

What do you hope to learn from this course?

- What it takes to be a CME
- About CME/Is it right for me?
- Jobs – what's available and how to get one/other options when I graduate
- Courses that I have to take
- What does the chem. Eng discipline expect from me
- How to survive the CME program
- Life of an average CME

What excites you the most as you begin your studies?

- Becoming smarter/learning new things/opportunities/challenges/learning about something I really like/proving to myself that I can succeed
- Learning more depth about my major
- Graduating/starting a new job
- Possibilities available to me with degree in CME
- Meeting people/interaction with teachers, students/learning viewpoints of different people
- Freedom and responsibility of learning on my own
- Starting a life away from home
- Big campus/University life
- Working before I graduate/Co-Op
- Being in an evolving field
- Not knowing what comes next.
- Everything!

What concerns do you have as you begin your studies?

- Hard exams/not learning quick enough/bad grades/engineering standing/graduating/failure/not being able to understand
- Keeping scholarships
- Not meeting expectations that I set for myself
- Certain classes/CME 200/Chemistry/Calculus
- Larger classes
- Becoming too narrowly focused in one aspect of studies
- Freedom
- Staying focused/balancing work, school, fun.
- Classes with international professors/TA's
- Finding a job after college
- Tuition
- Wrong career choice/figuring out what I want to do/what if chemical engineering isn't for me/

Why do you want to be a chemical engineer?

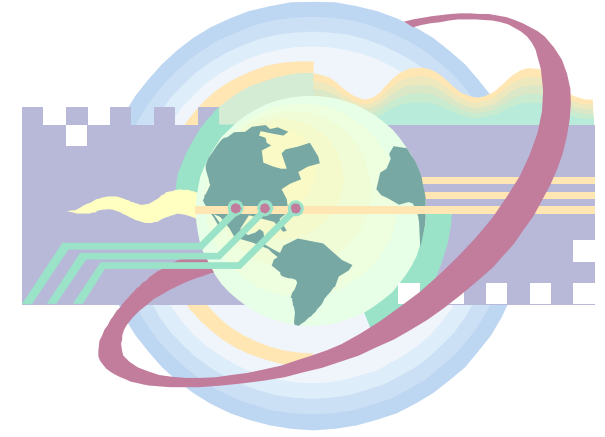
- Enjoy/strong in math, science, chemistry
- Love building and designing things
- Love solving problems
- Broad spectrum of opportunities/medicine/pharmacy
- Paycheck/decent living
- Challenging
- To help people
- Know a Chem Eng and I think its right for me.
- Someone told me its right for me
- Don't know

National Survey on why did you choose chemical engineering

- 1% - Studied the alternatives and decided that I was born to be a chemical eng.
- 13% - Someone else decided chemical engineering was for me.
- 23% - heard that engineers make more money
- 63% - English and history are a drag and pure sciences don't make enough cash and aren't practical

Reasons why I think you should consider chemical engineering:

- Good living
- Challenging/Exciting/Not boring
- Versatile education/can go in many directions
- And.....



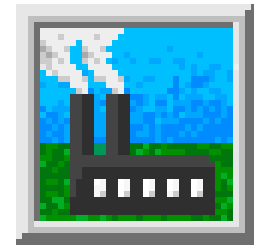
YOU CAN CHANGE THE WORLD WITH
CHEMICAL ENGINEERING

Overview of Chemical Engineering

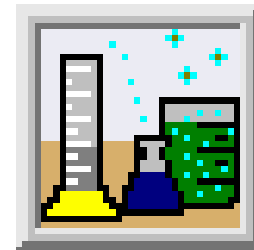
- What is a chemical engineer?
- Various roles of chemical engineers.
- Problem with a product!!– Case Study
- Hot areas
- Job opportunities and salary
- Curriculum
- Student activities in our department
- What can I do when I graduate?

What Is a Chemical Engineer?

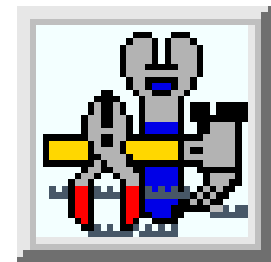
a) An *Engineer* who manufactures chemicals,



b) A *Chemist* who works in a factory,



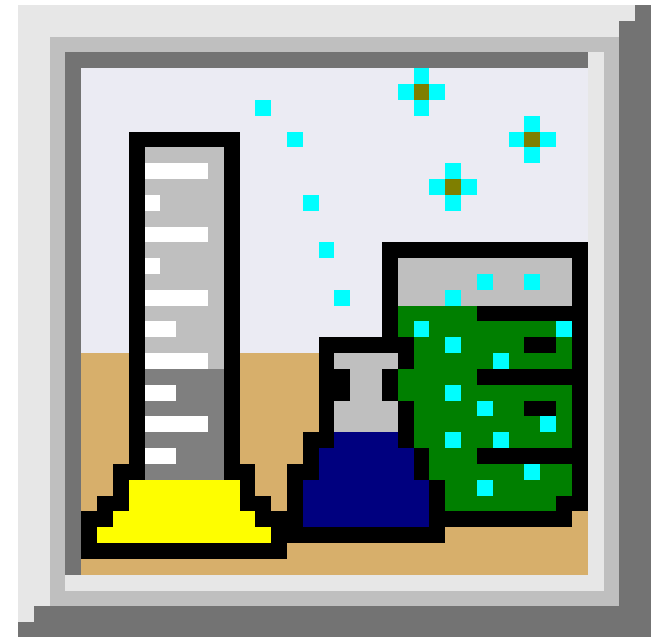
c) A glorified *Plumber*?



Answer: None of the above

What Is A Chemical Engineer?

- A chemical engineer is comfortable with chemistry but does much more with this knowledge than just make chemicals.
- Chemical engineers are very versatile and are trained to handle a wide range of technical problems. (Universal Engineer!!)



Difference Between a Chemical Engineer and a Chemist?

Let's talk about tootsie roll production!!!



Some Issues The Chemical Engineer May Deal With in Tootsie Roll Production

- Heat Transfer
- Fluid Flow
- Separations
- Reactions



Roles that Chemical Engineers Play

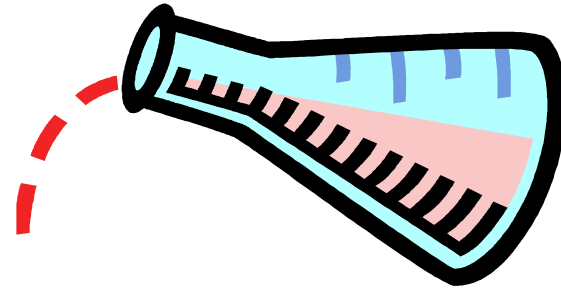
- Research and Development Engineer
- Process Design Engineer
- Product Engineer
- Project Engineer
- Plant Process Engineer
- Process Safety Engineer
- Quality Control Engineer
- Technical Services Engineer
- Sales and Marketing Engineer

Conception and
Design

Implementation,
Troubleshooting,
Maintenance

Research and Development Engineer

- Exploration and Discovery
- Working on multi-disciplinary teams
- Application of fundamental research
- Works in the laboratory
- Often requires advanced degree (MS, Ph.D.)



Process Design Engineer

- Designs manufacturing facilities and the equipment and material used inside facilities.
- Regularly consults with R&D engineers
- Pays attention to safety, environmental and regulatory aspects of design.



Product Engineer

- Follows production cycle of a product
- Ensures that it is being produced to specification
- Works with R&D and marketing. Are we meeting needs of customers
- Specific product orientation
- Sees product from conception to commercialization.
- Combination of strong technical and business background



Project Engineer

- Oversees the design and construction of specific processes.
- Assists with equipment testing, operator training and plant start-up.
- Specific process orientation
- Often an expert in one process
- Work closely with plant personnel



Plant Process Engineer

- Provides technical support to staff and troubleshoots processes in a production facility to keep a plant running efficiently.
- Work closely with operators – avoid shutdowns.
- May be involved in some design work for improvement projects
- Plant setting
- Broad range of responsibilities
- Classic entry-level job for BS graduates



Process Safety Engineer

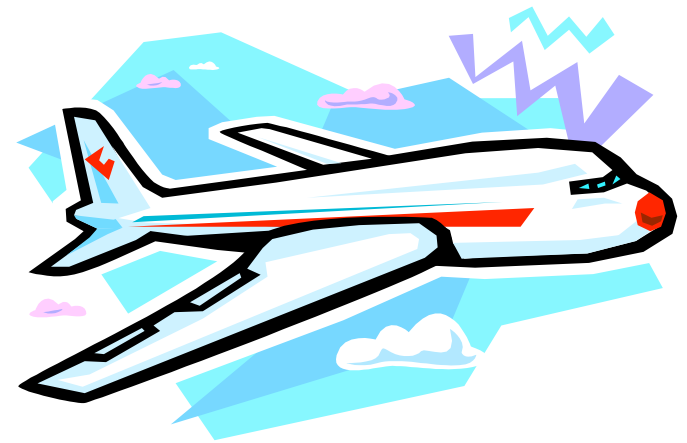
- Conduct safety analyses of new and existing equipment and train employees on how to safely operate equipment
- Integral part of the design process

Quality Control Engineer

- Monitors the manufacture of a product to ensure that it meets specifications. Also, tests materials to determine how they perform over time.
- Interfaces with plant process engineering

Technical Services Engineer

- Works with customers on-site to solve production problems caused by a specific process or machine.
- Large amount of travel.



Sales and Marketing Engineer

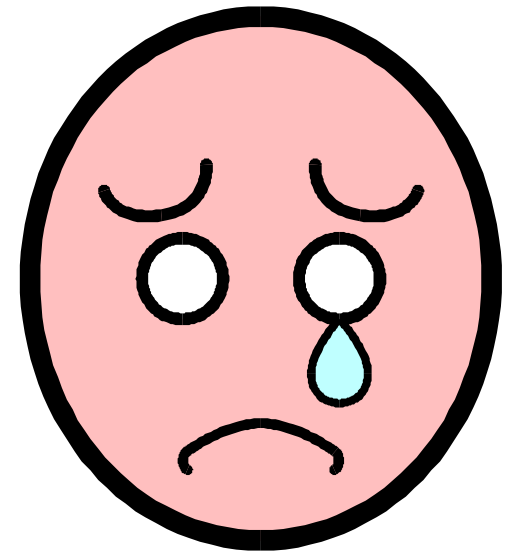
- Assists customers in solving production and process problems by providing products and services to meet their needs
 - Sell Products!!
- Requires ability to find appropriate product/solution for customer
- Must understand technical aspects, as well as the marketplace for the product
- Communication skills a must!!!



Solving a Problem and Following An Idea to Production at Tootsie Roll Inc

- Marketing Team reports that consumers are not happy with tootsie rolls.
- Problems with Tootsie Rolls

Stick to teeth
Stick to wrapper
Melt to easily
Too hard



Problem Goes To Management Team

- Responsible for developing business strategies. Make money
- Requests a solution and cost estimate from the ***Technical Manager***



Research and Development Team Assembled

- Includes *R&D engineers, Product engineer*, chemists etc.
- Looks at re-formulating the process so that tootsie rolls are better but they also retain good qualities.
- After several months, new idea! Came up with new additive that keeps the tootsie roll from sticking to teeth!!!

Must Consider Regulatory Issues



- During production of new additive, a chemical is released that may cause environmental issues.
- **Regulatory Affairs Engineer** at EPA
 - Researches the chemical and develops policies and procedures to ensure the proper handling of chemical

Patent???

- New additive could be used in making other foods and could make more money for company
- **Patent Attorney** researches process/chemical to see if it is eligible for a patent.



Sales and Marketing

- **Sales and Marketing Engineer** determines demand for product
- Business manager takes design info from R&D and projects the cost.
- Management Team reviews business plan and approves.



Design Team

- Designs new plant for manufacturing
 - **Project Manager**
 - **Product Engineer**
 - **Six Process Design Engineers**
 - **Three Project Engineers**
 - **Environmental Eng** (*Waste*)
 - **Automation Eng** (*Designs instrumentation for control and monitoring*)
- Consults regularly with R&D team
- Question: How many distinct process operations are involved in production of the new tootsie roll???



Technical Responsibilities

- Three new processes
- Project Manager assigns
 - One project engineer to lead the design of each process
 - Two process design engineers to work with each project engineer.
 - Product engineer works with all three groups
- Environmental engineer works closely with all three groups
- Automation Engineer works closely with all three groups.

Construction

- After pilot plan testing under the supervision of the process design engineers, construction company helps with project.
- Construction manager works closely with ***Project engineers and Project manager*** to build each process as designed.



Safety

- **Process Safety Engineer and Plant Process Engineer** – Trains operators on use and does safety analysis



Manufacturing

- **Product Eng** works daily with operators
- **Plant Process Eng** monitors daily operation of equipment – troubleshoots with product eng.
- **Quality Control Eng** – checks specifications of product.



Delivery

- **Sales and Marketing** give input on delivery and consumer interests
- Management Team receives regular updates on new process from Business Manager and **Technical Manager**



Summary – Taking a Product to Market

- Management
- Product Engineer
- Regulatory Affairs Eng.
- Patent Attorney
- Sales and Marketing
- Project Engineer
- Process Design Engineer
- Environmental Engineer
- Plant Process Engineer
- Automation Engineer
- Process Safety Engineer
- Quality Control Engineer.

TEAMWORK!!!



All Chemical Engineers Don't Wear Hardhats

- Work in plant
- Work in lab
- Design
- Management



Products Made By Chemical Engineers

- shampoo
- textiles
- paper
- detergents
- foods
- leather
- fuels
- cement

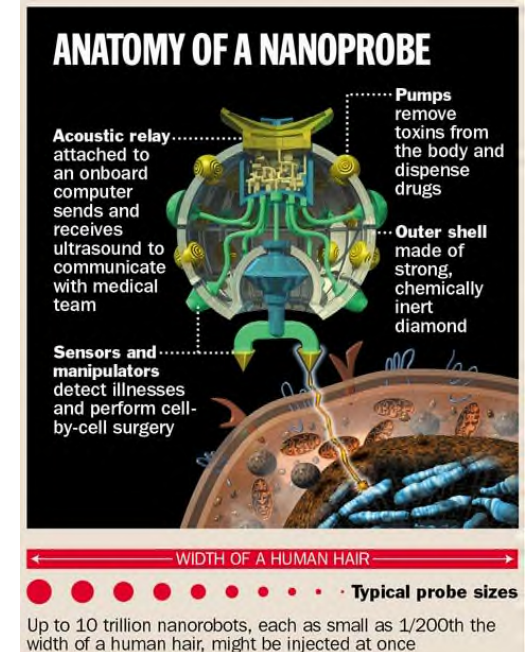


- pesticides,
- paints,
- polymers,
- natural and synthetic fibers
- drugs
- and numerous others



RECENT HOT AREAS OF SPECIALIZATION

- Environmental
- Bioengineering/Biotechnology
 - Pharmaceuticals
 - Making products from microbes/animal cells
 - Artificial devices
- Materials/Polymers
- Nanotechnology



Job Opportunities

- Marathon Ashland Petroleum, OH & MN
- Dupont
- Valvoline, KY
- Westvaco, VA
- Corning Inc, KY
- Procter and Gamble, OH
- Pfizer, MI
- Osram-Sylvania, PA

Average Salary:
\$53,000

Curriculum

- See Handout

Student Activities In Department

- CME 395 and other research opportunities
- Co-Op
- AIChE – National and Regional Meetings
- Other Opportunitites
 - Environmental Certificate
 - Biomedical Engineering Certificate
 - Bioprocess Engineering Certificate



What Can I Do When I Graduate?

- Get a job
- Go to Graduate School
 - Chemical Engineering
 - Environmental Engineering
 - Biomedical/Bioengineering Engineering
 - Pharmacy
- Go to Law School
- Go to Medical School
- Go to Business School



What Can I Do to Learn More?

- Talk to faculty
- Shadow an engineer in industry
- Visit the internet
 - www.aiche.org
 - www.careercornerstone.org
 - www.usnews.com/usnews/edu/home.htm



Homework Assignment

- Pick 3 chemical engineering courses from the chemical engineering curriculum
- Read their descriptions/Web/Bulletin
- In one page or less (double spaced, 12 pt font), describe how you would use the information from these courses in your “dream” job.