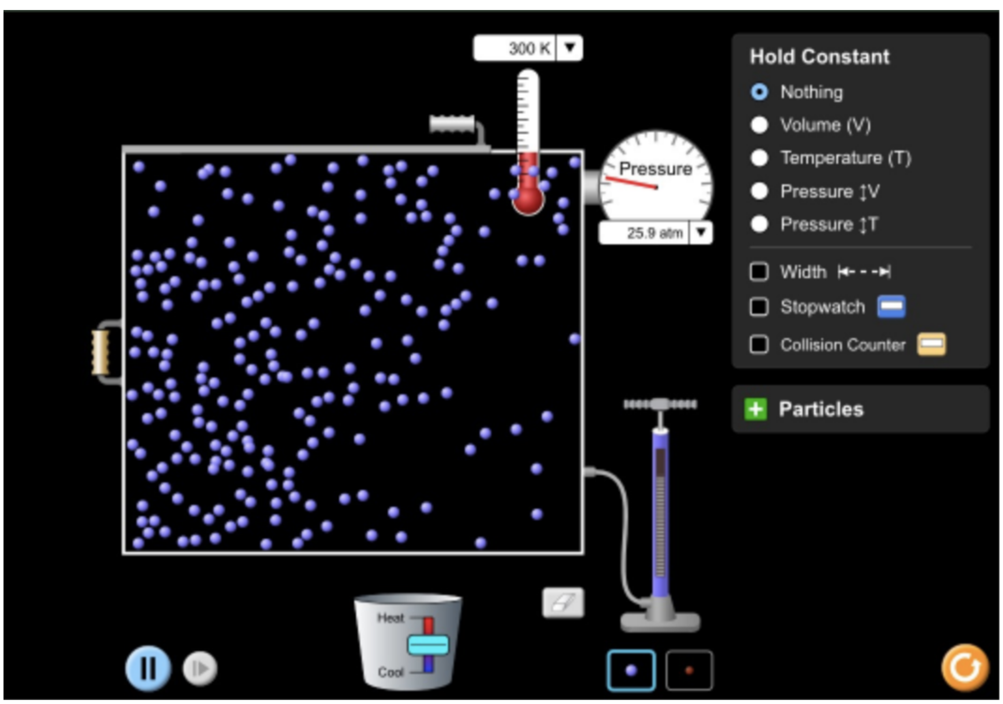

Figure 81 - gas-properties, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.15 PhET Simulation: energy-forms-and-changes **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/energy-forms-and-changes

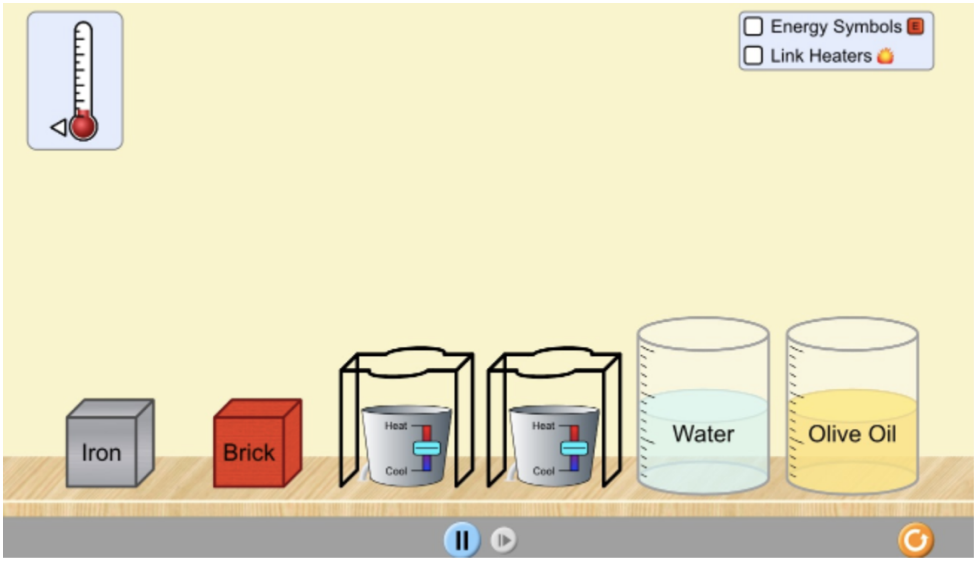

Figure 82 - energy-forms-and-changes, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.16 PhET Simulation: forces-and-motion-basics **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/forces-and-motion-basics

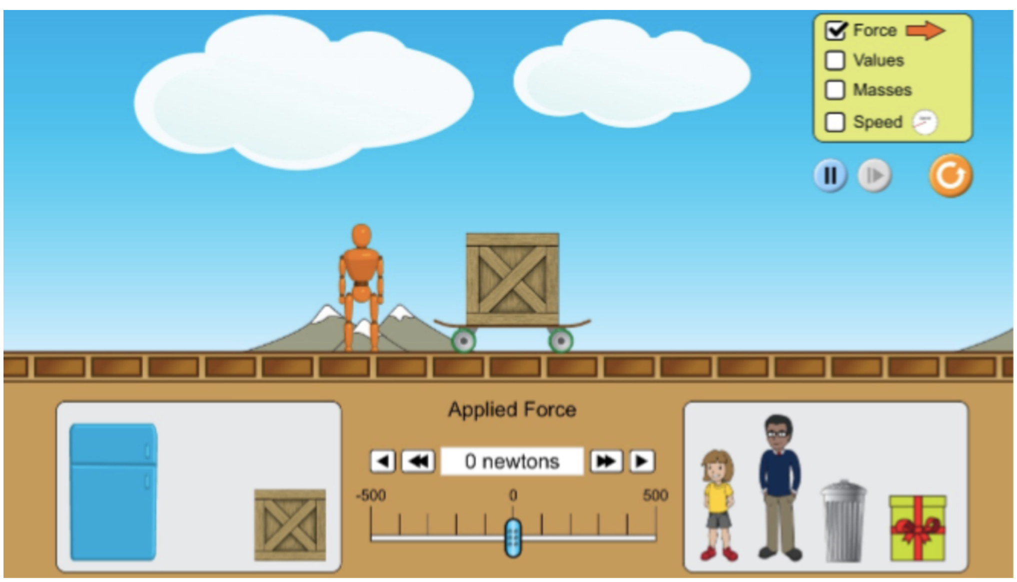

Figure 83 - forces-and-motion-basics, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.17 PhET Simulation: coulombs-law **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/coulombs-law

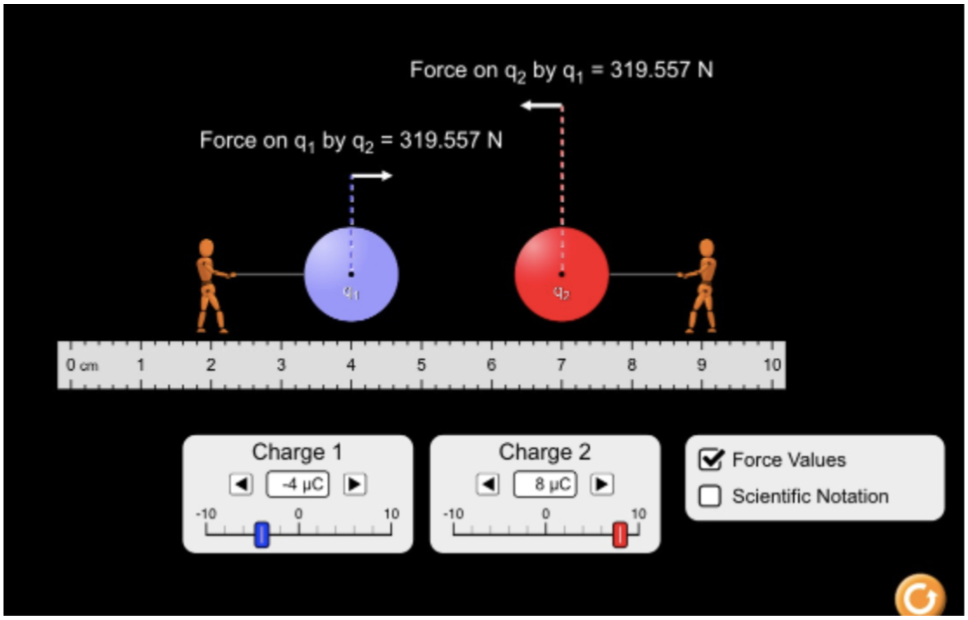

Figure 84 - coulombs-law, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.18 PhET Simulation: molecule-polarity **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/molecule-polarity

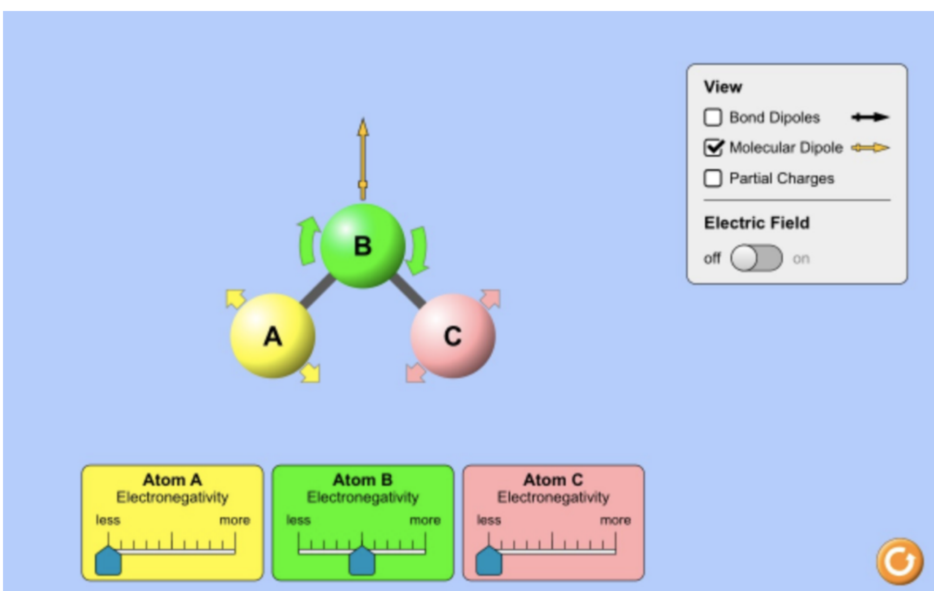

Figure 85 - molecule-polarity, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.19 PhET Simulation: states-of-matter-basics **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/states-of-matter-basics

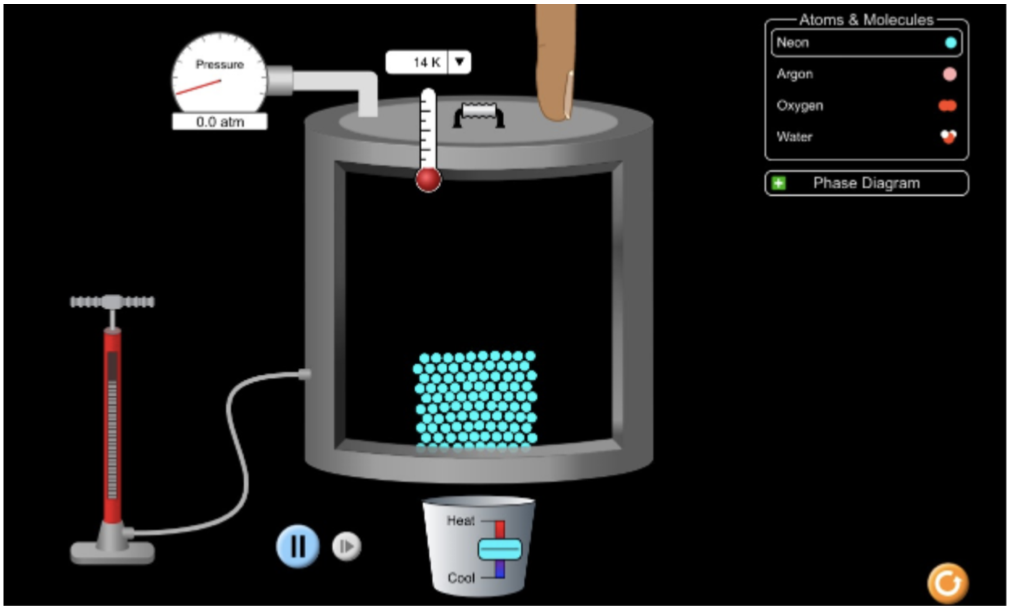

Figure 86 - states-of-matter-basics, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.20 PhET Simulation: states-of-matter **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/states-of-matter

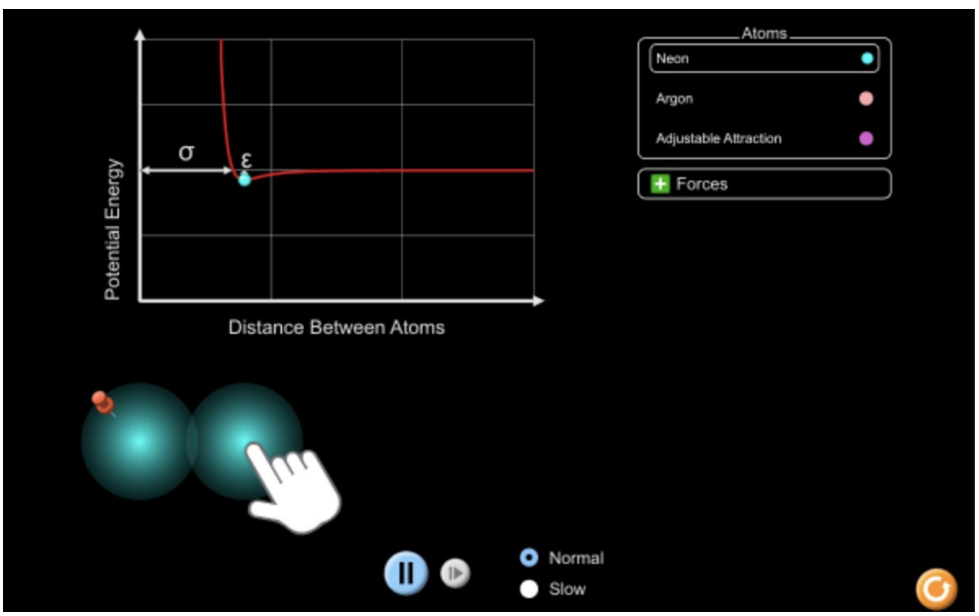

Figure 87 - states-of-matter, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.21 PhET Simulation: isotopes-and-atomic-mass **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/isotopes-and-atomic-mass

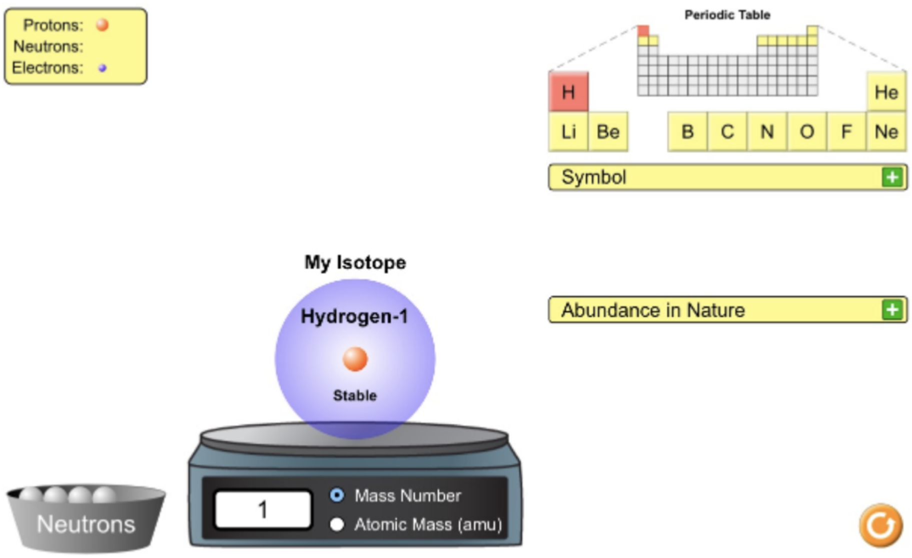

Figure 88 - isotopes-and-atomic-mass, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.22 PhET Simulation: molecule-shapes **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/molecule-shapes

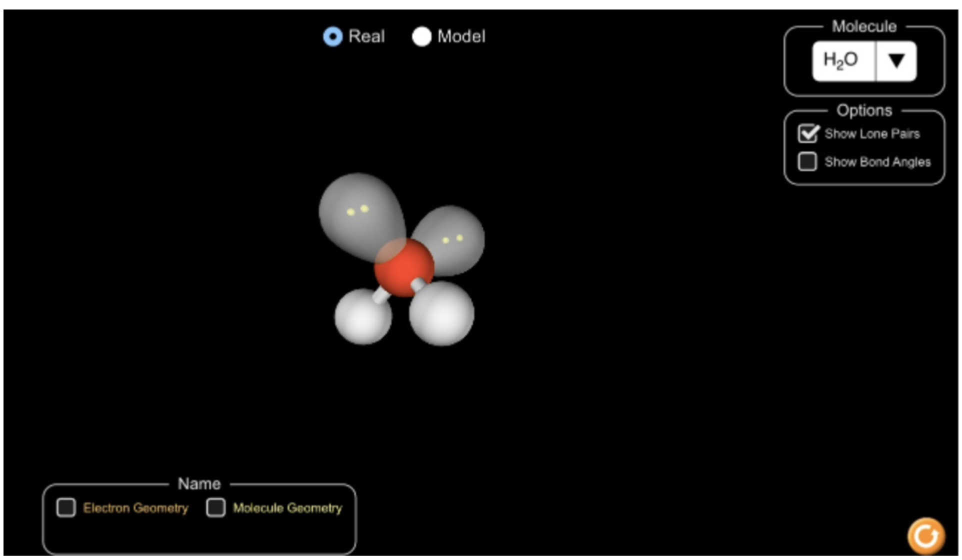

Figure 89 - molecule-shapes, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.23 PhET Simulation: molecule-shapes-basics **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/molecule-shapes-basics

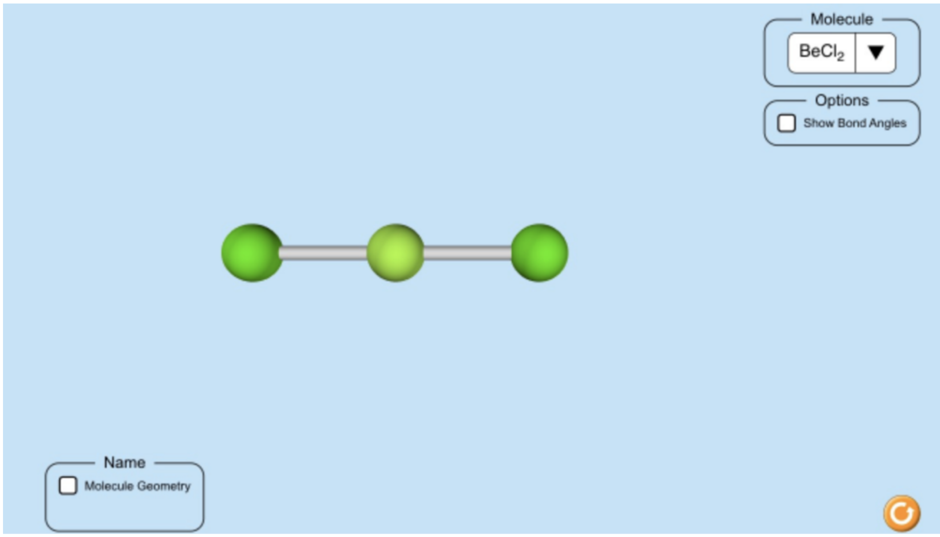

Figure 90 - molecule-shapes-basics, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.24 PhET Simulation: molecules-and-light **(CC BY 4.0 DEED)**

https://phet.colorado.edu/sims/html/molecules-and-light/latest/molecules-and-light_all.html

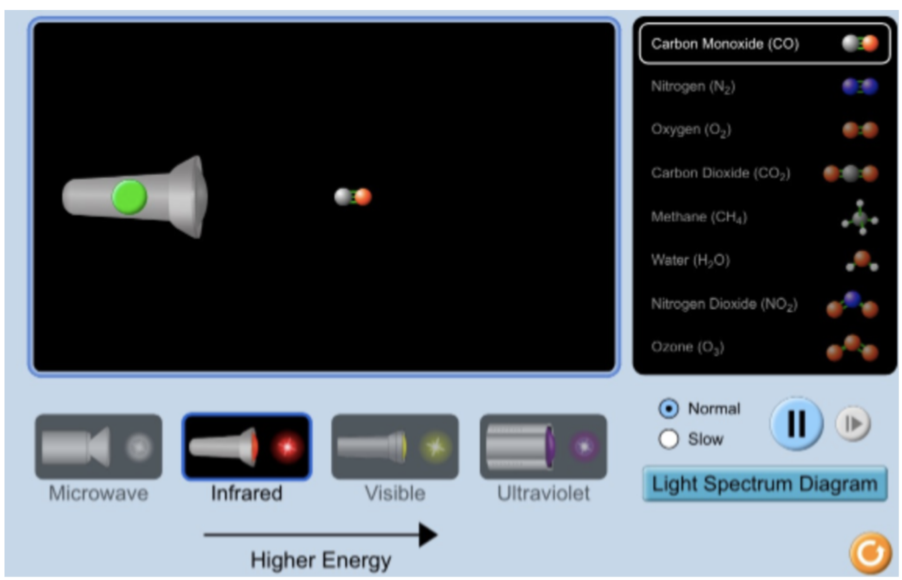

Figure 91 - molecules-and-light, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.25 PhET Simulation: reactants-products-and-leftovers **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/reactants-products-and-leftovers

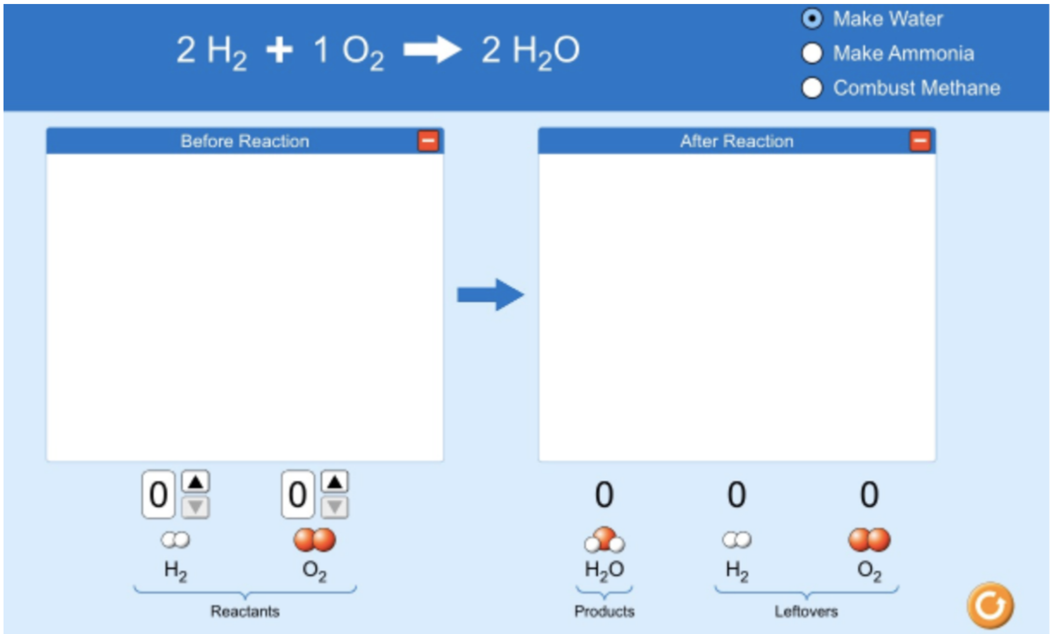

Figure 92 - reactants-products-and-leftovers, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.26 PhET Simulation: balancing-chemical-equations **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/balancing-chemical-equations

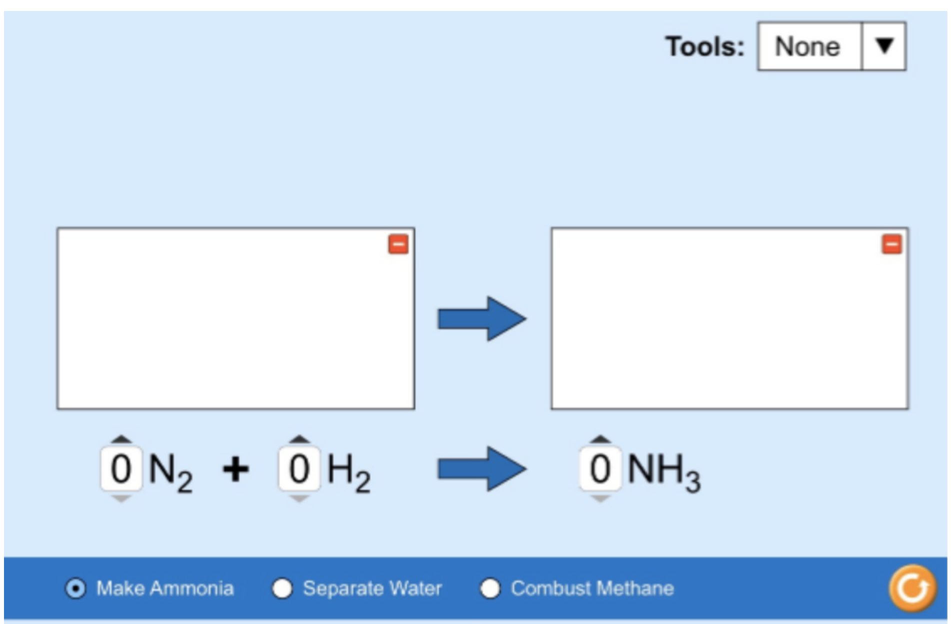

Figure 93 – Balancing Chemical Equations, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.27 PhET Simulation: ph-scale-basics **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/ph-scale-basics

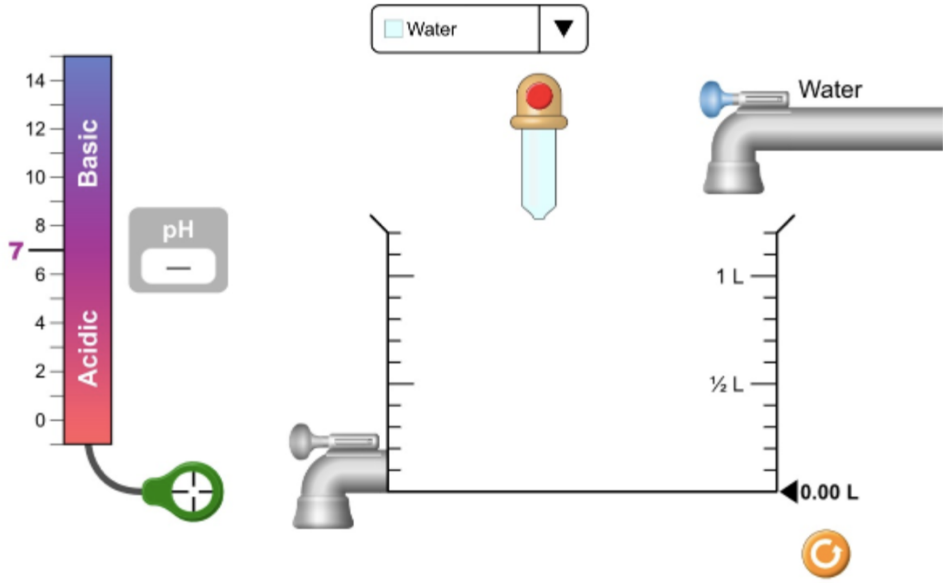

Figure 94 - ph-scale-basics, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.28 PhET Simulation: ph-scale-basics **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/ph-scale

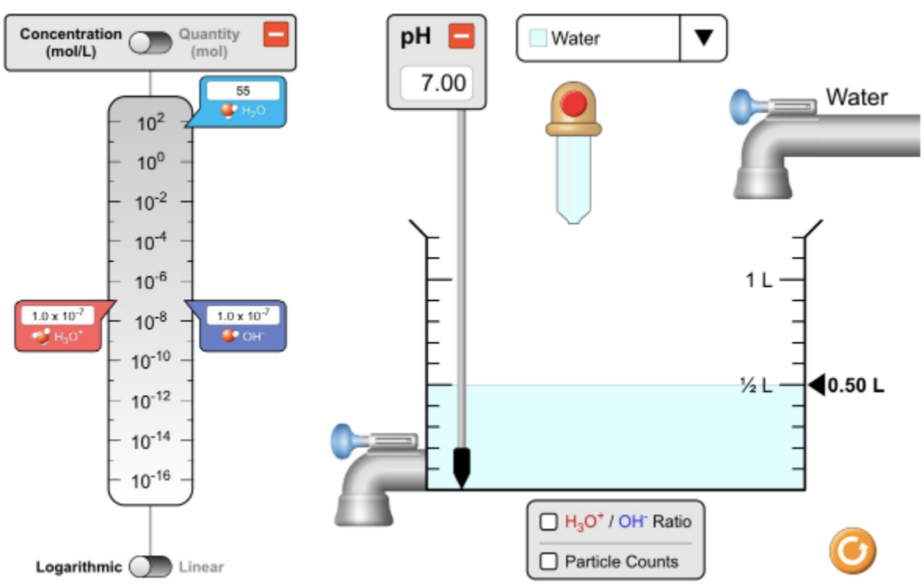

Figure 95 - pH-scale-basics, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.29 PhET Simulation: acid-base-solutions **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/acid-base-solutions

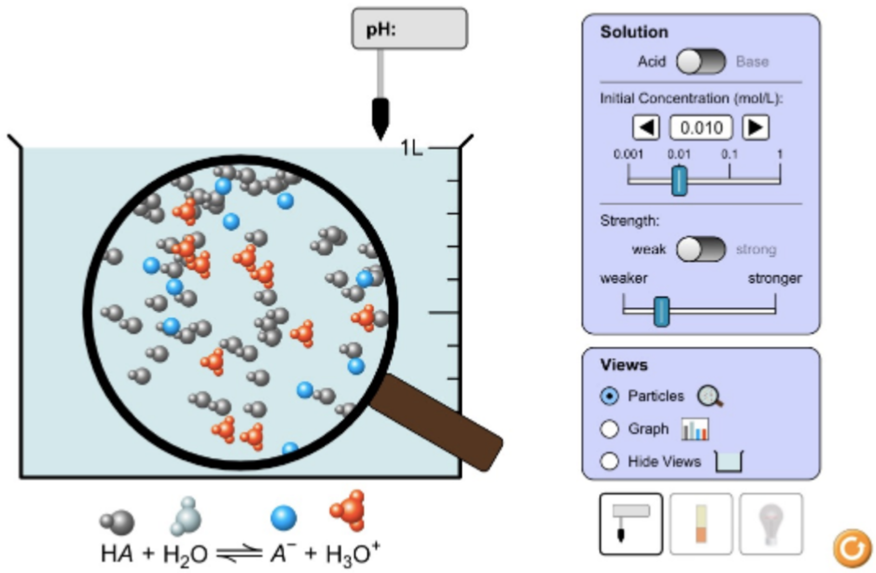

Figure 96 - acid-base-solutions, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.30 PhET Simulation: concentration **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/concentration

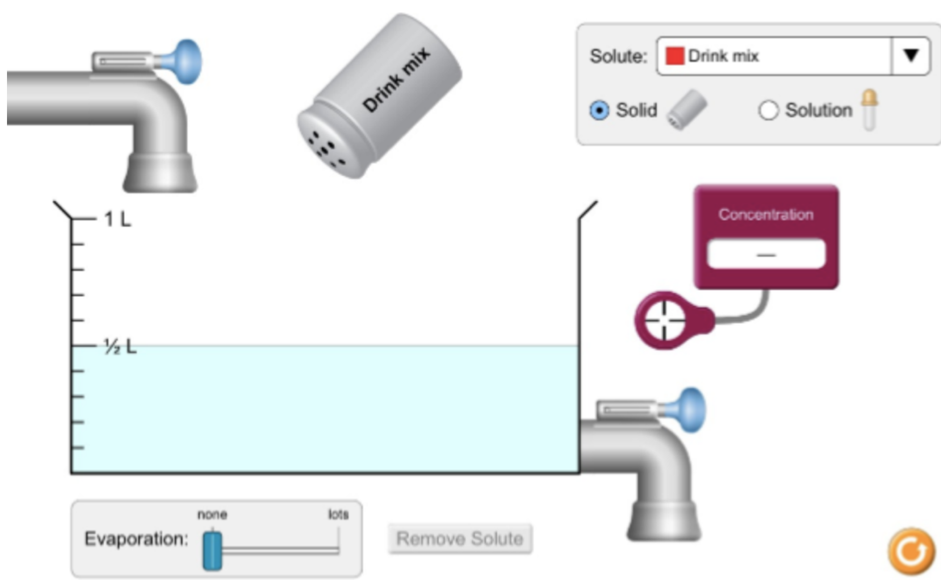

Figure 97 – Concentration, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.31 PhET Simulation: molarity **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/molarity

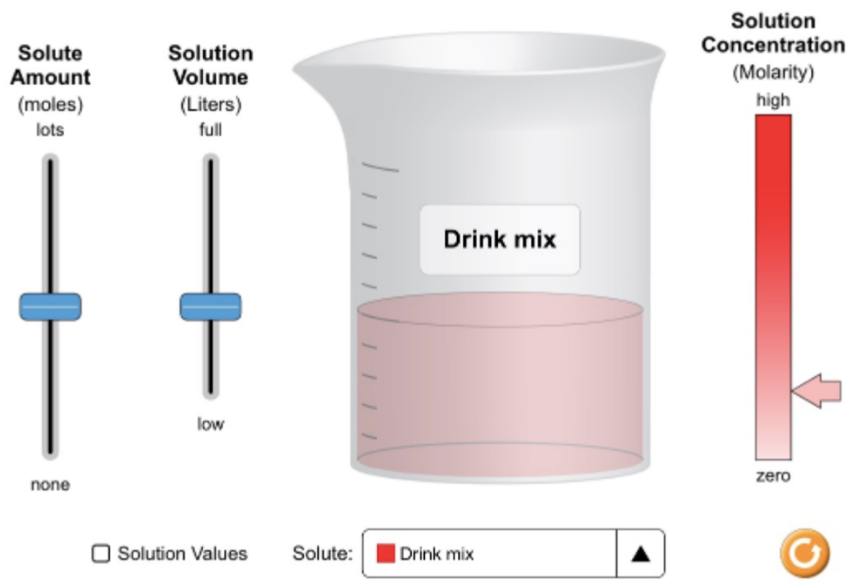

Figure 98 – Molarity, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

3.32 PhET Simulation: Build an atom **(CC BY 4.0 DEED)**

https://phet.colorado.edu/en/simulations/build-an-atom

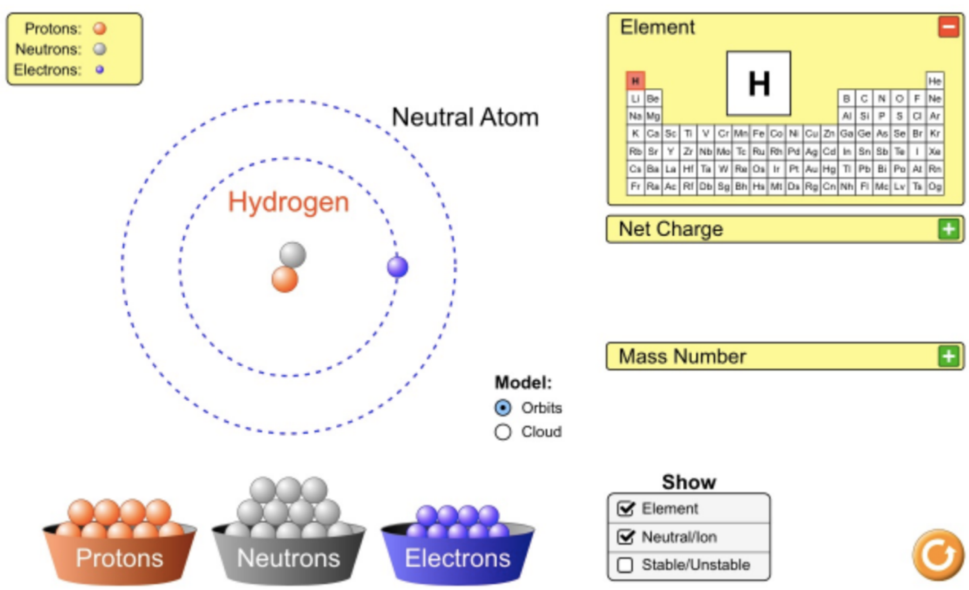

Figure 99 - Build an atom, Simulation by PhET Interactive Simulations, University of Colorado Boulder, licensed under CC-BY-4.0 (https://phet.colorado.edu).

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