

Fun with Quicksilver

Mercury, the Liquid Mystery Metal, Offers a Fascinating Field of Experiment to Amateur-Chemistry Enthusiasts

MERCURY seems to be nature's joke on the scientist. The only metal that is liquid at ordinary temperatures, it still outweighs most solid ones—lead included. Volume for volume, among all the substances you encounter in your everyday life, only a few such as platinum, “gold, and tungsten are heavier than mercury. Though it runs like water, it does not wet objects, and a drop of mercury in the palm of your hand is so elusive that it defies you to pick it up with your fingers.

You might expect that you could perform strange experiments with the compounds of such a queer metal, and you will not be disappointed. Through a magnifying glass or a low-power microscope, you can watch yellow crystals change magically to red when you touch them with a needle. You can make a transparent liquid so heavy that glass marbles will float in it. Trick boxes of matches, easily prepared in your home laboratory, will produce April-fool “serpents” when lighted.

Suppose you start with the color-changing experiment. Dissolve about twenty grams of potassium iodide in 200 cubic centimeters of water (or four teaspoonfuls of the chemical in seven fluid ounces of water). Also dissolve ten grams of mercuric chloride, more familiarly known as bichloride of mercury, in about 300 cubic centimeters of water. (This is equal to one teaspoonful of the chemical in ten fluid ounces of water; note that the abnormal weight of mercury compounds makes it necessary, for once, to deviate from the rough-and-ready rule that a teaspoon holds about five grams of a dry, powdered chemical.) REMEMBER that mercuric chloride is a deadly poison, but may be handled safely with ordinary precautions, such as keeping it away from the mouth, and washing the hands thoroughly after using it. Both the potassium iodide and mercuric chloride solutions will be water-white.

Slowly pour some of the potassium iodide solution into the mercuric chloride solution. A brilliant red precipitate forms. It consists of mercuric iodide. Let it settle, and add more potassium iodide to the clear part of the solution. If more precipitate forms, let it settle, and repeat. Stop adding potassium iodide just at the point where no more precipitate is produced. Then filter off the red mercuric iodide. Wash it well as it lies on the filter paper in the funnel, and then let it dry in the air.

This red powder will turn yellow if you heat it above 126 degrees centigrade (259 degrees Fahrenheit). Mix it with weak mucilage, or varnish, and you can use it as a heat-indicating paint. The yellow color will change back to red after some hours. Scratching the preparation hastens this change.

The color change from yellow back to red will also occur more quickly if the original precipitate of red mercuric iodide is converted into crystals. To do this, shake a gram or so of the powder with about ten cubic centimeters (three teaspoonfuls) of acetone for

about ten minutes. Filter the solution, collecting the liquid that passes through the filter in a watch glass. The solvent rapidly evaporates from the watch glass, leaving long, gleaming crystals of mercuric iodide in a few minutes' time.

Place several of these red crystals on a microscope slide or a sheet of metal. Warm them gently, over a small flame, until they turn yellow. Now observe one of the crystals under a microscope or magnifying glass, while you apply pressure to it with the point of a needle. Wherever the pressure stresses it, the crystal instantly turns back to red. Warm the crystal again, and.. the striking experiment can be repeated as many times. as you wish.

If the solutions of potassium iodide and mercuric chloride are hot when you originally mix them, the mercuric iodide that precipitates will be yellow instead of red. In this case, the precipitate settles slowly. Half an hour after mixing the solutions, the bottom of the beaker will be covered with red mercuric iodide, and yellow mercuric iodide will still be dispersed through the upper part of the solution, slowly settling out and changing into the red form.

Now for the trick of floating glass marbles in a liquid. Can you imagine a solution heavy enough to buoy up glass, bricks, and many kinds of rock, like corks in water? This remarkable fluid-which is known as Thoulet's solution, after the French chemist who introduced it-is easy to make for your self. It is prepared simply by dissolving precipitated red mercuric oxide into a strong solution of potassium iodide.

Start with a clean beaker containing a strong, almost saturated solution of potassium iodide in water. Stir the dried red mercuric iodide into it, a pinch at a time, until no more will dissolve. Then filter the solution. The clear, pale-yellow liquid that results really contains a distinct chemical compound, formed by the combination of the iodides of potassium and mercury.

If you have followed directions, you should now be able to float glass marbles, pebbles, and fragments of brick in the solution. In case your experiment fails, the solution held too little potassium iodide or mercuric iodide, and you will have better success with a stronger one. Notice the brilliant array of colors that the fluid exhibits, by strongly refracting the light that falls upon it. The solution has been used in mineralogy for determining the specific gravity of rocks, for separating minerals of different densities, and for determining the refractive index or light-bending power of crystals.

Pharaoh's serpents-the Fourth-of-July pellets that burn to make a voluminous ash -can be prepared in several ways. One good one is to add a solution of sodium or potassium sulphocyanide (these compounds are also known both as sulphocyanates and as thiocyanates) to a solution of mercuric chloride, until no further precipitate forms. Filter off the grayish-white precipitate, which consists of mercuric sulphocyanide. Wash it on the folded filter paper with plenty of water, and then let it dry at room temperature. Do not try to hasten the process with a drying oven, or it may convert itself spontaneously into ash in the process.

To make trick April-fool matches with your “snake” composition, mix it with five to ten percent of its weight of dextrin, and enough water to form a paste. While this paste is still moist, apply it to the heads of the matches. If the match heads are red, a little red household dye mixed with the paste will help to camouflage it. Anyone not in on the trick will get a surprise when he strikes one of the doctored matches, for the head will burn to produce a “snake” an inch or more long. The same paste may be molded into pellets to form the conventional Pharaoh’s serpents.

A small stock of pure mercury, or quicksilver, may well be one of your most prized laboratory possessions. Though it costs little more by weight than many other chemicals, its great density means that your money will buy proportionately less of it by volume. Nevertheless the investment will enable you to do fascinating stunts with this freakish metal.

One interesting and beautiful experiment you can perform with quicksilver requires no more than you can obtain from a discarded thermometer. Close one end of a piece of glass tubing, a quarter or half inch in diameter, by tying several thicknesses of closely woven cloth over it. Place a drop of mercury in this tubular basket. Suspend the tubing vertically in a test tube filled with silver nitrate solution, made by dissolving about a gram of silver nitrate in ten or fifteen cubic centimeters (three or four teaspoonfuls) of water. Use distilled water, by preference, in making up this solution. If you use tap water, chemical impurities in it are likely to produce a white precipitate of silver chloride, which you will have to remove by filtering before you use the solution.

Soaking through the cloth, the silver nitrate solution comes in contact with the mercury. Before your eyes, a beautiful treelike growth of metallic crystals appears. The glistening formation extends downward into the silver nitrate solution, below the cloth, and consists of crystals of pure silver.

If you are fortunate enough to have a fair quantity of mercury at your disposal, you can demonstrate its extraordinary buoyancy, which far exceeds even that of Thoulet’s solution. Iron nuts, brass screws, and copper fittings will bob about on the surface of a pool of mercury, without sinking. The liquid metal, thirteen and a half times as heavy as water, floats them with ease.

In case your supply of mercury seems dull and lifeless, and leaves a trail of scum behind it when rolled around the bottom of a beaker, it is contaminated with impurities. Usually the scum or dross consists of a film of oxide of mercury, grease, and other foreign matter clinging to the surface of the larger globules of mercury. Metals such as zinc and lead may also be present as impurities. Contaminated mercury may easily be cleaned, however, by one of several methods.

The simplest way is to prick about ten or twelve holes, with a needle, in the center of a sheet of filter paper. Place the twice-folded paper in a funnel, as for ordinary filtering, but do not wet the paper. Pour the mercury into the filter. If there is enough mercury to fill

the paper cone, the pressure will be sufficient to force the quicksilver through the holes at the bottom, and it will emerge bright and clean.

While this scheme removes ordinary dross, it does not get rid of baser metals amalgamated with the mercury. These may be eliminated by a simple washing process, in which as large a surface of the mercury as possible is exposed to a nitric acid solution of eight to ten-percent strength.

To assemble a handy mercury purifier for this purpose, tie a single thickness of silk cloth, with a piece of string, over the end of a plain glass chemical funnel. Then place the funnel in the top of a burette with a capacity of fifty to 100 cubic centimeters (or two or three fluid ounces) filled with a ten-percent solution of nitric acid. This may be made by adding about ninety cubic centimeters (three fluid ounces) of water to ten cubic centimeters of strong nitric acid. The silk cloth on the funnel should dip into the acid at the top of the burette. To purify the mercury, pour it into the funnel in five or ten-centimeter portions. The quicksilver will pass through the cloth and enter the nitric acid in a fine, foglike stream. The acid attacks and dissolves the baser metals, but does not affect the mercury falling through the liquid column. The purified mercury may be drained off at the bottom of the burette and passed through the acid once more for good measure. Then the burette is emptied of acid, thoroughly washed, and filled with fresh water; and the mercury is passed through it again to wash off any nitric acid.

Since mercury vaporizes almost as easily as water at high temperatures, and the vapor is poisonous, the metal should not be heated in home experiments. Even at room temperature, mercury gives off some vapor. However, droplets of mercury that have spilled from your chemical workbench soon become coated with a film of grease and scum that prevents them from becoming a health hazard.

To prevent the valuable metal from going to waste, you will still want to recover as many spilled droplets as you can. A convenient aid is a little homemade device that might be called a "mercury picker-upper." A small, wide-mouthed bottle of about one-ounce capacity, with its bottom cut off, is closed at each end with a one-hole stopper. One of the corks carries a medicine dropper whose stem, with the bulb removed, extends about half an inch into the bottle. The other cork carries a straight glass tube with a closed end and a small hole in its side. To make this fitting, seal the end of the tube in the Bunsen flame; heat the side wall, preferably with the pointed flame of a mouth blowpipe; blow into the tubing to puncture the softened glass; and smooth the rough edges by fusing them in a flame.

With a piece of rubber tubing attached to this fitting, the "picker-upper" is ready for use. Spear a drop of mercury with the tip of the medicine dropper, and suck on the rubber tubing. The mercury will obediently hop up the medicine dropper and fall into the bottle. The closed end of the upper tube prevents the droplet from being sucked into the mouth.

FUN



Glass marbles float in Thoulet's solution, which you can prepare by dissolving some red mercuric oxide in potassium iodide

MERCURY seems to be nature's joke on the scientist. The only metal that is liquid at ordinary temperatures, it still outweighs most solid ones—lead included. Volume for volume, among all the substances you encounter in your everyday life, only a few such as platinum, gold, and tungsten are heavier than mercury. Though it runs like water, it does not wet objects, and a drop of mercury in the palm of your hand is so elusive that it defies you to pick it up with your fingers.

You might expect that you could perform strange experiments with the compounds of such a queer metal, and you will not be disappointed. Through a magnifying glass or a low-power microscope, you can watch yellow crystals change magically to red when you

washing the hands thoroughly after using it. Both the potassium iodide and mercuric chloride solutions will be water-white.

Slowly pour some of the potassium iodide solution into the mercuric chloride solution. A brilliant red precipitate forms. It consists of mercuric iodide. Let it settle, and add more potassium iodide to the clear part of the solution. If more precipitate forms, let it settle, and repeat. Stop adding potassium iodide just at the point where no more precipitate is produced. Then filter off the red mercuric iodide. Wash it well as it lies on the filter paper in the funnel, and then let it dry in the air.

This red powder will turn yellow if you heat it above 126 degrees centigrade (259 degrees Fahrenheit). Mix it with weak mucilage, or varnish, and you can use it

By
**RAYMOND
B.
WAILES**

with QUICKSILVER

Mercury, the Liquid Mystery Metal, Offers a Fascinating Field of Experiment to Amateur-Chemistry Enthusiasts

as a heat-indicating paint. The yellow color will change back to red after some hours. Scratching the preparation hastens this change.

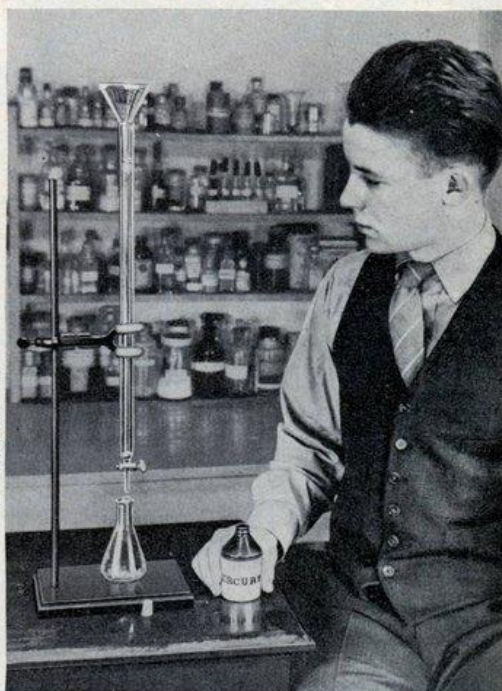
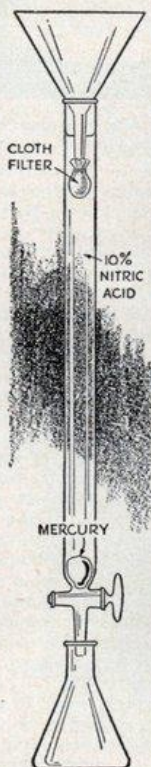
The color change from yellow back to red will also occur more quickly if the original precipitate of red mercuric iodide is converted into crystals. To do this, shake a gram or so of the powder with about ten cubic centimeters (three teaspoonfuls) of acetone for about ten minutes. Filter the solution, collecting the liquid that passes through the filter in a watch glass. The solvent rapidly evaporates from the watch glass, leaving long, gleaming crystals of mercuric iodide in a few minutes' time.

Place several of these red crystals on a microscope slide or a sheet of metal. Warm them gently, over a small flame, until they turn yellow. Now observe one of the crystals under a microscope or magnifying glass, while you apply pressure to it with the point of a needle. Wherever the pressure stresses it, the crystal instantly turns back to red. Warm the crystal again, and the striking experiment can be repeated as many times as you wish.

If the solutions of potassium iodide and mercuric chloride are hot when you originally mix them, the mercuric iodide that precipitates will be yellow instead of red. In this case, the precipitate settles slowly. Half an hour after mixing the solutions, the bottom of the

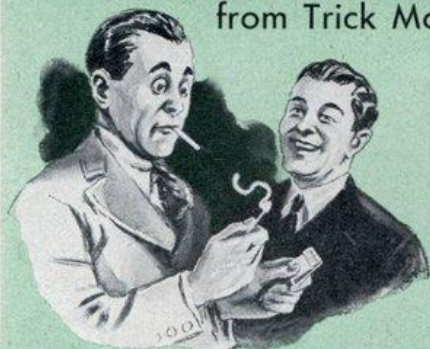
beaker will be covered with red mercuric iodide, and yellow mercuric iodide will still be dispersed through the upper part of the solution, slowly settling out and changing into the red form.

Now for the trick of floating glass marbles in a liquid. Can you imagine a solution heavy enough to buoy up glass, bricks, and many kinds of rock, like corks in water? This remarkable fluid—which is known as Thoulet's solution, after the French chemist who introduced it—is easy to make for yourself. It is prepared simply by dissolving



PURIFIER FOR MERCURY. Baser metals amalgamated with mercury can be removed with this simple apparatus. The quicksilver passes through nitric acid, which dissolves impurities

"Pharaoh's Serpents" Writhe from Trick Matches



You can April-fool your friends with trick matches doctored with a preparation made as shown in the drawings. When a match is struck, a long serpent of ash writhes out of it, to the amazement of your victim

precipitated red mercuric oxide into a strong solution of potassium iodide.

Start with a clean beaker containing a strong, almost saturated solution of potassium iodide in water. Stir the dried red mercuric iodide into it, a pinch at a time, until no more will dissolve. Then filter the solution. The clear, pale-yellow liquid that results really contains a distinct chemical compound, formed by the combination of the iodides of potassium and mercury.

If you have followed directions, you should now be able to float glass marbles, pebbles, and fragments of brick in the solution. In case your experiment fails, the solution held too little potassium iodide or mercuric iodide, and you will have better success with a stronger one. Notice the brilliant array of colors that the fluid exhibits, by strongly refracting the light that falls upon it. The solution has been used in mineralogy for determining the specific gravity of rocks, for separating minerals of different densities, and for determining the refractive index or light-bending power of crystals.

Pharaoh's serpents—the Fourth-of-July pellets that burn to make a voluminous ash—can be prepared in several ways. One good one is to add a solution of sodium or

potassium sulphocyanide (these compounds are also known both as sulphocyanates and as thiocyanates) to a solution of mercuric chloride, until no further precipitate forms. Filter off the grayish-white precipitate, which consists of mercuric sulphocyanide. Wash it on the folded filter paper with plenty of water, and then let it dry at room temperature. Do not try to hasten the process with a drying oven, or it may convert itself spontaneously into ash in the process.

To make trick April-fool matches with your "snake" composition, mix it with five to ten percent of its weight of dextrin, and enough water to form a paste. While this paste is still moist, apply it to the heads of the matches. If the match heads are red, a little red household dye mixed with the paste will help to camouflage it. Anyone not in on the trick will get a surprise when he strikes one of the doctored matches, for the head will burn to produce a "snake" an inch or more long. The same paste may be molded into pellets to form the conventional Pharaoh's serpents.

A small stock of pure mercury, or quick-silver, may well be one of your most prized laboratory possessions. Though it costs little more by weight than many other chemicals,

its great density means that your money will buy proportionately less of it by volume. Nevertheless the investment will enable you to do fascinating stunts with this freakish metal.

One interesting and beautiful experiment you can perform with quicksilver requires no more than you can obtain from a discarded thermometer. Close one end of a piece of glass tubing, a quarter or half inch in diameter, by tying several thicknesses of closely woven cloth over it. Place a drop of mercury in this tubular basket. Suspend the tubing vertically in a test tube filled with silver nitrate solution, made by dissolving about a gram of silver nitrate in ten or fifteen cubic centimeters (three or four teaspoonfuls) of water. Use distilled water, by preference, in making up this solution. If you use tap water, chemical impurities in it are likely to produce a white precipitate of silver chloride, which you will have to remove by filtering before you use the solution.

Soaking through the cloth, the silver nitrate solution comes in contact with the mercury. Before your eyes, a beautiful treelike growth of metallic crystals appears. The glistening formation extends downward into the silver nitrate solution, below the cloth, and consists of crystals of pure silver.

If you are fortunate enough to have a fair quantity of mercury at your disposal, you can demonstrate its extraordinary buoyancy, which far exceeds even that of Thoulet's solution. Iron nuts, brass screws, and copper fittings will bob about on the surface of a pool of mercury, without sinking. The liquid metal, thirteen and a half times as heavy as water, floats them with ease.

In case your supply of mercury seems dull and lifeless, and leaves a trail of scum behind it when rolled around the bottom of a beaker, it is contaminated with



Beautiful crystals of pure silver form a treelike growth before your eyes in this striking test

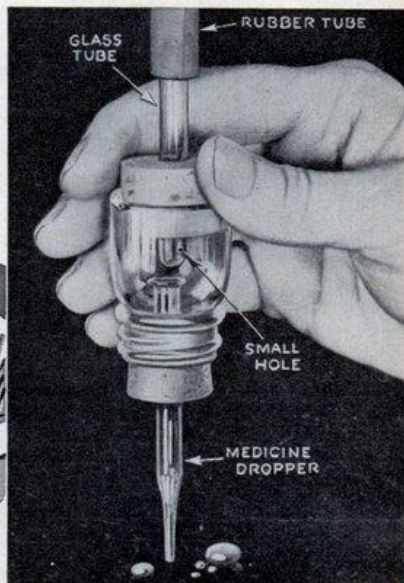
impurities. Usually the scum or dross consists of a film of oxide of mercury, grease, and other foreign matter clinging to the surface of the larger globules of mercury. Metals such as zinc and lead may also be present as impurities. Contaminated mercury may easily be cleaned, however, by one of several methods.

The simplest way is to prick about ten or twelve holes, with a needle, in the center of a sheet of filter paper. Place the twice-folded paper in a funnel, as for ordinary filtering, but do not wet the paper. Pour the mercury into the filter. If there is enough mercury to fill the paper cone, the pressure will be sufficient to force the quicksilver through the holes at the bottom, and it will emerge bright and clean.

While this scheme removes ordinary dross, it does not get rid of baser metals amalgamated with the mercury. These may be eliminated by a simple washing process, in which as large a surface of the mercury as possible is exposed to a nitric acid solution of eight to ten-percent strength.

To assemble a handy mercury purifier for this purpose, tie a single thickness of silk cloth, with a piece of string, over the end of a plain (Continued on page 244)

Droplets of mercury spilled on the table are easily picked up with this simple device. When you suck on the tube, quicksilver hops obediently up into the bottle




Be Wise - Alkalize



An Alka-Seltzer Tablet in a glass of water makes a sparkling pleasant-tasting solution. Drink it and it gives quick relief from Headaches, Sour Stomach, Distress after meals and other common ailments. It also helps overcome excess acid condition so often associated with these troubles.

30¢ & 60¢ BUCKS
 TUNE IN TO THE
**FRANK SINATRA
 BURNING NIGHT**
 AT DRUG STORE
 SODA FOUNTAINS
 NBC-NETWORK
 SATURDAY NIGHT

UPSET STOMACH



LET NOT EXCESS ACIDITY
 UPSET YOUR BILL OF FAIR.
 LET ALKA-SELTZER SETTLE THINGS,
 ENJOY THE SPRINGY AIR.

HEADACHE



BE READY WHEN A HEADACHE COMES,
 TO FREE YOURSELF FROM PAIN.
 WISE PEOPLE ALKA-SELTZERIZE
 AND WHISTLE IN THE RAIN.

MORNING AFTER



WHEN "MORNING AFTER" CLOUDS APPEAR,
 DON'T WASTE YOUR TIME A WHINING.
 LET ALKA-SELTZER GET THE FOG,
 YOU'LL FIND THE SUN STILL SHINING.

Alkalize with Alka-Seltzer AT ALL DRUGGISTS

CUT ME OUT

Cut me out, paste me on a postcard and mail to Popular Science Monthly, Dept. 49, 353 Fourth Ave., New York N. Y. I'll bring you complete supplies and instructions on how to make easily several dollars a week in your spare time.

Fun with Quicksilver

(Continued from page 203)

glass chemical funnel. Then place the funnel in the top of a burette with a capacity of fifty to 100 cubic centimeters (or two or three fluid ounces) filled with a ten-percent solution of nitric acid. This may be made by adding about ninety cubic centimeters (three fluid ounces) of water to ten cubic centimeters of strong nitric acid. The silk cloth on the funnel should dip into the acid at the top of the burette. To purify the mercury, pour it into the funnel in five or ten-cubic-centimeter portions. The quicksilver will pass through the cloth and enter the nitric acid in a fine, foglike stream. The acid attacks and dissolves the baser metals, but does not affect the mercury falling through the liquid column. The purified mercury may be drained off at the bottom of the burette and passed through the acid once more for good measure. Then the burette is emptied of acid, thoroughly washed, and filled with fresh water; and the mercury is passed through it again to wash off any nitric acid.

Since mercury vaporizes almost as easily as water at high temperatures, and the vapor is poisonous, the metal should not be heated in home experiments. Even at room temperature, mercury gives off some vapor. However, droplets of mercury that have spilled from your chemical workbench soon become coated with a film of grease and scum that prevents them from becoming a health hazard.

To prevent the valuable metal from going to waste, you will still want to recover as many spilled droplets as you can. A convenient aid is a little homemade device that might be called a "mercury picker-upper." A small, wide-mouthed bottle of about one-ounce capacity, with its bottom cut off, is closed at each end with a one-hole stopper. One of the corks carries a medicine dropper whose stem, with the bulb removed, extends about half an inch into the bottle. The other cork carries a straight glass tube with a closed end and a small hole in its side. To make this fitting, seal the end of the tube in the Bunsen flame; heat the side wall, preferably with the pointed flame of a mouth blow-pipe; blow into the tubing to puncture the softened glass; and smooth the rough edges by fusing them in a flame.

With a piece of rubber tubing attached to this fitting, the "picker-upper" is ready for use. Spear a drop of mercury with the tip of the medicine dropper, and suck on the rubber tubing. The mercury will obediently hop up the medicine dropper and fall into the bottle. The closed end of the upper tube prevents the droplet from being sucked into the mouth.