

INTRODUCTION TO CHEMICAL ENGINEERING

Dr. Siva Mohan Reddy
Chemical Engineering Department
IIT Roorkee
Ph: 01332-284833
Email: nsiva.fch@iitr.ac.in

Syllabus of Introduction to Chemical

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Engineering

NAME OF DEPTT./CENTRE: Department of Chemical Engineering

1. Subject Code: CHN-101 Course Title: Introduction to Chemical Engineering

2. Contact Hours: L: 2 T: 0 P: 0

3. Examination Duration (Hrs.): Theory Practical

4. Relative Weightage: CWS PRS MTE ETE PRE

5. Credits: 6. Semester: Autumn 7. Subject Area: DCC

8. Pre-requisite: Nil

9. Objective: To introduce the basic features and concepts of Chemical Engineering to the students.

10. Details of Course:

Module No.	Contents	Contact Hours
1.	Introduction: Framework of chemical industry and its classification, production routes, concepts of synthesis and segmentation; definition of chemical engineering, historical perspective and contribution; job description and attributes of a chemical engineer, chemical engineering and its seam less integration with other sciences and engineering disciplines; Societal needs and life cycle of technology, market forces; Economic scale of production; Waste utilization and recycle, sustainable technology, process integration and intensification; Employment opportunities, knowledge resources and software tools; Frontiers & future roadmap; Challenges of chemical engineering practice-safety, economics, ethics, regulation and IP.	7
2.	Chemical Process Industries: Evolution of chemical industries, Technological developments in major challenges; Chemical industries structure and segments of chemical industry, raw material and production pattern; Basic principles of chemical processes, unit processes and unit operations and various routes to produce chemicals; Petroleum, petrochemical and fertilizer industry integration; Cleaner and greener technologies.	7
3.	Basic Tools of Chemical Engineering: Physico-chemical and biological sciences; Mathematics and computation; Thermodynamics and kinetics, Material and Energy balances; Transport phenomena; Equilibrium and rate based processes; Reaction engineering and reactors; Various transport processes; Efficiency and economics of processes. Measuring instruments, automation and control, concept of scale-up- lab to industrial, nano to terrestrial; Dimensional analysis and semi empiricis; Degree of freedom analysis; Concept of design, modelling and simulation.	8

<https://www.iitr.ac.in/academics/uploads/File/2015/syllabi/UG/CH%20PDF.pdf>

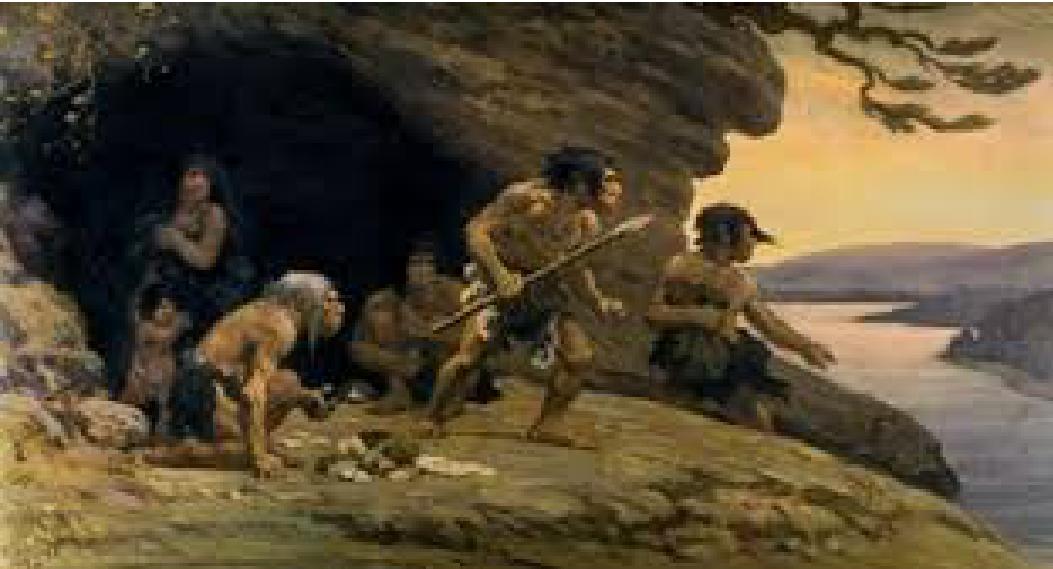
Syllabus of Introduction to Chemical Engineering

4.	Applications of Various tools and Examples: Flash unit and blending system; Coal combustion and gasification; Boiler and steam generation; Biomethanation and alcohol production; Petroleum fractionation and petrochemicals; Chemical vapour deposition; Nano-devices and drug delivery systems; Accidents and safety; Web-based learning and educational videos of refineries, petrochemical plants and fertilizer units; Important developments and milestones in chemical engineering.	6
	Total	28

11. Suggested Books:

S. No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
1.	Denn Morton M., "Chemical Engineering: An Introduction", Cambridge, University Press.	2012
2.	Himmelblau D.M. and Riggs J.B., "Basic Principles and Calculations in Chemical Engineering". 7th Edition., Prentice Hall.	2003
3.	Austin G.T., "Shreve's chemical processes in industries", McGraw-Hill Book Company, 5 th Edition.	1984
4.	Groggins, P.H., "Unit processes in organic synthesis", Tata McGraw Hill Education Private Limited, 5th Edition.	1995

Basic Needs



**Infrastructure
development**

To bring prosperity

**Chemical
Engineering**

**THE SEEDS OF
PROSPERITY**

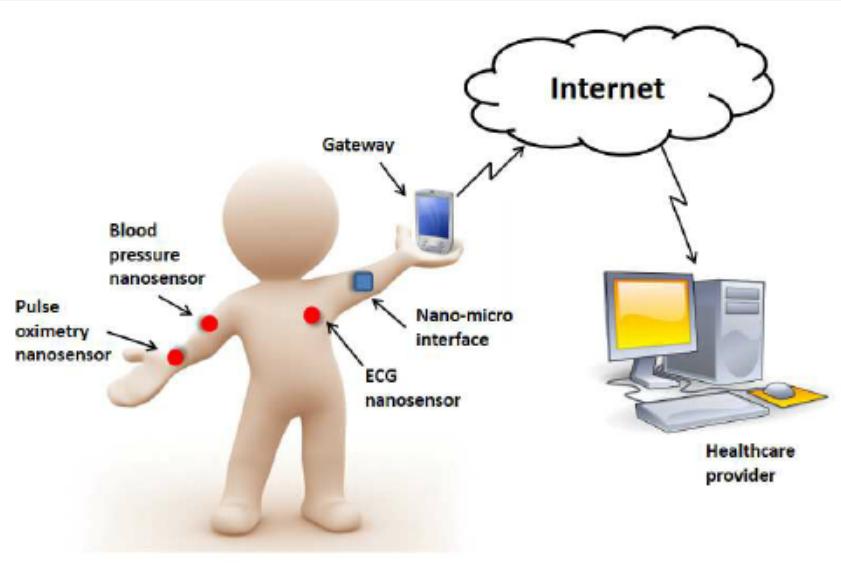
**Electronics
Engineering**

**Computer
Engineering**

**Civil Engineering
Mechanical Engineering
Electrical Engineering
Communication Engineering**

COUNTRY

Chemical Engineering







Chemical Engineering vs Chemistry



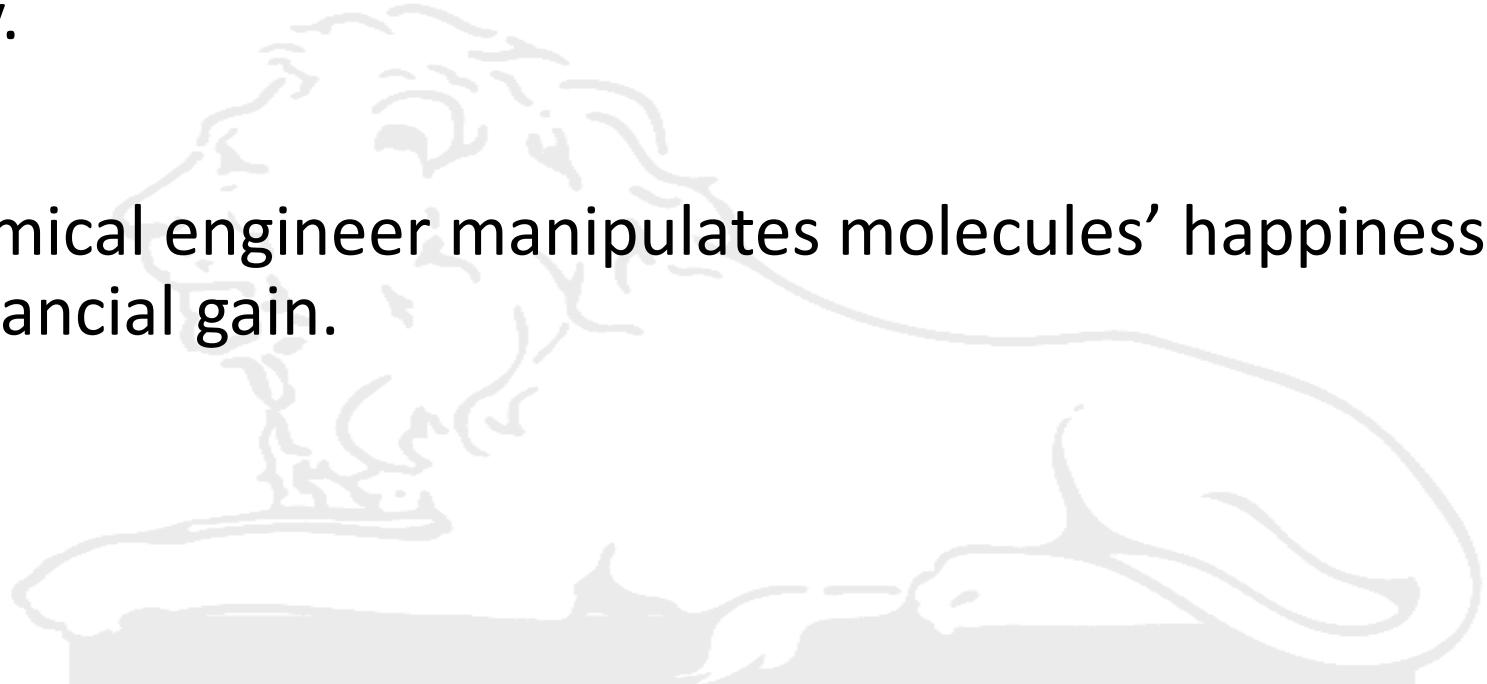
<https://www.rit.edu/kgcoe/chemical/>



Definition: Chemical Engineering vs Chemistry

A chemist tries to understand what makes molecules happy.

A chemical engineer manipulates molecules' happiness for financial gain.





Why choose Chemical Engineering



Modern society relies on the work of chemical and biochemical engineers –

Chemical Engineers manage resources, protect the environment and control health and safety procedures, while developing the processes that make the products we desire or depend on.

Chemical Engineers aka Process Engineers

Chemical engineering is all about changing raw materials into useful products you use everyday in a safe and cost effective way. For example petrol, plastics and synthetic fibres such as polyester and nylon, all come from oil.

Chemical engineers understand how to alter the chemical, biochemical or physical state of a substance, to create everything from face creams to fuels





Chemical Engineering

Chemical engineers master the process design required for the production of materials we use in our daily life.

They are involved in all phases of technology development:

IDEA → APPLICATION of SCIENCE → MANUFACTURE



Chemical engineers are described as the “universal engineer” because they have a broad knowledge of:

- Physical, chemical, biological & engineering science
- Economics, business, management science

Chemical Engineering





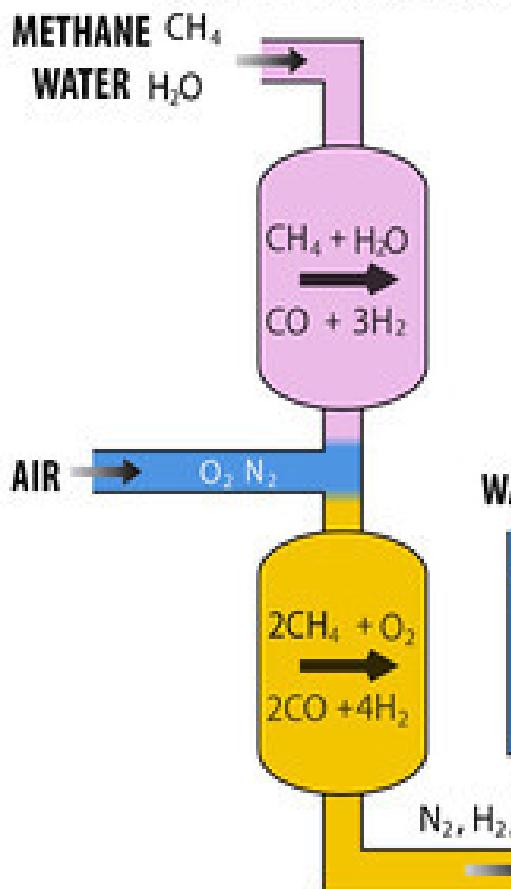
Process Development



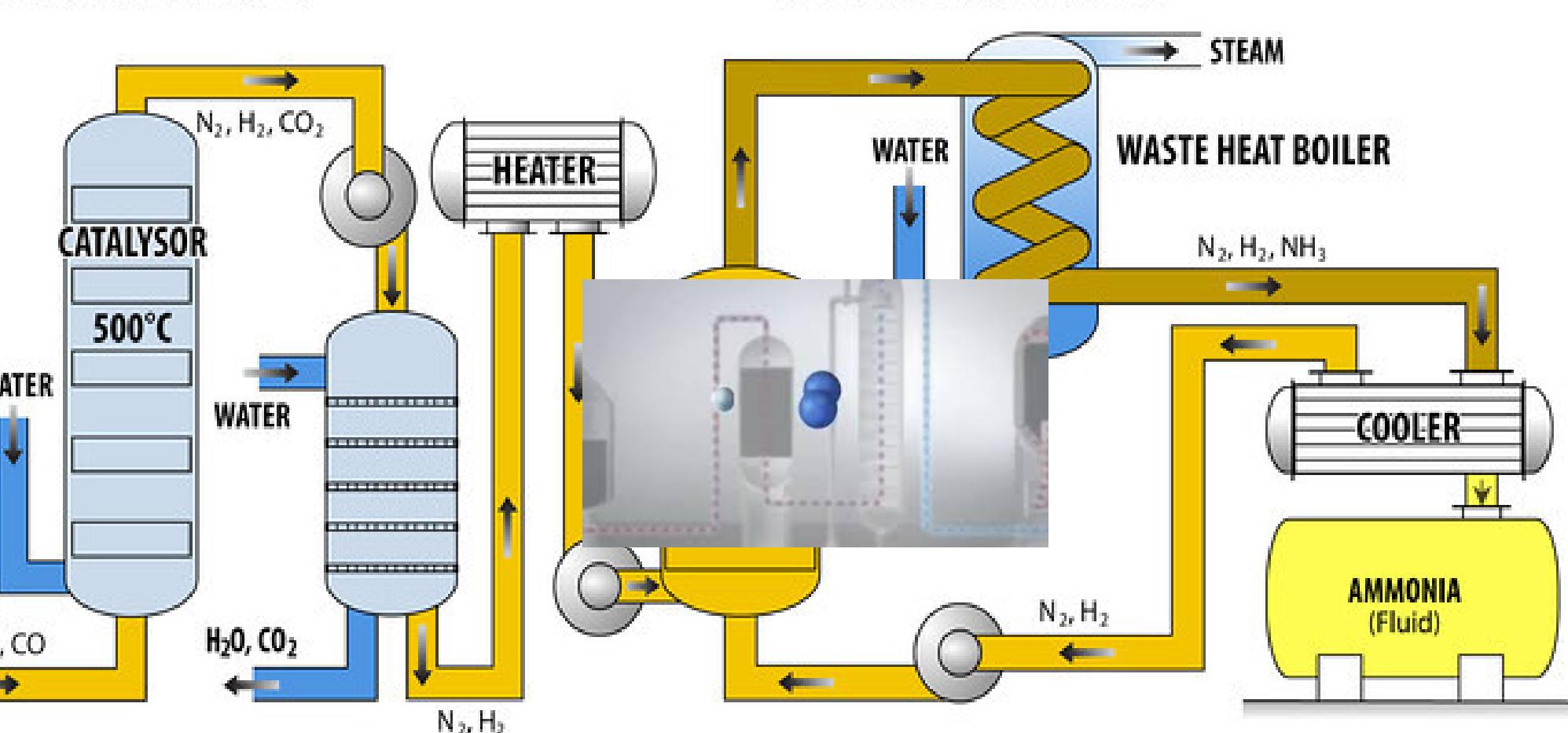
Product synthesis

The Haber Bosch Ammonia Process

PRODUCTION OF THE SYNTHESIS MIXTURE



PRODUCTION OF AMMONIA





Homogenous and Heterogeneous Mixtures

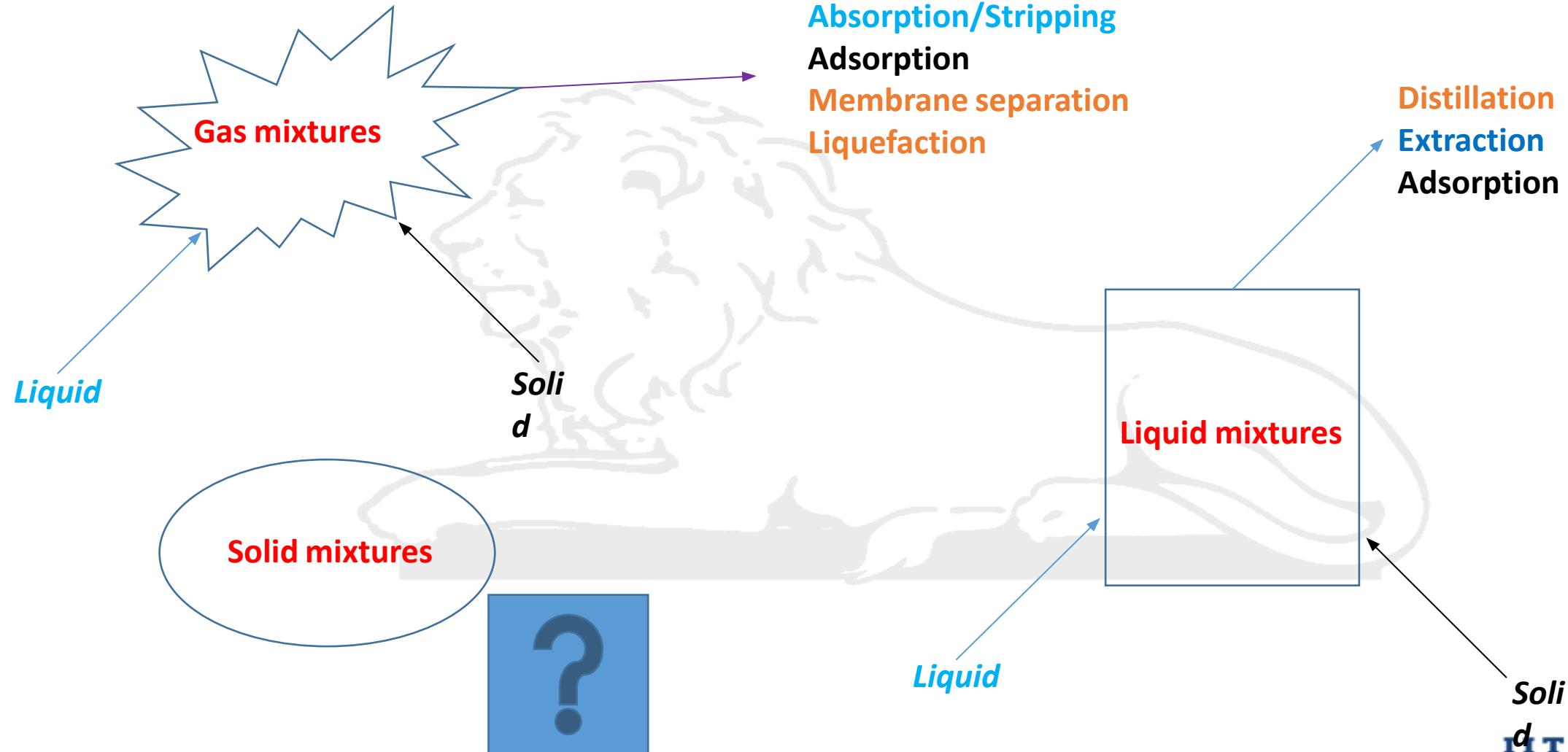


**Homogenous
and
Heterogeneous
Mixtures**

Separation

S

New Phase - Added





Its special when Chemical meets Engineering



Aspirin, one of the first drugs to come into common usage, is still the mostly widely used in the world - approximately 35,000,000 kg are produced and consumed annually, enough to make over 100 billion standard aspirin tablets every year.





Emerging Chemical Engineering

Focus on sustainability for progress





Chemical Engineering

Shell and Tube Heat Exchanger





Chemical Engineering



Opportunities to Chemical Engineers

- Biotechnology/ Biopharmaceuticals
- Food & Drink
- Water
- Pharmaceuticals
- Cosmetics
- Bulk chemicals / Speciality Chemicals
- Consultancy (Design & Operation)
- Energy
- Health, Safety & Environmental Services
- Materials
- Consumer Goods
- Education
- Even.....Business & Finance,

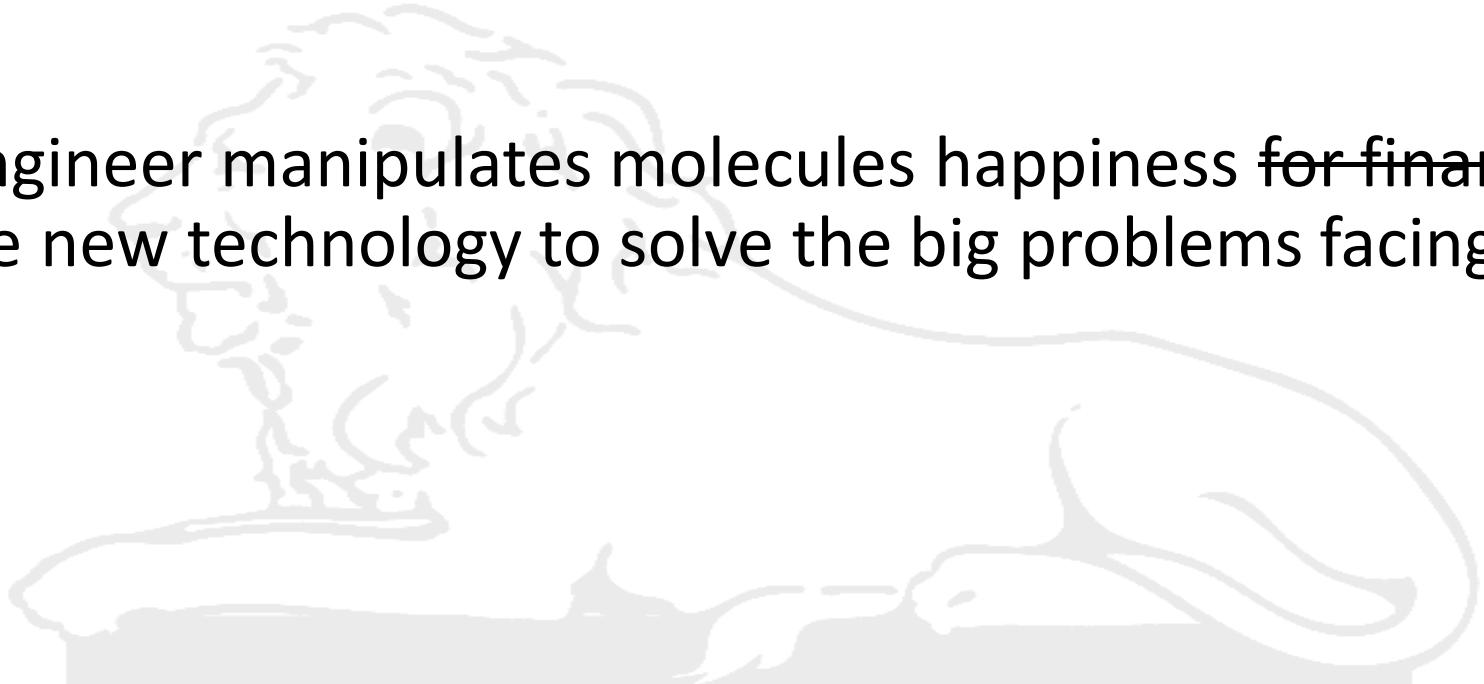




Correcting my Definition of Chemical Engineers

A chemist tries to understand what makes molecules happy.

A chemical engineer manipulates molecules happiness ~~for financial gain~~ to create new technology to solve the big problems facing humanity.





Career of Chemical Engineers

careerbuilder®





Financial rewards of Engineers



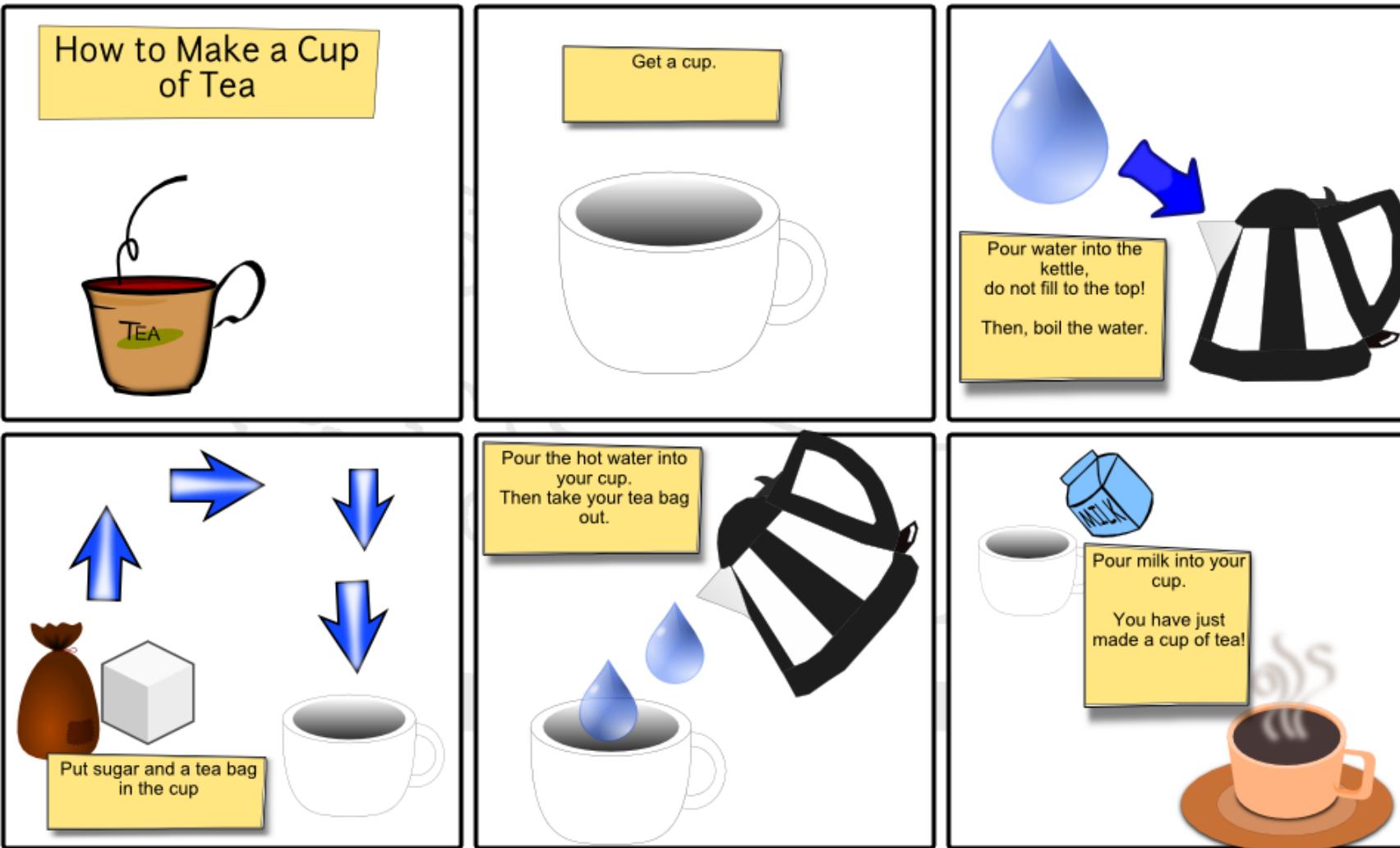
Profession	Graduate salary
Dentistry	£30,395
Chemical engineering	£29,582 #2
Medicine	£28,548
General engineering	£26,362
Economics	£26,283
Mechanical engineering	£26,076
Aeronautical & manufacturing engineering	£25,343
Veterinary medicine	£24,934
Electrical & electronic engineering	£24,639
Civil engineering	£24,524

*Source: Institution of Chemical Engineers (IChemE) Salary Survey 2014

**Source: published in The Times newspaper on 22 September 2014



Chemical Engineering in tea making



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