

Motivation Discussion — Examples

Below are some examples of industries and challenges in each industry that might be addressed by the chemical engineer. Selectively share from this list with students as they do brainstorming.

Industry	Challenges for the chemical engineer
Water	<ul style="list-style-type: none"> <input type="checkbox"/> Develop ways to test water for contamination <input type="checkbox"/> Help design purification systems <input type="checkbox"/> Design systems to remove salt from seawater to make fresh water <input type="checkbox"/> Design pipelines to move water across long distances <input type="checkbox"/> Develop water bottling systems <input type="checkbox"/> Create flavorings and vitamin additives for new beverages
Oil & Gas	<ul style="list-style-type: none"> <input type="checkbox"/> Help distinguish between kinds of oils and gases, their features, and best uses <input type="checkbox"/> Help develop cleaner-burning petroleum products <input type="checkbox"/> Help design refineries <input type="checkbox"/> Define pollution-control devices on petroleum processing plants
Pharmaceutical	<ul style="list-style-type: none"> <input type="checkbox"/> Find ways to extract chemicals with medical value from natural products such as plants and animals <input type="checkbox"/> Synthesize medicines <input type="checkbox"/> Design systems for large-scale production of medicines <input type="checkbox"/> Develop safe and effective packaging for medicines
Plastics	<ul style="list-style-type: none"> <input type="checkbox"/> Invent various types of plastics such as those used in packaging, fabrics, building materials, etc. <input type="checkbox"/> Invent new products from plastics <input type="checkbox"/> Find new sources from which to make plastics <input type="checkbox"/> Improve plastics recycling
Agriculture	<ul style="list-style-type: none"> <input type="checkbox"/> Improve and develop natural fertilizers <input type="checkbox"/> Develop synthetic fertilizers <input type="checkbox"/> Match fertilizers to their best uses <input type="checkbox"/> Evaluate effectiveness of fertilizers <input type="checkbox"/> Invent and build effective fertilizer distribution systems <input type="checkbox"/> Reduce negative environmental consequences from fertilizer use
Computer	<ul style="list-style-type: none"> <input type="checkbox"/> Design next-generation semiconductors <input type="checkbox"/> Build “biological” computers <input type="checkbox"/> Improve processes for recycling computer parts
Automotive	<ul style="list-style-type: none"> <input type="checkbox"/> Develop rust-free paints, lighter-weight auto body parts, and other improvements to vehicle components such as tires <input type="checkbox"/> Improve fuel efficiency of vehicles <input type="checkbox"/> Improve pollution controls on vehicles
Textile	<ul style="list-style-type: none"> <input type="checkbox"/> Create new synthetic textile materials <input type="checkbox"/> Develop systems for creating fabrics <input type="checkbox"/> Improve pollution controls on textile production <input type="checkbox"/> Improve systems for textile recycling

Teacher Sheet

Chemical Engineers and the Things They Do

Lesson Title: Chemical Engineers and the Things They Do

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Environmental Protection	<ul style="list-style-type: none"><input type="checkbox"/> Build systems to reduce carbon dioxide emissions or improve oxygen production<input type="checkbox"/> Improve systems for recovering materials from garbage dumps<input type="checkbox"/> Design systems for the clean-up of toxins such as oil spills, dumps, etc.
Mining	<ul style="list-style-type: none"><input type="checkbox"/> Develop systems to test for the location of desired materials such as precious metals<input type="checkbox"/> Develop systems for extracting minerals from rock or soil<input type="checkbox"/> Design systems to ensure that mineworkers have clean air, free of hazardous gases
Food	<ul style="list-style-type: none"><input type="checkbox"/> Invent new food products, preservatives, flavorings, and dyes<input type="checkbox"/> Invent processes for adding preservatives, dyes, vitamins, and other items to food<input type="checkbox"/> Develop systems to analyze food for calorie content and other nutrition factors<input type="checkbox"/> Develop packaging systems that reduce food waste and transportation costs

NOTE: There are many other industries and an endless number of challenges for the chemical engineer!

Great Feats of Chemical Engineering

Below are answers to questions students are asked regarding articles from the Inventor of the Week site.

[Dennis Weatherby: Automatic Dishwasher Detergent \(http://web.mit.edu/invent/iow/weatherby.html\)](http://web.mit.edu/invent/iow/weatherby.html)

1. What is the invention?
Cascade, an automatic dishwasher detergent.
2. When was it invented?
It was invented in the mid-1980s.
3. What problem does it address?
Past attempts at automatic dishwasher detergent solutions used pigments that stained dishes and the inside of dishwashers, making them inefficient to use. Weatherby's solution used dyes that worked with bleach and did not stain dishes.
4. Who was the inventor?
Dennis Weatherby.
5. Where did the inventing happen?
Weatherby came up with his invention in Cincinnati, Ohio, where he was working for the Procter & Gamble Company.

6. What education and work experience did the inventor have?
Weatherby received a bachelor's degree in chemistry from Central State University and a master's degree in chemical engineering from the University of Dayton. He became a process engineer for Procter & Gamble and then moved on to another company before taking a series of jobs at universities.
7. How has this invention affected you and/or your community?
Almost everyone with a dishwasher uses automatic dishwasher detergent to wash their dishes. Using a dishwasher saves people time since they do not have to stand at the sink to wash each dish by hand.

[Madam C.J. Walker: Hair Care Products \(http://web.mit.edu/invent/iow/cjwalker.html\)](http://web.mit.edu/invent/iow/cjwalker.html)

1. What is the invention?
Hair care products and processes.
2. When was it invented?
It was invented in the latter part of the 19th century.
3. What problem does it address?
It addressed the problem of how to treat a then-common scalp disease and the problem of how to groom hair.
4. Who was the inventor?
Madam C. J. Walker.
5. Where did the inventing happen?
The inventing happened somewhere "on the side" such as in her home — she was a laundress. Eventually, she worked in an office; then in a plant in Indianapolis.
6. What education and work experience did the inventor have?
She had very little education. She was the daughter of former slaves.
7. How has this invention affected you and/or your community?
Her products helped launch the hair care industry, which almost everyone uses today. Many women still use hair-straightening products like those originally formulated by Walker.

[Art Fry & Spencer Silver: Post-it® Notes \(http://web.mit.edu/invent/iow/frysilver.html\)](http://web.mit.edu/invent/iow/frysilver.html)

1. What is the invention?
Post-it® Notes.
2. When was it invented?
They were invented in the 1970s.
3. What problem does it address?
They solved the problem of bookmarks falling out of pages.

4. Who was the inventor?
Spencer Silver invented the adhesive and Art Fry invented the notes.
5. Where did the inventing happen?
The inventing happened at 3M headquarters, although Fry came up with his idea during a sermon at church.
6. What education and work experience did the inventor have?
Fry majored in chemical engineering at the University of Minnesota and spent his whole career working at 3M. Spencer earned a B.S. in chemistry at Arizona State University and a Ph.D. in organic chemistry at the University of Colorado. He also has spent his entire career at 3M.
7. How has this invention affected you and/or your community?
People use Post-it® Notes for many purposes: to mark a page, to show where a document should be signed, or to leave a note on something that they don't want to mark up.