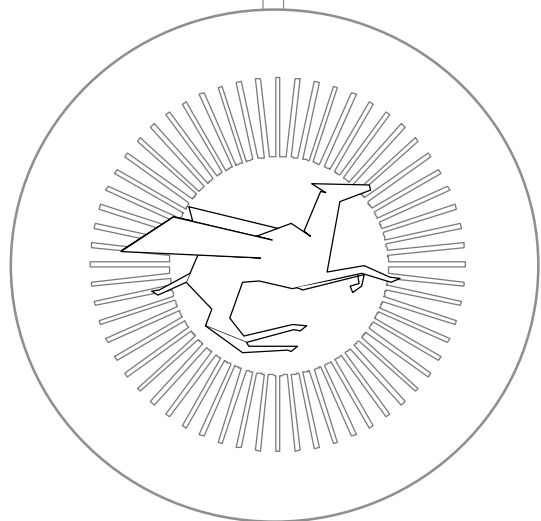




## THE MAGIC IN CHEMISTRY

A COMPLETE PACKAGE FOR NINETY MINUTES OF VISUAL DELIGHT  
MAGIC-ILLUSION-TRUTH-EXPLANATION-SCIENCE-HINTS-SAFETY

SUBRAMANIA RANGANATHAN



VIDYANANTHA

A REGISTERED SOCIETY FOR THE PROMOTION OF EDUCATION, ARTS AND CRAFTS

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RESPECTFULLY DEDICATED TO  
DARSHAN RANGANATHAN  
WHO PASSED AWAY ON HER  
SIXTIETH BIRTHDAY  
JUNE 4, 2001



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*S. Ranganathan*

Hyderabad, 2001



## PREFACE

The best way to propagate the message and bounty of science is to present its manifestations that project the basic principles. This is all the more true in the realm of chemistry, as a discipline that profiles the dynamic melody between energy and matter. When teaching enjoyed a premier place in the dissemination of science, experimental demonstration was always the forum and one could find examples of this form from the time of Faraday and Raman. This art has all but vanished from our classrooms and academic gatherings. A revival would have a positive influence in our understanding, learning and propagation of science and this book is a very small step in this direction.

Several accounts of experimental demonstration have left a deep impression on me. Faraday's lectures on the candle, his demonstration of the liquefaction of gases, Raman's demonstration of the Raman effect and aspects of vision are outstanding examples. The one, which I vividly remember, is a lecture at the Royal Institute of Chemistry, narrated in Kendal's book entitled, *Young Chemists and Great Discoveries*. Here, a furnace was keeping lead molten and the speaker stated that dry hands can safely receive the molten lead and invited the Prince of Wales, the future king, to receive this, which he unhesitatingly did. Does the scientist of the present hold such confidence amongst laymen!

Several criteria have played a role in the selection of over a dozen examples that comprise this book. These include, the visual impact, the quantum of scientific message, ease with which it can be shown in a limited time, use of simple protocols with readily available materials and a concern for safety. All examples have been tried on several occasions and are quite reproducible.



## THE MAGIC IN CHEMISTRY



## THE FLAME

### PATTER

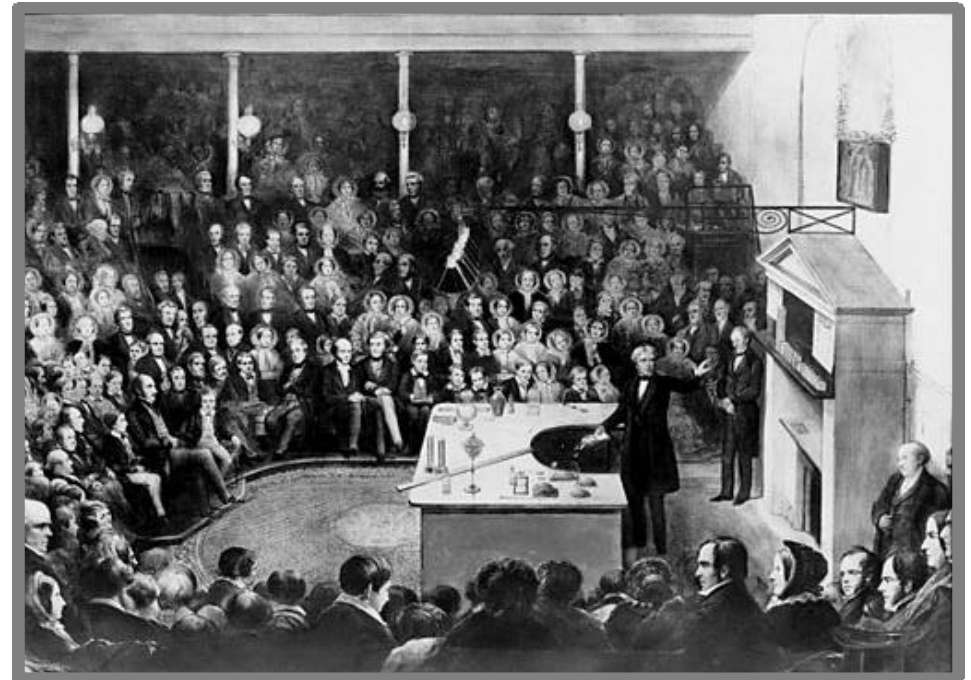
The creation of a flame will perhaps remain the best example of Magic. It invariably evokes the deeply latent atavistic impressions, connected to our most primitive existence

### MAGIC

Light a candle in a dark hall.

### TRUTH/EXPLANATION/SCIENCE

Centuries ago, Michael Faraday, in his lectures on the chemistry of a candle, described the light seen, as a pale reflection of the Sun. How true it is! In present day comprehension, the light of the candle originates from the bond energy of hydrogen, which on nuclear fusion leads to electromagnetic radiations. These received by the earth, unite carbon dioxide and water by a process that requires energy, leading to energy-rich bonds. The combustion of these back to carbon dioxide and water gives electromagnetic radiations seen!



Inventor and scientist Michael Faraday lectures at the Royal Institution. The Prince Consort with his sons the Prince of Wales and the Duke of Edinburgh are seated in the front row facing Faraday. From a painting by Alexander Blaikley.



## THE TIP OF THE ICEBERG

### PATTER

Generally, what our senses report is based on life experiences and at times they could be erroneous. Indeed, much of magic and illusion relate to misleading the senses, to create unnatural impressions. The truth/science behind these, is like and iceberg, the overt tip that is magic and the large latent part that is truth/explanation/science.

### MAGIC

Liquid filled to the brim in a 25 ml conical flask is declared as kerosene by the audience. You invite one to drink this, which will be politely refused. You drink it yourself!

### TRUTH/EXPLANATION/SCIENCE

The contents as kerosene was a carefully created illusion by adding just a drop of kerosene to the flask filled with pure water.



"The Icebergs had wholly lost their chilly aspect, and glittering in the blaze of the brilliant heavens, seemed in the distance like masses of burnished metal or solid flame. Nearer at hand they were huge blocks of marble inlaid with mammoth gems of pearl and opal. One in particular exhibited the perfection of the grand. Its form was not unlike that of the Colosseum, and it lay so far away that half its height was buried beneath the line of blood-red waters!"

-Hartwig, G. 1877. From *"The Polar and tropical worlds: a popular and scientific description of man and nature in the polar and equatorial regions of the globe."*



## BURN WITHOUT PAIN

### PATTER

Can fire be an illusion?! Can something be put on fire, without being damaged?! I have seen people walking on burning coal and have read the science behind it. All it requires seem to be lots of courage and some precautions. I certainly do not have the former!

### MAGIC

Dissolve ~ 0.5 g of strontium nitrate in 50 ml of water. Mix it with 50 ml of ethanol. Immerse a currency note in this, drain most of the solvents, hold it firmly by a pair of long tongs and set ablaze. Brilliant red flames engulf the note. The flame self-extinguishes. Similarly, set ablaze a small piece of coarse cotton fabric. Here the flame will engulf the fabric, burn vigorously for ~ 3 minutes before self-extinguishing. The cloth will be so wet that water in quantities can be squeezed out!

### TRUTH/EXPLANATION/SCIENCE

A highly efficient partitioning system is illustrated in these simple experiments. The preference for water by the cotton fabric makes it thoroughly wet and therefore non-inflammable at the expense of the surroundings, which will be very rich in the flammable ethanol. We see fire, but it actually surrounds the fabric without affecting it. Many such simple partitioning systems are used, that range from pickling to chromatographic separations!



### HINTS/SAFETY

Even a single burn spot can mar the show. This could happen at the site the fabric is being held by tongs. To prevent this not frequent possibility, wet the tip of the fabric that is being held by the tongs. The fabric should not drip!