

**F^{PHOTOGRAPHERS'}
FORMULARY**

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FORMULARY PRINTING-OUT PROCESS**1/2-liter kit**

Printing-out paper (POP), also called salted paper, is a very old technique and was originally developed by Talbot. In the process, paper is first coated with a chloride containing solution. After drying, the paper is then sensitized with silver nitrate, which reacts with the chloride to form light sensitive silver chloride. Upon exposure to ultraviolet light, the silver chloride is converted to silver metal forming the image. Development is not necessary, thus the term "printing-out".

The POP process is self-masking. As the print is exposed to light, silver chloride is converted to silver metal, which shields the un-reacted silver chloride remaining on the paper. The effect is the greatest in the shadow areas allowing shadow detail to remain in the final print.

CHEMICALS CONTAINED IN THIS KIT

Your kit contains the following chemicals:

Chemical	Amount
Gelatin, hard (250 bloom)	11 g
Sodium citrate	11 g
Ammonium chloride	11 g
Silver nitrate	13 g
Borax	4 g
Gold chloride, 1% solution	8 ml
Potassium dichromate	2 g
Sodium thiosulfate, pentahydrate	50 g

CHEMICAL SAFETY

All chemicals are dangerous and must be treated with respect. Please read the warning on each package. Three chemicals in this kit need special attention: silver nitrate, gold chloride, and potassium dichromate.

Silver nitrate is both an oxidizer (can supply oxygen to a fire) and a caustic (can cause skin burns). Clean up any spilled solid silver nitrate with water and dispose of any excess down the drain. Never dispose of solid silver nitrate in a wastepaper basket.

If solid silver nitrate comes into contact with the skin, a chemical burn may result. Wash the area with cold water followed by soap and water. Treat any wound in the same manner you would treat a heat burn.

When dilute solutions of silver nitrate are spilled on the skin, a brown to brown-black stain results. The color is due to silver metal bound to the protein of the skin and cannot be washed off. While there are chemical methods for removing these brown stains, the best procedure is to just let them wear off.

If you are concerned with finger stains, we strongly urge you to use rubber gloves, such as Playtex gloves, when working with solutions of silver nitrate (and gold chloride).

Gold chloride is a caustic and can cause skin burns. In dilute solution, gold chloride will stain the skin purple. The stain is due to gold metal bonded to the protein of the skin and cannot be chemically removed. The only procedure for removing these spots is to let them wear off.

Potassium dichromate is both toxic and an oxidizer. To dispose of excess solid potassium dichromate, always wash the solid down a drain with copious amounts of water. Never dispose of the solid in a wastepaper basket.

Spillage of a dichromate solution on the skin will cause a chemical burn, which will appear as an ulceration. In addition, all chromium compounds are potential carcinogens. Potassium dichromate is included in this kit for optional use only. Should you choose not to use this compound, discard the sealed bag in the trash. Should you choose to use this compound, we strongly urge you to use disposable gloves when working with the solid or its solutions. Clean all trays and containers thoroughly with water followed by soap and water. Dispose of all excess dichromate salts and their solutions down a drain with a large volume of water.

Contact local sewer and water authorities regarding proper disposal of darkroom chemicals in your area.

The user assumes all risks upon accepting these chemicals. IF FOR ANY REASON YOU DO NOT WISH TO ASSUME ALL RISKS, PLEASE RETURN THE CHEMICALS WITHIN 30 DAYS FOR A FULL REFUND.

The first tray full will turn cloudy. The idea is to wash with additional trays of water until you get a tray full that is not cloudy. Do not over-wash; the image can be lost. During the washing the tone of the print will lighten and become reddish.

The print is still light sensitive and will remain so until fixing; therefore, work in subdued light.

TONING

An untoned POP print, after fixing, will have a reddish-brown cast. It is a common, but optional, practice to tone the POP print prior to fixing to alter its tone. The print can also be toned after the final wash, if desired.

Your kit contains chemicals for alkaline gold toning, which will cause a shift in print color towards the blue.

If you plan to tone the print, trim its edges to conserve the gold toner. Use the toning bath (Solution D) at 21°C/70°F. Immerse the print in the toning solution for 6 to 12 minutes. Unfortunately, it is difficult to judge the end result of the toning until the print is fixed, washed, and dried. You will have to experiment to gain experience. In general, the print develops a colder tone the longer it is in the toning bath. This cold tone increases upon fixing and drying.

FIXING

Immerse and agitate the untoned or toned print in the fixing solution (Solution E) for 10 minutes to remove all silver salts. The print needs not be washed between the toning bath and the fixer; however, be careful not to contaminate the toning bath with the fixer.

FINAL WASHING

After fixing, the print is no longer light sensitive and the image is stable. Wash the print for at least 1 hour. Be careful of the prints, however, because the chemical treatments will have weakened the fibers of the paper and they will abrade easily.

The prints can be re-toned after this final water wash if desired. If you do re-tone, be sure to re-wash the print thoroughly to remove the toning chemicals.

Dry the print in any suitable manner.

Allow the print to dry in the dark. If you wish, you can use mild heat from a hair dryer to speed the drying. Sensitized paper can be stored if you are very careful to protect it from moisture and light.

Contrast Control

The contrast of the final print can be increased by adding potassium dichromate solution (Solution C) to the salting solution prior to its application on the paper. If you wish to use this technique, plan on applying the salting solution by brushing. The effect of 3 drops of the dichromate solution in 28 ml of Solution A will be noticeable; more can be used.

When using Solution C, be sure it is thoroughly mixed into Solution A before applying the mixed solution to the paper. After coating, discard the excess mixed solution. Clean the mixing bowl and the brush thoroughly.

EXPOSURE

The salted paper is only sensitive to the ultraviolet portion of the spectrum. For exposure, you can use sunlight, a UV light box, or a mercury vapor yard lamp (available at discount stores).

The paper must be dry. If it is wet, it can stain the negative. (A thin acetate sheet between the negative and the salted paper can be used to eliminate this potential problem.) Position the negative on the paper in a contact-printing frame. For exposure control, it is wise to also place a step table (cat. no. 09-0330 and 09-0335) on the paper.

Upon exposure, the paper will darken rapidly at first, and then darken more slowly as exposure is continued. The duration of exposure will depend upon the light source. With a mercury vapor yard lamp at 18 inches, 10-20 minutes of exposure is not unusual. We recommend you calibrate your printing apparatus and technique by exposing and developing only a step table before actually printing negatives.

Immediately after exposure, mark the lightest step of the step table on the print that shows darkening. This step, and usually four more steps, can be lost upon washing, toning, and fixing. By knowing exactly how many steps will be lost in your processing, you can compensate by increasing exposure time to darken the additional steps.

INTERMEDIATE WASH

The free silver nitrate must be washed from the print prior to toning and fixing. Wash the print in a tray rather than by using running water.

MIXING THE SOLUTIONS

Solution A (The Gelatin-salt Solution)

You will need a 500 ml storage container and a mixing bowl.

Chemical	Amount
Distilled Water (20°C/68°F)	180 ml
Gelatin	11 g
Distilled Water (38°C/100°F)	320 ml
Sodium citrate	11 g
Ammonium chloride	11 g

Place the water in the mixing bowl and add the solid gelatin. Allow the mixture to stand for about 10 minutes to soften the gelatin, and then add the 320 ml of hot water. Stir the mixture to dissolve the gelatin. This may take a considerable period of time and it may be necessary to re-warm the solution in a hot water bath. After the gelatin has dissolved, add the sodium citrate and the ammonium chloride and stir the mixture to dissolve the solids. Finally, transfer the solution to the storage container.

Solution B (The Silver Nitrate Solution)

You will need a 100 ml brown glass storage container and a small mixing bowl (such as a drinking glass).

Chemical	Amount
Distilled Water (20°C/68°F)	100 ml
Silver Nitrate	13 g

Place the water in the mixing bowl and add the silver nitrate. Stir the solution to dissolve the solid then transfer the solution to its storage container. Silver nitrate itself is not light sensitive but in strong light it does decompose forming a black precipitate. It is best to store the solution in a dark place.

Solution C (For Contrast Control)

You will need a 30 ml (1 oz) bottle for a storage container and a small mixing bowl.

Chemical	Amount
Distilled Water (20°C/68°F)	30 ml
Potassium Dichromate	2 g

Place the water in the mixing bowl and add the potassium dichromate. Stir the solution to dissolve the solid then transfer the solution to the storage container.

Solution D (The Gold-borax Toning Bath)

You will need a 500 ml brown glass storage container and a mixing bowl.

Chemical	Amount
Distilled Water (38°C/100°F)	500 ml
Borax	4 g
Gold chloride, 1% solution	8 ml

Place the warm water in the mixing bowl and add the borax. Stir the solution to dissolve the solid. Add the entire contents in the gold chloride-solution bottle. Stir the solution to ensure it is homogeneous then transfer it to the storage container.

Solution E (The Fixer)

You will need a 500 ml storage container and a mixing bowl.

Chemical	Amount
Distilled Water (52°C/125°F)	500 ml
Sodium thiosulfate, pentahydrate	50 g

Place the hot water in the mixing bowl and add the sodium thiosulfate. Stir the solution to dissolve the solid. The large crystals of the sodium thiosulfate dissolve slowly. Stir the solution; let it stand for about 5 minutes, then stir again. Repeat if necessary. The solid will not dissolve unless the solution is stirred. Once the solid is in solution, transfer the solution to the storage container.

NEGATIVES

POP printing is a contact printing process. You will need a negative that is the same size as that of the print you wish to make. The negative should be prepared well in advance of the preparation of the POP paper.

Due to the self-masking effect of the POP printing process, your negative should have an abnormally long scale. The details in the shadows should have excellent separation, otherwise some of the detail will be lost and the shadows will print flat.

Contrast can be increased to some extent by the addition of potassium dichromate to the salting solution prior to coating; however, the range of

control is limited. In general, if your negative prints correctly with Kodak grade o paper, you should be able to obtain a good POP print.

PREPARATION OF THE POP PAPER

Select a good quality single ply paper. The porosity of the paper should be minimal. In general, sizing is not necessary because the salting solution contains gelatin, which will minimize the amount of the solution that soaks into the paper. If you wish to use a porous paper, plan to size it with arrowroot starch (not included in the kit) prior to salting it.

Salting the Paper

The paper is salted by either brushing Solution A onto the paper, or by soaking the paper in the solution. We recommend that you soak the paper and, as you gain experience with the entire process, proceed to brushing.

Working in room light, place a sufficient volume of Solution A in a tray and immerse the paper to be salted in the solution for about 30 seconds. Be sure to remove any air bubbles clinging to paper.

Remove the paper from the solution and allow the excess solution to drain from the paper. Dry the paper by either allowing it to air-dry or by using heat from a hand-held hair drier. The trick is to dry the paper so that it is evenly coated with the gelatinized salt solution. Proper drying will require some practice and experimentation on your part.

The excess salting solution can be returned to the storage container for future use.

The dry salted paper can be stored provided its storage area is dry. The paper is quite hygroscopic (absorbs atmospheric moisture). We suggest you store the salted paper in a small box with each sheet separated by a soft tissue so the surface does not abrade.

Sensitizing the Paper

Sensitize the paper by brushing Solution B on the surface then allowing it to dry. While the application of Solution B can be carried out under a tungsten lamp, we do not recommend it.

Tack the dry salted paper to a board with pins. Working in a darkroom under a red light, coat the paper with Solution B by brushing the solution onto the surface with a flat tipped, soft brush. Coat the paper horizontally then vertically. Be sure the entire surface is evenly coated; otherwise the final print will have streaks.