

# A Chemist's Guide to Chemical Engineering

## Course Objectives

In order for chemists and engineers to interact and collaborate they need to understand and appreciate the point of view of the other discipline. This course sets out to give chemists an introduction to the main topics in chemical engineering and help them realise the importance of the subject. The course will not be attempting to convert chemists into design engineers but it is hoped that it will help chemists understand what chemical engineering is and how chemists can improve their own job function and career prospects. The course will attempt to introduce and describe the principles of chemical engineering without resorting to the excessive use of mathematics. It will attempt to assist chemists to appreciate the type of data needed by engineers and why it is needed. In so doing it will allow chemists to realise how a better understanding of chemical engineering will improve their own work in process research and development. It is hoped that attendees on the course will better appreciate the vital interaction between chemistry and engineering.

## Outline

### Section 1 – Introduction

What is Chemical Engineering?  
Dimensionless Numbers, what are they and what do they mean?  
Mass Balances  
Energy Balances  
Process Flow Diagrams

### Section 2 - Fluids and Fluid Flow

Introduction to Fluid Flow  
Reynolds Number  
Bernoulli's Equation  
Friction in Pipes  
Pumping Fluids  
Types of Pumps

### Section 3 - Heat Transfer

Introduction to Heat Transfer  
Heat Exchangers  
Introduction to Drying  
Analysing Drier Performance  
Psychrometric Charts

### Section 4 - Column Separation Methods

Introduction to Mass Transfer  
Introduction to Separation Processes  
Introduction to Column Separations  
Distillation and Gas Absorption Techniques  
Vapour Pressure and VLE Data  
Distillation Terms and Techniques  
Information Required for Column Design

### Section 5 – Solid/Liquid Separations

Introduction to Solid Liquid Separation  
Selecting SLS Equipment  
Centrifugation and Centrifuges  
Evaluating Centrifuge Performance  
Crystallisation and Crystallisers

### Section 6 – Extraction Processes

Introduction to Extraction Processes  
Mass Balance in Extraction  
Using and Understanding Phase Diagrams

### Section 7 – Reactors

Types of Reactors  
Reactor Design  
Scale up of Reactors  
Batch Reactor Performance and Modelling

### Section 8 - Mixing

The Importance of Mixing  
Mixing and Blending  
Methods of Mixing  
Types of Mixers and Agitators  
Effect of Mixing on Reactions and Products

R&D chemists are very often at a disadvantage when working in process research and development because of their lack of knowledge about the basic principles of chemical engineering. Most chemical engineering courses, that are aimed at chemists, are actually developed and presented by chemical engineers. Therefore they tend to be very mathematically based and not really suitable nor interesting for R&D chemists. This course is different and has been developed and is presented by a chemist for chemists. Therefore, it does not dwell on the derivation of a mathematical formula or equations but focuses on what chemists need to know about the information and data that engineers require. Chemical engineering without mathematics is impossible and so this course does contain mathematics which should not trouble degree level chemists. A chemist only needs to know why a mathematical formula or equation is important and needs to appreciate where and how the data are used. Chemists do not need to know how to design plants and equipment and since most chemists are not interested this course does not attempt to teach them.

## Tutor



**Dr Keith Turner** *Kappa Tau Consulting* received his BSc in Chemistry from London University in 1971 after a four year sandwich course with BP, during which time he spent industrial training periods at Sunbury Research Centre, Baglan Bay Chemical Factory and Belfast Oil Refinery.

He was awarded a DPhil by Sussex University in 1974 for research work into Organometallic chemistry with Professor M.F. Lappert. He then worked for three years with Rohm & Haas UK Ltd. in Tyneside as a process development chemist on acrylic and methacrylic monomers and polymerisation chemistry.

In 1978 he moved to Davy Powergas process research and development group on Teesside (now Davy Process Technology) where he worked on the development of homogeneous and heterogeneous catalysed processes for the organic and petrochemical industries. As well as laboratory investigations, he also participated and led teams involved in the marketing and commercialisation of technologies including licensing evaluations. He finally became Business Development Co-ordinator where he co-ordinated R&D and commercial activities between Davy and its various collaborators.

In 1991 he joined US based Catalyst Consultants at its UK office in East Sussex as a project manager and left to set up his own consultancy practice in November 1992. He undertakes consultancy work in the field of chemical process development and biodiesel production. He also develops and offers training for personnel in these industries. [keith@kappa-tau.co.uk](mailto:keith@kappa-tau.co.uk)

## Who Should Attend?

**Chemists** who are working or have recently begun work on process R&D, pilot plants or production plants

## Workshops, Problems and Case Studies

The course will include some basic problems and case studies on an individual and group basis. These will include evaluation of mass and energy balances, estimating pumping requirements and fluid flow, some basic process design concepts and calculation of heating and cooling requirements.

## Fees

Fee includes lunch & refreshments, course dinner and course manual.

## Accommodation

Scientific Update use high quality venues around the world. Preferential room rates including bed & breakfast are usually available.

Please check the Course Schedule on our website for venues, dates and availability.