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Using Television Shows, Popular Movies, Novels, and Analogies as Teaching Tools for Chemistry

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Programs for youth



- ▶ **Dr. Seuss**
 - ▶ Bonding and Antibonding Sneetches



- ▶ **Spongebob Squarepants**
 - ▶ Awesome surface tension of the Dirty Bubble



- ▶ **Wizard of Oz**
 - ▶ Dissolving not melting witch



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Comedians



- ▶ **Dimitri Martin**
 - ▶ Melting of ice
 - ▶ Physical change



- ▶ **John Pinette**
 - ▶ This ain't bread!
 - ▶ Jelly rolls off
 - ▶ Butter slides off
 - ▶ Scotchgard
 - ▶ Can't toast it
 - ▶ Intermolecular interactions
 - ▶ Hydrogen bonding
 - ▶ London dispersion forces
 - ▶ Fluorocarbon coated ceramic



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Misconceptions from TV Shows



THE HISTORY CHANNEL.

- ▶ Zorba Pastor – On Your Health
 - ▶ Aluminum “Molecules?!”
- ▶ History Channel
 - ▶ Carbon-14 “molecule” used in radioactive dating
- ▶ Assessment for introductory courses
 - ▶ Atom versus molecule



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BBC Series



- ▶ Red Dwarf
 - ▶ Lithium Carbonate
 - ▶ Antidepressant
 - ▶ Gas tank



- ▶ Doc Martin
 - ▶ Alcohol
 - ▶ Diabetic shock
 - ▶ Ketone Bodies
 - ▶ Breathalyzer
 - ▶ Ethanol
 - ▶ 3-Hydroxybutyrate



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Chemistry in History



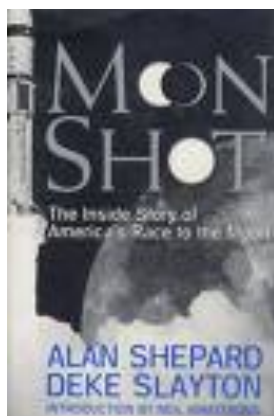
- ▶ White Phosphorous – incendiary device
 - ▶ Patton 360
 - ▶ Ken Burns Civil War
 - ▶ M*A*S*H
 - ▶ Emergency
- ▶ Carbon dioxide – fire control system
 - ▶ USS Yorktown
 - ▶ Civil War Commanders at Battle of Midway
- ▶ Ammonium nitrate spill – freezing point depression
- ▶ Ice expanding and contracting – phase diagrams



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Novels: *Das Boot* and *Moon Shot*



- ▶ Acid in the Bilge
- ▶ Litmus paper
 - ▶ Chlorine gas????
 - ▶ Hydrogen chloride
- ▶ Lime
 - ▶ Acid/base chemistry
- ▶ Density
 - ▶ We have to get the water out
- ▶ Docking analogy
 - ▶ Requirements of a chemical reaction
 - ▶ Collision
 - ▶ Orientation
 - ▶ Energy



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Popular Movies: Apollo 13



*Okay, Houston, we've
had a problem here.*

- ▶ Scientific Methodology
- ▶ Observations
 - ▶ Spacecraft movement
 - ▶ Audible bang
 - ▶ Loss of electrical power
 - ▶ Computer restart
 - ▶ Communication reset
- ▶ Initial hypotheses
 - ▶ Instrument failure--sensors
 - ▶ Cabin repressurization valve
 - ▶ Meteor hit the spacecraft
- ▶ Additional observations
 - ▶ Gas venting
 - ▶ Visible damage



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Twelve Angry Men



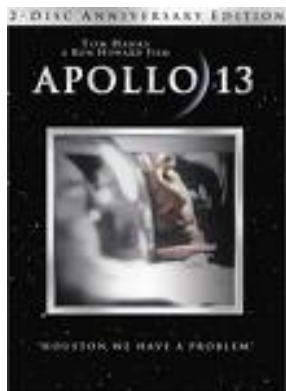
- ▶ Scientific methodology
- ▶ Different experiences
- ▶ Careful observations
- ▶ Debating ideas
- ▶ Biases



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Chemistry Topics taught using Apollo 13



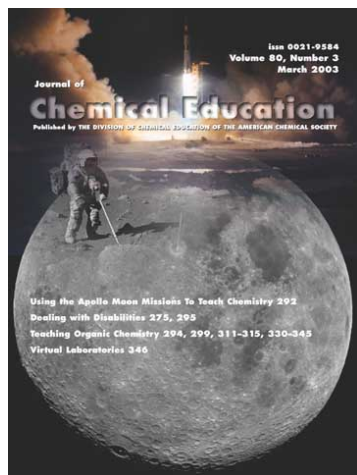
- ▶ Kinetics
 - ▶ Insulation burning
 - ▶ Concentration of oxygen
- ▶ Supercritical fluid
- ▶ Gas laws
- ▶ Lithium hydroxide
 - ▶ Base solution and dry ice demonstration
- ▶ Chemical reactions
- ▶ Gas laws
- ▶ Carbonate blood buffer



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Chemistry Topics taught using From the Earth to the Moon



- ▶ Electrolytes – ions increase electrical conductivity in air
- ▶ Accuracy & relative error – 535 ft
- ▶ Educated observer
 - ▶ Crystalline rock
 - ▶ Orange soil – evidence of water
- ▶ Lithium hydroxide
- ▶ Chemical reactions
- ▶ Gas law
- ▶ Carbonated blood buffer
- ▶ Base solutions & dry ice demo
- ▶ Problem solving
- ▶ Types of fuels



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Types of Fuels



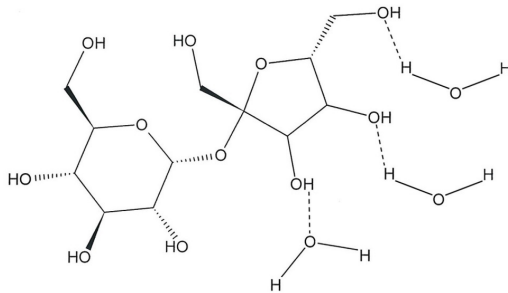
- ▶ First stage
 - ▶ Kerosene and oxygen
- ▶ Second and third stages
 - ▶ Hydrogen and oxygen
- ▶ Thrusters service module
 - ▶ Hydrazine, I, I-dimethyl hydrazine
 - ▶ Nitrogen dioxide-Dinitrogen tetroxide
 - ▶ Hypergolic
- ▶ Ignition source/activation energy



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October Sky and *Rocket Boys*



- ▶ Body of Knowledge
- ▶ Trial and Error
- ▶ Propellant systems
 - ▶ Homogeneous
 - ▶ Materials
- ▶ Inspiration from a teacher
- ▶ Skilled machinists
- ▶ Uneven combustion
- ▶ Oxidation of materials used for rockets
- ▶ Propellant systems



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Propellant Systems

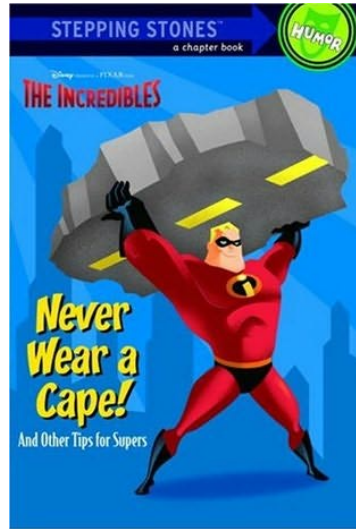
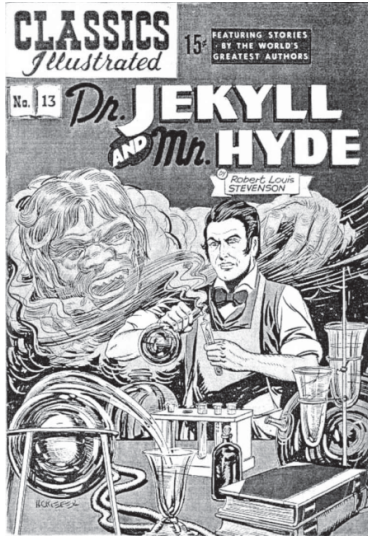
<u>Type of Mixture</u>	<u>Organic</u>	<u>Oxidant</u>	<u>Added Reductant</u>
Gunpowder	Charcoal	KNO_3	Sulfur
Rocket Candy	Sugar	KNO_3	None
Zincoshine	Ethanol	Sulfur	Zinc powder
Solid Rocket Booster	Polymer and Epoxy	NH_4ClO_4	Aluminum powder



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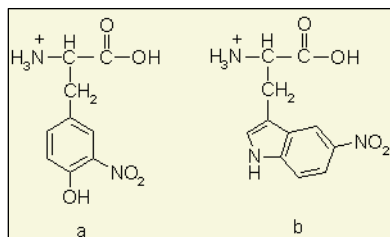
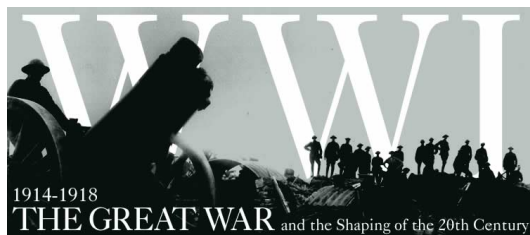
Safety Comics and Movies



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Chemistry Topics taught using The Girls with Yellow Hands



- ▶ World War I munitions workers
- ▶ TNT poisoning
 - ▶ Skin discoloration
 - ▶ Headaches
 - ▶ Dilation of blood vessels
- ▶ Chemistry of the yellow hands
 - ▶ Nitration demonstration
- ▶ Safety
 - ▶ Discussion of lab equipment and ventilation



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Food Analogies

▶ Cookie Analogy

- ▶ Cookie – Substrate
- ▶ Mouth – Active site
- ▶ Enzyme kinetics
 - Inhibition
 - Competitive and noncompetitive
 - Reversible and irreversible
 - Feedback
 - Reaction reversibility



▶ Buffet Analogy

- ▶ Chromatography
 - ▶ Stationary Phase - Bar
 - Interactions of patrons with food and drink
 - ▶ Mobile Phase – Line
 - Length of line and impatient patrons



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Were I Use Popular Media

- ▶ Use examples from popular media in class
- ▶ Use material for exam and quiz questions
- ▶ Assign movie for a course
- ▶ Assign papers for a course
- ▶ Show clips during class



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Sample Video Clip



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References

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Acknowledgements

- ▶ Kevin Roesselet
- ▶ Mark Greip
- ▶ Co-Authors
 - ▶ B.J.Woods
 - ▶ Stacie Mundringer
 - ▶ Jenifer Ley
 - ▶ Amy Schiebel
 - ▶ Tarah Nytes
 - ▶ Dolores Snell
 - ▶ Lindsay Wilkinson



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