

COPY & CLOSE-UP PHOTOGRAPHY

GUIDE



Ontario Police College
Identification Training

Module P-15

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INTRODUCTION

RATIONALE

Identification Officers make photographic copies of two dimensional subjects and illuminate and photograph small objects, sometimes for identification of the object itself and, more often, for comparing the detail left on an object with detail on an instrument suspected of making the markings. Both of these functions necessitate use of short camera-to-subject distances and artificial lighting arrangements. Due to these shortened distances, lighting ratios must be considered and increases in exposure must be accurately calculated based on the bellows or lens extension factor. Although the best lighting is often the product of trial and error, it is generally founded on a combination of some basic set-ups of predictable lighting effects.

PREREQUISITES

- See Course Map

WHAT THIS MODULE CONTAINS

- GUIDE - this booklet, a resource guide
- ACTIVITIES - the booklet of practice activities
- ACTIVITY CHECK-OFF SHEET - a progress report
- CRITERION TEST - a test instrument

HOW TO WORK THROUGH THIS MODULE

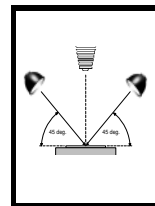
- read the objective to discover what you will attain for your efforts
- gather the resources listed in this guide
- examine the Criterion Test to learn how you will provide evidence of attaining the objective
- start reading this guide and follow written instructions

The material in the Guide and the Activities booklets, although integral parts of this training package, are by no means adequate by themselves to ensure success. Study the resource material. The resources have been carefully selected for their relevancy to the objective.

THINGS YOU WILL NEED

- tripod
- 35mm camera kit with 60mm lens or 4x5 view camera with 150mm lens
- unexposed 135 film and sheet film
- shutter release cable
- air brush and lens cleaning tissue

COPY & CLOSE-UP PHOTOGRAPHY



OBJECTIVE:

Given camera, film, accessories, video and written materials, at the end of the session the student will be able to photographically copy a two dimensional original with acceptable exposure and balanced lighting; perform close-up photography of small objects displaying fine detail through effective use of natural and artificial lighting; as evaluated by the facilitator.

KEY CONCEPTS:

- copying
- original
- copy negative
- reproduction
- continuous tone original
- line original
- halftone original
- copy stand
- copyboard printing frame
- line art
- continuous-tone image
- duplicate
- close-up photography
- shape
- surface texture
- texture accents
- transillumination
- tenting
- image-to-object ratio
- photomacrography
- photomicrography
- microphotography
- macrophotography
- focal distance
- close-up lens
- focal frame
- bellows unit
- extension tubes
- macrolens
- exposure factor
- ringflash

RESOURCES

Video: *On Assignment: Photographic Light*

(Cassettes #1 & #2)

Nature of Light

Direction

Form

Contrast

Book: *Glossary of Photographic Terms*

Book: *Photography, Art And Technique*

Close-up Photography 338

Available-Light Close-up Techniques 348

Close-up Flash Photography 350

Photomacrography 362

Book: *Introduction to Photography*

Lighting Small Objects 317

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The Accent Lights 318

The Fill Light 319

The Background Light 319

Lighting Glass Objects and Shiny Objects 319

Questions to Consider 322

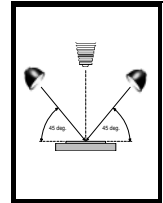
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Closeup and Copy Photography 401

Closeup-Photography 401

Copy Photography 407

COPY & CLOSE-UP PHOTOGRAPHY



Safety

- ◆ Treat hot lights as *hot* lights. The lamp housing and barn doors get hot enough to burn skin and paper and melt plastic camera parts and exhibits at short distances. Keep lamps at a safe working distance.
- ◆ When not in use, shut off lights, unplug and recoil their cords to prevent accidents.
- ◆ To prevent damage to lamp filaments, never jar a lamp while the filament is still hot, even after shutting off.

Copying

Study *Introduction to Photography*, pp 407-11. Copying by photography is an accurate method of reproducing photographic prints, drawings, sketches, and printed matter. In police work copying is employed often in the reproduction of fingerprints for chart making and for duplicating photographs where no negative exists. The following is a list of copying terms and their generally accepted meanings:

Copy: to photograph two dimensional material such as photographic prints, drawings, paintings and documents.

Original: the material to be copied.

Copy Negative: the negative obtained by photographing the original.

Copyboard: an illuminated board or easel to which the original is attached for copying.

Reproduction: a print from the copy negative.

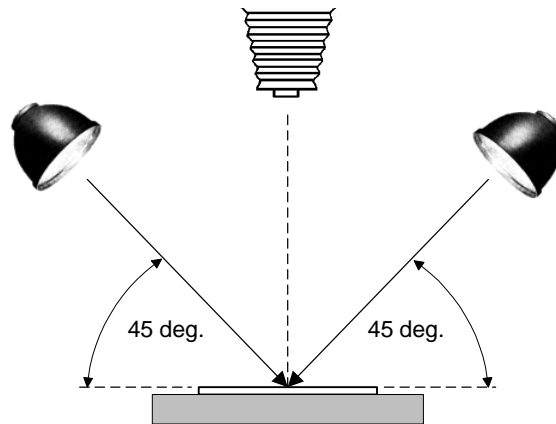
Continuous Tone Original: material that has gradation of tones between the extremes of light and dark; e.g., photographs and paintings.

Line Original: an original made up entirely of lines. Usually reproduced as black on white or white on black; e.g., drawings and text.

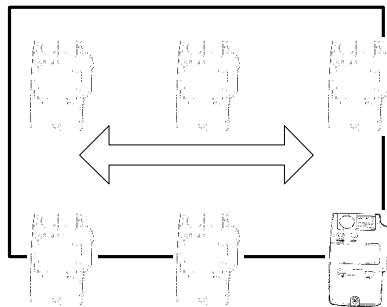
Halftone Original: a photo mechanical reproduction of a continuous tone original. The image is made up of dots that vary in shape and size; e.g., magazine reproductions.

Procedure

- Copying may be done in a vertical or horizontal orientation of the camera. In a horizontal set up the camera is usually installed on a tripod or camera stand and the original is held in a copyboard fixed to a wall. In a vertical set up the camera is normally installed on a copystand. The original is held flat on a built-in copyboard which forms part of the copystand.
- The prime consideration in obtaining good copies is lighting. The light intensity reaching the copy board must be accurately balanced. Even slight variations in intensity will be noticeable in the copy negative. If electronic flash is to be used then the flash units must be a matched pair and contain modelling lamps to facilitate balancing.



- With the camera facing the copy board, place a light on either side in such a manner that it faces the copy board at an angle of 45° and at a distance of approximately one metre. Centre the image of the original in the viewfinder or ground glass and ensure the camera back is level with the original.



- Place an incident exposure meter on the copy board. Turn on the lamps. Scan the light incident on the entire copy board area by moving the meter from one side to the other and from corner to corner. If the lights are accurately balanced, the meter will not show any deviation in exposure throughout the scan. If the reading changes, the

lighting is not balanced and must be corrected, usually by changing the distance of one of the lamps. Repeat the process until the lighting is balanced. If the correct film speed has been set on the meter, this reading may be used to calculate exposure (see below for exposure calculation for lens or bellows extension). If you are using electronic flash, balance the lighting with the modelling lamps. Obtain the exposure by firing the flash while reading with a flash meter.

- If a reflected light meter is to be used, a clean monotone sheet (white paper or gray card) must temporarily replace the original while light balancing is carried out. The photographer must scan light values reflected from this sheet in a similar pattern as the incident method. The meter must be held close and perpendicular to the gray card. Care must be taken not to cast shadows in the reading area. The monotone sheet is replaced with the original and the copy is made. One could not balance lights based on reflected readings from the original because the original does not reflect a constant value across its surface. Once balance has been established, an exposure reading may be taken of reflected light from a photographic gray card temporarily placed on the copyboard).
- Lighting cannot be balanced easily with a light meter lacking in full gradations between f stops.

Exposure adjustment for lens or bellows extension in copy and close-up photography

If you are using a through-the-lens metering system on the camera, then a reflected light reading from a photographic gray card on the copyboard requires no additional calculation. Otherwise, one must calculate an exposure compensation for the closeness of the subject. The difficulty lies in the fact that f numbers are established via their relationship of the diameter of the aperture and the distance between the lens and film when the lens is focused at infinity ($N=f/d$)¹. Relative aperture assumes that lens or bellows extension is equal to the focal length. When the lens is focused at any distance short of infinity, the lens is extended toward the subject. In effect, for this greater lens-to-film distance, f stop settings render less image illuminance (or exposure) when focused at distances shorter than infinity. Fortunately for us, this becomes apparent only with very short distances such as those encountered in copy and close-up photography where the image is one-quarter of the original or larger. Rather than apply equations we will commit the table following to memory. This will satisfy most of our requirements.

Image Size	Change In Exposure
1:4 or ¼	+½ f stop
1:2 or ½	+1 f stop
1:1 or actual	+2 f stops

Inclusion of a scale

¹ Relative aperture (N), expressed in f numbers, is found by dividing the focal length of the lens (f) divided by the diameter (d) of the aperture.

It is always wise in copy and close-up photography to include a scale such as a small ruler. The scale is a reference to original size when enlarging. At any future time copies can be made with the image reproduced to the same size as the original. The scale must be placed on the same plane as the surface of the subject being photographed. In practice, one photograph is taken with the scale and a second, intended for the end-user, is made from the same position with the scale omitted. The scale should be so positioned as not to obscure any part of the subject. This is especially important in evidence photography. Obviously, care must be taken not to damage the subject when including the scale.

Flare

Flare is the unintentional exposure of film by extraneous, non-image-forming light. Flare is encountered when making long exposures. Longer than normal exposures may be anticipated in copy and close-up work due to the relative brightness of the light sources and the use of filter and lens extension or bellows factors. It causes a loss of contrast and a loss of shadow detail.

Cause	Prevention
Light entering the camera through the lens bounces back and forth between the inner surface of the lens and the film at the back of the camera.	Where possible use shorter exposure times.
Extraneous light.	Turn off all lights except those necessary. Use a lens shade.
Specular reflection from the copyboard.	Use a black copyboard or use glare free glass in the copyboard.
Dust or dirt inside the camera bellows.	Remove dust and dirt from the interior of your camera and clean both surfaces of your lens

Film and colour quality of light

For black-and-white photography, the colour quality of the light is irrelevant but for colour work ensure the film you are using is balanced for the colour temperature of the lights in use; 3200K for tungsten, 3400K for photolamps and 5500K for electronic flash. See *Introduction to Photography*, page 286.

Turn to the Activities book and complete Activity One.

Close-up Photography of Small Objects

This is something the Identification Officer performs many times. Many pieces of evidence gathered at crime scenes require photographic records before further processing and comparing. Unlike copying, there is generally no advantage to balancing the lighting. Effects are best observed from the position of the ground glass or viewfinder and lighting should be arranged to produce the best depiction of the evidence in terms of form and contrast. Finding a lighting set up that best shows in a photograph what is intended can often be a challenge.

Study *Introduction to Photography*, pp 302-8, 317-21 and 407-11.

Exposures

Subject size and working distance between lens and subject generally dictate the type of exposure reading the photographer will use.

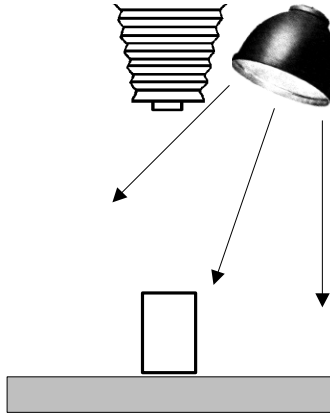
If you are using an *incident* meter, you must position the meter's white dome on the subject plane and at the same distance from the lamps as the subject. This is often impractical. For dark subjects increase exposure by one to two stops to ensure the detail is recorded.

A *reflected* light reading directly from the subject is often the method of choice. For bright subjects, increase exposure by one to three stops to ensure the detail is recorded.

Whether you use incident or reflected methods, in addition to any increases in exposure for subject brightness, you must supplement those exposures with increases for *lens or bellows extension*.

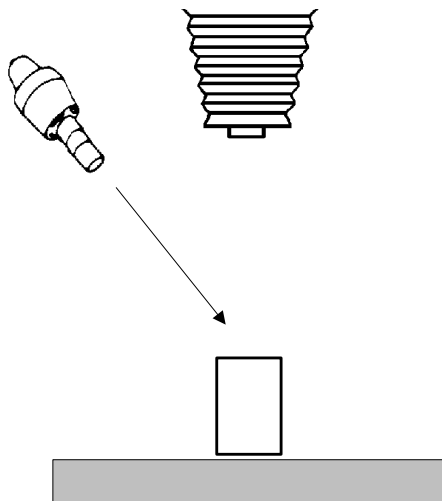
Set-ups

Following are some typical small-object lighting arrangements. The description accompanying each of the diagrams will assist you in selecting the best arrangement for the subject you are photographing and the effect you wish to attain. Be prepared to change your mind and modify the arrangement. Not everything turns out as planned.



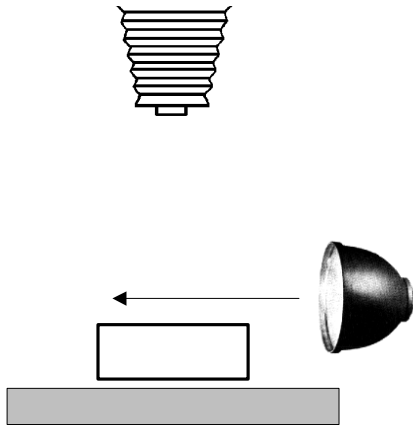
Frontal Lighting

The light direction is nearly parallel with the lens axis. Specular highlights must be watched for particularly on any smooth shiny surface. Shadows are dense and short.



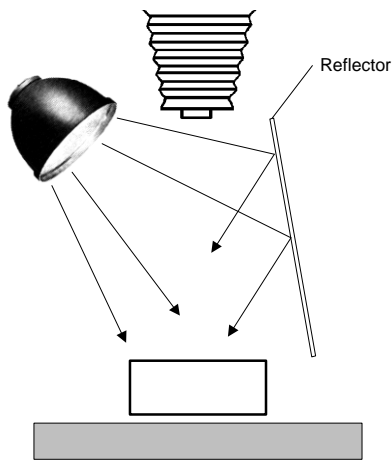
Directional Lighting

Usually more useful with smaller light sources, this lighting enhances texture more than frontal lighting. Shadows are dense and longer.



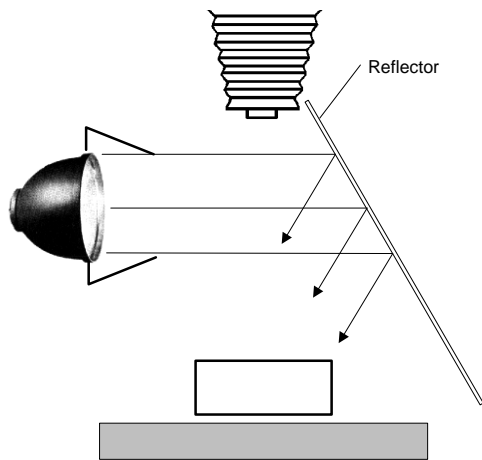
Side Lighting

This oblique lighting accentuates depth to surface detail. Contrast is high. To maintain balanced exposure across a large surface, the light source may have to be relocated further from the subject.



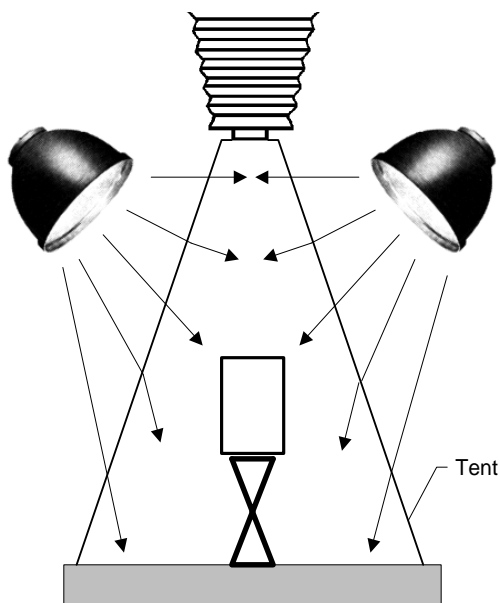
Reflector Fill

Here, a lamp is directed toward the subject and spill-light is reflected back to the subject to lighten shadow and reveal detail otherwise obscured. A reflector, made of a white rigid cardboard, is often a better substitute for another lamp. Intensity of the reflected rays may be increased by moving the reflector closer or covering it with another material such as aluminum foil which has been first crumpled then unfolded and flattened.



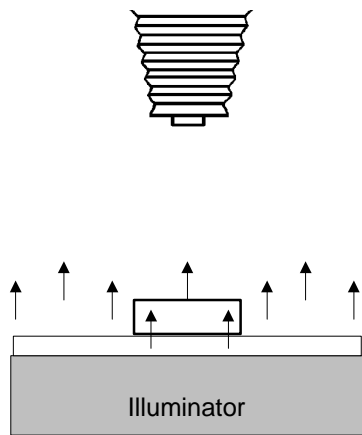
Reflected Light

In this case, a broad-beam lamp's light misses the subject and is directed entirely to the reflector. The reflected light produces softer shadows and more even distribution of light. Highly reflective materials usually photograph well under reflected light.



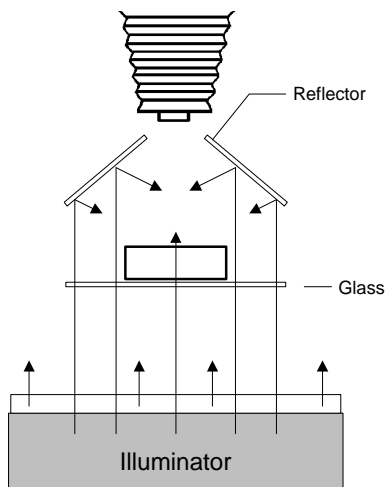
Tent Lighting

Lights are configured as in a copy set-up. A translucent cone, to diffuse the lighting, is installed to encircle the lens and the subject. A cone may be constructed of white paper or translucent white plastic. This is usually the lighting choice for highly reflective subjects. Where unwanted specular highlights appear, one or two narrow strips of opaque paper can be taped to the outside of the cone after finding the proper location by experimenting.



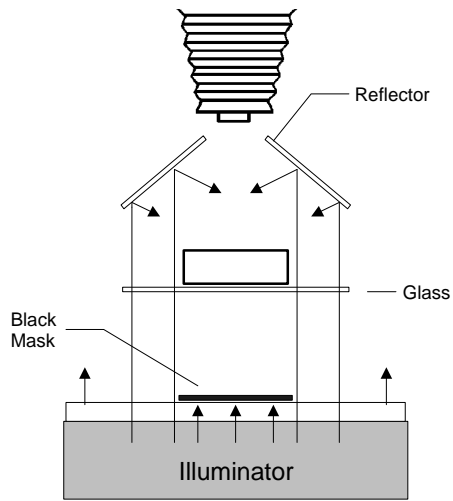
Transmitted Light

An illuminator may be a lightbox or a sheet of white translucent glass or plastic illuminated from behind. Opaque subjects photographed against an illuminator will provide a shadowless background if the frontal or directional lighting is not overpowering. Transparent or translucent subjects can be photographed with the illuminator exclusively .



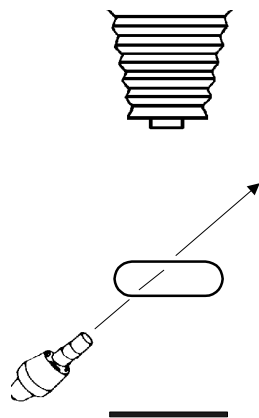
Transilluminated and Reflected Fill Light

The only change here is that the subject is placed on a sheet of clear glass so that it's height can be adjusted for the right balance between the intensity of the light from the illuminator and the light bouncing from the reflectors installed above.



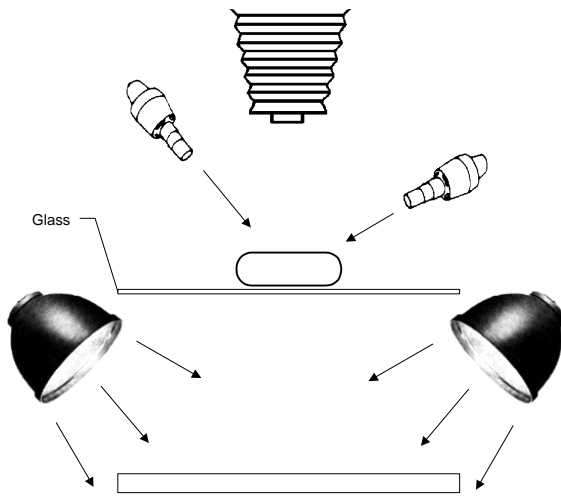
Dark Field Illumination, reflected

This is similar to a previous set-up. A black background has been introduced to enhance surface texture of a transparent subject.



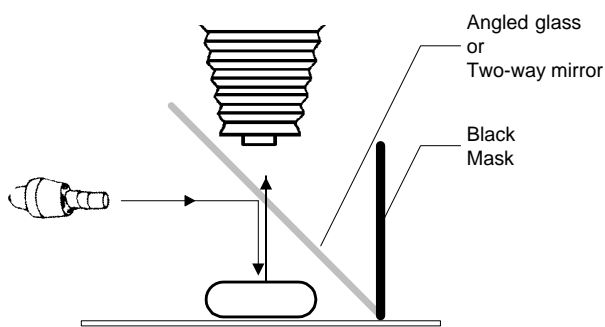
Dark Field Illumination, transmitted

This is an excellent means of photographing powdered finger impressions on transparent and translucent materials. Light is transmitted from the side of the subject furthest from the camera. Never direct the light at the camera lens. Flare will obliterate the image. The background is not illuminated.



Background Separation Lighting

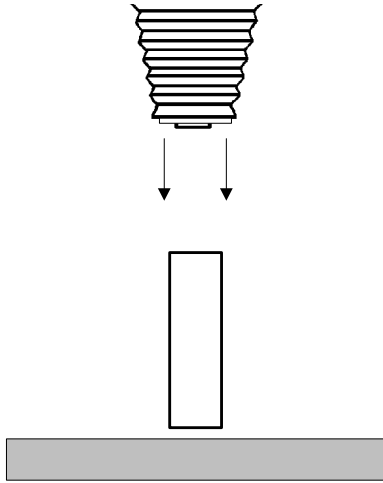
Once again, the subject is separated from the background on a sheet of clear glass, this time to control the type and intensity of the background lighting. Separate lighting is used for the subject. This lighting is very effective as shadows can be easily controlled and if shooting in colour, the background colours can also be controlled with coloured lights.



Axial Lighting

Ever tried to illuminate a small diameter cylinder while looking into it? Well, that's not why this set-up was devised but it would work! In this case, a clear sheet of glass or a two-way mirror is installed at forty-five degrees to the lens axis. A black card is installed vertically opposite the narrow beam light. This prevents

flare. The glass reflects the light beam to the subject and the light reflected by the subject passes through the glass to the lens. The light is actually travelling in opposite directions simultaneously along the lens axis. This lighting is especially useful when photographing objects with highly reflective reliefs such as engravings and coins et cetera.



Ring Lighting

An electronic flash unit shaped like a bagel or doughnut encircles the lens when installed on the camera. On highly reflective surfaces doughnut-shaped specular highlights may result. The beauty of the light is that it is multi-directional producing near shadowless illumination accented by brilliant highlights. It is the closest to axial lighting of all the other set-ups.

Turn to the Activities book and complete Activity Two.

Fingerprint Photography

Photograph fingerprints and other powdered impressions before attempting to lift them. You can never predict the quality of a lift . . . only observe it. Fingerprint photography gets special mention here because in addition to including a *location* photograph, i.e., illustrating the orientation of an impression, the surface on which it is found and its location within a scene, we should photograph a visible impression for its detail. That means the detail of the impression is the subject of importance.

Generally, fingerprints are photographed 1:2 or 1:1. Actual size, especially on large format cameras, is usually preferred because no enlarging is required. One simply make a contact print. Whatever the case, it is preferable to use the same magnification all the time. This eliminates confusion and reduces time when making enlargements or contact prints. If fingerprints appear in a cluster, two or more from the same hand, photograph the cluster at 1:2, or smaller. Try to be consistent with this ratio too, although it may be smaller than the one used for single prints. Then photograph each of the impressions individually at your usual magnification, especially if there is any doubt about having cropped any impressions in the cluster.

There is no advantage to photographing fingerprints in colour unless it is to eliminate changing the film already in use. The biggest advantage to photographing impressions in black-and-white is contrast control. With black-and-white film you are able to control contrast through the use of contrast filters on the camera lens to eliminate or change the density of background colours. During enlargement contrast may be controlled further through the choice of paper grades.

Choices in lighting for impressions developed on opaque surfaces is limited to some form of frontal lighting. On translucent or transparent surfaces reflected and transmitted light may be tried. Very often the two methods produce different results in terms of contrast. When lighting molded (three dimensional) impressions, the lighting should be directed to produce short shadows of the furrows. Long shadows tend to obscure rather than enhance detail.

With continuous lights, exposure is calculated the same way as other small object photography. Exposure readings of subjects transilluminated present a little more experimentation. Try taking an incident reading of the light transmitted through the subject and increase the exposure by 2 stops.

Scene photography of fingerprints will invariably be done with electronic flash. For this, one should conduct exposure tests with constant flash-to-subject distance. For example, you use the same flash and camera equipment all the time but sometimes you use a film rated at ISO 125 and sometimes you use a film rated at ISO 400. Make the following test subjects: one fingerprint dusted with gray powder on a black opaque surface, a coloured opaque surface and on clear glass or plastic. Make a black powder impression on a white surface.

- load one of the films
- set your camera for 1:2 or 1:1 (whichever magnification you normally would use)
- set the electronic flash for *manual* mode and $\frac{1}{4}$ power
- hold the electronic flash at the same distance and angle to the subject for all tests, (e.g., 45° at 500cm)
- use the seek-focus² method on one of the test subjects
- take successive exposures based on: the calculated exposure, plus 1 *f*-stop and minus 1 *f*-stop for each of the test subjects
- repeat the process for other film speeds
- identify and record the best exposure for each subject

Select the best exposure for each of the different subject types. Retain these test results as a kind of prescription for future work. This eliminates guess work and the need to calculate each time you encounter similar subjects.

Turn to the Activities book and complete Activity Three.

² Seek-focus is a term used to describe the movement of the camera toward and away from the subject until a point is reached where the subject is in sharp focus when the focus distance for the lens has been predetermined

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