Education

From the time we develop language, stories are one of the most powerful, enduring ways in which we connect with our world and in which our culture is passed on. Much of our knowledge and understanding, wisdom, sense of belonging, sense of identity, values and even our joy of life comes from the stories to which we have been exposed. Little wonder that most people love stories over their entire lifetime.

For this reason, chemistry teachers need to tap into the wonderful, rich, almost bottomless pit of fascinating stories in chemistry. You could tell well-chosen stories every single lesson – some short, some longer, some funny, some just simply astonishing – and never 'waste valuable class time'. For it is amazing how much better students will remember something when they have learnt it through a story.

For example, ordinarily students would not remember that ammonia molecules are shaped like pyramids. Even if you show *why* the molecules are this shape and give the students opportunities to predict the shapes of other molecules (a skill required in many chemistry courses), many will not be very interested.

But if you start by telling the story of ammonia, you can have the students spellbound. This is far better motivation than the fact it might be 'on the exam'. Start with the worship of the god Amun (also known as Amon) in ancient Egypt and the temple of Jupiter Amun in ancient Libya. The ancient Romans discovered deposits of a salt that gave off a rather pungent gas in the ground near this temple. They called it 'sal ammoniacus' (*salt of Amun*), later commonly known as 'sal ammoniac' and now known as ammonium chloride.

By the Middle Ages, dyers had discovered that sal ammoniac could alter the colour of vegetable dyes. To produce the salt, they collected urine and distilled it. (It was once thought that being golden, urine could be distilled to extract gold. Of course, this was a dismal failure. However, gold can be obtained by distilling seawater; it is one of the side benefits of desalination plants. But I digress.)

Later, another salt of ammonia was produced by distilling the shavings of deer horns and hooves. Deer were then called harts, so this salt was known as 'spirit of hartshorn'. It also was known as 'sal volatile' because of its odour, and as it was able to arouse consciousness, it became better known as 'smelling salts'. These were given to swooning ladies, described in many popular stories of Victorian England. (The ladies generally swooned because they laced their bodies up in tight corsets to the point where they could barely breathe, just to give the impression of a very slim figure.) Interestingly, in ancient Thebes, the god Amun was associated with the 'breath of life'. Even last century, smelling salts were provided in first aid kits. Fortunately this practice was eventually stopped, as breathing in ammonia was found to be harmful. The chemical name of 'sal volatile' is ammonium carbonate.

After its early discovery in the land that borders Egypt, it is ironic that after all that, chemists then discovered its molecules were shaped like pyramids. Now, aren't you just a little fonder of ammonia, too, after this little tale?

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On the inside-out balloons (December 2009 issue)

Stephen Grocott FRACI CChem has kindly proposed an explanation. In summary, this states that by the time the students fit the balloon, the reaction has started and some of the air has been displaced from the flask by the CO_2 evolved. The CO_2 continues to be produced and the balloon inflates. However, the partial pressure of CO_2 inside the balloon is higher than in the atmosphere, so it diffuses out of the balloon. The collapse of the balloon is faster than the rate of diffusion of air back in. Hence, overnight the balloon deflates and is pulled into the flask. By the next morning, the partial pressure of the gases inside and outside the balloon is closer to equilibrium. Stephen suggests that his hypothesis could be tested by placing the solid bicarb of soda inside the balloon, then sealing the flask with the balloon. This way no air can escape before the flask is sealed. Would anyone like to try that or suggest any other hypotheses? Your ideas would be most appreciated.