Career of the Month

November 2010, Based on Interviews With Professionals Using Science in the Workplace

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Applied Chemical Technology Professional

Applied chemical technology professionals (ACTP) are key members of laboratory teams. From pharmaceutical testing to environmental monitoring and basic research to complex projects, they work in a variety of settings and assume many different responsibilities. With a background in chemistry and strong problem-solving skills, ACTPs such as John Engelman have the opportunity to contribute to new technological advances that improve the quality of our lives. After 46 years in the field, Engelman reflects that his fun and rewarding career is the next best thing to a hobby.

Work overview.

ACTPs' skills and knowledge are applied in an extensive array of chemical technology jobs—there are over 300 different titles associated with this profession. We are technicians, operators, and analysts. We develop new products, collect and analyze data, prepare compounds, monitor commercial production, test for product quality, troubleshoot equipment, and present results. We are involved in agricultural, pharmaceutical, biochemical, nanotechnology, consumer product, automotive, and chemical industries. Our contributions span the scientific gamut.

Career path.

I was first drawn to science my freshman year of high school. My biology teacher had a passion and instructional style that gave me a thirst for more. In the following years, enthusiastic physics, math, and chemistry teachers helped make those subjects engaging. I remember being fascinated by what could be done with chemicals.

After high school, I joined the army. Once I was discharged, I entered a two-year associate's program in industrial chemical technology. The program included general and organic chemistry; qualitative, quantitative, and instrumental analysis; synthesis laboratories; advanced math; technical report writing; physics; and general education classes.

When I transitioned into my first chemical technology job, I continued my formal education by taking night classes—paid for by the company. Over the years, my employers have paid for courses in physical chemistry, polymer chemistry, biochemistry, statistics, calculus, computer programming, and business. I have also participated in on-the-job classes and training. Learning is ongoing in this field.

Creating consumer products.

When I started in the chemical technology field, I worked in radio and radiation chemistry and used gamma rays to induce chemical reactions and synthesize silicone compounds. Over the course of my career, I have learned to develop composite materials for the aircraft industry, engineer thermoplastics and sealants for the automobile trade, and create consumer products (e.g., soap, bathroom, and kitchen cleaners).

Currently, I develop household consumer products for SC Johnson. I work mainly with my company's foreign subsidiaries; my job is to produce new formulas or modify current formulas to meet customers' needs in specific countries. Communication is an important part of my job. I correspond with peers in other countries to understand regulatory issues, culture, and consumer lifestyles—all of which can vary widely from place to place.

Advice for students.

There are many institutions that offer two- and four-year programs in chemical technology. To be successful in any of these programs, you need at least high school chemistry, biology, and math. Classes in communication skills (e.g., public speaking and English) have also become exceedingly valuable.

Students should know that most community colleges and small state universities are teaching institutes, which means the professors are not bound to research programs. As a result, the quality of learning is great due to smaller classes and more teacher-student interaction. Most of these schools also have lower education costs.

In my experience, my two-year associate's degree allowed me to pursue a range of job opportunities that may not have been possible had I pursued my bachelor's degree.

A leading technician.

On May 10, 2003, I was humbled to receive recognition of years of hard work and a passion for my career. On this day, during my alma mater's graduation ceremony, I was awarded an honorary doctorate of science as

"one of the leading technicians in the nation." As icing on the cake, I stood in front of my family, former professor, friends, TV cameras, and 5,000 people to deliver the commencement address. A second milestone happened this August, when I was inducted into the 2010 class of American Chemistry Society (ACS) Fellows.

Learning never stops.

Through my work, I am always meeting and interacting with people who are interesting and filled with knowledge. I have taken a little piece from each of these encounters over the years, making me a mosaic of all I have learned from those individuals. I feel privileged to pass on what has been imparted to me. For instance, as a career consultant for ACS, I get to assist others looking for a job or career change.

Science and technology is always changing and progressing—if you work in this expansive field, you will never stop learning. Every day, I come across something new, which keeps my work challenging and exciting.

BONUS POINTS

Engelman's education:
AAS, Chemistry; DSc, Chemistry

On the web:
American Chemistry Society
(www.acs.org)

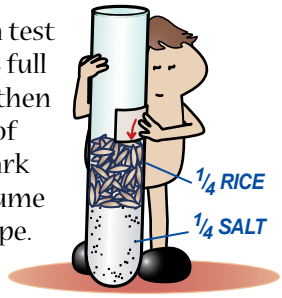
Related careers:
Biological technician, chemical salesperson, chemistry teacher, chemical safety consultant, food chemist, environmental chemist

Try this TOPS IDEA!

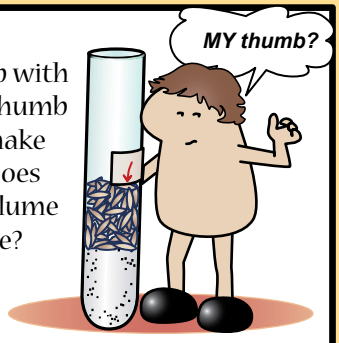
in between

…adapted from **SOLUTIONS #12** by TOPS Learning Systems

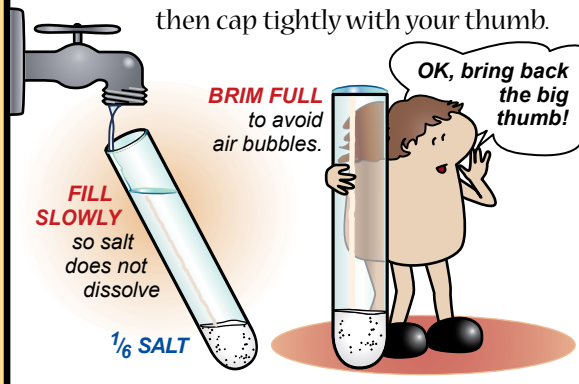
1. Fill a test tube 1/4 full of salt, then 1/4 full of rice. Mark the volume with tape.



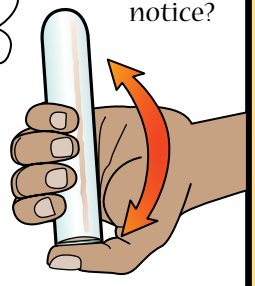
2. Cap with your thumb and shake well. Does the volume change? Why?



3. Empty the tube, and fill 1/6 full of salt. Trickle water down the side until brim full, then cap tightly with your thumb.



4. Rotate the tube slowly to mix. What pressure change do you notice?



5. Explain the pressure change in terms of the rice/salt model.

OBJECTIVE

To understand why salt and water lose volume when mixed together.

LAB NOTES

BACKGROUND: Solid crystals of table salt break apart into positively and negatively charged atoms called *ions* as they dissolve in water. Alcohol molecules, by contrast, intermix with water molecules in the process of dissolving (and they *negligably* break apart into charged ions.

Step 3. *Gently* adding water prevents the salt from dissolving too soon. Filling the tube *brim* full expels *all* air from the tube before capping its mouth.

MATERIALS

- A small, dry test tube.
- Rice and fine-grained table salt.
- Masking tape and scissors.
- Water source and paper towels.
- A metric ruler (optional).
- For extension: rubbing alcohol. 70% concentration will work.

ANSWERS

2. Yes, the level drops about 1 cm below the marker after mixing. The volume decreases because salt fills the empty spaces between rice grains.

4. The pressure decreases in the sealed tube, drawing the thumb gently inward.

5. Salt grains fill spaces between rice grains, so the mixture loses volume. Similarly, dissolving salt (sodium and chloride ions) enters sites between water molecules, reducing the volume of the solution and creating a slight vacuum.

EVALUATION

Q: Corn oil plus water, and alcohol plus water, are combined in graduated cylinders with these results:

10.0 mL oil + 10.0 mL water = 20.0 mL mixture

10.0 mL alcohol + 10.0 mL water = 19.8 mL mixture

Account for the differences in volume.

A: The results suggest that alcohol molecules dissolved between water molecules, resulting in decreased volume. Oil and water are additive, however, suggesting mutual insolubility.

EXTENSION

Gently trickle alcohol into a test tube half full of water. Fill to brim, cap with thumb, and invert to mix. *Again a slight vacuum is created, because water and alcohol molecules occupy less space when dissolved than when layered separately.*

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